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.” Each “Stage” declaration within the county triggers drought stage reduction measures.

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 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 2021 Water Year began after a non-existent monsoon that was the hottest and 2nd driest on record, resulting from high pressure positioned over the state that suppressed thunderstorms and kept moisture blocked to the south in 2020. October 2020 was the 5th warmest, with record average high temperatures 7.7°F above normal and only trace rain. November continued warm and dry, with fall being the 2nd warmest and 2nd driest on record. Pima County declined into 17 percent Extreme drought and 61 percent Exceptional drought by the end of November. The average high-temperature records waned into winter, and moderate Pacific storm systems brought some snow and rain in January. At this point, Tucson was entering a record dry period, and at the end of February, it was the driest 12-month period on record. Winter ended with a 1.75” deficit in precipitation and 2.2°F warmer. Exceptional drought dominated eastern Pima County, with Extreme, Severe, and Moderate drought radiating into western Pima County.

Spring began with normal temperatures and below normal rainfall, continued into April with higher temperatures and trace rainfall, and ended in May with higher temperatures though slightly lower and trace rainfall. Spring was the 7th warmest on record with a deficit of -0.69” precipitation. June was the hottest on record with below-average rainfall, and January 2020 to June 2021 was the driest 18-month period. The
last 22-month period ending in June is the driest on record as hot and dry conditions continued. At this point, the Water Year was in deficit -3.5” of precipitation.

July was the wettest on record and the wettest calendar month on record, the wettest monsoon on record through July, and the coolest July since 2012. The Tucson area received 8.06” of rain, a surplus of 5.85” of rain above normal for the month. Region-wide rainfall in July resulted in CAP canal and Union Pacific railroad damages with an extreme rainfall event on July 25th. While precipitation was above average in August, +1.87”, it was far below the record for July but contributed to the 2nd wettest and 16th warmest summer on record and altered the Water Year to a surplus of +4.23”. July and August average temperatures were below normal for the first time since 1990.

By mid-July, the monsoon season receded all Exceptional drought in eastern Pima County and almost all Extreme drought by the end of July. Severe drought had receded by mid-August, and only Moderate drought remained across 99 percent of Pima County, a three-stage improvement in eastern Pima County.

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

<table>
<thead>
<tr>
<th>WY20-21</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation</td>
<td>0.00</td>
<td>0.15</td>
<td>0.25</td>
<td>0.73</td>
<td>0.00</td>
<td>0.31</td>
<td>0.00</td>
<td>0.00</td>
<td>0.17</td>
<td>8.06</td>
<td>3.85</td>
<td>0.71</td>
</tr>
<tr>
<td>Normal Precip</td>
<td>0.89</td>
<td>0.57</td>
<td>0.93</td>
<td>0.94</td>
<td>0.86</td>
<td>0.73</td>
<td>0.31</td>
<td>0.20</td>
<td>0.23</td>
<td>2.21</td>
<td>1.98</td>
<td>1.32</td>
</tr>
<tr>
<td>Difference +/-</td>
<td>-0.89</td>
<td>-0.42</td>
<td>-0.68</td>
<td>-0.21</td>
<td>-0.86</td>
<td>-0.42</td>
<td>-0.31</td>
<td>-0.20</td>
<td>-0.06</td>
<td>+5.85</td>
<td>+1.87</td>
<td>-0.61</td>
</tr>
<tr>
<td>Cumulative</td>
<td>-0.89</td>
<td>-1.31</td>
<td>-1.99</td>
<td>-2.20</td>
<td>-3.06</td>
<td>-3.48</td>
<td>-3.37</td>
<td>-3.57</td>
<td>-3.63</td>
<td>+2.22</td>
<td>+4.09</td>
<td>+3.48</td>
</tr>
<tr>
<td>Rank</td>
<td>13th Dry</td>
<td>40th Dry</td>
<td>34th Dry</td>
<td>61st Wet</td>
<td>Driest</td>
<td>41st Dry</td>
<td>13th Dry</td>
<td>25th Dry</td>
<td>48th Wet</td>
<td>1st Wet</td>
<td>16th Wet</td>
<td>46th Dry</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>WY20-21</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Temperature</td>
<td>76.1</td>
<td>64.8</td>
<td>54.2</td>
<td>54.1</td>
<td>58.0</td>
<td>60.7</td>
<td>71.9</td>
<td>78.3</td>
<td>89.8</td>
<td>85.8</td>
<td>85.7</td>
<td>83.0</td>
</tr>
<tr>
<td>Normal Temperature</td>
<td>71.0</td>
<td>59.8</td>
<td>51.9</td>
<td>52.6</td>
<td>55.3</td>
<td>60.1</td>
<td>67.0</td>
<td>76.8</td>
<td>86.1</td>
<td>88.2</td>
<td>86.9</td>
<td>82.8</td>
</tr>
<tr>
<td>Difference +/-</td>
<td>+5.1</td>
<td>+5.0</td>
<td>+2.3</td>
<td>+1.5</td>
<td>+2.7</td>
<td>+0.6</td>
<td>+4.9</td>
<td>+1.5</td>
<td>+3.7</td>
<td>-2.4</td>
<td>-1.2</td>
<td>+0.2</td>
</tr>
<tr>
<td>Rank</td>
<td>5th Hot</td>
<td>4th Hot</td>
<td>22nd Hot</td>
<td>18th Hot</td>
<td>16th Hot</td>
<td>36th Hot</td>
<td>3rd Hot</td>
<td>13th Hot</td>
<td>1st Cool</td>
<td>42nd Hot</td>
<td>38th Hot</td>
<td>16th Hot</td>
</tr>
</tbody>
</table>

**2020-21 Season Ranking (NWS-Tucson)**

<table>
<thead>
<tr>
<th>WY20-21</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Monsoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precp Rank</td>
<td>2nd Dry</td>
<td>20th Dry</td>
<td>17th Dry</td>
<td>2nd Wet</td>
<td>3rd Wet</td>
</tr>
<tr>
<td>Temp Rank</td>
<td>2nd Hot</td>
<td>13th Hot</td>
<td>7th Hot</td>
<td>16th Hot</td>
<td>17th Hot</td>
</tr>
</tbody>
</table>

*Period of record for Tucson 1895-2021*
### Pima County Drought Conditions

<table>
<thead>
<tr>
<th>WY 20-21</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long Term</strong></td>
<td>D3</td>
<td>D2</td>
<td>D3</td>
<td>D2</td>
<td>D3</td>
<td>D3</td>
<td>D3</td>
<td>D3</td>
<td>D3</td>
<td>D2</td>
<td>D2</td>
<td>D2</td>
</tr>
</tbody>
</table>

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

### Pima County Drought Status

(US Drought Monitor & Monitoring Technical Committee)

#### Short Term

The 2021 Water Year started with Extreme drought, Severe drought, and Moderate drought radiating from eastern Pima County to west in that order. Within a week, Exceptional drought was introduced into eastern Pima County, 61 percent of the county in Extreme drought and 17 percent in Exceptional drought. Mid-November Exceptional drought spread west to cover 60 percent of eastern Pima County. From mid-November until mid-July, Pima County remained in 61 percent Exceptional drought, 18 percent Extreme drought, and 21 percent either Severe or Moderate drought.

July 2021 changed from the previous conditions to 0 percent Exceptional drought and 78 percent Extreme drought and then dropped another category to 19 percent Extreme drought and 67 percent Severe drought. Improvement continued through August as Severe drought was replaced by 99 percent Moderate drought. By mid-September, 40 percent of Pima County was in Abnormally Dry conditions on both the eastern and western halves, with the remainder of central Pima County in Moderate drought.

#### Long Term

From October to December, western Pima County was in Severe drought worsening to the east with Extreme drought. By January, Extreme drought had expanded in the western areas with isolated areas of Severe drought. Drought conditions continued to expand through the dry months leading into the monsoon season with expansion of Extreme drought across Pima County and Exceptional drought in eastern Pima County.

### Colorado River Basin & Central Arizona Project (CAP)

A total of nine water providers deliver Central Arizona Project municipal water to Pima County water users. Tucson Water has the largest CAP annual municipal allocation in the state. Agricultural users and the Tohono O’Odham Nation also have access to and use CAP water. The drought status of the Colorado River Basin and probabilities of any shortage declaration are monitored by the Pima County Local Drought Impact Group and impacts to these sectors.

Lake Powell and Lake Mead

The August 2021 Bureau of Reclamation 24-Month Study projected Lake Mead would be below elevation 1,075’ above mean sea level on December 31, and concurrent with the 2007 Operating Guidelines and the Drought Contingency Plan, Lake Mead will be operating in a Tier 1 shortage beginning 2022. The first declared shortage will impact CAP water supplies by reducing 512,000 acre-feet cutting all Excess water, and reducing Agricultural Pool water, which has been backfilled with mitigation water as part of the Drought...
Contingency Plan. The shortage declaration is not unexpected, and Arizona, the Basin states, and the federal government are continuing to work in re-consultation of the 2007 Operating Guidelines and other consultation to reduce the decline of Lake Powell and Lake Mead in light of a hotter and drier climate.

April-July runoff into Lake Powell was 26 percent of average and unregulated inflow was 32 percent of average. The dry spring runoff was the 2nd lowest on record and contributed to the decline of Lake Powell and Lake Mead by 30’ and 20’ respectively. At the end of Water Year, 2021, combined storage will be 31 percent of average. The Operating Guidelines will change operation tiers to a Mid-Elevation Balancing Tier for lake operations, and the next two Water Year releases from Lake Powell will be 7.48 MAF, contributing to Lake Mead’s decline. The most recent probability calculations from the BOR conclude a 23-34 percent probability of further shortage with a Tier 2 shortage in 2023 and a 20-38 percent probability of a Tier 3 shortage by 2025. CAP water supplies would be cut 640,000 and 720,000-acre feet in subsequent Tier 2 and 3 shortage declarations. With the probability of Lake Mead falling below elevation 1,030’, the Secretary of Interior must consult with the Lower Basin states on further actions to reduce the decline of Lake Mead.

Tier 1 Shortage

The impact for Pima County in the near time is minimal. Municipal and Industrial (M&I) supplies from CAP are not impacted until a Tier 3 declaration. Pima County agriculture uses CAP M&I water in Groundwater Savings Facilities, meaning higher priority CAP water is used to irrigate, unlike other agricultural operations using CAP Agricultural Pool water. Pima County also has fewer Non-Indian Agricultural (NIA) water allocations compared to other Active Management Areas. With mostly M&I allocations, Pima County does not anticipate water reductions to its water providers until a Tier 3 shortage which would result in a four to 15 percent reduction in CAP M&I water supply, but that can be mitigated by water providers’ long-term planning that includes recharge and recovery of unused CAP supplies.

With the Tier 1 CAP shortage declaration, water providers receiving CAP water will begin implementing drought responses consistent with their respective drought preparedness plans.

Drought Impacts

Wildfire

Wildfire activity in Pima County was limited. The Bighorn Fire occurred last Water Year in the Santa Catalina Mountains; however, the fire burn scar is still of concern to the Pima County Regional Flood Control District (RFCD), and flooding potential will have to be monitored and mitigated for several years as a result of the fire. The drought limited vegetation growth in the area, increasing the possibility of flooding. RFCD has installed additional real-time weather monitoring stations and stream gauges and is partnering with the University of Arizona on a sediment study. RFCD has communicated with approximately 1,000 property owners along washes downstream of the burn scar. Smoke from wildfires in California caused hazy skies, but the smoke was high enough to avoid detection at Pima County’s air quality monitoring locations.

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 in the region along Cienega Creek, Davidson Canyon, and Tanque Verde Creek. Groundwater levels have recovered in many of the areas since 2014 though there is an established long-term downward trend in groundwater levels for most areas. RFCD will continue to monitor whether the more recent recoveries are just a temporary delay in a downward trend.
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. Pima County Regional Flood Control District successfully submitted an Endangered Species Act project request for CEP water in 2020 to support streamflow in the Santa Cruz River downstream of the Agua Nueva Water Reclamation Facility and the effluent dependent stretch sustaining the Gila topminnow. The approved CEP volume is 5,600 acre-feet a year and will equate to an average of 5 million gallons a day to ensure a minimum flow of water sustaining the Gila topminnow and associated habitat.

Kino Environmental Restoration Project (KERP)

KERP is an environmental restoration project that harvests urban stormwater and controls flooding in Tucson. KERP covers 141 acres with 28 acres of open water and riparian habitat. A central pond banks stormwater and stores the water for irrigation within the KERP basin and Kino Park. The six-acre “Deep Pond” is 50' deep when full. KERP has struggled to retain enough stormwater for irrigation over the past two years, given drought conditions.

Cienega Creek

Located in eastern Pima County, Cienega Creek continues to show the impacts of sustained drought and shifts to seasonal patterns of flow. Pima Association of Governments’ (PAG) reporting depicts the localized drought impacts on a shallow groundwater-dependent system and designated Outstanding Arizona Water, 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 and its partners have monitored the 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 represent the minimum extent of perennial flow within a year. In June 2021, PAG recorded 0.641 miles of flow in the monitored stretch of Cienega Creek, about 37% less flow than was recorded in June 2020, demonstrating increased drought impact. This is a record low, at only 7% of the 9.5-miles that flowed perennially and throughout the monitoring area in 1985, revealing severe long-term impacts. In addition, record low flows for each quarter were observed during the monitoring year (July 1, 2020 - June 30, 2021), three of which were under one mile of flow. Flow extents under one mile were previously only observed in June 2013, 2014 and 2015. 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 2021.

There was no baseflow in the monitored stretches of Davidson Canyon, a major tributary to Cienega Creek, in June 2021. In addition, Davidson Canyon was dry upstream of Interstate 10 (I-10) all four quarters. This was the first monitoring year in which this upper stretch of Davidson Canyon was dry on all monitoring dates. In both December 2020 and March 2021, one small, isolated pool was observed in lower Davidson Canyon, upstream of the confluence with Cienega Creek. Different precipitation and groundwater recharge regimes impact Davidson Canyon and Cienega Creek, contributing to a balance of sustained flows in Cienega Creek.

Environment

Drought impacts on Saguaroos and other desert vegetation were reported during winter and spring. A soft feather puppus grass invasion and resurgence of buffel grass have been observed in the Tortolita Mountains and other areas following the monsoons.
Municipal Water Demand

Water providers reported increased water demand during winter and spring and decreased demand once the monsoon season began.

Drought Response Actions

Pima County continues to adhere to its policy framework regarding water resources and drought management. This framework includes 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 Resources Asset Management Plan
- Strategic Plan for Use of Reclaimed Water
- Sustainable Action Plan for County Operations
- Drought Response Plan and Water Wasting Ordinance

The Lower Santa Cruz River Management Plan (LSCRMP) is purposed to develop a management strategy to balance flood risk management, drainage infrastructure protection, water recharge, recreation opportunities, and riparian habitat preservation for the Santa Cruz River from Grant Road to Trico Road. This multi-benefit project will maximize the recharge of effluent within the channel. Stakeholder comments have been received, and responsible parties are collaborating on a task list.

Pima County is participating with the Bureau of Reclamation in a five-year study of the Lower Santa Cruz River Basin (LSCRB). The in-kind study offers Bureau 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 imbalance and climate change.

As of now, the region’s water providers and other entities with established drought plans are at Drought Stage 1 or its equivalent (voluntary reductions). Pima County remains at Drought Stage One.

Summary

Pima County had a minimal summer monsoon in 2020, leading into a hot and dry fall. Dry conditions continued through the winter and spring, leading into the summer 2021 monsoon season. In July 2021, the significant monsoon activity reversed short-term drought conditions, and above-average precipitation in August contributed to a surplus Water Year. While short-term drought conditions have improved substantially, long-term drought improvement is lagging, and the upcoming fall and winter seasons are expected to be entering a La Niña phase.

###