



Submitted to the Arizona Governor's Office
November 25, 2014



PROTECTING
ARIZONA'S WATER SUPPLIES
for ITS NEXT CENTURY

2014 Arizona Drought Preparedness Annual Report

Acknowledgements

The *Arizona Drought Preparedness Plan* was adopted in 2004 and its continued implementation ordered in 2007 (EO 2007-10). The 2014 Annual Report covers the drought conditions and preparedness activities for the 2014 water year, from October 1, 2013 through September 30, 2014. The Arizona Department of Water Resources acknowledges and thanks the State Drought Monitoring Technical Committee and the Local Drought Impact Groups for their contributions to this report.

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1. Introduction

Arizonans, along with others in the Southwest, are confronting the challenges of the ongoing 15 year drought. While the state as a whole is not currently facing an immediate water crisis, long term drought is impacting water supplies in some areas. In September 2013, Lake Mead reached its lowest level since Hoover Dam was constructed in the 1930s. In southeastern Arizona, some communities experienced wells going dry. Every county had United States Department of Agriculture disaster designations due to drought this water year. Although enhanced chances for above normal winter precipitation could help alleviate short-term drought conditions, extended years of normal or above normal precipitation are needed to alleviate the long-term moderate drought conditions experienced over most of the state. Given the long term and current drought conditions, Arizona’s drought preparedness plan activities continue to provide a framework to monitor drought, improve understanding of drought impacts, and determine mechanisms for limiting future vulnerability.

2. Drought Status Summary

A. Winter Precipitation: October 2013 – April 2014

The winter of 2013 (Figure 1) was the 3rd consecutive dry winter in Arizona. The winter of 2014 was even drier throughout the state (Figure 2). Fortunately, 2014 was wetter in the upper Colorado Basin than the previous two winters. Until April, even the upper Colorado Basin was experiencing its 4th consecutive dry winter, but late winter storms brought some relief. Typically the dry winters correspond to a La Niña circulation pattern, which keeps winter storms well north of Arizona. However, the winter of 2014 was a neutral year, which turned out to be quite dry for Arizona, exacerbating already dry conditions. Virtually the entire state received less than 70% of normal precipitation, and the southeastern and southwestern counties received less than 50% of normal.

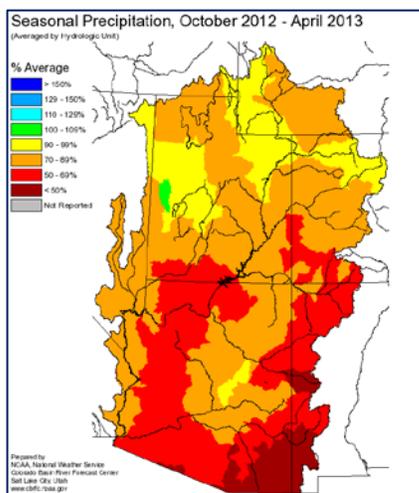


Figure 1. Precipitation Oct 2012 – Apr 2013.

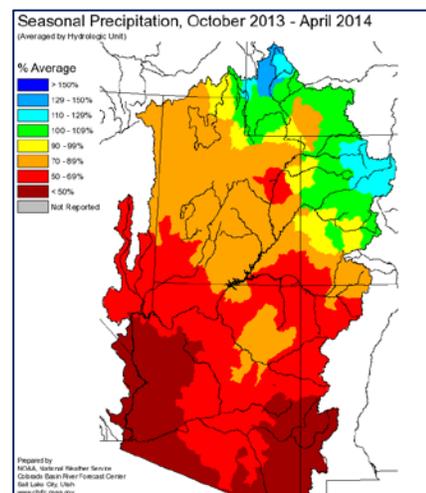
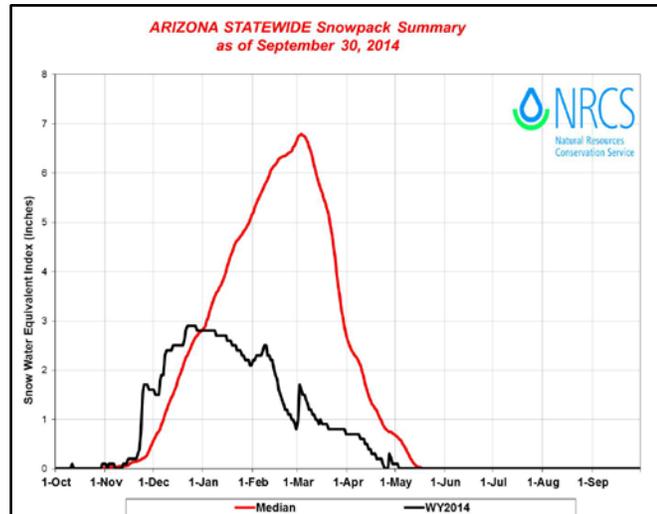


Figure 2. Precipitation Oct 2013 – Apr 2014.

Snow accumulation during the winter season was below normal across the State. While major storms early in the season brought the snowpack to above normal levels through mid-December, snow water equivalent levels for the remainder of the season remained well below the 30-year median.

Figure 3. 2014 Snowpack Summary According To Data Collected From The USDA Natural Resource Conservation Service.



B. Monsoon Precipitation: July – September 2014

Both the 2013 and 2014 monsoon seasons were much wetter than normal (Figures 4 and 5). By contrast, the 2013 monsoon was wettest across northern and western Arizona, with Santa Cruz, San Pedro, and Bill Williams watersheds receiving near average precipitation. This past summer, central and southern Arizona were the wettest areas, largely due to a series of tropical storms that brought copious amounts of moisture into southern Arizona, causing widespread flooding to the Phoenix area as well as to Nogales, Douglas and other southern communities. The wet conditions may be attributed to extremely warm waters off the coast of Mexico as a precursor to El Niño development. (El Niño has not yet fully developed, as of autumn 2014.) The hurricanes that developed off Mexico tended to move north along the coast, and the southeasterly flow brought the moisture into the state. 2014 saw three very significant precipitation events, including moisture associated with tropical storms Norbert and Odile, impacting Arizona. The precipitation events were unusual in that they all had a 500-year or greater return interval, so they were larger than would normally be expected. The result of the monsoon was summer rainfall exceeding the 95th percentile in many watersheds.



Figure 4. Precipitation Jul - Sep, 2013

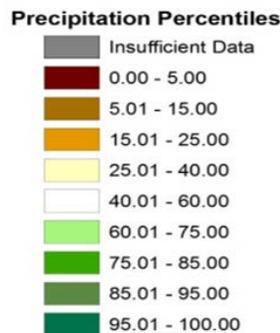


Figure 5. Precipitation Jul - Sep, 2014.

C. Drought Index Wells

Two ADWR groundwater index wells located in the southeastern part of the state have been identified as meeting criteria for drought index wells. Drought index wells serve as a qualitative supplement to existing drought indicators and help establish drought status for watersheds where either precipitation or stream flow data are lacking. USGS Climate Response Network observation well criteria can be found at [USGS Groundwater Watch](http://www.usgs.gov/ClimateResponseNetwork/groundwater/index.html).

– Lower San Pedro Watershed Groundwater Index Well

The 2014 groundwater level trend for the Lower San Pedro transducer well site (**Figures 6 and 7**) continues to correlate with long-term drought conditions showing an overall decline in water levels, although seasonality patterns similar with previous years are observed. Annual fluctuations are observed with increases in water levels typically during summer precipitation events. Continuous water level monitoring began in June 2007 with a depth to water (DTW) below land surface (bls) of 32.21 feet (ft). Since this time, a spike in water levels was observed on September 20th 2014 to 26.23 ft bls, which is the highest water level recorded at this well by continuous monitoring (previous high of 29.11 ft bls recorded on August 7th 2007). The lowest DTW was also recorded this past year on July 4th 2014 at 33.89 ft bls (previously maximum DTW recorded on July 4th 2013 at 33.85 ft bls).

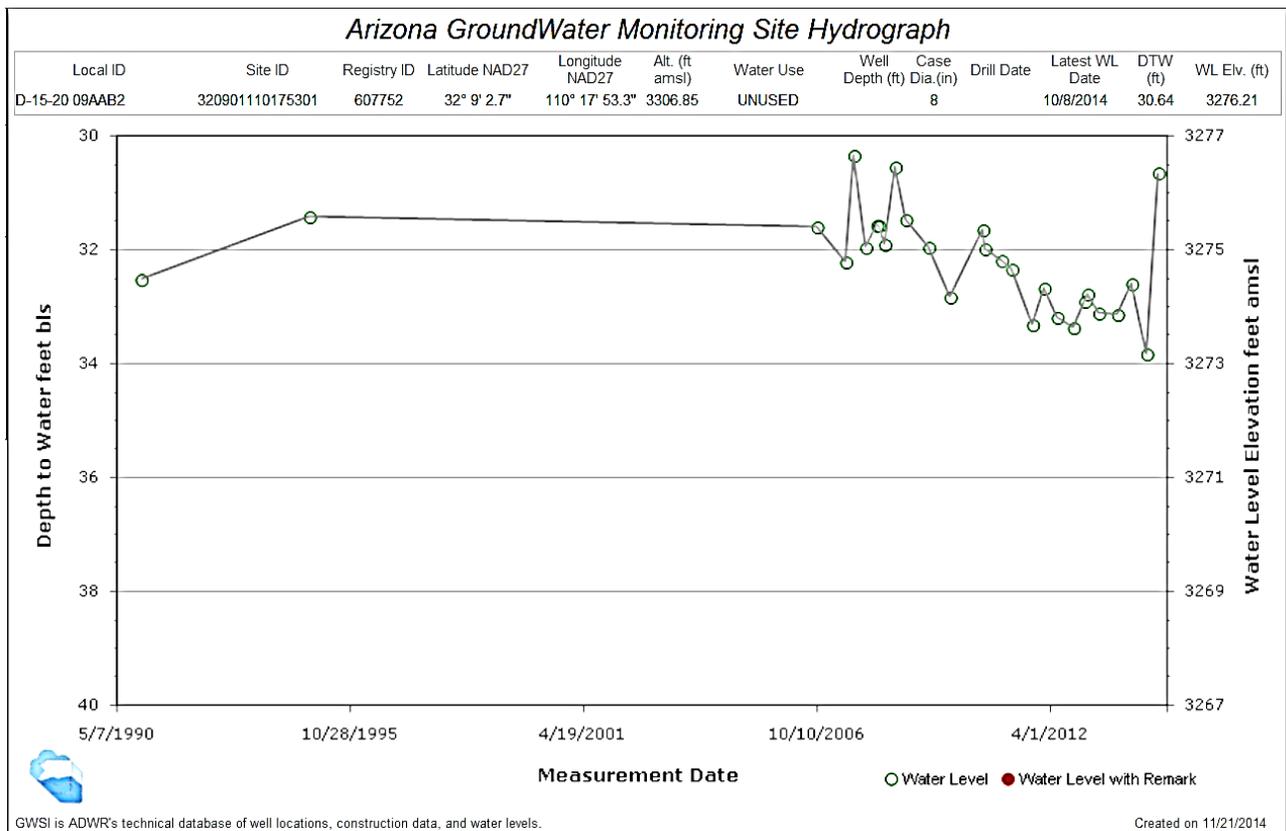


Figure 6. Discrete Groundwater Levels for Drought Index Well in the Lower San Pedro Watershed (D-15-20 09AAB2).

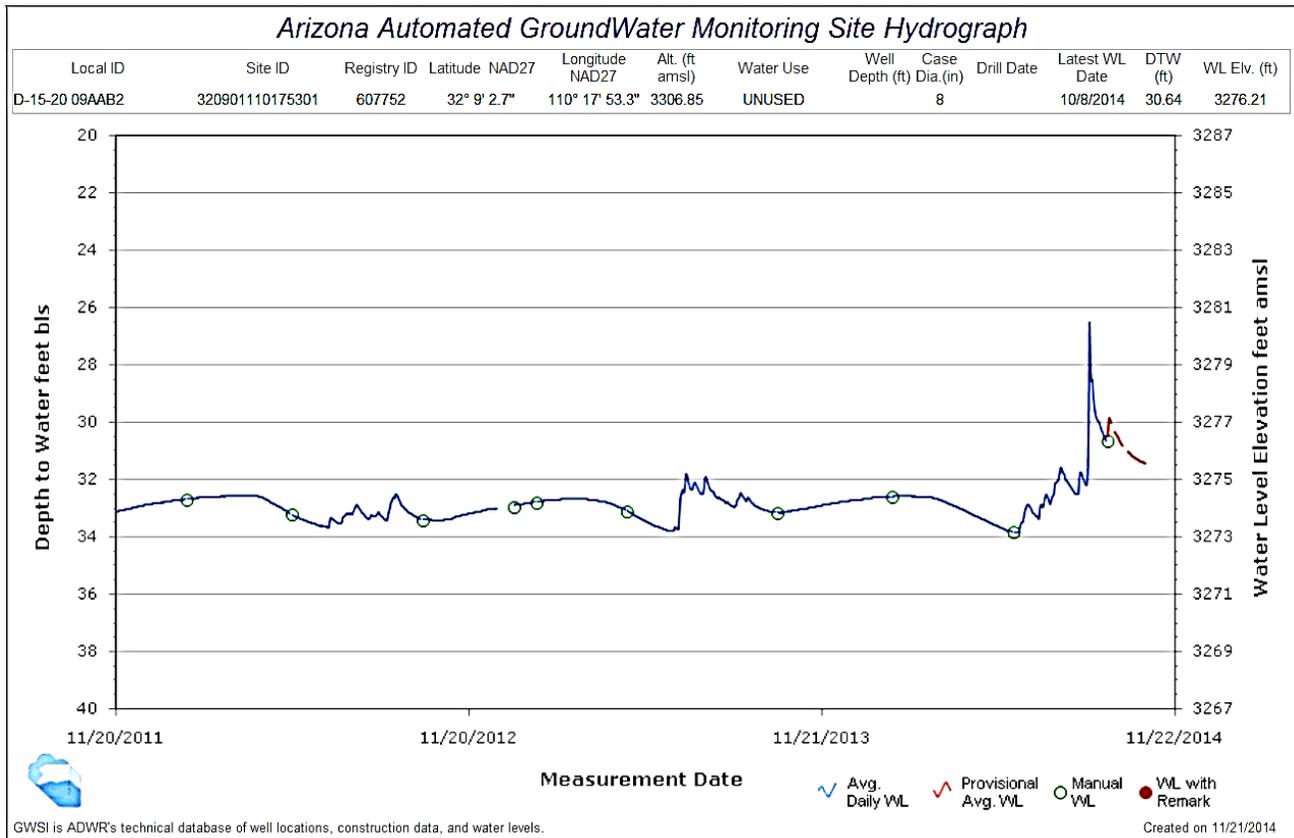


Figure 7. Daily Groundwater Levels for Drought Index Well in the Lower San Pedro Watershed (D-15-20 09AAB2).

– Whitewater Draw Watershed Groundwater Index Well

Continuous water level monitoring began in April 2009 with a DTW bls of 4.76 feet (ft). Since this time, the highest water level recorded was on October 5th 2014 at 2.54 ft bls, while the lowest DTW at this site was recorded on September 13th 2012 at 18.35 ft bls. Groundwater levels at the Whitewater Draw transducer site generally declined gradually through the year from 3.08 ft bls on October 15th 2013 to a yearly low of 7.81 ft bls on July 9th 2014. During the year, two significant spikes in water levels correlated with precipitation events in July and September, as indicated by the hydrographs in **Figures 8 and 9** and the Leslie Creek streamgage station, USGS 09537200. Each contributed to significant water level recovery in the well and correlate with improvements in long-term drought conditions in SE Arizona from extreme to moderate.

Arizona GroundWater Monitoring Site Hydrograph

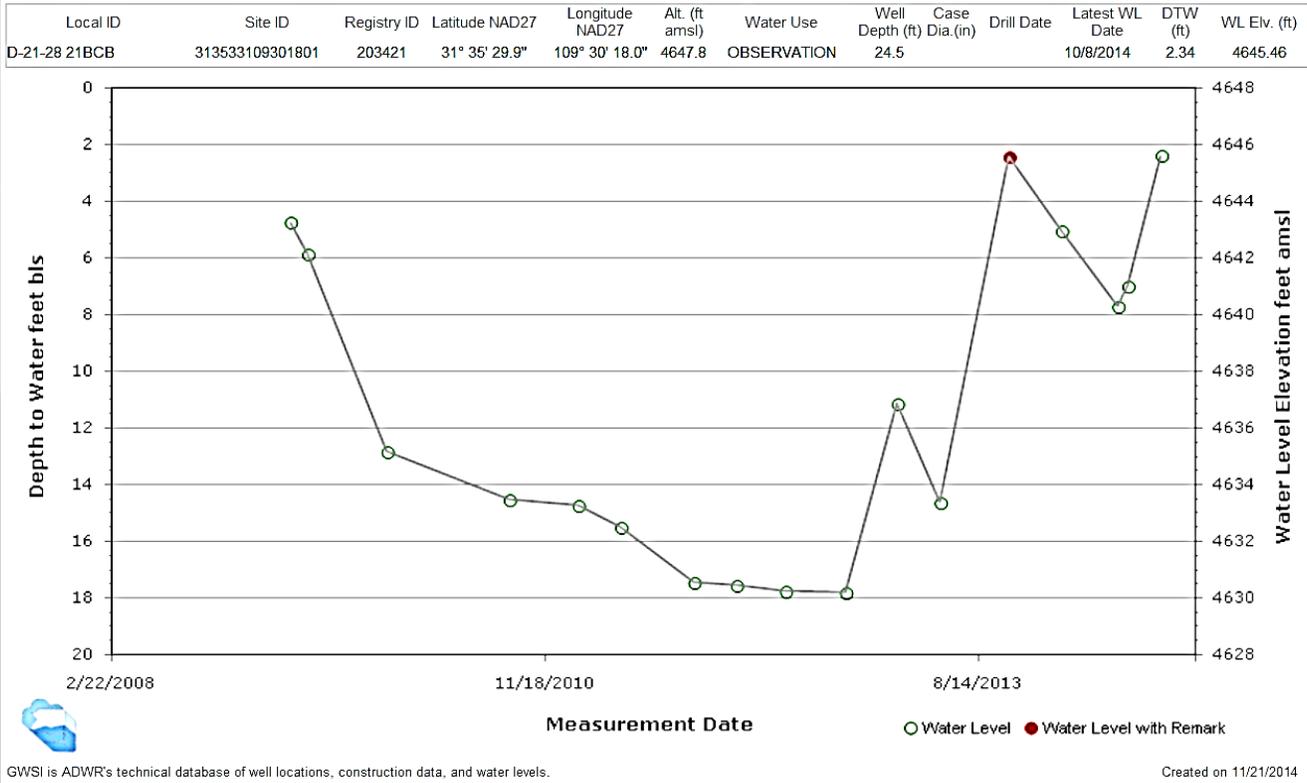


Figure 8. Discrete Groundwater Levels for Drought Index Well in the Whitewater Draw Watershed (D-21-28 21BCB).

Arizona Automated GroundWater Monitoring Site Hydrograph

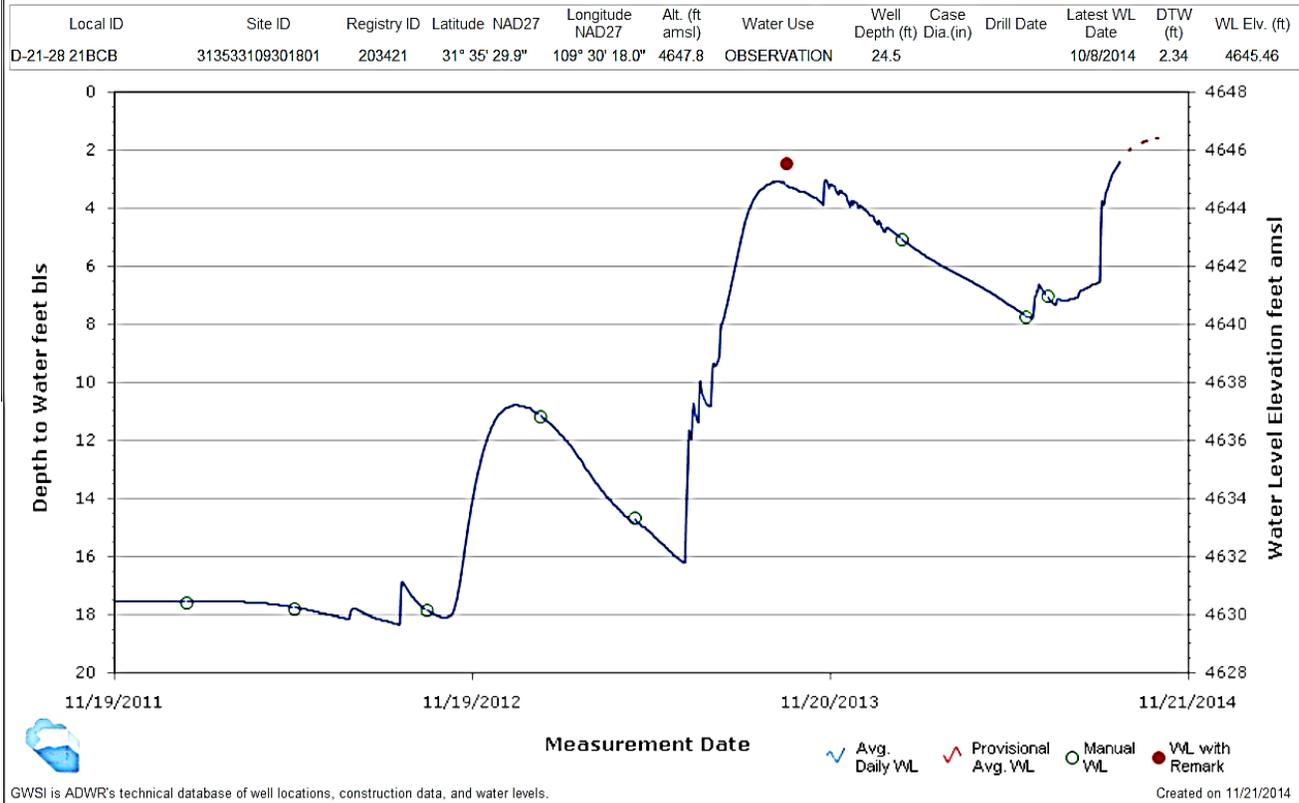


Figure 9. Daily Groundwater Levels for Drought Index Well In the Whitewater Draw Watershed (D-21-28 21BCB).

D. Cumulative Precipitation and Streamflow Summary

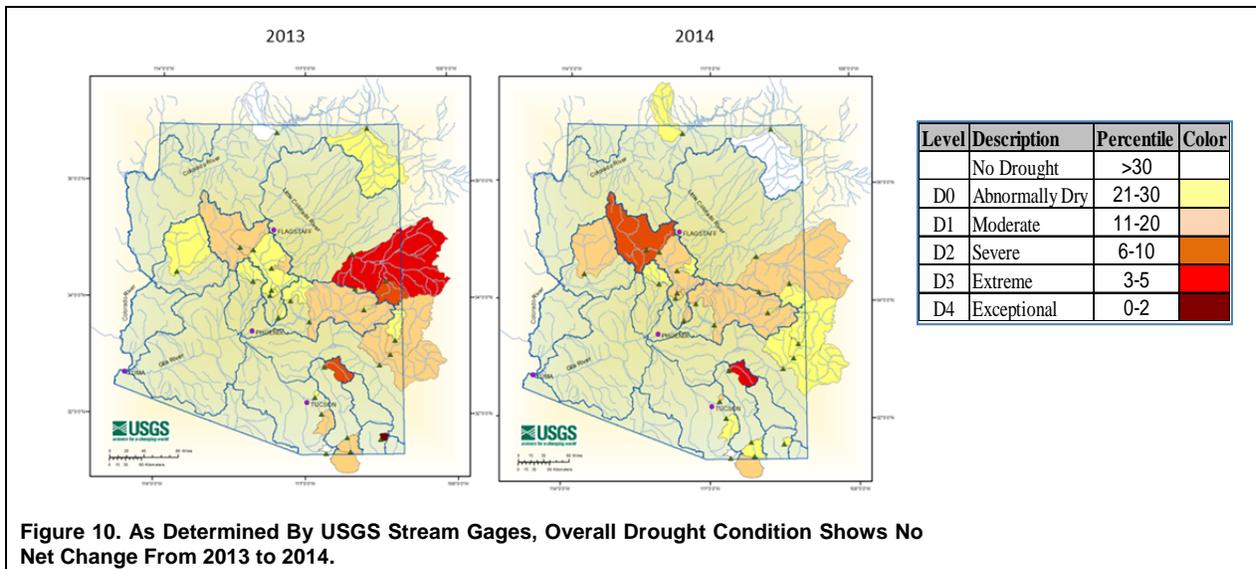
– Cumulative Precipitation

Cumulative precipitation for Water Year 2014 was below normal throughout the mountainous areas of Arizona, ranging from a low of 75 percent of average in the San Francisco-Upper Gila River Basin to a high of 80 percent of average in the Verde River Basin (**Table 1**).

<i>Major Basin</i>	<i>Percent of 30-year Average Precipitation</i>
Salt River Basin	79%
Verde River Basin	80%
San Francisco-Upper Gila River Basin	75%
Little Colorado River Basin	76%

– Streamflow Summary

Drought status, as indicated by streamflow data, shows a slight increase in the number of basins that increased in drought severity, but an overall decrease in severity for the state from 2013 to 2014. Shifts in drought status within basins did so by only one or two drought categories. Out of the 26 basins, five remained at the same level, nine decreased, and eleven increased in drought intensity. Winter and spring streamflow were significantly below normal in 2014 due to the lack of snowpack and subsequent snow melt. This impact to streamflow carried into late summer until the Monsoon season began. During the summer and fall, streamflow increased to above normal conditions due to the heavy precipitation from the wide spread tropical storms referenced above.

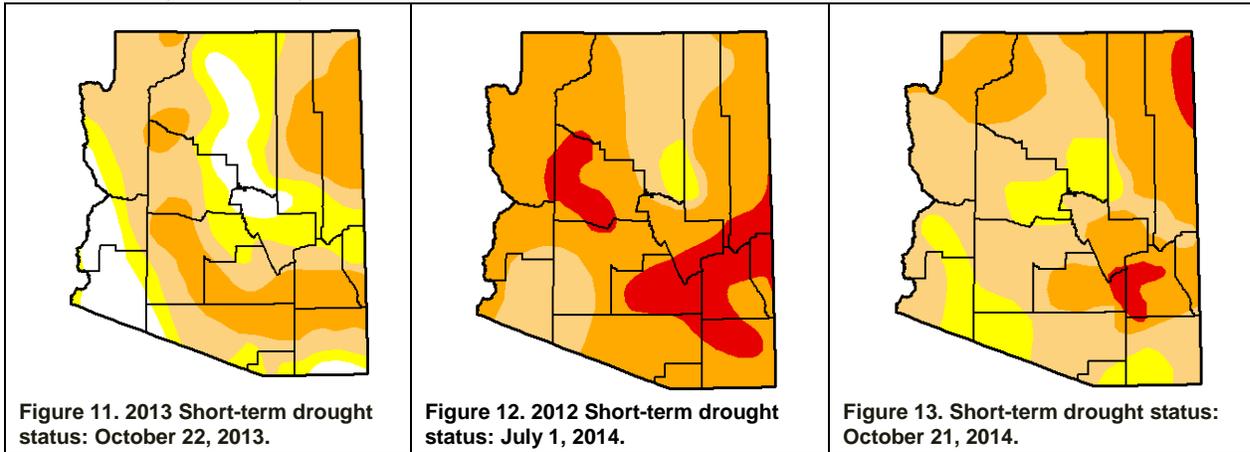


E. Drought Status Changes

Arizona's drought status is continually monitored and updated. The short-term drought status is updated weekly and monthly. Long-term drought status is seasonally updated at the end of each quarter.

– *Short-term Drought Status*

Due to the dry winter, the current short-term drought (**Figure 13**) is significantly worse than a year ago (**Figure 11**). However, the current status is significantly better than pre-monsoon conditions this year (**Figure 12**). A year ago, much of Yuma County and north central Arizona were not in a drought condition, and there were no areas of extreme drought. By the onset of the summer of 2014, almost all of the state was in moderate drought or worse, with extreme drought in much of southeast Arizona. A very wet monsoon alleviated the short term drought conditions, particularly in western and central Arizona.



– *Long-term Drought Status*

For the long-term, 2014 brought some drought relief to White Water Draw and the San Simon watersheds in southern Arizona, bringing them out of extreme drought, and eliminating extreme and exceptional long-term drought conditions from the state. The lower Colorado area of La Paz County transitioned out of drought completely. However, drought conditions worsened in the Santa Cruz and Bill Williams watersheds, moving from moderate to severe drought. The Salt River Watershed shifted from abnormally dry conditions to moderate drought. Overall the state long-term drought conditions have improved, in large part due to the heavy summer rainfall. However, as of the end of October 2014, most of the state continues to be in a moderate, or worse, drought condition. The number of watersheds in each drought category as of October 2013 (**Figure 14**) and October 2014 (**Figure 15**) can be seen in **Table 2**.

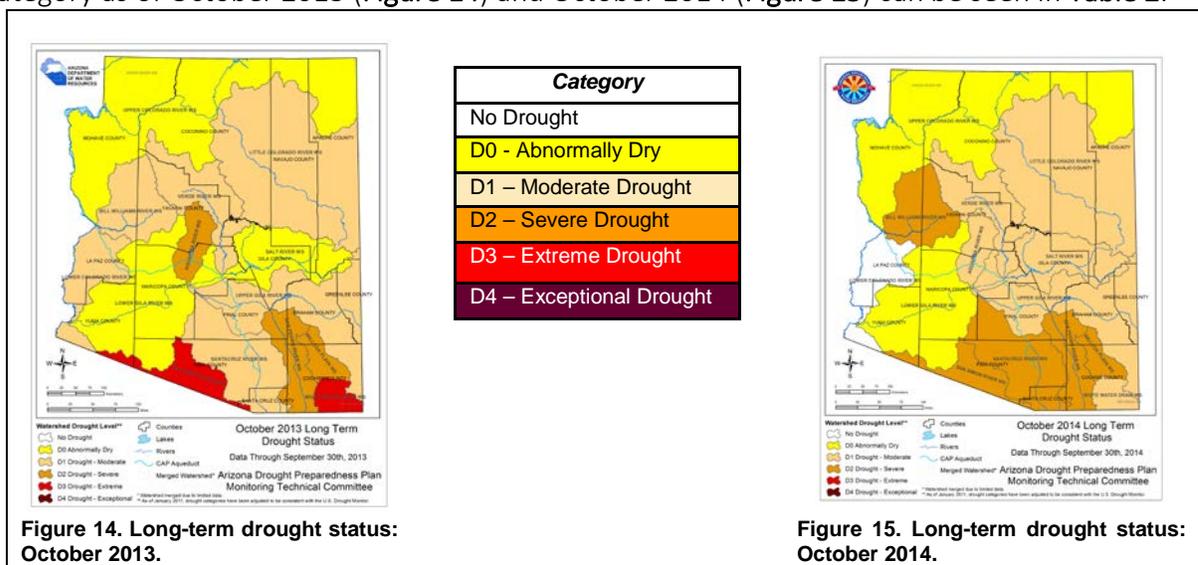
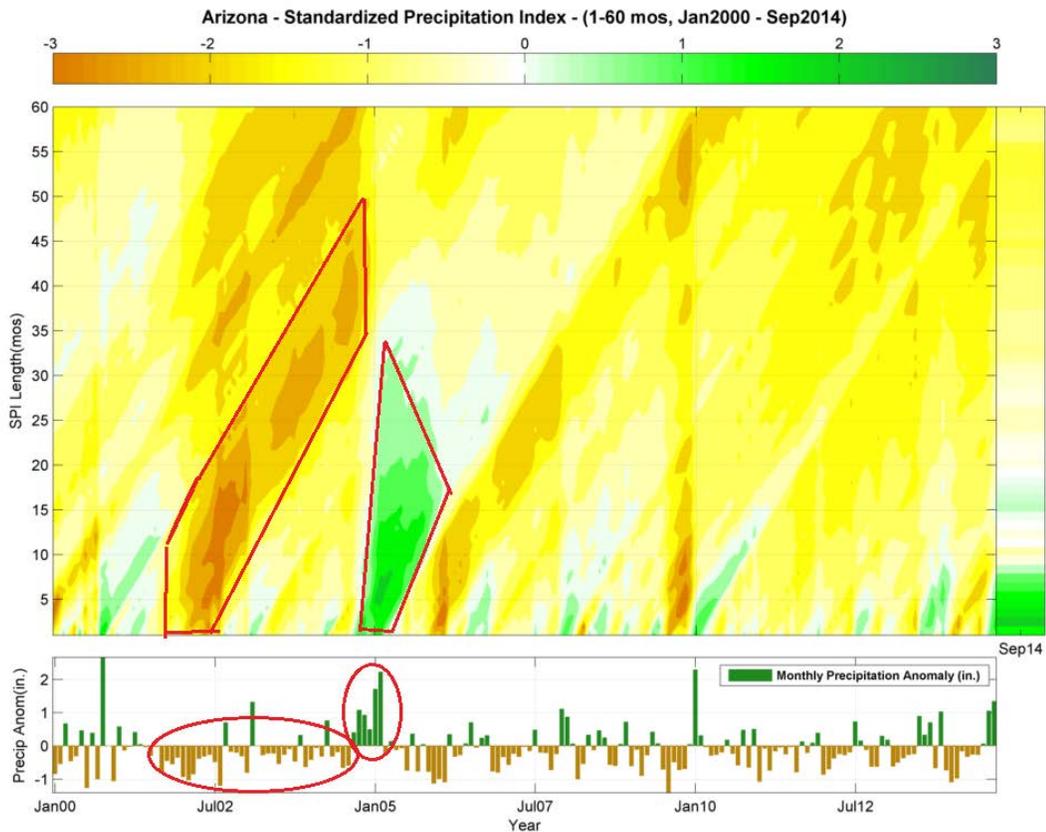


Table 2. Number of Watersheds in Each Drought Category			
Category	2012	2013	2014
No Drought	0	0	1
D0 - Abnormally Dry	2	3	2
D1 - Moderate Drought	7	6	7
D2 - Severe Drought	3	3	5
D3 - Extreme Drought	3	3	0
D4 - Exceptional Drought	0	0	0

The [Standardized Precipitation Index](#) (SPI) graph in **Figure 16**, below, shows the changes in drought over time, Short-term drought conditions (0 – 15 months) are at the bottom and longer term drought conditions (48 – 60 months) are near the top. The bottom bar graph below shows the monthly anomalies with green being wetter than average and brown being drier than average.

The brown areas on the SPI Index Graph move up and to the right, showing extended drought through time. The longer the dry period continues, the more intense the drought and the farther the brown area extends toward the top of the graph. When a brief wet period follows, it impacts the short-term drought conditions, but does not immediately change the extended drought, as indicated near the top of the graph.



Climate Science Applications Program
University of Arizona Cooperative Extension
<http://cais.arizona.edu/climate>

Data source: NOAA National Climatic Data Center
<http://ftp.ncdc.noaa.gov/pub/data/cirs/climdiv>
Base Period= 1900-2014 Date created: 17-Oct-2014

Figure 16. Standardized Precipitation Index for Arizona, January 2000 - September 2014

Note that 2002 was our driest year in the past 14 years, with a brief wet period around 2005. The most recent September wet period can be seen at the far right. For more information about how the graph can be used to correlate precipitation and drought impacts, visit the Climate Science Application Program website at <http://cals.arizona.edu/climate/misc/spi/spicontour.png>.

F. Outlook for 2014- 2015

– *Winter 2014-2015* (Figure 17)

Sea surface temperatures across the central and eastern equatorial Pacific Ocean (a proxy for El Niño/La Niña) have been slowly warming through the spring and summer months. There is a 55-60% chance of El Niño conditions fully developing during the late fall and winter months, however the most likely outcome is for only a weak El Niño event. Generally, weak El Niño events have little predictable influence on weather across the southwest United States.

The official outlooks from NOAA’s Climate Prediction Center depict the chances of temperatures and precipitation being in the above normal, near normal, or below normal categories. The outlook for January-March 2015 shows near equal chances for above, below, or near normal temperatures, with better chances for cooler than normal weather to the east of Arizona and warmer than average west of Arizona. The precipitation outlook shows enhanced chances for precipitation to fall in the above normal category. This precipitation outlook is supported by climate models which have historically displayed skillful forecasts for the region and a shift in the Pacific Decadal Oscillation measure from negative to positive which, in conjunction with an El Niño phase can lead to wetter than typical winter weather in the Southwest United States.

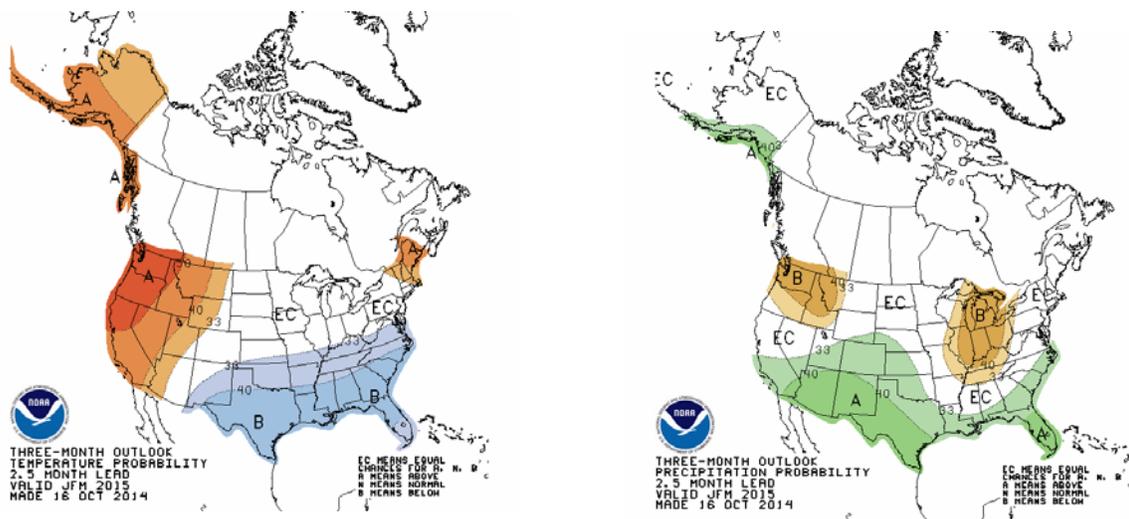


Figure 17. Climate Prediction Center outlooks for temperature (left) and precipitation (right) for January – March 2015. Shading indicates the percentage increased chances of being above or below normal.

– *Summer 2015* (Figure 18)

The Climate Prediction Center’s outlook for June-August 2015 shows much better chances that the average temperature during these three months will be above normal statewide. This outlook is based primarily in recent trends over the past 10 years versus the longer term 30-year average. The precipitation outlook shows no discernible signal during this period. That is, there are equal chances for the 2015 monsoon season to have above, below, or near normal rainfall. This is very typical for our monsoon season where thunderstorm activity can be

localized, and is not influenced by larger scale climate signals (the most likely outcome is for El Nino to become neutral by summer 2015).

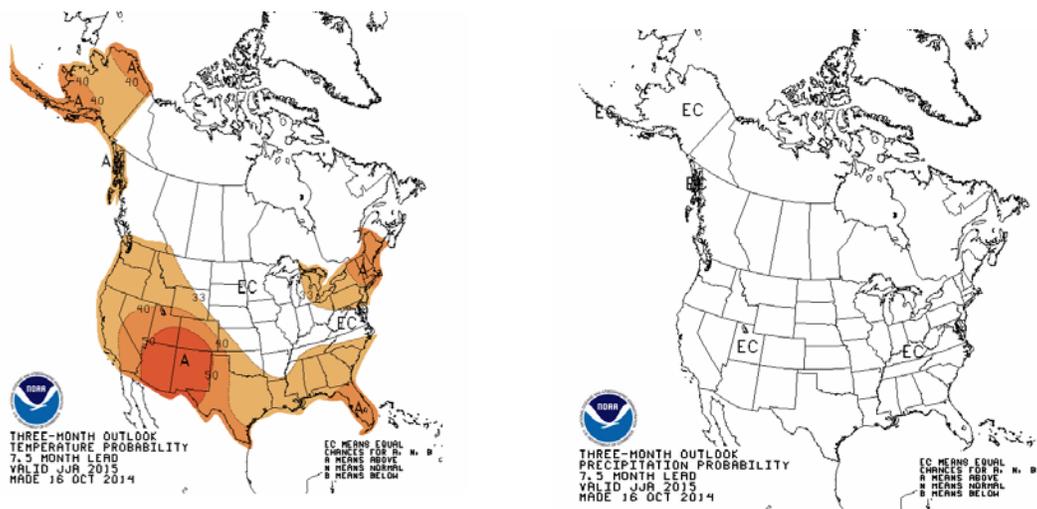


Figure 18. Climate Prediction Center outlooks for temperature (left) and precipitation (right) for June – August 2015. Shading indicates percentage increased chances of being above or below normal.

3. Drought Declarations and Designations

A Drought Emergency Declaration has been in effect in Arizona since 1999. The current declaration, PCA 99006, issued by the Governor in June 1999, was continued by Executive Order 2007-10. The Drought Interagency Coordinating Group is responsible for recommendations to the Governor about drought declarations. The declaration maintains the state’s ability to provide emergency response if needed, and enables farmers and ranchers to obtain funding assistance through the Farm Service Agency if they experience significant production losses due to drought.

A disaster designation from the Secretary of the U.S. Department of Agriculture (USDA) is necessary for farm operators in both primary and contiguous disaster areas to be considered for assistance from the Farm Service Agency. The USDA uses the U.S. Drought Monitor to help determine designations. Extreme (D3) or Exceptional (D4) drought conditions qualify as automatic designations, while severe (D2) drought for eight consecutive weeks during the growing season qualifies for nearly automatic designation. This “Fast Track” authority designation process delivers fast and flexible assistance to farmers and ranchers.

The following disaster designations by the U.S. Department of Agriculture occurred this water year:

- January 15, 2014: Two counties were named as contiguous disaster counties -- La Paz and Mohave, which was a result of the designation of Riverside County in California and Clarke County in Nevada.
- February 26, 2014: Six counties were designated primary disaster counties: Cochise, Pima, Gila, Pinal, Graham and Maricopa. One county designated as contiguous disaster county: La Paz, which was as a result of the designation of Riverside and Imperial County in California.
- March 26, 2014: Santa Cruz County was designated a primary disaster county and Cochise and Pima were designated as contiguous counties.

- April 9, 2014: Two counties were named as contiguous disaster counties -- La Paz and Yuma, which was the result of the designation of Riverside and Imperial counties in California.
- April 16, 2014: One county was designated a primary disaster county: La Paz -- which was the result of four contiguous disaster counties: Maricopa, Mohave, Yavapai and Yuma.
- April 23, 2014: One county was named as a contiguous disaster county -- Mohave, which was the result of the designation of Clarke County in Nevada.
- July 2, 2014: One county was named as a contiguous disaster county -- Apache, which was the result of the designation of Montezuma County in Colorado.
- July 9, 2014: One county was designated a primary disaster county: Yuma -- which was the result of three contiguous disaster counties: La Paz, Maricopa and Pima.
- September 17, 2014: Two counties were designated as contiguous disaster counties -- La Paz and Mohave, which was the result of 42 disaster counties in California.

4. Drought Preparedness Plan Implementation Highlights

A. Drought Planning for Community Water Systems

Since 2006, Arizona’s approximately 800 community water systems have been required to submit a drought plan to ADWR every five years. The drought plans are designed to reduce local drought vulnerability and provide a means for the state to gather water-use data. The drought plan is part of the required System Water Plan, which also includes a water supply plan and a conservation plan. The drought plan asks water systems to describe their drought stages and triggers, emergency sources of water, customer communication strategies, and other planning actions. ADWR provides assistance to water providers in meeting these requirements through web-based resources, online reporting tools and phone or in-person consultations. The most recent fact sheet, scheduled to be posted on the ADWR website in December 2014, is “Emergency Sources of Water---What You Should Know.”

For calendar year 2013, 378 out of 477 (79%) annual reports were received from community water systems outside the active management areas. Five-year updates to the system water plans were received from 382 out of 753 (51%) water providers both inside and outside the active management areas. The following emergency sources of water were described in the drought plans submitted:

- 179 - haul water
- 131 - use backup well
- 100 - utilize interconnection
- 99 - provide bottled water
- 42 - drill new well
- 33 - other
- 60 stated that they do not have a backup supply

Most of rural Arizona relies exclusively on groundwater as its primary water source and lacks the groundwater regulations and conservation requirements present in the state’s active management areas. This can result in water supplies being more stressed in some areas of rural Arizona. For example, on May 12, 2014, the Associated Press reported the following:

- Safford has been under strict water restrictions since February 2013, with the aim of reducing usage by 30 percent. Residents cannot refill swimming pools or spas, plant new grass or install sod. Watering outdoors is limited to twice weekly. Water at restaurants comes upon request only.
- Williams, imposed its most severe water restrictions earlier this year. They prohibit outdoor watering and washing cars with potable water. The city also stopped issuing building permits for new development because water is scarce.
- The town of Payson has set a goal for each resident to use no more than 89 gallons of water per day.

Additionally, ADWR has received reports of wells going dry in the southeastern parts of the state. In response to these reports, ADWR Field Services staff will be conducting detailed basin sweeps of water level conditions throughout those areas. Widespread cooperation of local well owners will improve the effectiveness of this data collection effort.

Recent studies have identified the potential for a long-term imbalance between available water supplies and projected water demands developing over the next 100 years if no action is taken. In January 2014, the Arizona Department of Water Resources released “Arizona's Next Century: A Strategic Vision for Water Supply Sustainability”(Appendix C), which provides a comprehensive water supply and demand analysis for Arizona and creates the framework for addressing future water supply challenges. Over the next 25 to 100 years, Arizona will need to identify and develop additional water supplies to meet projected growing water demands. While there may be viable local water supplies that have not yet been developed, water supply acquisition and importation will be required for some areas of the state to supply these projected demands. http://www.azwater.gov/AzDWR/Arizonas_Strategic_Vision/

B. Local Drought Impact Group Efforts

Local Drought Impact Groups (LDIGs) participate in monitoring, education and local mitigation, mainly through cooperative extension and county emergency management programs. Initial planning efforts included ten LDIGs, and as many as eight LDIGs have been active in the past. Since 2008, LDIG focus has been entirely on drought impact monitoring and reporting in response to local fiscal and staffing limitations. At the present time, only Mohave County and Pima County are active. See **Appendix A** for the Mohave County LDIG report and **Appendix B** for the Pima County LDIG Report.

C. State Drought Monitoring Technical Committee Efforts

The State Monitoring Technical Committee (MTC) is responsible for gathering drought, climate, and weather data, and disseminating that information to land managers, policy-makers and the public. Specifically, the MTC prepares the short and long-term drought status reports, briefs the ICG on drought conditions, and provides assistance to Local Drought Impact Groups (LDIGs).The two co-chairs are Nancy Selover, State Climatologist and Mark O’Malley, National Weather Service Phoenix Office.

– Communicating Drought Status

The MTC and ADWR coordinate to achieve the primary goal of improving the accessibility of drought information to resource managers, state decision-makers and the public. To further communication, information is updated on the ADWR Drought Status webpage on a weekly, monthly and quarterly basis as follows:

Weekly - The MTC confers weekly to advise the U.S. Drought Monitor authors on the current conditions in Arizona, and makes recommendations about the position of the drought boundaries for Arizona. The U.S. Drought Monitor is the official record of drought for Federal drought relief claims. Information used by the MTC in advising the Drought Monitor authors includes numerous drought indices, precipitation and stream flow data, and impacts data. Every Thursday, the [ADWR Drought Status webpage](#) automatically updates with the latest U.S. Drought Monitor map of Arizona.

Monthly - At the end of each month, the MTC produces a web-based, short-term drought status update based on U.S. Drought Monitor's maps for the past four weeks. An email with the latest map and summary is sent to interested parties.

Quarterly - The MTC meets on a quarterly basis and produces a long-term drought status map and summary report. This report incorporates the 24-, 36- and 48-month precipitation and streamflow percentiles for major Arizona watersheds (i.e., 4-digit U.S. Geological Survey Hydrologic Unit Code (HUC)). Vegetation indices, snowpack, temperature, reservoir levels, and county-scale drought impact information are used to verify or modify the result of the calculations. The long-term drought status reports are posted on the ADWR website and disseminated via email seasonally: in May (for January – March), August (for April – June), November (for July – September) and February (for October – December.)

The monthly and quarterly reports serve as an information resource for the public and as a planning tool for resource managers developing mitigation and response strategies.

– Arizona DroughtWatch and the new Arizona DroughtView

Arizona DroughtWatch was an experimental program designed to facilitate the collection of drought impact reports submitted through the county-level local drought impact groups across Arizona. Local drought impact reports are critical information to accurately determine drought status and track vulnerabilities to drought across the state. Available funding limited the level of development and period of operation of the initial web tool at <http://azdroughtwatch.org>. A program evaluation determined several strategies to improve the data collection process, including a simplified impact survey and the inclusion of supporting climate and drought information. These elements are being incorporated into a new program called DroughtView, which will replace Arizona DroughtWatch in 2015. This online tool will collect impact and visualize impact information as well as incorporate several remote sensing and climate drought monitoring products (<http://droughtview.arizona.edu>).

– Community Collaborative Rain Hail and Snow (CoCoRaHS) Network

The CoCoRaHS network of citizen precipitation observers in Arizona continues to expand. A drought impacts reporting tool enables the 890 observers in Arizona to efficiently add their drought impact observations to their precipitation observations. An online "Drought Impacts Reporting Guide" explains drought and its impacts, as well as how to report various impacts. Drought data is intended to go directly to the Drought Impacts Reporter. The data collected are important in Arizona's drought monitoring as well as flood warning. In addition to the urban centers in Maricopa (380 observers) and Pima-Pinal counties (303 observers), there are 58 observers in Cochise County, 55 in Yavapai County, and at least one observer in every other county except Greenlee.

– *ADWR Drought Index Wells*

ADWR’s Field Services Section collects groundwater levels statewide from approximately 1,800 index wells, including the state’s two drought index wells. Field Services also maintains a statewide network of roughly 120 automated groundwater monitoring sites and an ORACLE database that contains field-verified data including discrete water level measurements, location, and other well specific information. The Section also collects data for land subsidence studies and aquifer storage monitoring.

– *Calculating the Standardized Precipitation Index*

The MTC will explore the possibility of using gridded data to calculate drought intensity. This will allow the MTC to generate a higher resolution map that does not depend on watershed boundaries. The newly available data is provided by the monthly Standardized Precipitation Index dataset. How quickly this can be accomplished is a resource issue as there have been cutbacks on the State Climate Office.

– *Drought Impact Reports from State and Federal Agencies*

Drought impact data is used by the Drought Monitoring Technical Committee in its efforts to correlate drought conditions with precipitation and streamflow data. Impact information is received from hydrologists, researchers and other field staff from the Bureau of Land Management, United States Geological Survey, U.S.D.A. Natural Resources Conservation Services, Arizona Forestry Division, Arizona Game and Fish Department, Arizona State Parks, Native American Communities and other state and federal groups.

Arizona State Park Managers have been asked to rate drought conditions from 1 to 10 and provide comments for more than 30 individual state parks. Compared to last year, this year saw improvements in most of the ratings, as can be seen in **Appendix D**.

The U.S.D.A. Arizona Natural Resources Conservation Service submits a water year report about the impacts of drought on range and farmland. The 2014 report (**Appendix E**) states that areas impacted by drought reported reduced forage, livestock water shortages, reduced livestock carrying capacity and crop production losses.

– *Funding and Resource Needs*

The MTC has identified the following three funding and resource needs, the second two previously stated in the 2007 through 2013 annual reports:

1. **Use gridded precipitation data to create gridded SPI maps and a gridded drought status map, using the same calculations for drought status currently used for watershed level mapping.** The gridded maps will provide smoother transitions across the state rather than the abrupt watershed boundaries. The results should be more reflective of the DM maps and will facilitate internal decision making. Even though drought declarations may be made at the county level, the higher resolution data will provide better information about which parts of individual counties are having the worst drought problems.
Estimated cost: \$7,500

2. **Development of a strategic plan to identify data gaps and monitoring needs.** Arizona's current network of meteorological and hydrological observations for drought monitoring lacks sufficient spatial resolution to accurately characterize drought status at the local

level requested by stakeholders throughout the state. Improving the spatial, temporal and altitudinal resolution of Arizona's drought monitoring network will improve the Committee's ability to serve the needs of Arizona stakeholders, including the local drought impact groups. In particular, Arizona faces the following conspicuous data gaps:

- Complete lack of soil moisture monitoring
- Few high elevation meteorological monitoring stations
- Constantly decreasing network of streamflow gages

Although the MTC has identified these data gaps in general terms, it is imperative to conduct a systematic evaluation in order to characterize and prioritize these identified data and observation gaps. A strategic plan, with carefully considered criteria for prioritization, is essential for making state funding requests and for taking advantage of Federal funding opportunities. The MTC recommends funding to develop a strategic plan, conduct data and observation gap analyses, and document priority locations using geographic information system technology. *Total cost: \$9,000*

3. **Incorporation of groundwater data for drought status determination.** ADWR evaluates groundwater level changes around the state, however, further analysis is needed to determine what role drought plays in these observed changes. Drought index wells serve as a qualitative supplement to existing drought indicators and help establish drought status for watersheds where either precipitation or stream flow data are lacking. The Basic Data Unit of the Field Services Section is exploring the use of groundwater data in a more quantitative manner, perhaps by a modified Palmer index. As the groundwater level signature may include influences other than a climate response, such as pumping or artificial recharge, additional research is needed to determine the suitability of each well site with regards to percentile analysis. The MTC plans on further assessment of statewide groundwater index wells to identify and incorporate data that meet the criteria for drought index wells. Incorporating groundwater level trend data will be critical in determining future drought conditions and impacts on water supply. Funding would help support the implementation of a Monitoring Well Network Optimization Plan. *Total cost: \$38,000 per year.*

D. Interagency Coordinating Group Efforts

The Interagency Coordinating Group (ICG) has met biannually since 2006 and advises the Governor on drought status, impacts, and any necessary preparedness and response actions. The meetings include a review of statewide monitoring efforts and drought status, water supply updates, rangeland conditions, forest health, and the impacts of drought on wildlife. At both the November 2013 and May 2014 meetings, the ICG recommended continuation of the state's Drought Emergency Declaration (PCA 99006) and Drought Declaration for the State of Arizona (Executive Order 2007-10). The presentations and subsequent decisions are on the [ADWR web site](#). ICG members contributed information to the Arizona Drought Assistance Matrix, posted on the ADWR drought website in November 2013. This matrix describes the types of drought assistance and resources available from 25 state and Federal agencies. It includes the agency name and link, target audiences, types of assistance and contact information. The types of assistance include financial, technical and educational, as well as support of local level preparation and response.

5. Conservation Program Highlights

ADWR promotes and encourages the wise and efficient use of water throughout Arizona by developing conservation tools and resources, assisting Arizona communities and water providers, collaborating with regional and national partners, and participating in outreach activities. At the current time, one part-time staff member assists in these and other efforts. ADWR assists communities that may be susceptible to drought through its Statewide Planning efforts.

A. Regulations and Assistance

Staff is available to consult with water providers about their required conservation plans or programs. For large providers in active management areas regulated under the Non-per Capita Conservation Program, ADWR offers descriptions of the best management practices, a matrix that matches service area characteristics with best management practices and a list of best management practices applicable to all systems. For small water providers and water systems located outside of the state's active management areas, ADWR offers sample conservation plans, FAQs, and a fact sheet, "Conservation and Drought Planning: how they Work Together".

B. Outreach and Education

Staff is available to provide materials and answer inquiries from the general public, the press, water professionals, students, researchers, and others about water conservation and drought. Each April, ADWR launches Arizona's Water Awareness Month campaign. The 2014 campaign website included "Eye on Drought", a section with useful drought-related tips, resources and activities for the public. In summer 2014, a new conservation website was launched: ArizonaWaterAwareness.com. This spin-off from the Water Awareness Arizona website is a central source of information for all Arizonans about water, submitted by stakeholders from around the state. It includes regional and seasonal tips, resources and activities about a variety of conservation topics, including drought, and offers current content all year long. ADWR has also prepared several conservation fact sheets on topics such as metering, conservation water rate structures, plant watering, and how to start a basic water conservation information program.

In 2014, staff participated in two workshops sponsored by Arizonans for Responsible Water Policy. At the first workshop held in Lake Havasu City, ADWR presented general information regarding Colorado River rights and usage, community water system requirements in the state, and water conservation Best Management Practices (BMPs). At the second workshop held in Flagstaff, ADWR staff presented information regarding water conservation BMPs, community water system requirements in the state, the ADWR Strategic Vision for Water Sustainability, current conditions on the Colorado River and associated drought contingency planning.

APPENDIX A

**Mohave County Local Drought Impact Group
(LDIG)
2014 Annual Report**

Mohave County Local Drought Impact Group Annual Report 2014

Introduction. This report summarizes the Local Drought Impact Group activities conducted in Mohave County in 2014. The established drought monitoring network continued to function efficiently with monitors providing monthly impact information to the County Emergency Management Technician, who compiles and files the report information. The LDIG continues to function as an informal advisory body to the Mohave County Division of Emergency Manager and the County Extension Office.

Status of Drought. As in many areas of Arizona, the 2014 monsoon season and the remnants of two tropical storms provided significantly more precipitation than has been received in many years. Although some areas of the county received more precipitation than others, the overall situation has moderated the drought status (as of early October) to moderate drought in the southern portions of the county, including the Kingman area, and severe drought in the northern part of the county north of the Colorado River. Much of this moderation is expected to be temporary, however, unless significant winter rainfall is experienced.

Drought Impacts. Drought conditions throughout the county were severe to extreme in early spring due to lack of winter precipitation. By April-May, conditions resulted in extremely dry vegetation, high forage loss, and a severe wildfire threat in many areas, which resulted in early imposition of open fire bans by fire districts and the county. Ranchers were hauling water, and lack of available surface water brought wild animals into populated areas. Noticeable erosion occurred due to high winds and low soil moisture. Native drought tolerant plants did not bloom when some rain was received.

Monsoon rainfall began in isolated areas in July and impacted wider areas during August and September. Rainfall was heavy and short lived, creating road damage, and resulted in considerable greening and vegetative growth in many areas, particularly around Kingman and in the Hualapai Mountains.

Due to continued low snowpacks in the Rocky Mountains, the Colorado River has experienced no recovery in streamflow volume, and Lake Mead continues to see water levels fall, with mandatory water conservation measures for jurisdictions that tap into the river likely to be implemented in 2015. This potentially impacts Lake Havasu City, Bullhead City, and unincorporated areas south of Bullhead City. The populated areas from Wikieup north through Kingman and the Hualapai Mountains and extending northwards to the Arizona Strip and Colorado City are dependent on monsoon and winter rainfall and aquifers generally not associated with the Colorado River.

Drought Related Actions. No drought response or mitigation measures are currently in effect. The Mohave County Alert Flood Warning System, which has expanded to 172 weather stations across the county, continues to provide near real time precipitation and stream flow information. Valuable impact information continues to be provided by the BLM, State Game and Fish, and other agencies, as well as ranchers.

Work continues on developing trigger points for implementing the general mitigation and conservation measures identified for a countywide Mitigation Plan. Distinct population density/elevation zones and maps delineating these zones along with vegetative overlays were developed in 2012 to assist monitoring efforts. Specific impact indicators, particularly regarding vegetation impacts, have been difficult to directly associate with activation of specific mitigation measures in rural areas.

APPENDIX B

**Pima County Local Drought Impact Group
(LDIG)
2014 Annual Report**

Pima County Local Drought Impact Group (LDIG) 2014 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 that have an interest in the cause and effect of drought conditions in Pima County. LDIG meets bimonthly 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 that corresponds 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 the impacts of drought 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 in relation to their effect on drought conditions and climate variability in the southwest. For a list of presentations and agendas, please visit Pima County's [LDIG website¹](#).

The study of tree ring growth, especially at the University of Arizona's Tree-Ring Laboratory, has been used to reconstruct flows in the Colorado River and to identify periods of drought as far back as 800 A.D.; by comparison, precipitation records began in 1880. This data is being used to understand the extent, frequency, duration and severity of drought. LDIG also monitors the status of the summer monsoon season and convenes roundtable discussions of drought and water conservation outreach programs.

DROUGHT STATUS

In Tucson, the first half of the 2014 calendar year (January 2014 to June 2014) was the warmest on record with an average yearly temperature to date of 3.6°F above normal². The summer of 2014 was the 4th warmest on record with an average temperature of 87.4 °F, 1.7°F above normal (85.7 °F). At the Tucson International Airport, the first half of the year was the third driest on record, measuring only 0.61 inches of precipitation (3.27 inches is normal for January through June). Through September 26, 2014, Tucson International Airport had received 6.69 inches of rainfall³ since the beginning of the calendar year, 74 percent of the normal 9.07 inches. In September, Tropical Storm Norbert produced record rainfall at the Tucson Airport, widespread flooding and high river flows. The Santa Cruz River, Rillito River and Cañada del Oro Wash recorded the highest flows since 2007. Flows of 25,000 cubic feet per second were recorded at the Santa Cruz River and Valencia Road. Preliminary 2014 monsoon rainfall totals are projected to be slightly above normal, 5.23 inches.

The Arizona Department of Water Resources' (ADWR) long-term drought status through June 2014 shows the majority of Pima County having a drought level of "D2 Drought – Severe", covering the San Pedro River, Santa Cruz River, and San Simon River watersheds. Only the Lower Gila River watershed in the northwest corner of the county has a drought level of "D0 Abnormally Dry". ADWR acknowledges the limitations of the watershed scale drought level mapping. Drought levels are reflective of the average precipitation across an entire watershed. Because some watersheds have very few gauges, the change in drought conditions between neighboring watersheds looks stark and can be misleading. Rather, the drought conditions change gradually across watershed boundaries.

Several water providers are taking delivery of water from the Central Arizona Project. Tucson Water has the largest CAP annual municipal allocation in the state; 144,172 acre-feet. Metropolitan Domestic Water Improvement District, the Town of Oro Valley and others have smaller CAP allocations. Agricultural users and the Tohono O'odham Nation in Pima County also have access to and use CAP water. Consequently, the drought status of the Colorado River and the potential for a shortage declaration is of interest to these sectors.

¹ LDIG website: <http://webcms.pima.gov/cms/one.aspx?portalId=169&pageId=70243>

² <http://www.wrh.noaa.gov/twc/climate/monthly/jun14.php>

³ <http://www.nws.noaa.gov/climate/index.php?wfo=twc>

Every month the Bureau of Reclamation releases their 24-Month Study which provides operational announcements and near-term projections. The study released in August 2014 stated that the water release from Lake Powell to Lake Mead for water year 2015 (October 2014 to September 2015) will be ten percent greater than that of water year 2014.⁴

On August 12, 2014, the water level elevation of Lake Mead was at its lowest (1080.19')⁵ since being filled in the 1930s. Even with the increased water releases from Lake Powell, the Lake Mead water level is projected to decline in 2015. Based on the Bureau of Reclamation's projections the most probable (50th percentile) Lake Mead inflows and resulting water levels in January 2016 are three feet above the first shortage trigger of 1075'; the minimum probable (10th percentile) projected water level is four feet below 1075', which would trigger the first tier of shortages. The earliest likelihood of a shortage declaration is 2017. This shortage declaration is not expected to reduce deliveries of CAP water to Native American or municipal and industrial users.

Outflow from Lake Mead has been exceeding the inflow since 2000, except in 2004 and 2010 when there was significant snowpack in the Colorado River Basin. The flow imbalance, referred to as a structural deficit, is lowering the elevation of Lake Mead. At the current rate of decline, Lake Mead's elevation could fall below 1000 feet in five to eight years unless equalization or corrective action is taken. The consequences could reduce diversions of CAP water to municipal and industrial users and Indian users. The CAP, Arizona Department of Water Resources and Colorado River basins states are evaluating options for corrective action to reduce the declining water elevation in Lake Mead.

IMPACTS IN PIMA COUNTY

The 32 shallow groundwater areas in Pima County are important for riparian areas that are dependent on groundwater. Sustained drought conditions can adversely impact groundwater levels if nearby well owners pump more groundwater to mitigate drought effects on their property. Invasive species like buffel grass and tamarisk and fewer birds, Gila Topminnows and aerial arthropods are being observed in Pima County. There is also a significant decrease in ephemeral stream flows.

Agua Caliente Park, located northeast of Tucson has historic and cultural significance. The park's focal point is a natural artesian spring that feeds a creek and produces an abundant variety of oasis vegetation and a habitat for native species. The natural spring has been historically pumped to feed a pond which produces a recreational element for neighborhood residents and park visitors. Recently, water levels have decreased to levels where pumping is ineffective to keep the pond filled. Pima County has begun investigating measures to maintain the health and vigor of Agua Caliente Park. Components of Pima County's commitment to the park include detailed hydrologic studies, legal implications of water rights in the region, structural improvements to the pond and importing reclaimed water from the local water provider.

Cienega Creek, in eastern Pima County, continues to show the impacts of sustained drought. Pima Association of Governments' (PAG) drought reporting uniquely depicts the localized drought impacts on a shallow groundwater dependent system, important for habitat and rural residents dependent on this water source. Streams and rivers are rare exceptionally productive systems in the arid landscape of Arizona that are especially sensitive to changes in water availability. With long term support and interest from its member jurisdictions, PAG has consistently monitored the shallow groundwater-dependent riparian area of Cienega Creek Preserve on a monthly and quarterly basis since 1989 and reported the findings to ADWR for compilation into state records. This rich dataset is used by numerous entities to track and evaluate the seasonal, annual and cumulative impacts of drought. This Preserve, located outside of Tucson, AZ, is the site of a rare, low-elevation perennial stream that is of regional importance for its environmental and recreational value and has been designated as an "Outstanding Water" by the State of Arizona.

In 2014, PAG's analysis documented several record-breaking water level trends that indicate a heightened level of drought risk to the ecosystem, especially during the driest times of the year. June 2014 showed only 0.86 miles of flow, which is the lowest flow length in the historical record, nine percent of the full 9.5 miles of flow extent observed in June of the mid-1980s. In addition, 2014 records showed the lowest levels of average annual

⁴ <http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=47753>

⁵ <http://lakemead.water-data.com/index2.php>

stream flow on historical record and a five-foot drop in average groundwater well levels, with some wells dropping as much as 12 feet in one year (see Attachment 1). Because surface water base flows and groundwater are strongly correlated, these downward trends parallel each other.

Annual reports and studies can be found on PAG's [Cienega Creek web pages](#). Based on a 2014 Pima County report⁶, precipitation in the Cienega Watershed has been declining in the winter but shows no trend in the summer. PAG's Cienega Creek monitoring data reflects the lack of winter rains as found in June, which is the season with the most significant decline in stream flow. This delayed seasonal impact can only be recognized by monitoring the creek and tracking long term response in addition to precipitation.

Erosion is another result of drought in this system. PAG has tracked a major erosion head-cut in the streambed that progressively erodes after major flood events, if those floods are preceded by dry periods. Mortality of cottonwood and mesquite bosques, due to dropping water tables and erosion has been observed since 2001, with continuing observations in 2014.

With disappearing flow extents and a significant drop in groundwater levels, the Pima County Administrator has requested staff to prepare a risk assessment and conservation strategy for protecting Pima County's conservation lands in the watershed, including at the Cienega Creek Natural Preserve. PAG recommends that further ecological monitoring be conducted to track the populations of species and their habitats and their water needs in Cienega Creek Preserve. Pima County's preserve has been a successful harbor for threatened and endangered species with few invasive species issues to which the impacts of drought pose an increasingly serious threat.

Increased coordination with land use planners and well owners to encourage conservation strategies near vulnerable riparian area is recommended. Monitoring is recommended where groundwater restoration methods are applied to increase stormwater infiltration. PAG's 2012 report on groundwater use near shallow groundwater areas showed a steady increase of wells drilled the Cienega-Davidson since 1990. Drought information is primarily disseminated by large municipal water providers in urban areas, and private wells are isolated from, and exempt from, coordinated water use tracking requirements. These well owners may not be receiving conservation messaging even while their water use may increase to compensate for the lack of rainfall.

DROUGHT RESPONSE PLAN

During 2014 Pima County conducted a review of its drought response plan and ordinance. The *Vulnerability Assessment in Drought Mitigation Report* reviewed Pima County's vulnerability to drought conditions concluding that County-owned open space and riparian habitat is the county asset most vulnerable to drought. The report recommended revising the Drought Response Plan and Water Wasting Ordinance and the drought stage and trigger events to more accurately reflect current drought conditions, improve coordination with other jurisdictional declarations, correct font loading of response measures, provide more flexibility and buffer against oscillating changes of drought status. On August 5, 2014, the Pima County Board of Supervisors approved a text amendment to the *Drought Response Plan and Water Wasting Ordinance*. Ordinance No. 2014-38 relating to drought amends Pima County Code Chapter 8.70 to redefine the Pima County Drought Stages (Table 8.70.050), which identifies the drought conservation measures to be put in place at each stage. The drought stages are based on the findings from the Arizona Drought Monitor Report relating to Pima County.

Table 1: Pima County Drought Stages (Table 8.70.050, revised)

Indicator	Arizona Drought Monitor Report (Pima County)
Stage 1 Alert	Moderate-Severe
Stage 2 Warning	Severe-Extreme

Powell, B. F. 2013. *Trends in surface water and ground water resources at the Cienega Creek Natural Preserve, Pima County, Arizona*. Unpublished report of the Pima County Office of Sustainability and Conservation, Tucson, Arizona.

Indicator	Arizona Drought Monitor Report (Pima County)
Stage 3 Emergency	Extreme-Exceptional
Stage 4 Crisis	Exceptional

At the August 5 meeting, the Board of Supervisors also requested a report on the status of drought conditions and Colorado River Water Supplies. The September 5, 2014 report to the Board of Supervisors notes that, although serious drought conditions continue in the desert Southwest, Arizona is in a better position as a result of the State's groundwater management code and establishment of the Arizona Water Banking Authority. It also notes that Pima County has advanced a sustainability framework for County operations and implemented land use planning and development regulatory actions to assure water conservation and water use efficiencies are emphasized. Continuing declines in Lake Mead present serious challenges for the continuation of water service to all current recipients of Colorado River water. Although municipal supply is excluded from Tier One shortage restrictions, continued drought will place additional stress on all water supplies potentially impacting municipal supplies (see Attachment 2).

As of June 2014, all of the entities located within Pima County (City of Tucson, Town of Oro Valley, Town of Marana, Metropolitan Domestic Water Improvement District, Community Water Company of Green Valley, and Pima County) are at Drought Stage 1.

DROUGHT RESPONSE ACTIONS

Pima County continues its efforts to respond to drought conditions. Several organizations, such as Conserve to Enhance (C2E), urge water conservation that translates into donations to support environmental enhancement. C2E participants have saved 5.3 million gallons (16.3 acre-feet) of water since the program inception in 2011.

The Conservation Effluent Pool (CEP) is an effluent allocation set aside pursuant to intergovernmental agreements between the City of Tucson and Pima County for use in riparian restoration projects. Over the last year a CEP taskforce, coordinated by the Community Water Coalition, identified thirteen candidate projects for CEP effluent allocations. The projects are prioritized into three groups: immediate potential, strong potential, and long-term potential. Four of the projects have been recommended for implementation that all have immediate potential.

Persistent drought conditions can increase the severity and intensity of wildfires. In July 2013, Pima County released the Community Wildfire Protection Plan. With the support of the local jurisdictions, Altar Valley Conservation Alliance, Southern Arizona, Buffleggrass Coordination Center, Salt River Project, Tucson Electric Power, TRICO Electric Cooperative, Arizona State Forestry Division, Bureau of Land Management, Pascua Yaqui Tribe, Coronado National Forest, Saguaro National Park, Buenos Aires National Wildlife Refuge, and twenty-two fire departments and fire districts, the Community Wildfire Protection Plan was developed in response to the Healthy Forests Restoration Act of 2003. The act focuses on at-risk communities and unincorporated areas located in and around public lands. It provides an unprecedented incentive for the development of comprehensive wildfire protection plans in a collaborative and inclusive process. For communities to take advantage of the beneficial opportunities and federal funding, a Community Wildfire Protection Plan is necessary. Pima County has completed its plan to better protect communities from wildfire risk, educate citizens about fire risk, and be eligible and ready to apply for federal funding to implement wild land fire mitigation projects and programs.

In 2010, Pima County and the City of Tucson completed the *Water & Wastewater Infrastructure, Supply and Planning Study*. An important outcome of the study was the [2011-2015 Action Plan](#) for Sustainability. During 2014, the fourth year of the action plan implementation, Pima County completed several recommended actions. In addition to the Drought Response Plan Update, Pima County implemented the following:

- The Regional Optimization Master Plan (ROMP) is a master plan that allows Pima County Regional Wastewater Reclamation Department to meet current environmental regulatory requirements mandated by the Clean Water Act. The fundamental component of the ROMP was the replacement of one and the upgrading of the second major wastewater reclamation facilities serving the Tucson metropolitan area using state-of-the-art technology and infrastructure. As a result of the ROMP improvements,

higher grade reclaimed water is being produced by the facilities. In January 2014, both new facilities were online. The higher grade reclaimed water is anticipated to be utilized more completely within the region's water provider portfolios.

- Green infrastructure and low impact development (GI/LID) are important design strategies for building in communities by adding value-based benefits with a minimal alteration to the natural environment. The cost of such community benefits is an important consideration for community leaders. As one of the results from the City of Tucson and Pima County collaboration, *Water & Wastewater Infrastructure, Supply & Planning Study*, Pima County released the AutoCASE™ Beta Testing Project Report in July 2014. The cost-benefit report focuses on data specific to the southwest and could be used as a tool to evaluate the spending of public funds on GI/LID initiatives like infiltration trenches, pervious pavers, and water harvesting cisterns.
- Pima County's Comprehensive Plan update effort, [Pima Prospers](#), will guide the region's growth, conservation and community design for decades to come and includes core elements for use of land, physical infrastructure connectivity, human infrastructure connectivity and economic development. Drought preparedness, adaptability and response actions are integrated throughout the draft plan. Pima Prospers will be finalized in the coming year.

RECOMMENDATIONS

Although drought conditions persist in Pima County, the State groundwater management code and banking of CAP supplies have helped mitigate impacts to county residents. Implementation of sustainability initiatives, land use planning, development regulatory actions and public education emphasize water conservation and water use efficiencies. Continued decline of Lake Mead is a serious concern to Pima County residents. Although municipal water supplies are exempt from Tier One shortage restrictions, continued drought will place additional stress on all water supplies potentially impacting municipal supplies. Drought impacts to open spaces and riparian areas will continue to be of concern.

The following are recommendations regarding ADWR's Drought Program:

- Arizona and ADWR, in particular, must continue to monitor the status of the Colorado River and work with the Basin States and the Bureau of Reclamation to address the structural deficit in Lake Mead. Failure to take corrective action could have impacts to both agricultural, municipal and industrial CAP deliveries in Southern Arizona in the future
- Water providers in Pima County have made significant water infrastructure investment to increase the use of renewable water supplies to achieve the Groundwater Management goal of Safe Yield. ADWR's and ADEQ's regulatory setting should be supportive of adaptive management strategies to develop new and renewable water supplies and innovative demand management
- ADWR's Drought Management Program should continue to monitor the status of drought and report statewide drought conditions through the Drought Monitoring Technical Committee and the Interagency Coordinating Group.
- ADWR should incorporate environmental benefits from recharging and/or reducing groundwater pumping near shallow groundwater dependent ecosystems when designing and developing criteria for Special Enhancements Areas and similar efforts.
- ADWR should encourage and promote a study evaluating the effectiveness of managed stormwater recharge throughout Arizona, as recommended by the Blue Ribbon Panel, and evaluate potential for recharge credits.
- Monitoring of riparian areas in other regions for localized drought impact reporting should be encouraged.

- Drought response resources should be disseminated to exempt well owners not receiving drought alerts from water providers
- Unique drought response resources should be disseminated to areas of shallow groundwater dependent ecosystems that are sensitive to well impacts and drought.
- ADWR should improve statewide coordination and information sharing of local drought responses by posting water providers' drought response plans to ADWR's Drought Program website. This could assist communities that wish to prepare or update their drought program
- During the year a number of communities, including Safford, Payson and Williams were implementing strict water restrictions. ADWR should maintain on its website a list of cities and towns where water restrictions are in place. Doing so illustrates the extent and severity of drought on water supplies
- An annual statewide roundtable of county agencies might reinvigorate the establishment of local drought impact groups. These groups can provide valuable input to the ADWR on drought conditions. They can provide a forum for sharing drought impacts, adaptive management strategies and successful drought preparedness measures for their constituencies.

APPENDIX C

**Arizona's Next Century: A Strategic Vision for
Water Supply Sustainability
(Summary)**

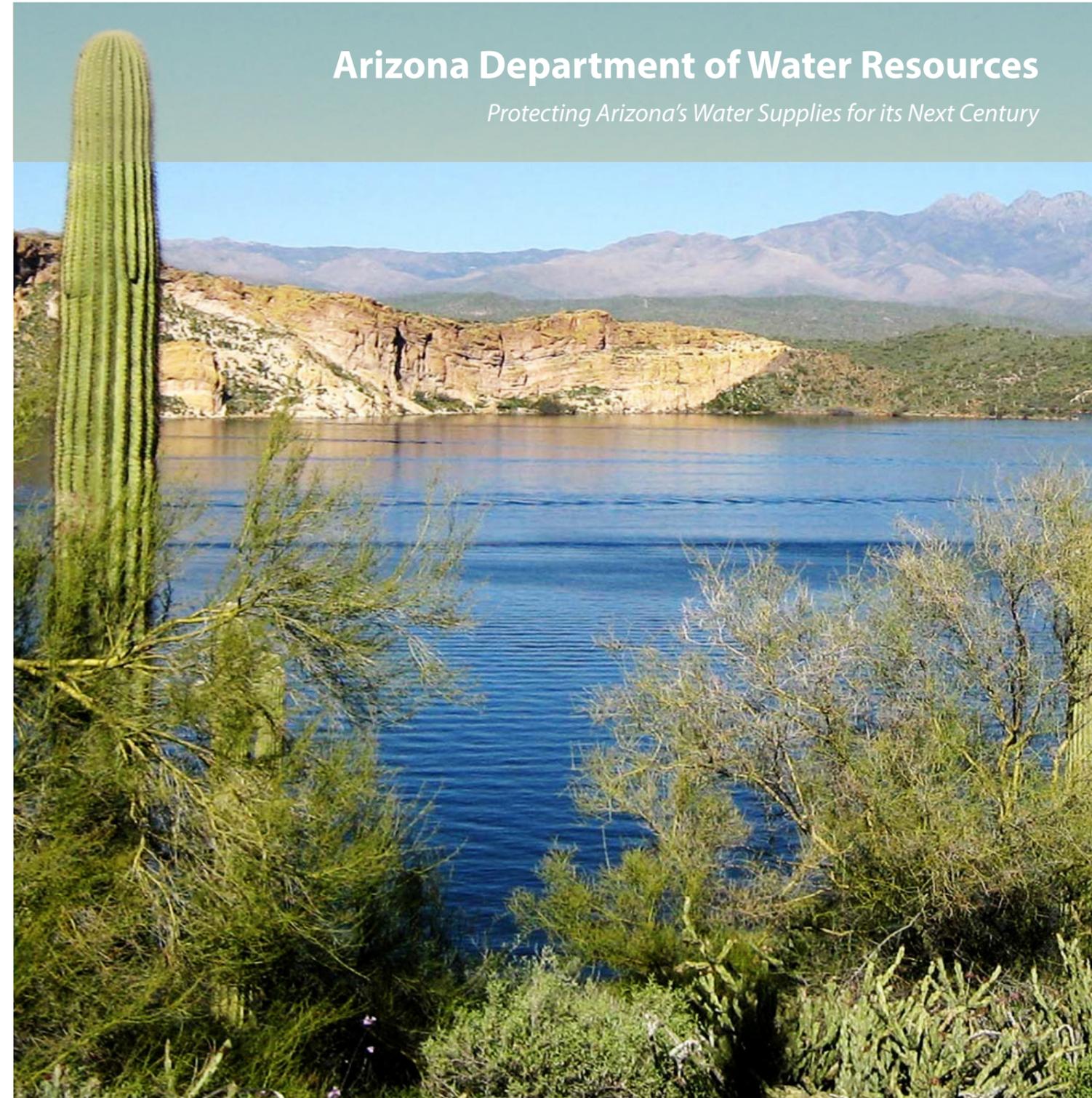


Strategic Vision Ten Year Action Plan

- Legislate Strategic Vision update every 10 years (Year 1)
- Begin Discussions on Ocean Desalination (Year 1)
 - Exchange Options
 - California
 - Mexico
 - Direct Options
 - Mexico
- Resolve ADOT Right-of-Way Issues for utilities (Year 1)
- Establish Adjudication Study Committee (Year 1)
- Begin Discussions on Water Development Financing (Year 2)
 - Immediate Needs for Water Resources Development Revolving Fund for rural Arizona
 - Long-Term Needs for Large-Scale water importation projects
- Remove current statutory limitation (A.R.S. § 45-801.01(22)) on the ability to receive long-term storage credits for recharging reclaimed water beyond 2024 (Year 2)
- Review Legal and Institutional Barriers to Direct Potable Reuse of Reclaimed water – develop and implement plan for resolution (Year 3)
- Review and implementation of Adjudication Study Committee Findings (Year 3)
- Develop and Begin Implementation of Direct Potable Reuse of Reclaimed Water Public Perception Campaign (Year 4)
- Begin discussions with New Mexico on an intrastate cooperative program for watershed management/weather modification in the Upper Gila watershed (Year 4)
- Resolve Remaining Indian Settlements (Year 1 - 10)
- Resolve General Stream Adjudications (Year 5 - 10)



While many of the mechanisms necessary to address our future imbalances are available today, there are still limited supplies. Arizona's history is its future. We must continue to invest and develop water supplies to support economic growth and preserve Arizona's natural environment.



Arizona Department of Water Resources

Protecting Arizona's Water Supplies for its Next Century



Arizona's Next Century: A Strategic Vision for Water Supply Sustainability

Address

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Phoenix, Arizona 85012

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F : (602) 771-8681

Website

www.azwater.gov



Many of Arizona's greatest historic accomplishments have been directly linked to our past successes in managing our water supplies; Arizona's future prosperity is tethered to how effectively we continue to manage and secure our water resources and develop new water supplies and infrastructure to ensure Arizona's long-term economic stability.

Building on Past Successes

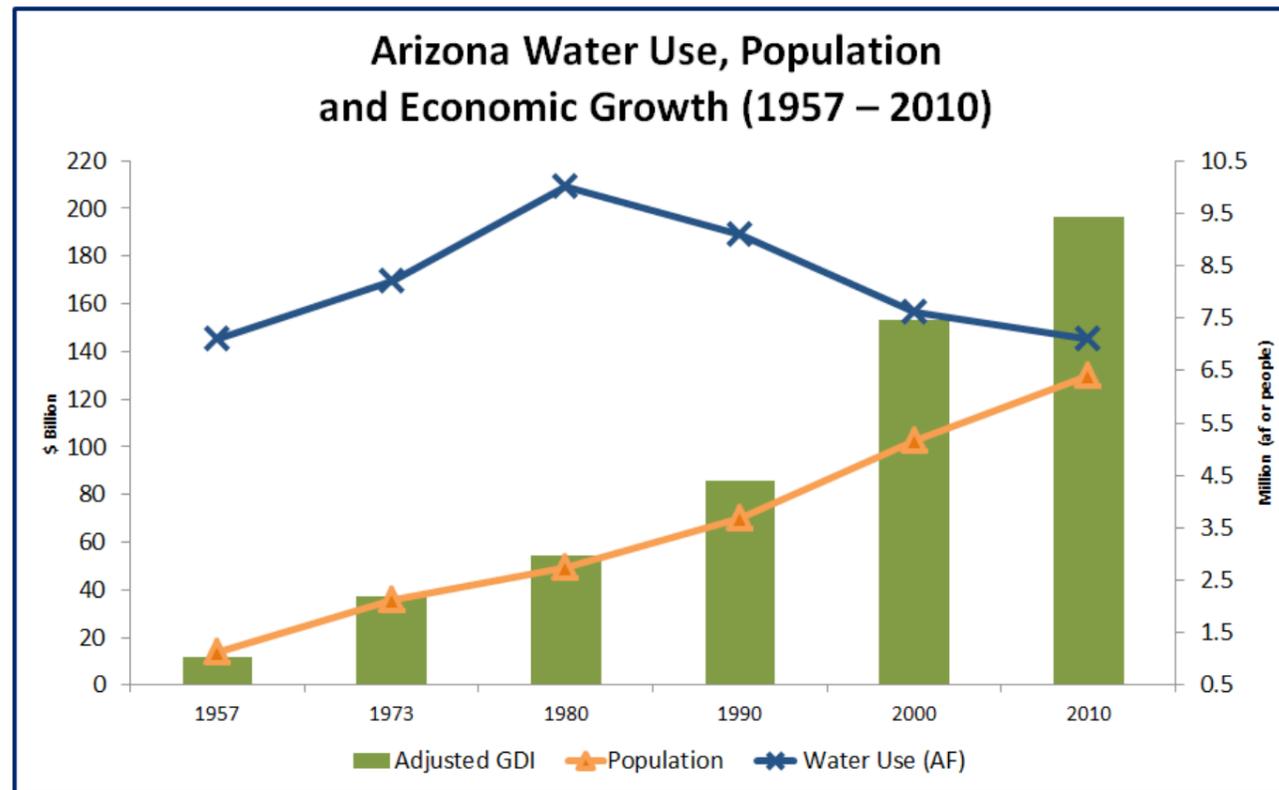
Arizona has a long history of developing proactive solutions to the challenges of ensuring sufficient and dependable water supplies in our arid state. While we reside in what some perceive as a harsh environment, those with great vision and leadership have harnessed the natural resources needed to support a thriving Arizona economy. While diverse, these actions have shared a common premise of being solution-oriented to meet not only the immediate needs of the state, but more importantly address future challenges the state would face.

- Salt River Project
- Colorado River Compact & Law of the River
- Central Arizona Project
- Resolution of Tribal Water Rights Claims
- 1980 Groundwater Management Act
- Assured and Adequate Water Supply Program
- Recharge and Recovery and Arizona Water Banking Authority

Strategic Vision

The Arizona Department of Water Resources, in partnership with many in Arizona's water community has recently participated in the development of comprehensive water supply and demand analyses. Through the work of the Water Resources Development Commission and the Colorado River Basin Water Supply & Demand Study analyses conclude that Arizona may be facing an imbalance between available water supplies and projected demands of nearly one to just over three million acre-feet in the next century.

The Strategic Vision was developed to help guide Arizona through the coming decades on steps that Arizona can take to secure water supplies to meet current and anticipated demands and provide a stable economy for our future. While many of the mechanisms necessary to address our future imbalances are available today, there are still limited water supplies. A comprehensive Strategic Vision that identifies viable strategies will assist all water users in Arizona to come together to address our needs.



Conclusion

No single strategy can address projected water supply imbalances across the State. Instead a portfolio of strategies needs to be implemented dependent on the needs of each area of the State. It is very important to recognize the uniqueness of the various regions throughout the State and the varying challenges facing those regions. However, as we analyze the various strategies there are specific measures that have widespread potential benefit to all Arizonans.



Arizona now must face its next challenge in water supply security and management. While the State as a whole is not facing an immediate water crisis, there are local areas that require more immediate action.

The lack of an immediate problem increases the potential for inaction. Arizona's future prosperity is tethered to how well we continue to manage our water resources and develop new water supplies and infrastructure. Our present success cannot sustain Arizona's economic development forever and we must continue to plan and invest in our water resources.

Strategic Priorities:

- Identify the Role of In-State Water Transfers
- Resolution of Federal and Non-Federal Water Rights Claims
 - General Stream Adjudication
 - Indian Water Rights Settlements
- Continued Commitment to Water Conservation & Reuse of Reclaimed Water
 - Including Direct Potable Reuse
- Comprehensive Statewide Data Collection & Analysis
 - Modeling Local Conditions
- Supply Importation - Desalination
- Funding
 - Rural Infrastructure
 - Business leaders, Community and State leaders



Water Supply and Demand Analysis		
Water Resources Development Commission (2010)	Assessed statewide water demand and available supplies for the next 25, 50 and 100 years (2035, 2060 and 2110) and identify potential water supplies to meet projected demand.	<ul style="list-style-type: none"> ● Total statewide demand between 8.1 MAF in 2035 and 10.6 MAF in 2110 (current demands 6.9 MAF). ● Identified an imbalance between 900,000 acre-feet and 3.2 million acre-feet over the next 25 to 100 years
Colorado River Basin Water Supply & Demand Study (2012)	Identified future imbalances in water supply and demand in the Colorado River Basin through the year 2060, and develop strategies to resolve identified imbalances.	<ul style="list-style-type: none"> ● Identified a Colorado River Basin-Wide average imbalance of 3.2 million acre-feet by 2060 ● Arizona's imbalance between 259,250 to 1,393,080 acre-feet by 2060 (Est)

Arizona's Strategic Vision creates the framework for analysis of potential strategies to address projected imbalances and provides context for maximizing them to address the needs of multiple water users across the State.

Over the next 25 to 100 years, Arizona will need to identify and develop an additional 900,000 to 3.2 MAF of water supplies to meet the projected water demands.

APPENDIX D

Arizona State Park Drought Assessment

Drought Ratings by Arizona State Park Managers

DATE:	05nov2013	April/May 2014	Aug 2014	NOV 2014			
PARK	RATING	RATING	RATING	RATING	RATING	RATING	RATING
ALAMO – nr Parker AZ	10	10	10	10			
BTA – nr Superior AZ	7-8	6-7	6-7	6			
BUCKSKIN – nr Parker AZ	0	3	3	2			
CATALINA – nr Tucson AZ	7	8	5-7	4 (avg of 2 rpts)			
CATTAIL - nr Parker AZ	0	0	1	0			
DEAD HORSE – at Cottonwood AZ	0	3	8	3			
FOOL HOLLOW – Show Low AZ	8	7	9	7			
FT VERDE – at Camp Verde AZ	5	8	5-6	7			
HOMOLOVI – nr Winslow AZ	1	1	0	4			
JEROME – at Jerome AZ	5	5	2	6-7			
KARTCHNER – nr Benson AZ	6	9	4	4-5			
LAKE HAVASU at Lake Havasu AZ	0	0	3	0			
LOST DUTCHMAN – nr Apache Junction	3	4	5	2			
LYMAN – nr St Johns AZ	8	8	7	6			
McFARLAND – in Florence AZ	*	*	4	**			
ORACLE – nr Oracle AZ	7	8	5	3			
PATAGONIA LAKE – nr Nogales AZ	5	5	8	1			
PICACHO PEAK – nr Eloy AZ	4	1	10	0			
RED ROCK – nr Sedona AZ	7	8	8	6			
RIORDAN MANSION – in Flagstaff	*	*	8	**			
RIVER ISLAND – nr Parker AZ	0	3	3	2			
Roper / Dankworth – nr Safford AZ	8-9	8	3	5			
SAN RAFAEL – nr Lochiel AZ	6	9	4	3			
SLIDE ROCK – nr Sedona AZ	6-7	8	10	0			
SONOITA CREEK – nr Nogales AZ	5	5	8	1			
TOMBSTONE – in Tombstone AZ	*	*	0	0			
TONTO NATURAL BRIDGE – nr Payson	4	7-8	7	4			
TUBAC – in Tubac AZ	*	*	6	**			
VERDE RIVER GREENWAY – nr Cottonwood	0	5-7	8	3			
YUMA QUARTERMASTER DEPOT	*	*	2	2			
YUMA TERRITORIAL PRISON	*	*	0	2			
* = no inquiry sent to historic parks operated by partners, thus no report		** = No Response Received		(continued on next page)			

	<u>NOV 2014</u>		
<p><u>Region I = Western Region (overall)</u> Alamo Buckskin River Island Cattail Contact Point Lake Havasu Homolovi Riordan Mansion Yuma Quartermaster Depot Yuma Prison</p>	3		
<p><u>Region II = Northern Region (overall)</u> Dead Horse Ranch Verde River Greenway Jerome Ft. Verde Red Rock Slide Rock Tonto Natural Bridge Fool Hollow Lyman Lake Roper Lake</p>	5 This is an average of the parks within the region ----- No inquiry was sent. The Region Manager position is currently in transition to a new person		
<p><u>Region III = Southern Region (overall)</u> Patagonia/Sonoita Creek San Rafael McFarland Tombstone Tubac Picacho Catalina/Oracle Lost Dutchman Boyce Thompson</p>	3		

*= no inquiry sent to historic parks operated by partners, thus no report

** = No Response Received

(individual comments = following pages)

Park Manager comments re Drought Assessment at their park (AUG-NOV 2014)

Flagstaff, AZ – Joe Meehan- Riordan Mansion State Historic Park: XXXXXXXXXXXXX

Sedona, AZ – Steve Pace, Manager, Slide Rock State Park: We have received a lot of rain. Creek flow seems normal. I would say we are 0 at this time..

Sedona, Az – Eric Buzonas, Assistant Manager, Red Rock State Park: Drought/water usage is always an issue in AZ and subsequently impacts Parks- I would say a "6" however I would trust your judgement/research over mine in this regard. We do limited watering here. We have recently installed a new drip system (on a timer) at our Hummingbird Patio to water some newly added hummingbird attractant plants. Other than that things have been fairly "green" on their own thru September. Oak Creek is still flowing! And we obviously draw water for public use and consumption which impacts our water table. Sorry I don't have more to add from a scientific standpoint.

Jerome, AZ – Wes Yeager, Asst Manager, Jerome State Historic Park: I would rate the Jerome area at around 6 or 7 despite the rain we have received, very dry. The summer rainfall totals are as follows: June 0" July 2.44" August 6.38" September 4.26" October 0.68"

Cottonwood, AZ— George Christensen, Manager, Dead Horse Ranch State Park: We have had over 10" here at the park this year. Our average is 12" and we have exceeded that the last couple of years. If we had a more accurate rain gauge I'm sure we are over our 12" here due to the fact that right across the river Max has already at his house has exceeded that. Our staff does not always record it timely and it gets missed. I would have to say that by the looks of our vegetation and growth we continue to grow out of this supposed drought. I would say were at a 3.

Clarkdale, AZ to Camp Verde, AZ – Max Castillo, Manager, Verde River Greenway (the Greenway lies along the Verde River from the Tuzigoot Bridge near Clarkdale to Beasley Flat downstream of Camp Verde AZ).

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Camp Verde, AZ – Sheila Stubler, Manager, Ft. Verde State Historic Park: It's hard to say .. Based on the level of the Verde River Camp Verde is probably a 7, as we could always use more rain...

St Johns, AZ – Mike Rollins, Manager, Lyman Lake State Park: Lyman is about a 6.

Winslow, AZ -- Chad Muenier, Manager, Homolovi State Park: I would say drought severity would rate a 4. We received slightly more than average for the monsoon period, but vegetation is still suffering from an extremely dry winter last year. Higher flows in the LCR have taken out our waterline. It has been 4 years since we had a loss to our waterline due to high flows in the river.

Show Low, AZ – Jim Wilson, Manager, Fool Hollow Lake State Park: About the same 7.0. Some recharge of the lake during monsoonal run – off. Lake is down 8 feet instead of 9.5 feet. We are seeing more elk and white-tails in the area coming down to drink. That is good as long as they don't get toooo used to people. Noticing some drought tolerant invasive species (toadflax & an as yet unidentified plant similar to castor bean) moving in as native grasses and plants cannot keep up. Almost no wildflower season. Birds and small animals are hunting hard are for food sources to get them through the winter. Recreational activities impacted slightly. Access to fishing docks and boat launch areas still at very steep angles. Many fishing docks sitting on former lake bottom. Underwater habitat for fish now exposed (brush piles, catfish condo's etc.). "Catching" seems to be way below normal ... unsure why ... water quality, higher pH, higher mineral concentrations all have been suggested but not verified. Also with habitat out of water fewer places to hide/breed for non-predator species. Higher water bills a factor to help maintain specimen species and limited landscaping. Hope this help. Jim

Pine/Payson, AZ – Steve Jakubowski, Manager, Tonto Natural Bridge State Park: Monsoonal moisture was very good this year at the park and surrounding vicinity. Ample rains were able to provide sufficient moisture for the forest. In fact USFS prescribed burns in the area have been delayed or affected by the high moisture content. I would give the park and surrounding area a rating of 4 as the long term drought the region is in is a long way from relief.

Superior, AZ – Cathy Babcock, Boyce Thompson Southwest Arboretum: I think we are still around a 6. We didn't receive all that much rain this summer.

Eloy, AZ – Aaron Soggs, Manager, Picacho Peak State Park: 0 for Picacho at this time.

Apache Junction, AZ – Tom Fisher, Manager, Lost Dutchman State Park: LDSP is a 2. We had over 10 and half inches of rain during the monsoon. Tom

Florence, Az – Wayne Costa or Jessica Licano or Kate Milzarski, McFarland State Historic Park: XXXXXXXXXXXX

Wenden, AZ – Mark Knapp, Manager, Alamo Lake State Park: Were still at the #10 marker. Mark

Lake Havasu City, AZ – Pete Knotts, Manager, Lake Havasu State Park: The drought situation has not affected Lake Havasu. 0 is my rating this year.

Lake Havasu City, AZ – Gary Peaslee, Manager, Cattail Cove State Park: NO impact to Cattail Cove State Park at this time...

Parker, AZ – Jerry Rather, Manager, Buckskin Mountain State Park: With the past rain we have had I would rate the drought conditions at Buckskin Mountain and River Island State Parks as a 2.

Benson, AZ—Chris DeMille, Manager, Kartchner Caverns State Park: As per a discussion with Brent and a review of the water levels on the park we would still be about a 4-5 range for the drought . Erika Way

Tombstone, AZ – Julie Vanderdasson- Tombstone Courthouse State Historic Park: We are at a "0" .. been great green grass for days! :) If anything we couldn't keep up with the mowing!

Safford, AZ – Rob Young, Manager, Roper Lake State Park & Dankworth Pond State Park: The park received moderate rainfall this past monsoon season. However, Mount Graham has received ample rain this monsoon season. As a result the ditch company was able to provide us additional water to raise the lake level 5 feet. I would rank us at a 5.

Tucson, AZ – Steve Haas, Manager, Catalina State Park: *I rate Catalina at a 2. Jack McCabe, Asst. Mgr* = Because of the summer rain I will come down just a little but we will need a good winter to keep us going. I think Catalina is a 6 at this time.

Oracle, AZ – Steve Haas, Manager, Oracle State Park: *I rate Oracle at a 3.*

Nogales/Patagonia, AZ – Colt Alford, Manager, Patagonia Lake State Park & Sonoita Creek State Natural Area: Right now I would rate Patagonia Lake and Sonoita Creek at a 1 and rising. We had a good monsoon which has come to an end and we are still releasing at a rate of 200 acre feet per month. So the lake is beginning to recede from the spillway.

Lochiel/Patagonia, AZ – Dave Pawlik, Region III Manager: I'd say a "3", we received about 20" since July 2nd.

Tubac, AZ – Shaw Kinsley- Tubac Presidio State Historic Park: XXXXXXXXXXXXXXXX

Yuma,AZ –Tina Clark- Yuma Prison State Historic Park: [both State Parks in Yuma remain a 2](#)

Yuma,AZ -- Tina Clark- Yuma Qtr Master State Historic Park: [both State Parks in Yuma remain a 2](#)

Region I Manager's Perspective: **

Alamo
Buckskin
River Island
Cattail
Contact Point
Lake Havasu
Homolovi
Riordan Mansion
Yuma Quartermaster Depot
Yuma Prison

Region II Manager's Perspective: **

Dead Horse Ranch
Verde River Greenway
Jerome
Ft. Verde
Red Rock
Slide Rock
Tonto
Fool Hollow
Lyman Lake
Roper Lake

Region III Manager's Perspective: 3

Patagonia/Sonoita Creek
San Rafael
Tombstone
Tubac
Picacho
Catalina/Oracle
McFarland
Lost Dutchman
Boyce Thompson

APPENDIX E

**Arizona Natural Resources Conservation Service
2014 Drought Report**

ARIZONA NRCS DROUGHT REPORT

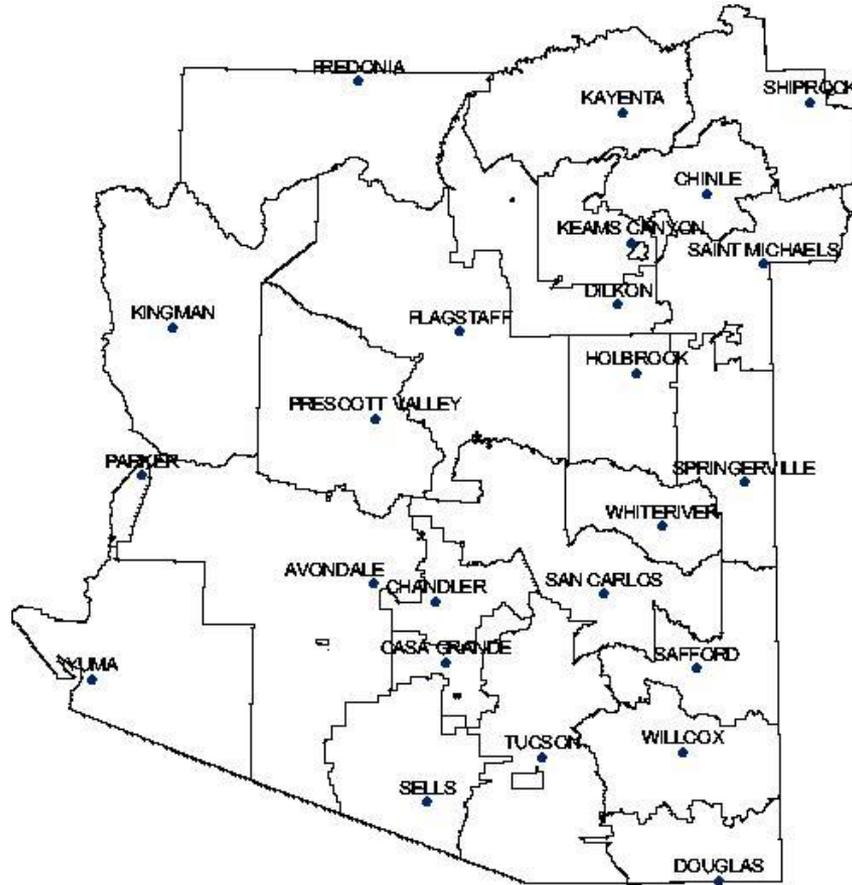
November 2014

Byron Lambeth

State Rangeland Management Specialist
USDA Natural Resources Conservation Service, Arizona

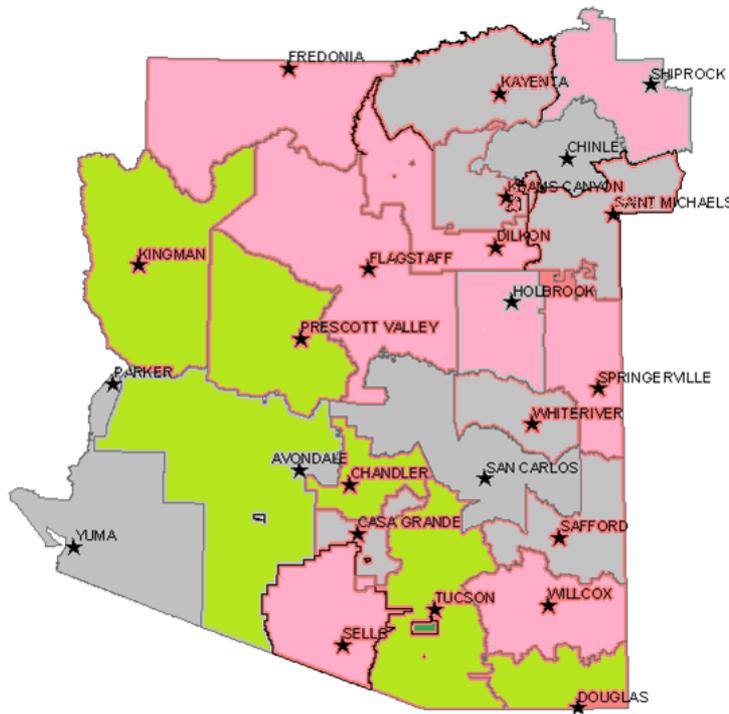


NRCS Field Offices



- NRCS has 24 Field Offices located throughout the state.
- The District Conservationists and staff provide the on-the ground knowledge and data collection.
- A survey was sent to all Field Offices in October 2014 to assess conditions on Arizona's range and croplands following the precipitation year.

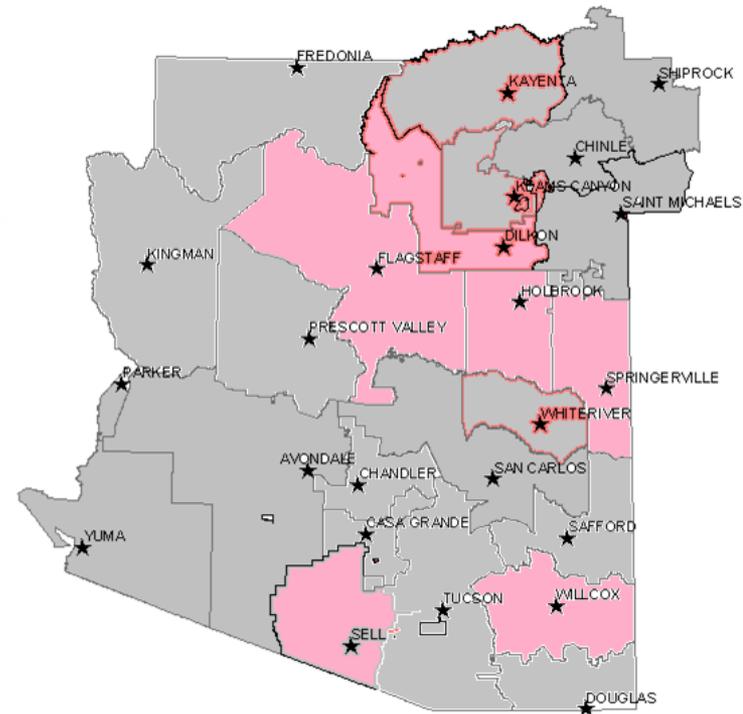
Field Offices Reporting Drought Impact



- 8 offices reported drought conditions continue (pink) to some degree within the work area.
- 6 offices reported drought conditions improved (green) within the work area.
- Continued drought affects from reduced forage and/or water shortage

Drought Affected Cropland

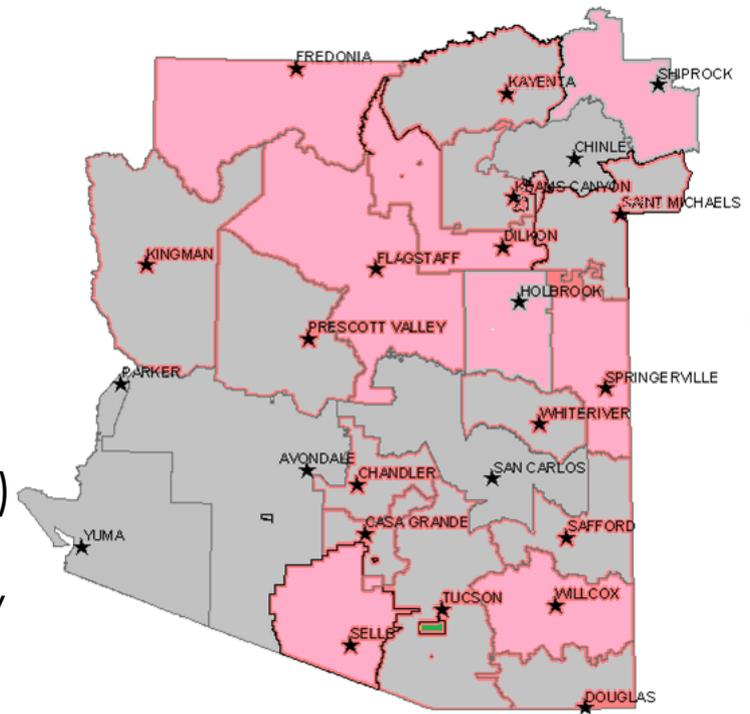
- 2 offices (Sells and Dilkon) reported there was dryland cropland affected by drought in the work area.
- Crop loss on affected acreage was 30 and 75 percent which was down from last year's reported loss.
- 6 offices (Sells, Willcox, Holbrook, Springerville, Flagstaff and Dilkon) reported there was irrigated cropland affected by drought in the work area.
- Crop loss on affected acreage ranged from 5 and 60 percent with an average of 15% loss, which was down from last year's reported loss.



Livestock Water

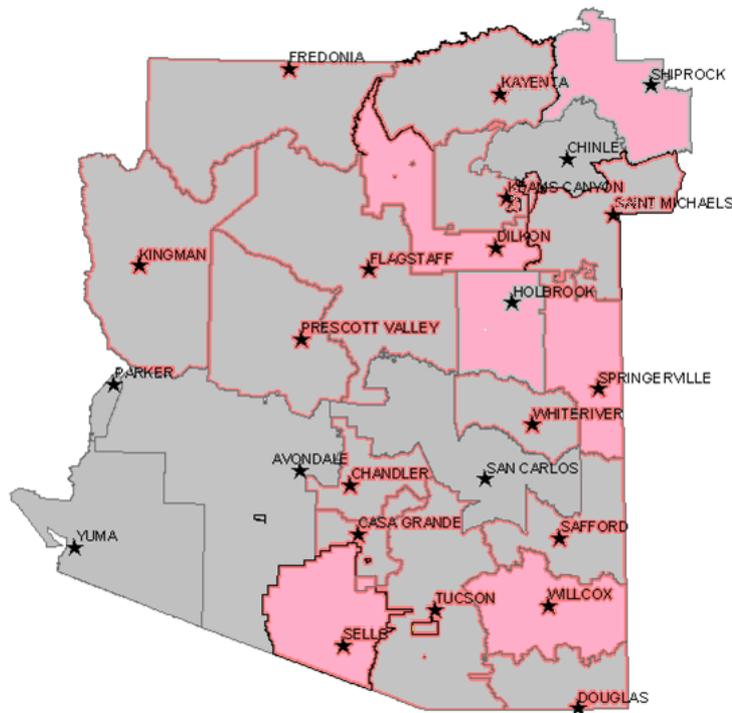
- 8 field offices reported livestock water shortages occurred in the field office work area.
- 8 offices reported ranchers were hauling water due to drought conditions.
- The percent of ranchers hauling water in these field offices range from 5% (Willcox) to 60% (Springerville, Dilkon).
- Dirt ponds ranged from 0% dry to 70% dry with the driest ponds occurring in northern Arizona.

Livestock Water Shortage



Rangeland Forage Production

Areas reporting livestock forage shortage



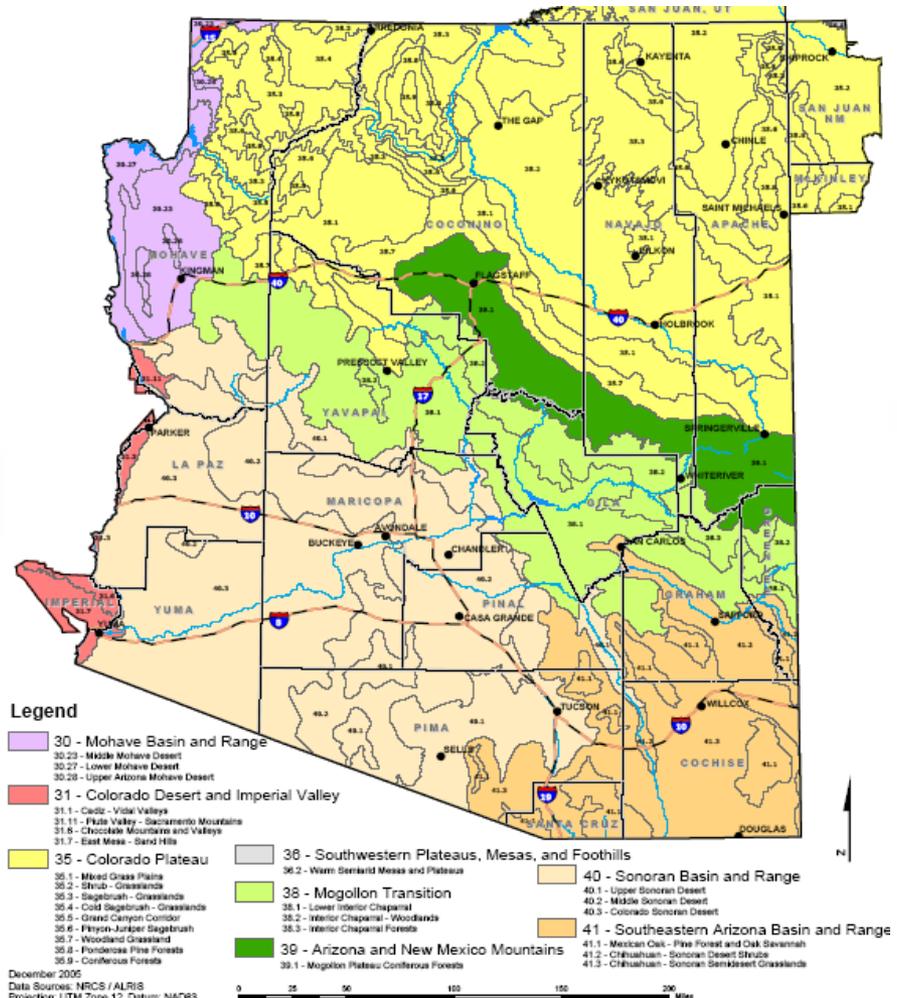
- 6 field offices reported shortages of livestock forage due to drought conditions in the work area.
- Percent of normal for the entire growing season ranged from 50% (Shiprock) to 100%.
- Livestock numbers were 50% to 100% of established carrying capacity in these offices.

Arizona Major Land Resource Areas

Arizona 2014 Forage Loss Report

MLRA	MLRA Name	% Forage Loss
40	Sonoran Desert	0
41	Southeastern Basin and Range	21
35	Colorado Plateau	23
38	Mogollon Transition	0
30	Mohave Desert	0

Statewide Average **9%**



December 2005
 Data Sources: NRCS / ALRIS
 Projection: UTM Zone 12 Datum: NAD83
 For Further Information Contact:
 Arizona NRCS State Headquarters - (602) 280-8831
 230 N. 1st Ave., Suite 509, Phoenix, AZ 85003

