Drought Preparedness Plan

August 2021

City of Tempe
Municipal Utilities Department
Water Utilities Division

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Water Resources Glossary

Abbreviation	Term	Definition
ADWR	Arizona Department of Water Resources	State regulatory agency created to manage water resources.
AF (af)	Acre-feet	Measure of quantity of water. One AF is enough water to cover one acre of land with one foot of water, approximately 325,851 gallons.
AF/yr	Acre-feet per year	Measure of quantity of water in a year (365 days).
AMA	Active Management Area	Geographic areas (five) within which groundwater or other waters are monitored by ADWR.
ADMTC	Arizona Drought Monitoring Technical Committee	An ADWR committee that confers weekly to advise the U.S. Drought Monitor authors on the current drought conditions in Arizona and makes recommendations about the position of the drought boundaries for Arizona.
AWS	Assured Water Supply	A process by which ADWR certifies that a water supply meets five criteria defined by statue that ensure the provider will have sufficient supplies to meet the needs of the water service area for 100 years. Also referred to as the Assured and Adequate Water Supply.
CAP	Central Arizona Project	The reclamation project and associated works that conveys about 1.5 MAF of Colorado River water per year to Pima, Pinal and Maricopa counties.
DCP	Drought Contingency Plan	Tiered shortages to Colorado River supplies tied to Lake Mead surface elevations intended to prevent shortages that would trigger federal actions.
LTSC	Long Term Storage Credit	An account established to credit water stored using a water storage permit at a water storage facility for future use.
M&I	Municipal and Industrial (sub-contract)	Contract by which water users can obtain a share of Arizona's allotment of Colorado River via CAP. Primarily for municipal and industrial users, these contacts are the means by which Tempe and other users receive the majority of their CAP allotments.
NCS	New Conservation Space	Surface water stored behind the additional space was created when SRP's Theodor Roosevelt Dam was modified in the 1990s. Tempe's portion of the storage capacity is 13,500 AF. This water right is not appurtenant to the land, meaning it can be utilized anywhere with the water service area for beneficial uses.
NOAA	National Oceanic and Atmospheric Administration	A scientific agency within the United States Department of Commerce that focuses on the conditions of the oceans, major waterways and the atmosphere.
SRP	Salt River Project	The reclamation project and associated works that collects and conveys water from the Salt and Verde watersheds to the Phoenix Metropolitan area.
NIA	Non-Indian Agriculture (sub-contract)	Contract by which water users can obtain a share of Arizona's allotment of Colorado River via CAP. Primarily for irrigation districts, these contracts can be acquired by other users through agreements and settlements.

Executive Summary

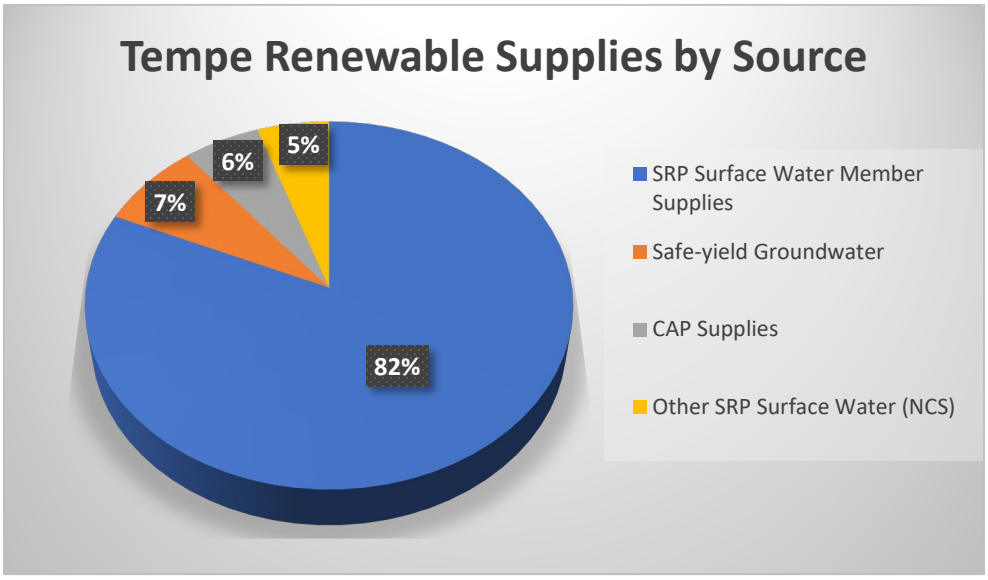
The Drought Preparedness Plan ensures Tempe has strategies in place to predict, prepare for and react to shortages in order to meet the demands of the water service area now and into the future.

Drought Preparedness Plan Objectives

- Monitor drought conditions that can create shortages.
- Understand the impact of shortages on Tempe's supplies.
- Maintain the ability to adjust operations to meet demands.

Climate studies illustrate that the Western United States has experienced cyclical periods of drought and above average rainfall for many millennia. These cycles occur at different frequencies and intensities, and result from numerous and complex factors. Despite these challenges, many communities in the Central Arizona desert have managed to adapt and thrive. Utilizing renewable resources as a primary means to meet demands is critical to sustaining life in the desert. From the first peoples that settled in the Salt River Valley who built canals, to the farmers near Hayden Ferry in the late 1890s who put up their land as collateral to tame the Salt River, to today's innovative reuse and transportation projects that provide sources of water unimaginable in the past, Tempe has a long history of responsible water use and sound water management practices. Figure 1 illustrates Tempe's typical allocation of renewable water supplies. In most years, the majority, 87 percent, of demands of the water service area are met by renewable surface water supplies provided by Salt River Project (SRP). These supplies include SRP Member supplies and New Conservation Space (NCS) water. The remaining demand is met with additional renewable supplies consisting of surface water delivered from the Colorado River by the Central Arizona Project (CAP) and safe-yield groundwater.

Figure 1 - Tempe's Renewable Supply Allocation in a Typical Year



In addition to providing a framework to meet supply challenges, maintaining a drought management plan is a requirement for all Community Water Systems operating in Arizona that serve more than 1,850 people (Arizona Revised Statues (A.R.S.) § 45-341 – 45-343).

In 2002, a prolonged drought on SRP's watersheds resulted in reduced allocation (or shortage) of SRP surface water supplies. In response, Tempe developed and implemented a drought management plan, which was approved by Tempe City Council in 2004. Shortly thereafter, the drought abated and SRP allocations returned to normal. Tempe's drought management plan is routinely reviewed and updated and during the 2012 review process it was incorporated into the Water Resources Plan.

This update to the drought management plan removes it from the Water Resources Plan and expands it to include the following information:

- Updates regarding Tempe's water supplies and demands.
- Water shortage indicators and triggers.
- How and when a Water Shortage Response Team will be convened.
- Updated and expanded Shortage Management Stages and Measures.
- Draft language for a Water Shortage Ordinance.

Shortage Indicators, Triggers and Management Stages

Identifying and monitoring drought indicators that can lead to shortages is a critical aspect of Tempe's drought preparedness efforts. For each of Tempe's supplies, there are identified shortage indicators and selected triggers that reflect a point at which drought conditions are anticipated to stress supplies and potentially lead to shortages.

Table 1 - Supplies, Shortage Indicators and Triggers and Estimated Impact to Water Utility Production

Shortage Management Stage	SRP Trigger	CAP Trigger	Groundwater Trigger	Long-term Storage Credit (LTSC) Trigger	Impact on Water Utility Production*
(0) Watch	Drought of concern on SRP/CAP watersheds	DCP Tier 0	Monitor and trend static groundwater levels from wells	Annual LTSC Utilization is greater than Recharge	0
(1) Alert	Allocation reduced by less than 10 percent	DCP Tier 1	Static groundwater trends indicated downward trend	<72,000 acre-feet LTSC balance	Up to 3.5
(2) Advisory	Allocation reduced by greater than 10 percent	DCP Tier 2	Static groundwater levels drop to within 50 feet of pump intakes at wells	<60,000 acre-feet LTSC balance	<4 to 8.2
(3) Emergency	Allocation reduced by 20 percent or greater	DCP Tier 3	N/A	N/A	8.3 or greater

*Note: Potential surface water supply reduction in millions of gallons per day

There are many tools available for the Water Utility to manage demands when water shortages are predicted or occurring. These may range from recommending changes to non-essential water using activities, to instituting fines and surcharges for non-compliance with temporary water usage restrictions. The demand management strategies described in this plan can be applied across many customer types to ensure Tempe maintains the ability to provide water for as much demand as possible, regardless of the magnitude of a shortage.

Tempe Drought Preparedness Plan

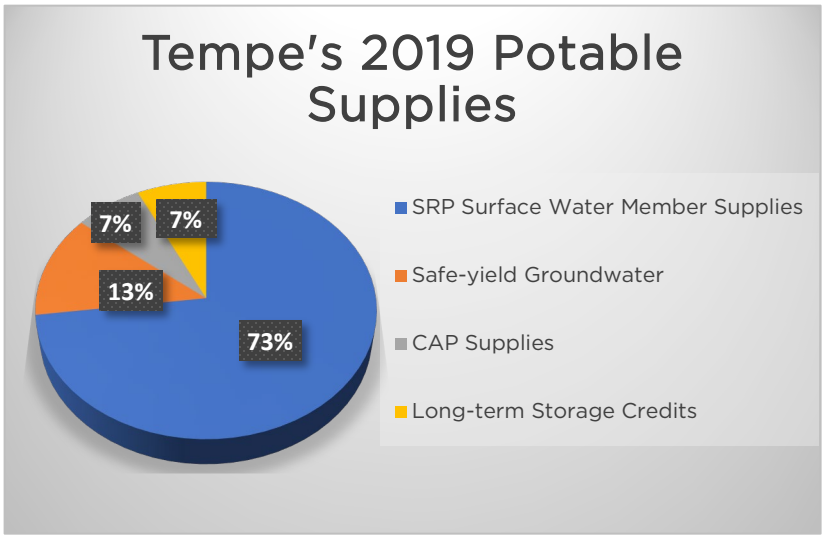
Throughout the majority of the past two decades, Arizona and much of the southwestern United States has experienced various levels of persistent drought. During this time, significant variations in the amount of annual runoff from the Salt, Verde and the Upper Colorado River watersheds have occurred. Historically, the storage and delivery systems of SRP and CAP have been efficiently managed to avoid significant shortages, despite prolonged and moderate droughts. Drought can also impact supplies of groundwater. This can occur directly by reductions to precipitation and stream flows that naturally recharge the aquifer or indirectly through increased groundwater pumping as surface water supplies grow scarce.

To ensure Tempe is prepared to meet potential supply challenges, the Water Utility is committed to monitoring drought conditions, maintaining a robust and resilient water resources portfolio, investing in infrastructure and operating an effective and efficient Water Conservation program.

Drought and Shortage

Tempe relies primarily on surface water to meet the demands of the water service area. Figure 2 illustrates Tempe's potable supplies utilized by source in 2019.

Figure 2 - Tempe Water Supply Sources 2019



For the purposes of this plan, drought is defined as a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group or environmental purpose. Droughts are the result of many factors that are largely beyond the control of a large municipal Water Utility. In contrast, shortages caused by droughts can be planned for, and potentially mitigated if they are predicted with significant lead time. Therefore, it is critical to understand how and when droughts have the potential to create shortages.

The relationship between drought and shortage may at first seem obvious. For surface water supplies, drought leads to less precipitation, less precipitation results in

less runoff, less runoff results in less surface water supplies, which results in shortages. However, the true relationship is much more complex. Tempe's Water Service Area exists significantly outside the geographic boundaries of the watersheds that provide it with surface water supplies. Although regional droughts can and do occur, it is also possible that the City of Tempe may experience a prolonged drought while the watersheds do not, or vice versa. While the Salt and Verde River watersheds and the Colorado River watershed may be simultaneously impacted by a regional drought, they may each respond quite differently. Recent studies indicate that the Salt and Verde Rivers may be up to four times more drought resilient than the Colorado River. Due to these factors, it is critical to understand and monitor drought on the watersheds and use this data to predict and plan for potential shortages.

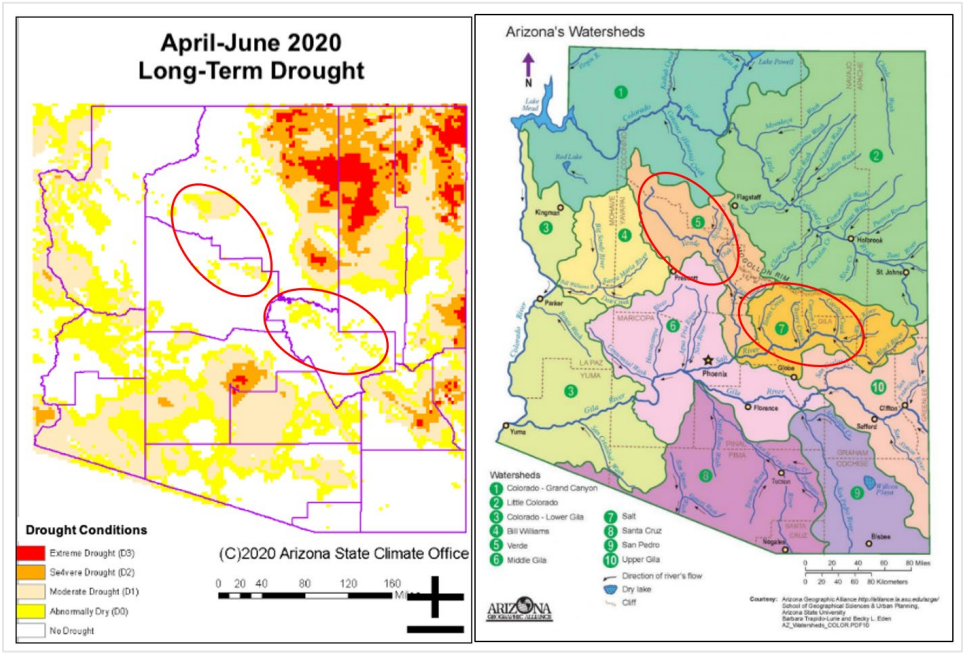
Shortage Indicators and Triggers

Identifying and monitoring appropriate shortage indicators for Tempe's water supply sources is a critical aspect of drought preparedness efforts. For each of Tempe's supplies, shortage indicators have been identified and triggers have been selected that reflect a point at which drought conditions are anticipated to stress supplies and potentially lead to shortages.

Drought Indicators on the Watersheds

SRP and CAP have significant resources dedicated to monitoring droughts and predicting potential shortages on their respective watersheds. It is prudent for Tempe to monitor drought conditions as well. To accomplish this for the Salt and Verde watersheds, the City of Tempe's Water Resources Section will monitor the drought status reports produced by Arizona Department of Water Resources (ADWR) Arizona Drought Monitoring Technical Committee (ADMTC). The indicator for a drought of concern on the Salt or Verde watershed is the drought status of the area covering SRP's watersheds in the ADMTC Long-term Drought Conditions report.

Figure 3 - Arizona Long-Term Drought Conditions Report and Map of Arizona's Watersheds



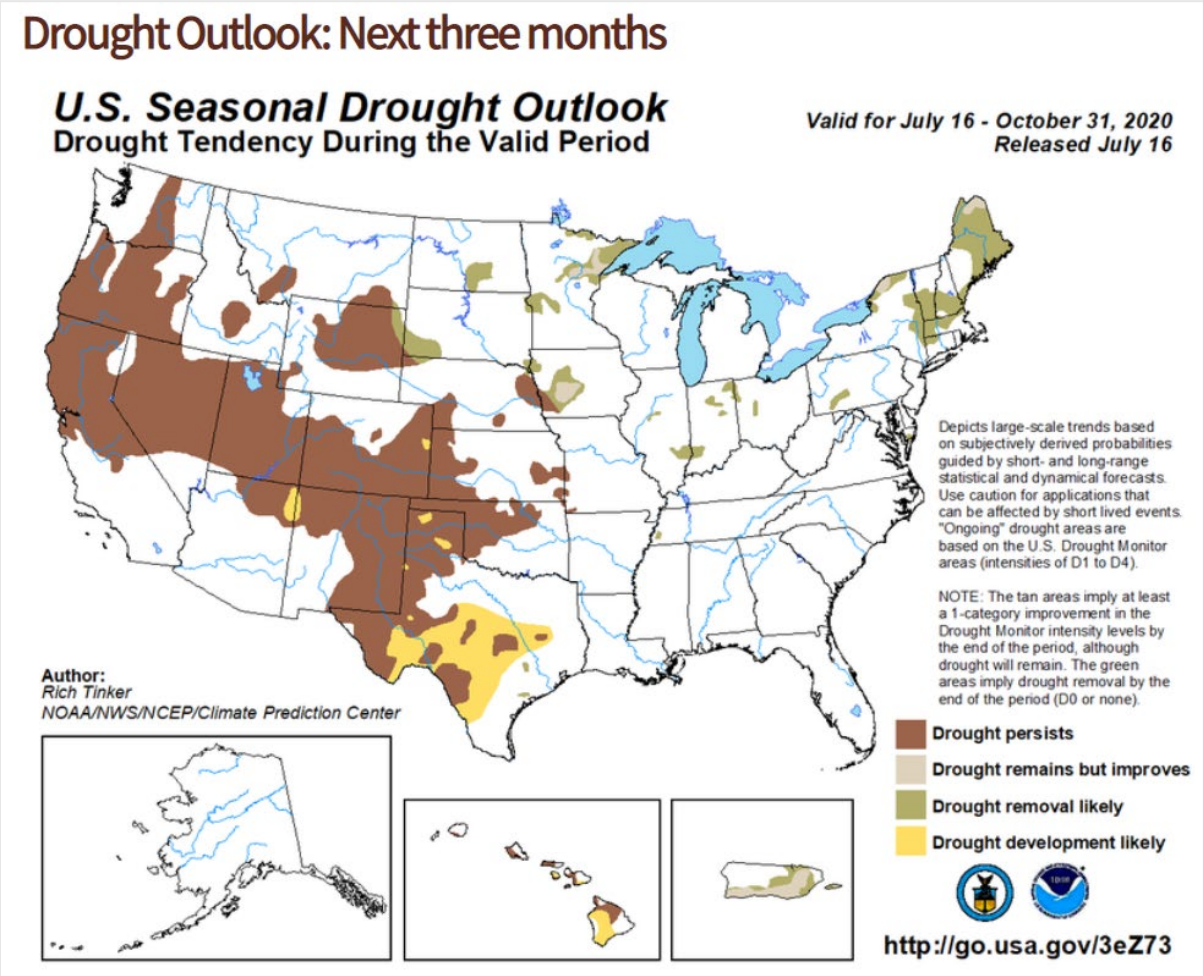
Overlaying Arizona's watersheds indicated by the red ovals in Figure 3 with the drought status in Arizona, allows for drought conditions on the Salt and Verde watersheds to be quickly and qualitatively evaluated.

The vast watershed of the Colorado River is divided into two basins and covers portions of seven western states and Mexico. The river is managed by the United States government, and there are significant federal resources invested in monitoring and communicating drought status, runoff conditions and shortages.

Figure 4 - Colorado River Watershed

Tempe will monitor drought on the Colorado River watershed by tracking the National Oceanic and Atmospheric Administration's (NOAAs) drought status and forecast reports.

Figure 5 – Three-Month Forecast Drought Conditions



When significant and prolonged drought conditions are observed on the Salt and Verde River watersheds, or the Colorado River watershed, the Water Utility will monitor the drought status and remain engaged with SRP and CAP to ensure Tempe is as prepared as possible for projected shortages.

Watershed Shortage Triggers

When drought conditions are forecasted or occurring on the majority of the Salt or Verde watersheds and/or Upper Colorado basin, Tempe will increase to Shortage Management Stage 0, which will involve regularly monitoring of the drought and watershed.

SRP Reduced Surface Water Allocations Shortage Indicator

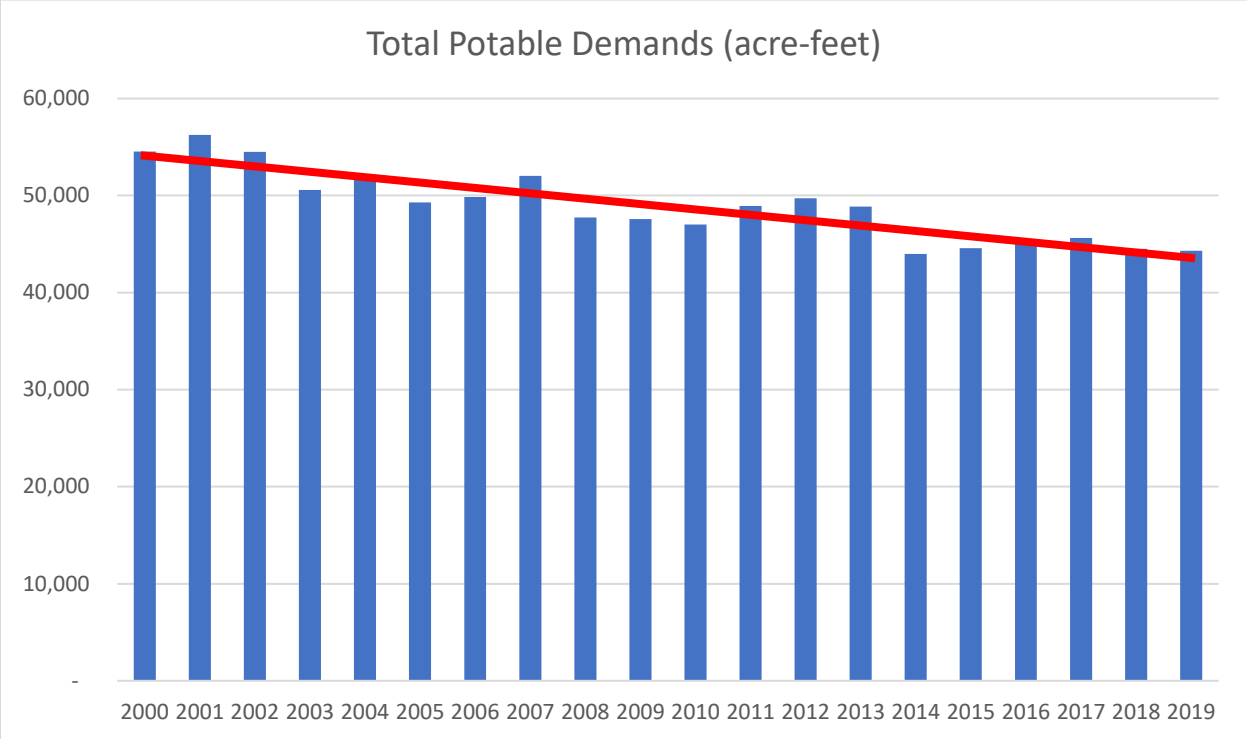
Tempe has benefitted for more than 100 years from SRP's effective management of the watersheds, rivers and reservoirs that provide the majority of surface water supplies used to meet the demands of the water service area.

The current drought cycle began in the late 1990s, when several unusually dry years occurred. It quickly became apparent that a potential shortage on SRP's system was looming. By the early 2000s, SRP confirmed that in coming years there would be a reduction in the water allocation from 3.0 acre-feet per acre to 2.0 acre-feet per acre for member lands.

In response, Tempe's Water Utility prepared a report for the Tempe City Council in 2002. The report outlined Tempe's drought planning and water management strategies (Tempe Drought Plan Stage 1 measures), which were implemented in 2003 and 2004.

In 2002, the total potable demand for the Tempe Water Service Area was approximately 55,000 acre-feet. This number was decreased immediately in the years that followed due in part to the implementation of Stage 1 measures of Tempe's drought plan. Since that time, increased conservation efforts, public awareness and development that favors lower water usage has led to a continual decline in overall water use in Tempe. Figure 6 illustrates the total potable demand of the water service area from 2000 to 2019.

Figure 6 – Total Potable Metered Demands of Tempe Water Service Area 2000-2019



In 2004, the Drought Plan was updated to include a second stage of management strategies (Stage 2) that would be implemented if drought conditions persisted. The Tempe City Council approved the measures outlined in the updated Drought Plan at a City Council Issue Review Session in September 2004. However, implementation of Stage 2 measures would require additional approval by the Tempe City Council. The trigger for implementing Stage 2 was also tied to reductions in SRP allocations (reduction to 1.5 acre-feet per acre) or if Tempe's CAP Municipal and Industrial (M&I) subcontract allocation was cut by 50 percent.

Fortunately, Stage 2 implementation was not required as a series of wet years occurred in the mid-2000s and conditions on the SRP watershed allowed a return to full allocations for SRP member lands.

Currently, SRP's system is nearly full and projections indicate that it will fill again in 2021.

SRP Shortage Trigger

When the SRP member land allocation mix is predicted to be less than a full allocation in the coming year, a shortage will be anticipated. Based on the magnitude of the shortage, and at the discretion of the Municipal Utilities Director or Deputy Municipal Utilities Director - Water Utilities, the appropriate Shortage Management Stage will be selected. Recommendations for these trigger levels can be found in the Shortage Management Stages Section of this document.

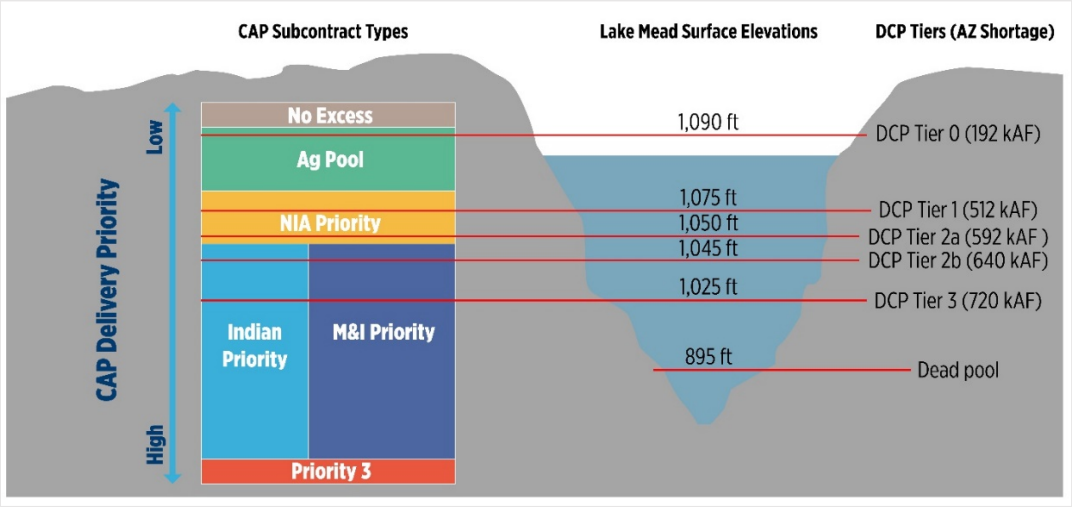
Colorado River Drought Contingency Plan Shortage Indicators

In the mid-2010s, the Colorado River reservoir system began to consistently struggle to maintain storage at 50 percent of capacity. This massive reservoir system supports nearly 5.5 million acres of farmland and provides water to more than 40 million people in the western United States and Mexico.

In order to prevent shortages that would trigger federal actions and create restrictions on the operation of the Colorado River system, users of the river convened to develop a plan. Representatives from the Department of Interior, the Bureau of Reclamation and each of the seven Colorado Basin states crafted agreements describing voluntary reductions in supplies and other measures that would be enacted should the level of reservoirs continue to decline.

The Drought Contingency Plan (DCP) effort in Arizona was not without conflict, however under the leadership of ADWR and CAP, the group of nearly 40 stakeholders developed a package of agreements that came to be called the Arizona DCP Implementation Plan. On April 16, 2019, the Drought Contingency Plan Authorization Act was signed into law and on May 20, 2019, the DCPs were signed by representatives from each state and agency.

Figure 7 – Arizona's CAP Subcontract Types and Delivery Priorities, DCP Shortage Tiers and Associated Reductions with Lake Mead Surface Elevation Triggers



In 2020, DCP officially started as the Colorado River system was deemed to be in DCP Tier 0 shortage and Arizona was required to take 192,000 acre-feet of shortage. This is equivalent to the water that Arizona users have voluntarily left in the river since 2015. Based on the current level of DCP Tier 0 shortage, CAP will not take deliveries of Colorado River water that would have been available for groundwater replenishment. Additionally, CAP agricultural allotment decreased by about 15 percent.

Moving forward, CAP and Native American communities will continue to avoid taking deliveries to leave water in the system and continue to prevent future shortages. The current DCP agreements expire in 2026 and new rules governing how to manage the supplies of the Colorado River System will need to be developed prior to that time. The term of DCP was set to coincide with the schedule for review and possible revision to the federal guidelines that describe how the Colorado River System is operated. The Bureau of Reclamation is required to review the current operational guidelines and develop new guidelines before 2026, through a process called "Reconsultation." Reconsultation could have significant impacts on how much Colorado River water is available to downstream users. It is critical that the new guidelines take the needs of all water users into account. At the state level, this process has already begun. In June 2020, ADWR resumed the DCP commission and renamed it the Arizona Reconsultation Committee (ARC). As with DCP, most of the activities associated with ARC will be conducted at the State level. However, Tempe will remain engaged in this process and provide comments and guidance when appropriate.

CAP Shortage Triggers

Should drought conditions persist and further cuts to Arizona's CAP allotment occur, impacts to Tempe will be based on the amount of water available to CAP in that year, whether or not all CAP sub-contractors take their full allotment of water and the level of Lake Mead's surface elevation. Monitoring these shortage indicators will be critical in determining the impact on potential shortages to Tempe's CAP supplies. Table 2 illustrates a potential estimate on Tempe's CAP supplies based on DCP Shortage Tiers and 2020 CAP allocations and orders.

Table 2 – Estimated Shortage to Tempe's CAP Supplies by DCP Tiers

DCP Tier Shortage	Reduction in Tempe's CAP Allocation
Tier 0	0%
Tier 1	0.2%
Tier 2a	0.5%
Tier 2b	3.4%
Tier 3	11.3%

Based on the magnitude of the shortage predicted and at the discretion of the Municipal Utilities Director or Deputy Municipal Utilities Director - Water Utilities, the appropriate Shortage Management Stage will be selected. Recommendations for these trigger levels can be found in the Shortage Management Stages Section of this document.

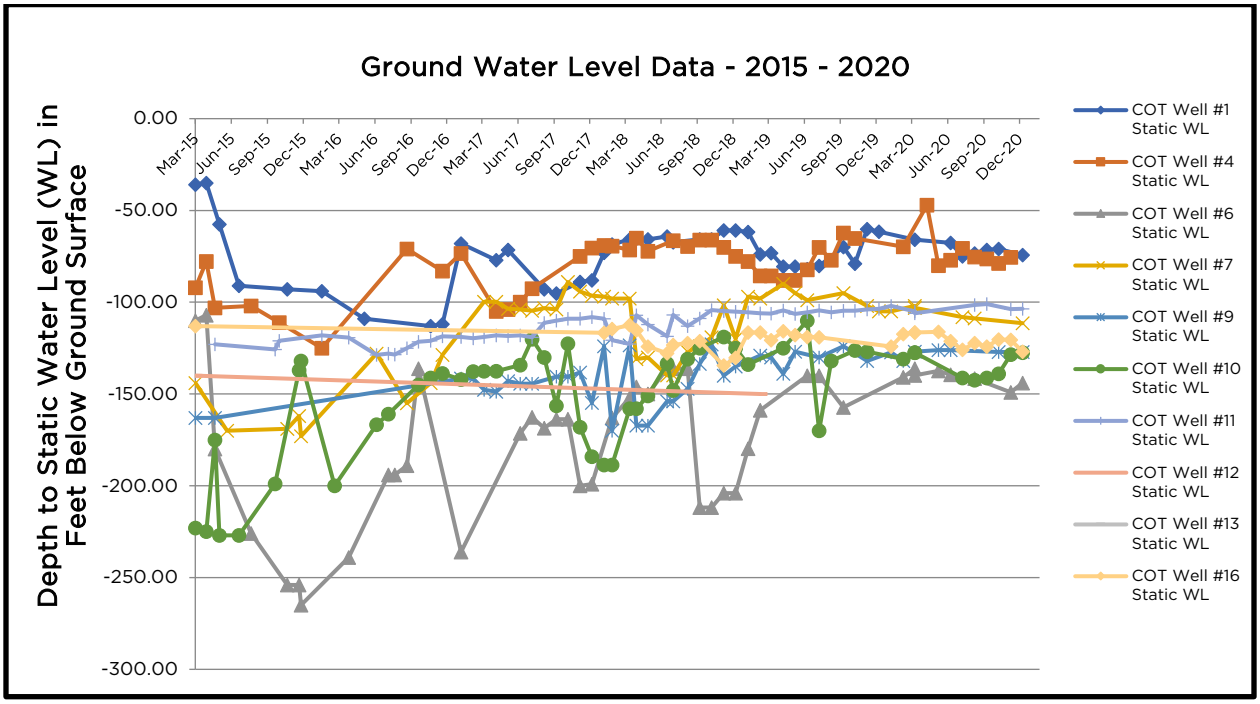
Groundwater Supply Indicators

Water providers operating within the Phoenix Active Management Area (AMA) are subject to limitations on the amount of groundwater they can utilize to meet demands. The management goal of the Phoenix AMA is to achieve and maintain safe-yield, which is a condition where the volume of withdrawals from an aquifer and the volume recharged are in balance. Through the Assured Water Supply (AWS) designation process, ADWR certifies a finite amount of groundwater available to each provider, called safe-yield groundwater, which can be withdrawn annually without impacting progress toward the goal of achieving safe-yield for the AMA. The safe-yield groundwater allotment available to providers like Tempe is therefore considered sustainable, and a renewable resource, as it is replenished without performing artificial recharge activities.

Although the Phoenix AMA has not achieved safe-yield, groundwater levels in the basin are mostly stabilizing due to the limited use of groundwater and significant recharge activities.

Groundwater level trends represent the best shortage indicator for Tempe's groundwater supplies. These trends are developed and maintained by Water Utilities staff, through monitoring of the static water levels at Tempe's production wells.

Figure 8 – Groundwater Level Trends



Groundwater Shortage Triggers

When downward trends in static water levels are observed for a majority of Tempe's potable water production wells, Shortage Management Stage 1 will be implemented. When a majority of potable water production wells are observed to have a declining static water level, to within 50 feet of pump intake levels, the Shortage Management Stage will be increased to Stage 2.

Long-term Storage Credits Indicators

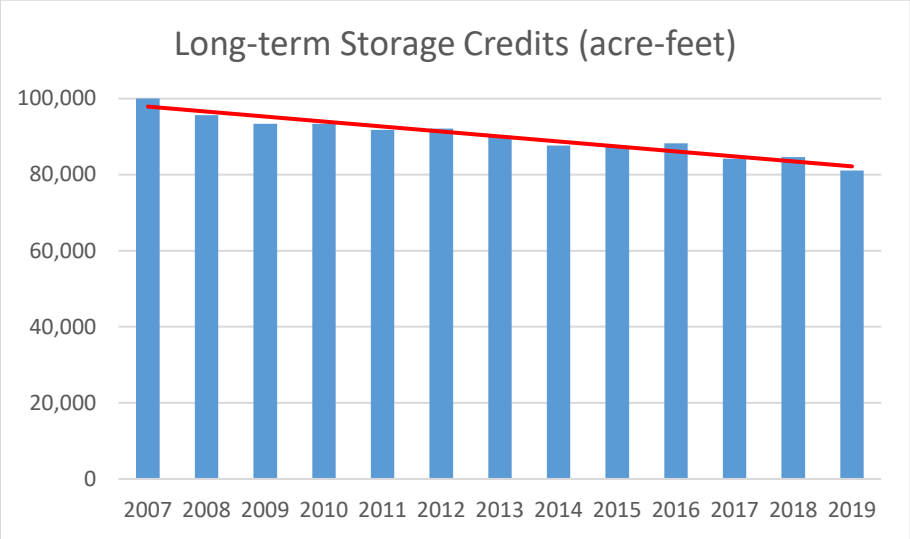
Long-term Storage Credits (LTSC) are generated by storing non-groundwater water in the aquifer. LTSC can be withdrawn from the aquifer without impacting the goal of achieving safe-yield and are therefore considered renewable. Tempe views the accrual of LTSC as a sustainable means to provide for future demands, should shortages occur to surface water supplies.

To ensure access to this critical backup water supply, Tempe must store sufficient water in the aquifer, develop and maintain the infrastructure necessary to withdraw the water and monitor the aquifer to ensure that it remains healthy and available for use when needed. This requires a collaborative effort, encompassing many aspects of the Water Utility. Tempe's Water Resources Master Plan describes how water is stored in the aquifer for future use. Detailed plans for developing and maintaining groundwater recharge and recovery infrastructure are in Tempe's Water and Sewer Master Plan. The Water Resources and Water Engineering Sections monitor the quantity of water withdrawn and recharged, and Tempe's Environmental Services Section manages the water quality permits that ensure water recharged into Tempe's aquifers meets or exceeds required regulatory standards.

Additional information relating to groundwater quantity and quality is located in Tempe's Groundwater Resources Master Plan (2018).

The storage of LTSC allows Tempe to pump renewable water supplies above the safe-yield pump allotment, without the need for approval from ADWR. Tempe has accrued 81,418.95 acre-feet of LTSC as of December 31, 2019. In recent years, process control and water quality objectives have resulted in the on-going utilization of more than 1,500 acre-feet of LTSC per year, on average. This utilization of LTSC represents a net decline in overall credits, as withdrawal has been greater than recharge during this period. This trend is illustrated by Figure 9, which shows a steady decline in Tempe's LTSC balance. The Water Utility has been working to address operational and water quality challenges through operational and engineering solutions, infrastructure and treatment process improvements, to minimize groundwater use.

Figure 9 – Tempe Utilization of LTSC



In order for LTSC to be a reliable source of water supply for the future, there must be a sufficient quantity of that supply to meet the needs of the water service area. Although the impacts of drought and shortage are highly variable and difficult to predict, it is necessary to make some assumptions about the quantity of LTSC that Tempe must maintain to prepare for a time when other sources of supply may be reduced. The projections of many water managers indicate a potential supply reduction of as much as ten percent within the next decade. Shortages of this magnitude could result in an approximate 4,500 acre-feet reduction in surface water supply for Tempe. Combining this with Tempe's current average utilization of net LTSC for operational purposes (1,500 acre-feet), it is reasonable to assume that Tempe will require at least 6,000 acre-feet of LTSC, on average each year, to meet demands during shortage. If a period of drought is significant and sustained, this need could continue for several years. As the severity and duration of droughts cannot be known precisely, it is advisable to apply a safety factor of 20 percent to the balance of LTSC required.

LTSC Shortage Triggers

When the Water Utility is unable to maintain a zero balance between LTSC utilization to generation, Tempe's Shortage Management Stage will be increased to Stage 0. When Tempe's LTSC balance approaches 72,0000 acre-feet, Shortage Management Stage 1 will be initiated. Should Tempe's LTSC balance drop to within the minimum annual threshold for ten years (60,000 acre-feet), Shortage Management Stage 2 will be initiated.

Water Shortage Response Team

If a situation arises that may impact the Water Utility's ability to meet water demands, the Water Resources Manager will request approval from the Municipal Utilities Director or Deputy Municipal Utilities Director - Water Utilities to convene a Water Shortage Response Team. Typically, this would take place when implementation of Stage 1 measures has occurred or are expected. However, the Municipal Utilities Director or Deputy Municipal Utilities Director - Water Utilities can request a Water Shortage Response Team be convened at any time.

Shortages can take many forms and have varied impacts. A shortage can be caused by a prolonged drought or a short-term emergency event. When the Water Shortage Response Team is convened, it will be constructed so as to meet the specific needs of the potential shortage at hand. At a minimum, the team will likely consist of the Water Utilities Managers, Deputy Municipal Utilities Director - Water Utilities and/or Municipal Utilities Director, Finance and Customer Services Managers, City Attorney's Office, Community Services Managers, staff from Facilities and Transit, staff from Communications and Media Relations and the Sustainability Department. Table 3 illustrates the positions and potential roles that the basic Water Shortage Response Team will contain.

Table 3 – Roles and Responsibilities of the Water Shortage Response Team

Title	Role	Responsibilities
Water Resources Manager	Water Shortage Response Team Leader	Lead and manage response effort, coordinate and disseminate information and communication with internal and external partners and customers
Plant Operations Manager	Water Quality and Treatment Management	Provide guidance on potable water production capabilities
Environmental Services Manager	Water Quality and Treatment Management	Ensure on-going compliance with water quality regulations
Water Engineering Manager	Planning and Engineering Manager	Liaison with City-wide planning to gather information related to water use projections for new connections, lead efforts to expand supply infrastructure and utilize emergency interconnections effectively
Public Information Officer	Communications Director	Deliver Water Utility's drought and shortage messaging, ensure effective communications with customers and the media and produce related press releases
Water Utilities Operations Manager	Distribution System Operations Manager	Oversee the frequency and intensity of leak detection efforts, coordinate flushing and flood irrigation efforts
Water Resources Manager	Conservation Manager	Provide appropriate water reduction measures based on shortage anticipated, provide liaison to water users in all sectors
Deputy Municipal Utilities Director – Water Utilities		Approve overall direction of the response and coordinate inter-department actions
Finance Manager	Finance Manager	Estimate cost impacts of operation changes, recommend rate changes and use of revenue stabilization funds
Customer Services Manager	Customer Service	Maintain primary means of customer contact and billing, increasing frequency of meter reading and coordination of meter testing
Legal Staff	Legal Staff	Review legality of program, shortage ordinances, proposed emergency rate changes, interagency agreements and contracts
Internal Support Departments	Parks and Recreation Managers, Facilities, Neighborhood Services, Economic Develop and Transit Managers, Sustainability staff	Provide guidance on modifying or curtailing water intensive activities at City facilities and rights-of-way, manage impacts of shortage to operations and programs

If convened, the leader of the Water Shortage Response Team will coordinate regular meetings and provide updates on the response as the situation progresses. Based on projected impacts of the supply challenge, the effort may be expanded to include additional stakeholders. As shortage response measures are planned, it will be crucial to determine potential challenges these measures may create in maintaining normal operations. Therefore, the Water Shortage Response Team may coordinate

stakeholder outreach committees in order to seek input. These committees will be specific to sectors of the economy and may include staff from other City departments, members of the public and/or owners of private businesses served by the water system.

Ongoing Water Conservation and Efficiency Verses Emergency Demand Management

Educating customers about water conservation and efficiency has many benefits, such as reducing water waste and saving customers money. Water conservation efforts are more than a regulatory requirement, they represent good stewardship of resources. Tempe has been committed to water conservation for more than 20 years, steadily advancing and improving conservation to meet the needs of the community and linking measurable savings to actions whenever possible. Tempe's ongoing conservation efforts seek to gradually advance the understanding of water users on how to efficiently and effectively utilize water while continuing to support the activities and lifestyles they have come to enjoy from Tempe's community.

In contrast, emergency demand management measures are intended to provide a means by which the Water Utility can reduce water demands when faced with potential supply shortages. Many of the proposed changes regarding use and restrictions, described in this plan, are not advocated as part of Tempe's on-going water conservation efforts. These measures are intended to be enacted in response to looming shortages and to be temporary in nature. It is likely that many of these strategies will have impacts on aesthetic aspects of the community, such as landscapes, or non-essential services such as dining or recreation. These measures will be enacted to ensure the Water Utility maintains the ability to meet the basic, essential demands of the water service area.

Tempe has specific experience with implementation of emergency demand management measures associated with shortages. The measures detailed in Shortage Management Stage 1, related to reductions in irrigation and golf course water use, come directly from that experience. Although time has passed since these specific measures were implemented, the systems they impact and activities they are meant to curtail or restrict remain largely unchanged. Therefore, there is significant confidence that these measures will continue to be successful in reducing demands now and into the future. Appendix B contains background information related to this subject.

Water Wasting, Fines and Surcharges

The following sections describe the financial tools available to the Water Utility to assist in meeting financial challenges created by shortages. Some, such as the Water Wasting Ordinance, exist in routine operation of the Water Utility, outside of shortage conditions. Others, such as surcharges and fines, are reserved for non-routine situations caused by shortages. As shortage conditions worsen, it is hoped that the implementation of measures contained in this plan will reduce water demand and allow the Water Utility to continue meeting as much of the essential demand as possible. However, as the demand decreases, revenue generated by the provision of water services will also decrease.

Water Wasting Ordinance

In 1992, Tempe City Council passed Ordinance 91.46, prohibiting wasting of water. The Water Wasting Ordinance contains a framework for communications with customers about water wasting and conservation. Notifications begin with verbal warnings, and after reasonable time, to correct the problem, escalate to written violations that include required actions and can carry financial penalties. Currently, this ordinance is utilized as a tool to advance education about conservation and ensure water is utilized efficiently and effectively. As shortages are anticipated, the ordinance can be re-focused and revised to allow for more aggressive actions and consequences for customers determined to be wasting water.

Fines and Water Shortage Revenue Surcharge

Fines are currently authorized in the Water Shortage Ordinance. Although fines will not have the benefit of preemptively saving water in most cases, they will provide additional impetus for customers to avoid non-essential water uses when shortages are predicted or occurring.

In order to ensure the Water Utility maintains sufficient funding to conduct shortage specific responses and normal operations, the Municipal Utilities Director or Deputy Municipal Utilities Director - Water Utilities may impose a water shortage revenue surcharge. In addition to generating revenue essential to operate the Water Utility, the increased costs to customers associated with the water shortage revenue surcharges will encourage customers to further reduce non-essential demands.

It is recommended that fines and surcharges be implemented early in the shortage response process, and in a phased-in manner. Revenues will be required immediately to support response efforts when a shortage occurs, and cost increases can be a strong driver for curtailing demand. In order to accomplish this as proportionally as possible, the magnitude of the fine or surcharge should be tied directly to the severity of the shortage. As shortage levels increase, the magnitude of the fine or surcharge should commensurately increase. During Shortage Management Stage 1, surcharges may apply only to Tempe's highest water tiers in each sector and "fines" will be issued as warnings. During Shortage Management Stage 2, surcharges may apply to water use in the second highest rate tier (where applicable) and fines may have monetary consequences. In Shortage Management Stage 3, surcharges may be applied to all but essential water use, and fines may carry significant monetary consequences.

Shortage Management Stages

Tempe's shortage management stages have been developed to easily communicate supply shortage conditions and associated demand management strategies that may be utilized to allow the Water Utility to continue to meet as much water demand as possible. In 2019, Tempe participated in a regional effort to review the published drought management plans of municipal providers in the valley and throughout the Southwest. The shortage management stages described in this plan are the result of that effort and contain recommended monitoring and conservation and demand management strategies. The strategies included in each stage of this plan are examples of the types of demand management strategies that are appropriate to Tempe's specific supplies and demands. These strategies were selected to be enacted to curtail water demands as shortages worsen. There are additional conservation and demand management strategies that can be implemented, which

can be found in Appendix C. The exact water shortage management stage, and associated conservation and demand management measures implemented, may be based on the triggers described in this plan or an emergency supply situation that cannot be easily predicted. Emergency implementation of any shortage management stage or demand management measure will be solely based on the discretion and directives of the Municipal Utilities Director or the Deputy Municipal Utilities Director - Water Utilities. Under non-emergency conditions, when a drought worsens and leads to water supply shortages, conservation and demand management strategies will be selected and implemented based on the recommendation of the Water Resources Manager or Water Shortage Response Team leader, with approval from the Municipal Utilities Director or the Deputy Municipal Utilities Director - Water Utilities.

Shortage Management Stage 0 (Watch):

Indicators and Triggers:

- Salt and Verde Watershed Drought of Concern
    - A majority of either the Salt or Verde watersheds are listed as "Moderate Drought – D1" by ADWR's Long-term Drought report.
        - https://new.azwater.gov/drought/drought-status
- Colorado River Drought of Concern
    - A majority of the Upper Colorado Basin is listed as "Drought Persists" by the NOAA Weather Service Climate Prediction Center Seasonal drought forecast
        - https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php
- Colorado River Allocation to Arizona is reduced by any amount
    - DCP Tier is 0 or greater or forecast of DCP Tier 0 or greater is probable (greater than 50 percent) for the upcoming year
- Groundwater levels
    - Monitor and trend static groundwater levels for all Tempe municipal wells
- LTSC
    - Annual utilization of LTSC for operational purposes is greater than capacity of current recharge

Planning and Mitigation Strategies:

- Begin routine updates regarding drought status, forecasts for watersheds and the potential impacts of the shortage on the Water Utility's ability to meet demands
- Begin public messaging of drought status and reduced water use recommendations
- Increase/begin recharge activities
- Cease pumping of groundwater above safe-yield groundwater allotment
- Evaluate alternative supply sources such as reclaimed water

Shortage Management Stage 1 (Alert):

Indicators and Triggers:

- Any Stage 0 triggers have occurred and:
    - CAP enters DCP Tier 1
    - SRP water allocations are reduced less than ten percent of full allocation
    - LTSC balance is less than 72,000 acre-feet

    - Static groundwater trends show decreasing levels at a majority of potable water production wells

Conservation and Demand Management Strategies:

- Convene Water Shortage Response Team
- Reduce SRP irrigation water use at city parks and athletic fields by 15 percent
- Reduce irrigation water use at all city parks not served by SRP irrigation by ten percent
- Reduce SRP residential flood irrigation deliveries by 11 percent (two less irrigation runs per year)
- Reduce total water use at municipal golf courses by ten percent
- Discontinue winter grass overseeding at Tempe city parks or facilities
- Recommend homeowners and businesses eliminate winter grass overseeding
- Recommend landscape watering times between 8:00 p.m. and 6:00 a.m.
- Increase public outreach and messaging of current shortage stage
- Increase the xeriscape landscape conversion rebate for turf removal
- Expand the low flow toilet rebate above normal funding levels
- Increase enforcement efforts and begin discussion to revise Water Wasting Ordinance (91.46)
- Implement stage 1 water shortage revenue surcharges and warnings for non-compliance with recommendations and water wasting

Water Supply Augmentation Measures:

- Continue to store reclaimed water and surface water supplies in aquifers

Shortage Management Stage 2 (Advisory):

Indicators and Triggers:

- Any of the Stage 1 triggers have occurred and/or:
    - CAP enters DCP Tier 2
    - SRP water allocations are reduced by ten percent
    - Static groundwater level is within 50 feet of pump intakes for a majority of potable water production wells
    - LTSC balance is less than 60,000 acre-feet

Conservation and Demand Management Strategies:

- All Stage 1 measures
- Restricting landscape watering times to between 8:00 p.m. and 6:00 a.m.
- Institute odd/even day landscape irrigation schedules
- Prohibit overseeding
- Implement Stage 2 water shortage revenue surcharges and implement fines for non-compliance with recommendations and water wasting
- Revise and obtain council approval for Water Wasting Ordinance (91.46)

Water Supply Augmentation Measures:

- Increase groundwater well production to supplement surface water supply production
- Continue to store reclaimed and surface water supplies in aquifers, provided potable demands are met
- Further reduce flood irrigation deliveries depending on available SRP allocation

Shortage Management Stage 3 (Emergency):

Indicators and Triggers:

- Any of the Stage 2 triggers have occurred and/or:
- CAP enters DCP Tier 3
- SRP water allocations are reduced by more than 20 percent

Conservation and Demand Management Strategies:

- All Stage 2 measures
- Restrict all landscape watering
- Eliminate flood irrigation deliveries
- Restrict all non-essential water usage (i.e., washing of sidewalks, cars, etc.)
- Implement Stage 3 water shortage revenue surcharges and fines

Water Supply Augmentation Measures:

- Request groundwater pumping drought exemption from the ADWR (AWS Rules)
- Maximize groundwater well production capacity as primary means for potable production
- Cease any flushing or street sweeping activities
- Cease all recharge activities

Table 4 summarizes the Shortage Management Stages and conservation and demand management strategies included in this plan. These strategies have been identified as potentially providing the highest likelihood of allowing the Water Utility to maintain the ability to meet as much demand as possible during surface water supply shortages. Tempe's Supplies, shortage indicators and triggers and the estimated impact to Water Utility production at each stage can be found on page 6 in Table 1.

Table 4 – Shortage Management Stages and Demand Management Strategies

Shortage Management Stage	City Facilities and Water Utility Operational Management Strategies	Residential, Commercial and Industrial Management Strategies
Watch	• Begin internal/external routine updates on drought status • Start/increase recharge efforts • Cease operational use of groundwater above safe-yield allotment • Evaluate alternative supplies	• Increase participation in Tempe Conservation Program
Alert	• Convene Shortage Response Team • Reduce irrigation at all facilities • Discontinue overseeding of turf areas • Increase conservation rebates • Increase Water Wasting Ordinance enforcement efforts • Implement Water Shortage Revenue Surcharges • Reduce Flood Irrigation deliveries	• Comply with voluntary water use requests: water landscape only between 8:00 p.m. and 6:00 a.m., no overseeding of turf areas
Advisory	• Increase groundwater production • Increase Water Shortage Revenue Surcharges and fines for water wasting	• Comply with required restrictions: water landscape only between 8:00 p.m. and 6:00 a.m., no overseeding of turf areas, odd/even day landscape irrigation schedules
Emergency	• Request groundwater drought exemption from ADWR • Cease all distribution system flushing and street sweeping • Cease all recharge • Increase Water Shortage Revenue Surcharges and fines for water wasting	• Comply with requirement to cease all landscape watering and non-essential water usage

Water Shortage Response Ordinance

Implementing a water shortage ordinance prior to the declaration of shortages will allow the Water Utility to be prepared to respond as quickly as possible when shortages are predicted.

The draft water shortage ordinance language in Appendix A identifies the Municipal Utilities Director or their designee as responsible for managing Tempe's response to an emergency supply situation. The details of the response come from this plan, and include setting shortage management stages, implementing specific shortage response operational related activities, issuing recommendations and restrictions on water use, implementing surcharges, fees and penalties, granting variances and lifting these measures as supply conditions improve.

Appendix A - Water Shortage Response Ordinance Draft Language

Draft language for a potential water shortage response ordinance:

Article VIII. – Water Shortage Response

DIVISION 1 – IN GENERAL

Sec. 33-143 Definitions

For the purposes of this article, the following words and phrases shall have the meanings respectively ascribed to them by this section; unless the context clearly indicates a different meaning:

Plan means the City's Drought Preparedness Plan

Director means the Municipal Utilities Director, or their designee

Sec. 33-144 Purpose

This article is intended to provide the Director the ability to manage demands of the water service area during emergency situations. Emergency situations may develop quickly and require immediate response. This article describes the rules and guidelines that govern response by the City to emergency conditions. This article is not intended to regulate beneficial water use under non-emergency conditions, water wasting (see Article VI) or water conservation (see Article VII).

Sec. 33-145 Authorization

In the event that the water supplies available to the city service area are currently, or forecasted to be, reduced the Director, in accordance with the Plan shall determine and implement the appropriate response(s) required.

DIVISION 2 – IMPLEMENTATION AND TERMINATION

Sec. 33-146 Demand Management Stages

The Director may implement any demand management strategy listed in the Plan at any stage. The demand management strategy implemented may apply to the entire water service area or a portion of the water service area as necessary to protect the public welfare and safety. The implementation of demand management strategies will be declared to the public by posting information related to the emergency situation on the Water Utilities Division webpage and filing the same information with the City Clerk.

Sec. 33-147 Termination

The Director may rescind the implementation of demand management strategies at any time by posting an update to the Water Utilities Division webpage and filing the same information with the City Clerk.

DIVISION 3 - ENFORCEMENT

Sec. 33-148 Surcharges, Fines and Variances

The Director may implement surcharges and fines for conditions of non-compliance with implemented measures of the Plan. Monies collected associated with this ordinance will be placed in a special fund and are not rates for production of water. These funds will be used to support demand measurement related expenses, including but not limited to: expenses related to enforcement of water restrictions, demand reduction restrictions that incur customer costs or procurement of additional water supplies.

The Director may grant variances to persons or organizations that apply for relief from water use restrictions or surcharges. These may include, but are not limited to, situations where application of demand reduction strategies may create conditions of potential concerns to public health or safety, or extreme economic hardships.

Appendix B - Background Information

Results from 2003 Stage 1 Measures Implementation

Stage 1 of the Tempe Drought Plan was implemented in 2003 and 2004 when the SRP Board of Directors reduced the water allocation for SRP member lands from 3.0 acre-feet per acre to 2.0 acre-feet per acre. The 2004 Tempe Drought Plan included additional proposed measures to be included in Stage 2 of the plan if the SRP water allocation was reduced to 1.5 acre-feet per acre in any year due to drought conditions or if the CAP M&I subcontract water allocation was reduced by 50 percent or greater because of drought conditions. Implementation of Stage 2 of the plan would require additional approval by the Tempe City Council. Stage 2 implementation was not required in 2004 due to changes in drought conditions and implementation of measures in Stage 1.

Compared to 2002, significant water savings were achieved in 2003 by implementing drought mitigation Stage 1 measures specified in the plan:

- 13.1 percent reduction in SRP irrigation water use at Tempe city parks
- 15.4 percent reduction in SRP residential flood irrigation water use in Tempe
- 13.1 percent reduction in irrigation water use at the Tempe Ken McDonald Golf Course
- No winter grass overseeding at Tempe city parks or city facilities
- 9.6 percent reduction in single family residential water use for the three-month fall period in 2003, reflecting savings from a voluntary program that encourages water customers to eliminate winter lawn overseeding
- 4.7 percent reduction in total water use in Tempe in 2003

Overall water use in the Tempe Water Service Area was reduced during implementation of the Stage 1 Drought Plan measures in 2003 and 2004, due in part to the City following the recommendations of the Tempe Drought Plan. Total potable water use in the Tempe municipal water system decreased from 58,657 acre-feet in 2002 to 55,916 acre-feet in 2003 and 53,972 acre-feet in 2004. Since 2003, total water use in Tempe has continued to decline slightly or remain flat.

Appendix C - Conservation and Demand Management Strategies

To better understand the list of potential options for demand management, Tempe worked collaboratively with the Arizona Municipal Water Users Association and

Arizona State University to evaluate drought management strategies. Those efforts led to the development of draft lists of demand management strategies and a better understanding of when and how each could be implemented when supply shortages occur. Tables 5, 6, 7 and 8 contain demand management strategies, and metrics to evaluate their usefulness in Tempe when surface water supplies are reduced.

Table 5 – Demand Management Strategies and Tempe Shortage Management Stage: Watch

Strategy	Directly Measurable Result (Y/N)	Measurement Method (Estimate/ Meter)	Magnitude (Minor/ Significant)	Passive	Active
Increase monitoring of weather and climate data related to surface water supply	N			X	
Increase conservation messaging	N			X	
Recommend restaurants provide water only on request	Y	Estimate	Minor		X
Recommend hotels wash linens upon request	Y	Estimate	Minor		X
Increase water wasting enforcement efforts	N			X	
Conduct water audits at all City Facilities	Y	Estimate	Minor		X
Increase rebate programs	Y	Estimate		X	
Start/increase aquifer recharge efforts	Y	Meter	Significant		X

Table 6 - Demand Management Strategies and Tempe Shortage Management Stage: Alert

Strategy	Directly Measurable Result (Y/N)	Measurement Method (Estimate/ Meter)	Magnitude (Minor/ Significant)	Passive	Active
Restrict restaurants to provide water only on request	Y	Estimate	Minor		X
Restrict hotels to wash linens only upon request	Y	Estimate	Minor		X
Reduce water use at City Facilities (Parks and Right-of-ways)	Y	Meter	Significant		X
Prohibit vehicle washing at City Facilities with potable water	Y	Meter	Minor		X
Implement irrigation scheduling (odd/even)	Y	Estimate	Minor		X
Restrict washing of impervious surfaces	Y	Estimate	Minor		X
Evaluate pool related rebate program	N			X	

Table 7 – Demand Management Strategies and Tempe Shortage Management Stage: Advisory

Strategy	Directly Measurable Result (Y/N)	Measurement Method (Estimate/ Meter)	Magnitude (Minor/ Significant)	Passive	Active
Restrict water use for City water features (fountains, splash pads)	Y	Meter	Minor		X
Implement drought surcharges and fines	N			X	
Limit construction water usage	Y	Meter	Minor		X
Limit public personal vehicle washing	Y	Estimate	Minor		X

Table 8 – Demand Management Strategies and Tempe Shortage Management Stage: Emergency

Strategy	Directly Measurable Result (Y/N)	Measurement Method (Estimate/ Meter)	Magnitude (Minor/ Significant)	Passive	Active
Request construction projects stop using water	Y	Estimate	Minor		X
Prohibit water use at water features (unless they support aquatic life)	Y	Meter	Significant		X
City may slow/ prohibit new development or landscape installation	Y	Estimate	Minor		X
No hydrant flushing or non-emergency usage	Y	Estimate	Minor		X
Limit the use of evaporative coolers	Y	Estimate	Minor		X
Consider a one day a week watering schedule	Y	Estimate	Significant		X
Plan for emergency purchases of water	N			X	