Tucson Water

ONE WATER 2100 PLAN

DRAFT | May 2023

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Abbreviations

ac-ft	acre-feet
Act	Arizona Groundwater Management Act
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AFY	acre-feet per year
AMA	active management area
AMI	Advanced Metering Infrastructure
AOP	advanced oxidation process
APW	Arizona Project WET
ASL	American Sign Language
AWBA	Arizona Water Banking Authority
AWS	Assured Water Supply
BCE	Before Common Era
CAGRD	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
CAVSARP	Central Avra Valley Storage and Recovery Project
CAWCD	Central Arizona Water Conservation District
CCF	100 cubic feet
CE	Common Era
CIP	Capital Improvement Program
City	City of Tucson
County	Pima County
CWAC	Citizens' Water Advisory Committee
DAWS	Designation of Assured Water Supply
DCP	Drought Contingency Plan
DPR	direct potable reuse
E	education
EEExchange	Environmental Education Exchange
EPA	Environmental Protection Agency
gpcd	gallons per capita per day
GSI	green stormwater infrastructure
GW	groundwater
GWAICC	Governor's Water Augmentation, Innovation & Conservation Council
HET	high-efficiency toilets
HFPO-DA	hexafluoropropylene oxide dimer acid
HI	Hazard Index

HOA	homeowner association
I	incentive
IGA	intergovernmental agreement
IPR	indirect potable reuse
LID	low impact development
LTSC	long-term storage credits
MCL	maximum contaminant level
MCLG	maximum contaminant level goals
MM	mandates and measures
msl	mean sea level
NPR	non-potable reuse
O&M	operations and maintenance
PAG	Pima Association of Governments
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonic acid
PFHxS	perfluorohexane sulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctyl sulfonate
Plan	Tucson One Water 2100 Plan
PMRRP	Pima Mine Road Recharge Project
RW	recycled water
S	stormwater
S2S	Storm to Shade
SAHBA	Southern Arizona Home Builders Home Association
SAVSARP	Southern Avra Valley Storage and Recovery Project
SHARP	Southeast Houghton Area Recharge Project
SW	surface water
TARP	Tucson Airport Remediation Project
TM	technical memorandum
WRF	Water Research Foundation

EXECUTIVE SUMMARY

The Tucson One Water 2100 Plan (Plan) is a comprehensive, long-range water resource management plan that aims to protect the reliability and quality of Tucson's water supply through 2100. The Plan looks at managing Tucson's water supply under changing and uncertain conditions and is intended to serve as a guide for Tucson Water's capital planning and conservation practices. Tucson has a history of proactive and adaptive water resource planning. Approximately every ten years the utility updates its long-range water resource plan. This Plan centers the One Water approach, which is an approach for managing water resources for long-term resilience and sustainability, meeting both community and ecosystem needs. The One Water approach values all types of water resources recognizing the interconnectedness of the surface water and groundwater supply, recycled water, and rain and stormwater harvesting.

Caption: Tucson takes an integrated water resource management approach that recognizes that all water has value.

Figure ES 1 Tucson One Water

A distinguishing feature of the One Water approach is the emphasis on public engagement, partnerships, and collaboration as keys to achieving progress. Throughout the development of the Plan, public engagement and feedback were key in defining vulnerabilities, opportunities, strategies, and actions for achieving a sustainable and resilient water future for the City of Tucson (City). The robust community engagement process, described in Chapter 2, began with surveys, interviews, and workshops to gather input from Mayor and Council, Tucson Water staff, and the public. The Vision and five Guiding Principles for the Plan were formed based on this feedback.

ES.1 Vision Statement

One Water is Tucson's commitment to resilience, equity, stewardship, and quality of life.

ES.2 Guiding Principles

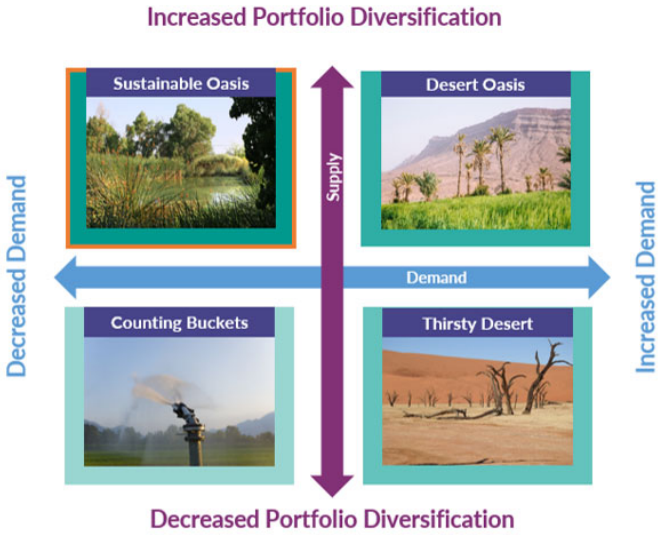
One Water is Tucson's commitment to resilience, equity, stewardship, and quality of life.

1. ***Deliver reliability*** *through water supply diversification, conservation, and innovative improvements to infrastructure.*
2. ***Reinforce resiliency*** *by planning for climate change, leading mitigation efforts, and implementing collaborative and adaptive strategies.*
3. ***Enhance the community's quality of life*** *by preserving and restoring riparian areas, increasing urban tree canopy, and supporting economic growth.*
4. ***Achieve affordability, accessibility, and social justice*** *by committing to fiscal responsibility and prioritizing equitable projects and programs.*
5. ***Ensure public confidence with safe, high-quality water supplies*** *and exceptional customer service that includes transparency and responsiveness.*

ES.3 Scenario Planning

Scenario planning, a foresight tool used to develop flexible strategies under uncertainty, was used to identify vulnerabilities and opportunities for Tucson's water future and to develop potential solutions for the areas of greatest concern. Through the scenario planning process, community stakeholders identified increased supply diversification, with an emphasis on locally controlled supplies, and increased demand management as the most important opportunities. Over-reliance on supplies from the Colorado River, climate change, and factors such as population trends increasing water demand were identified as the biggest vulnerabilities.

Future supply and demand uncertainties were combined into an overarching matrix for four future scenarios. This matrix, shown below, ranges from a future world with increased supply portfolio diversification and decreased demands (*Sustainable Oasis)* to a future with decreased supply portfolio diversification and increased demands (*Thirsty Desert).* With input from stakeholders and the community, Tucson Water is planning for a future where the region's water supply portfolio is increasingly diversified and water demands are well managed. Overall, the goal of this Plan is to develop strategies that will lead us toward a *Sustainable Oasis* future and mitigate the risks of the *Thirsty Desert* scenario.



Caption: In this overarching matrix, plausible future scenarios depend on both portfolio diversification and water demands.

Figure ES 2 Plausible Future Scenarios

ES.4 Community Engagement

As described in Chapter 2, the community was engaged in the Plan development through a series of community stakeholder workshops, a public town hall, public event booths, presentations, interviews, and a broad online survey that illuminated the community's priorities, concerns, and interests regarding water management. The community engagement process included outreach with stakeholder groups with diverse backgrounds, languages, and life experiences.

Caption: During the public town hall held in August 2022, Tucson Water introduced the Plan and its key elements.

Figure ES 3 Public Town Hall

ES.5 Stakeholder Workshops

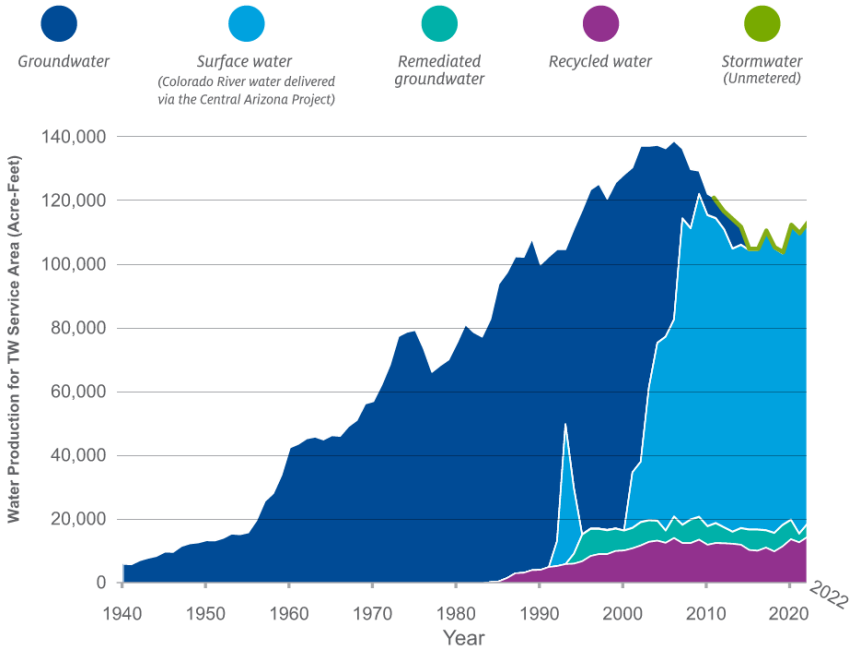
A series of workshops with community members was held focusing on identifying strategies that capitalize on the key opportunities and mitigate the key vulnerabilities identified through the scenario planning process. Strategies developed within these workshops addressed each of the Plan's five Guiding Principles. An emphasis was placed on strategies for demand management and for each water supply type, namely surface water, stormwater, recycled water, and groundwater.

Caption: Tucson Water ambassadors receiving feedback from a stakeholder about Plan strategies at one of the workshops events.

Figure ES 4 Community Outreach

ES.6 Tucson Water Management History

The evolution of Tucson Water's supply diversification history is depicted in the figure below. As shown, since the early 2000s, there has been a transition from reliance on groundwater to a diverse mix of renewable water supplies. Tucson became one of the first communities in the nation to recycle treated wastewater at a large scale for landscape irrigation. The introduction of renewable Colorado River water delivered via the Central Arizona Project (CAP) has allowed Tucson Water to move toward renewable supplies as the primary source of drinking water. In recent decades, Tucson has become a nationally recognized leader in rainwater harvesting, water recycling, and conservation. The community's commitment to water conservation is also evident as total water use has declined since the early 2000s despite continued population growth in the City's service area. This phenomenon is known as "decoupling," meaning water demand is no longer increasing along with population growth. Tucson's water supplies are discussed in Chapter 3 and water use and demand management are covered in Chapter 4.



Caption: While historically Tucson relied on groundwater, Colorado River water is now the main supply of potable water for Tucson. Additional water sources in Tucson Water's portfolio include recycled water, remediated groundwater, and stormwater.

Figure ES 5 Historical use of water supply sources from 1940-2020

ES.7 Vulnerabilities and Opportunities

The scenario planning process for Tucson Water identified key vulnerabilities and opportunities for water supply portfolio diversification and demand management. Supply vulnerabilities include over-reliance on the Colorado River, and the potential for the reduction of available water within each of the existing renewable water supplies due to drought, climate change, and other factors. Opportunities to further diversify the water supply portfolio include increasing the use of locally controlled and distributed sources, such as recycled water and rainwater and stormwater harvesting. Key vulnerabilities related to future water demands include population growth, land use changes, and economic factors. Opportunities for water demand management include developing and implementing a consistent and effective public outreach and education campaign to build on Tucson Water's strong existing water conservation programs.

ES.8 Supply and Demand Comparison

Future population and long-term potable water use projections were developed to support the Plan process. As described in Chapter 4, a comparison of supply and demand projections through 2100 was completed for the four plausible futures identified in the scenario planning process. The purpose of this comparison is to characterize the uncertainty related to the current water supply portfolio. Each scenario considers a different combination of water demand and water supply portfolio assumptions. The key water demand variables are gallons per capita per day and population growth. The key water supply variable is the City's allocation of Colorado River water. In all four scenarios, Tucson Water has sufficient supplies to meet demand through the year 2100. Under the *Sustainable Oasis* scenario, Tucson Water would be able to meet demands with renewable supplies and continue storing CAP water underground for future use. Under the *Thirsty Desert* scenario, storage credits are needed to meet future demand and Tucson Water begins to rely on groundwater resources again.

Tucson Water will use the strategies described in the Plan to avoid the risks of the *Thirsty Desert* scenario and work towards the *Sustainable Oasis* future where the water supplies are diverse, locally controlled, and water demands are well managed.

ES.9 Prioritization of Strategies

Based on feedback from the stakeholders and the community, 40 strategies were crafted by Tucson Water to achieve the Plan vision and five guiding principles. A public survey was conducted to understand the community's opinions on the proposed water supply and demand management strategies and to inform the Plan development. The survey focused on supply and demand management strategies as they were the areas identified as the most important and most uncertain in the scenario planning processes. The results of the survey were used to rank and prioritize the list of strategies. In total, the Plan identifies 16 high priority strategies across the water supply and demand management categories which are listed below.

Supply - Surface Water (SW) Strategies

- **SW-1:** Maximize the benefits of our current Colorado River water.
- **SW-2:** Work with the State of Arizona to explore additional water supplies for the Central Arizona Project.
- **SW-3:** Advocate for Tucson's allocation of Colorado River water through the Central Arizona Project in state and federal negotiations.

Supply - Groundwater (GW) Strategies

- **GW-1:** Partner with regional water organizations to protect the aquifer.
- **GW-2:** Accelerate groundwater cleanup efforts to make local supplies more available.
- **GW-3:** Explore and invest in new treatment technologies to address unregulated, emerging water quality issues.

Supply - Recycled Water (RW) Strategies

- **RW-1:** Adopt new policies for water reuse in buildings.
- **RW-2:** Begin purifying recycled water to drinking water standards.
- **RW-6:** Implement treatment technologies to address unregulated, emerging water quality issues.

Supply - Stormwater (S) Strategies

- **S-1:** Explore opportunities for large scale stormwater projects with multiple benefits.
- **S-2:** Integrate and align stormwater standards, policies, and practices across the region.

Demand - Incentive (I) Strategies

- **I-1:** Improve outreach for low-income assistance programs for homeowners and renters.
- **I-2:** Increase water savings opportunities through incentive programs for residential and commercial customers.

Demand - Mandates and Measures (MM) Strategies

- **MM-1:** Install "smart meters" that monitor water use in real time, provide leak alerts, and inform water use habits.

Demand - Education (E) Strategies

- **E-1:** Conduct research on new technologies and approaches.
- **E-2:** Provide landscape training to reduce outdoor water use, with emphasis on resilient, desert-adapted landscapes.

ES.10 Implementation Actions

Implementation actions are the specific projects, programs, policies, and/or tools that the City and Tucson Water will use to implement each of the recommended strategies. A total of 66 implementation actions across the water supply and demand management categories were identified and are described in Chapter 6. These implementation actions define sequential efforts that Tucson Water can undertake for each strategy. As an example, for strategy ***RW-2:*** *Begin purifying recycled water to drinking water standards*, there are 7 sequential implementation actions identified. These actions start with participation in the regulatory process and conducting a cost-benefit evaluation, a barrier survey, and a public outreach campaign, and ultimately lead to the implementation of a demonstration-scale and full-scale reuse project. Each strategy is accompanied by a relative expense and a relative level of effort while each implementation action has an implementation timeline. The full list of implementation actions is included in Chapter 6. Each of these actions takes time to undertake and adaptive management may be needed to refine the next steps as appropriate. Implementing the highest priority strategies will steer Tucson Water toward a more resilient water future and will help mitigate the risks of climate change.

Caption: Tucson Water staff at work

Figure ES 6 Tucson Water Staff at Work

ES.11 Plan Implementation

Several metrics were developed to evaluate progress on Plan implementation and are shown in the table below. These metrics will be used to gather data, update figures and graphs, and promote transparency to the public. The implementation of Plan recommendations must also adapt to changing conditions. While near-term policies can be implemented now to address immediate needs, the mid-term and long-term strategies will be regularly reevaluated as conditions change and new information becomes available and as community priorities evolve. Key metrics include the historic water production chart which will continue to be updated throughout the Plan implementation process to show the total volume produced by new water supply projects, and any changes in water production over time. The gpcd metric will also be a key indicator of whether demand is being reduced. This approach allows for flexibility and agility in response to evolving conditions, while still maintaining a long-term vision for a resilient and sustainable water supply.

ES.12 Reporting

A concise annual One Water 2100 Plan progress report will be produced every year and shared with the public to provide a progress update on the implementation of the Plan recommendations. These annual reports will summarize progress on the metrics described below as well as any other Plan related activities such as the completion of new projects, adoption of new policies, and community engagement activities.

Chapter 1

INTRODUCTION

1.1 Why "One Water"?

One Water is an evolving approach for managing water resources for long-term resilience and sustainability, meeting both community and ecosystem needs. This approach values all types of water resources, and considers the water cycle as an integrated system, recognizing the interconnectedness of the surface water and groundwater supply, recycled water, and rain and stormwater harvesting.

The One Water approach represents a shift in the way we manage our water resources. Traditionally, regulatory and governance structures have managed water in separate institutional silos. One Water provides a transition to an integrated planning approach that fosters collaboration between organizations and the communities they serve.

A distinguishing feature of the One Water approach is the engagement of stakeholders and partners. One Water emphasizes the idea that partnerships and collaboration are key to progress. When a diverse group of stakeholders, community members, and organizations come together, a wide variety of interests are considered to define more holistic water management solutions to achieve a more resilient and sustainable water future. Utilizing the One Water approach helps the City of Tucson (City) plan to better meet future conditions by expanding Tucson Water's resource portfolio and laying the foundation for strong lasting partnerships to make Tucson's One Water vision a reality.

Caption: Tucson takes an integrated water resource management approach that recognizes that all water has value.

Figure 1.1 Tucson One Water

1.1.1 Elements of the One Water Approach

The Water Environment and Reuse Foundation (now the Water Research Foundation or WRF) examined the transition to a One Water approach in *Pathways to One Water: A Guide to Institutional Innovation*. This 2015 study identified the following six key elements that contribute positively to a One Water approach:

1. Strong leadership and vision from senior positions, at both political and executive levels
2. Partnerships between departments and collaborating organizations
3. Organizational culture that embraces the One Water approach
4. Transparent engagement with the community and stakeholders
5. A conducive economic environment for private investments
6. A conducive regulatory and legislative environment for encouraging public and private participation

Moving toward One Water requires a vision of what cities and water systems can look like, active engagement of local stakeholders, and refinement of roles and responsibilities. For the One Water approach to be integrated into the City's infrastructure planning, an institutional structure needs to be in place, one that encourages innovation and supports alternative and decentralized approaches to integrated water management. These key elements informed the City and Tucson Water's planning process.

1.2 What is the One Water 2100 Plan?

The Tucson One Water 2100 Plan (Plan) is a comprehensive, long-range water resource management plan that aims to protect the reliability and quality of Tucson's water supply under changing conditions through the year 2100. The Plan guides Tucson Water's capital and financial planning, conservation practices, and provides information to support policy decisions.

1.2.1 Role of the Plan

City leaders, elected officials, staff, and the community should look to the Plan as the guide for developing, implementing, and refining important water policies, as well as making water system management and investment decisions. These Plan partners should use the Plan and its supplements to:

- Provide a framework and common goals for water planning and management within the Tucson Water service area
- Guide changes to local water policy and regulations
- Inform the City's resource, budgeting, and demand management decisions
- Support participation in regional planning and partnerships
- Promote continuous engagement of the community and stakeholders
- Evaluate and measure progress toward achieving defined One Water goals

1.3 About Tucson Water

1.3.1 Geographic Setting

Caption: Downtown Tucson with views of the Santa Catalinas and Rincon Mountains.

Figure 1.2 Downtown Tucson

The City was founded in 1775 and has since grown to be the second largest city in Arizona. Tucson is located within Pima County and the City currently has a population of nearly 550,000, while the metropolitan area has a population just over 1 million. Tucson is located at nearly 2,400 feet above sea level in the Sonoran Desert, a geography that presents substantial water supply challenges for a growing community. The City sits in the Tucson Basin, surrounded by the Rincon, Santa Rita, Santa Catalina, Sierrita, Tortolita, and Tucson Mountains.

Caption: The Santa Catalinas are a prominent mountain range to the north of Tucson area, with a peak elevation of 9,157 feet on Mount Lemmon.

Figure 1.3 Santa Catalina Mountains

The Sonoran Desert is characterized by its arid hot climate and seasonal rainfall pattern. On average, Tucson receives just under 12 inches of rainfall a year, increasing to as much as 29 inches per year on the highest peak above the City, Mount Lemmon. From December to March, frontal storms originating in the North Pacific bring occasional gentle rain. The summer monsoon, from July to mid-September, brings surges of wet tropical air and localized deluges in the form of violent thunderstorms. The area has generally mild winters, but summer months can see prolonged stretches of extreme heat.

Caption: The saguaro cactus (Carnegiea gigantea) is a large, iconic cactus species native to the Sonoran Desert.

Figure 1.4 Sonoran Desert

Climate change is already impacting the physical and social aspects of life in Tucson. The temperature and precipitation patterns within this area continue to change as climate change progresses. Average annual temperatures in Tucson have risen by nearly 4.5 degrees Fahrenheit from 1970 to 2018, making Tucson among the fastest warming cities in the United States. According to the National Climate Assessment, while some of this increase is related to the urban heat island effect, where temperatures increase locally due to urban features absorbing solar energy, much of this increase is attributable to the influence of global climate change. The impacts of climate change on the Tucson region are further discussed in the Tucson Water November 2021 Technical Memorandum (TM), *One Water 2100 Climate Projections* is included in Appendix A. Additionally, the September 2021 TM, *One Water 2100 Greenhouse Gas Emissions Inventory* looked specifically at Tucson Water's greenhouse gas emissions in 2018. This TM is included in Appendix B.

In early 2023, Mayor and Council adopted the Climate Action and Adaption Plan also known as *Tucson Resilient Together.* This document outlines the City's roadmap for reducing greenhouse gas emissions and building community-wide resistance to current and future impacts from climate change. In many ways, *Tucson Resilient Together* and the Plan are closely related and the planning process for *Tucson Resilient Together* and the Plan overlapped. Coordination with *Tucson Resilient Together* is further discussed in Chapter 5. Additional information about *Tucson Resilient Together* can be found at the City of Tucson Climate Action Hub.

Caption: A summer monsoon storm brings intense rainfall, lightning, and strong winds. More than half of Tucson's annual rainfall occurs during the summer monsoon season.

Figure 1.5 Monsoon Storm in the Sonoran Desert

1.3.2 Water Management

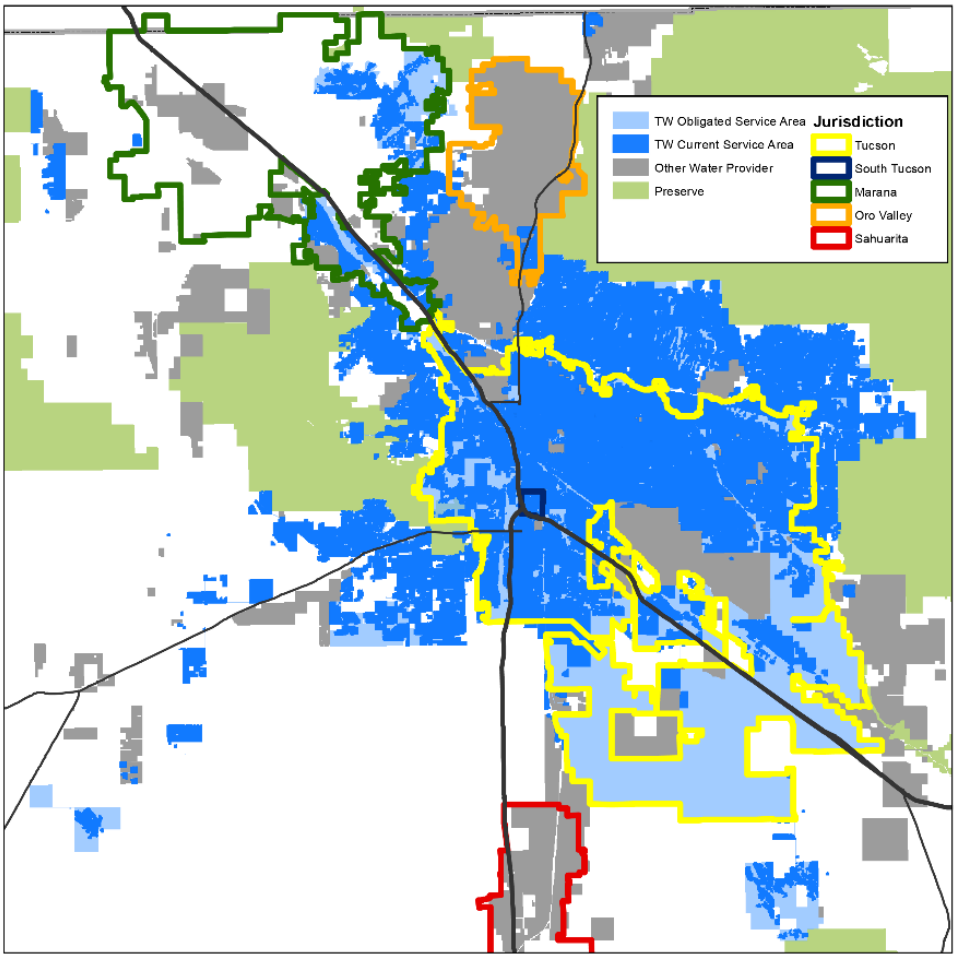
Tucson Water has delivered water to City residents and businesses as a municipally owned and operated water utility since 1901. Tucson Water is responsible for the delivery of high quality, safe, and reliable drinking water, as well as management of Tucson's Reclaimed Water System. The Plan identifies actions that Tucson Water can take to work toward a resilient water future for its service area. Partnership with multiple other agencies will be required to achieve many of the goals and strategies outlined within the Plan.

Key Partner Roles and Responsibilities

- **Central Arizona Project (CAP) –** Regional surface water importer and distributer.
- **Arizona Department of Water Resources –** Statewide water use regulatory agency.
- **Arizona Department of Environmental Quality –** Administers Arizona's environmental laws and delegated federal programs to prevent air, water, and land pollution and ensure cleanup.
- **Tucson Department of Transportation and Mobility –** Stormwater management infrastructure.
- **Pima County Flood Control –** Flood monitoring, flood control and floodplain management, activities.
- **Pima County Regional Wastewater Reclamation Department –** Wastewater collection, treatment, and discharge.

1.3.3 Water Service Area

The City established the Tucson Water service area boundary in 2010 with the adoption of a formal Water Service Area Policy. Tucson Water currently serves nearly 750,000 people. The current service area spans 390 square miles across several jurisdictions, with about 42 percent of the geographic area lying within the City limits, nearly 53 percent in unincorporated Pima County, and the remaining 5 percent in the neighboring towns, including Marana and Oro Valley. The following figure illustrates the extent of the current service area, as well as potential areas for water service expansion. The "Obligated Service Area" includes areas that Tucson Water is required to serve in the future. Outside of the Obligated Service Area, new water service requires submittal to Tucson Water for review with compliance with the Water Service Area Policy and approval of a water availability request subject to review by the Water Service Area Review Board.



Caption: The Tucson Water service area includes areas within the City of Tucson, unincorporated Pima County, and neighboring towns such as Oro Valley and Marana.

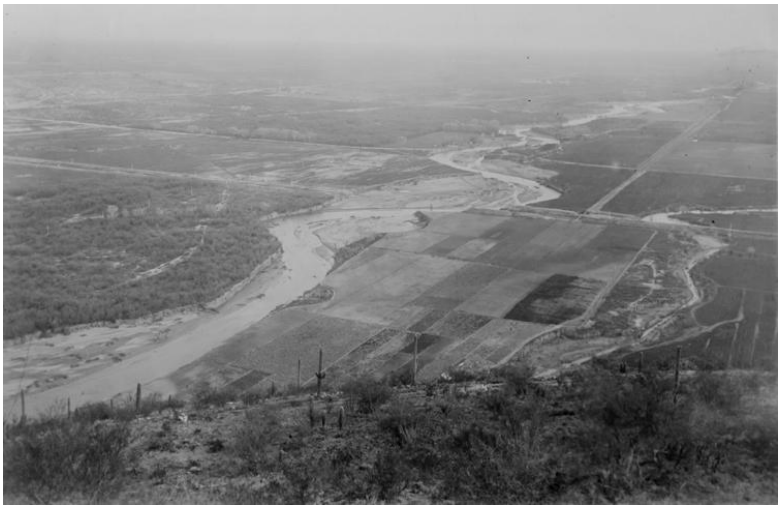
Figure 1.6 Tucson Water Service Area with Potential Service Areas

Other significant water providers in the area include Metro Water District, the Town of Oro Valley, the Town of Marana, Flowing Wells Irrigation District, and Vail Water. Tucson Water has common interests with these providers and provides some indirect services for areas outside the obligated service area. These include providing emergency backup supplies and helping to recharge and recover water supplies owned by other providers. Tucson Water also partners with other utilities to identify possible resources and water supply arrangements that would be mutually beneficial.

1.4 Tucson Water Management History

Tucson's water heritage spans millennia. As early as 2,100 Before Common Era (BCE), there were villages along the Santa Cruz River in the heart of what would become Tucson. By 1,200 Common Era (CE), the Hohokam used the Santa Cruz River for drinking water, irrigation, and fishing. Indigenous peoples have continuously inhabited this arid region from prehistoric times to today, pioneering water harvesting and dryland farming techniques and creating the oldest known irrigation canals in North America.

Throughout the 20th century, Tucson's expansion relied on groundwater, eventually becoming the largest city on the continent to be entirely dependent on groundwater. Over-pumping of groundwater dried up local springs, wells, and creeks including the Santa Cruz River. As the region pulled water from the aquifer faster than it was replenished, the land in some areas began to subside, putting buildings and infrastructure at risk. This period brought with it a recognition that Tucsonans embrace to this day—water is a precious and vulnerable resource in our desert city.



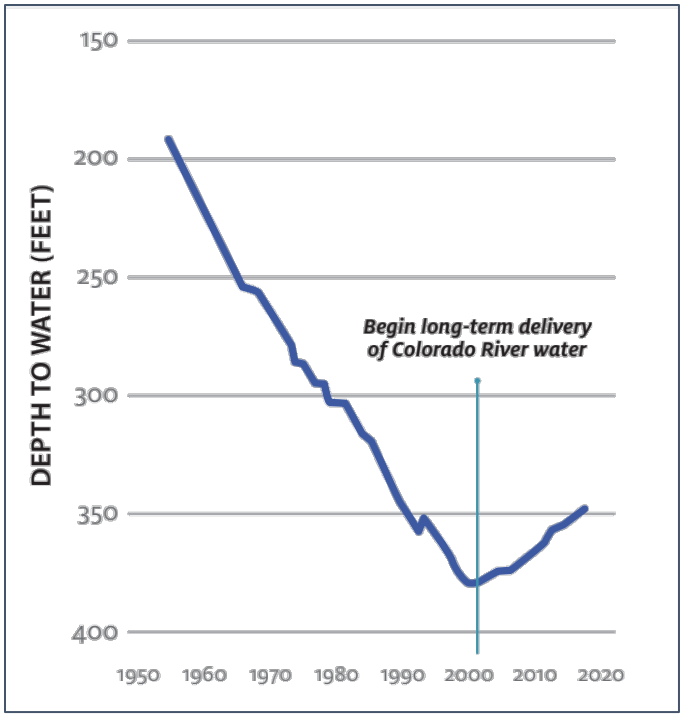
Caption: The Santa Cruz River as seen from Sentinel Peak in Tucson in the early 1900's. (Arizona Historical Society)

Figure 1.7 Santa Cruz River

With groundwater levels declining, Tucson started taking steps to plan for and adapt to future water uses. In 1984, Tucson became one of the first communities in the nation to recycle treated wastewater at a large scale for landscape irrigation. Today, most local golf courses and parks rely on Tucson Water's Reclaimed Water System, which has grown to be one of the largest in the country. In the later part of the 20th century, Tucson initiated robust conservation programs including education, rebates, and outreach for residential and commercial customers. Tucson Water's community conservation campaigns were effective in instilling a culture of responsible water resource management among new generations.

The introduction of renewable Colorado River water delivered via the CAP has allowed Tucson Water to move from finite groundwater resources toward renewable Colorado River water as the primary source of drinking water. CAP water is sourced from the Colorado River and delivered to Tucson by a series of canals, then recharged into the aquifer and recovered for use within the Tucson Water service area. A smaller portion of the Colorado River water is used directly by local agriculture recovered by Tucson Water through saved groundwater credits. For more than 20 years, Tucson Water has served this water to customers and stored available excess CAP water for the future. Colorado River water stored underground in the Avra Valley has become a "savings account," a backup supply to draw on in drier years. As groundwater pumping has reduced, aquifers have begun to recover, rising more than 100 feet near downtown Tucson.

Water levels in the Central Well Field area began rising in 2001, when Tucson Water began the long-term delivery of Colorado River water to customers and substantially reduced groundwater pumping in this area. The following figure shows a well hydrograph of a well near Broadway Boulevard and Wilmot Road. A well hydrograph is a chart of water levels measured over time in a single well.

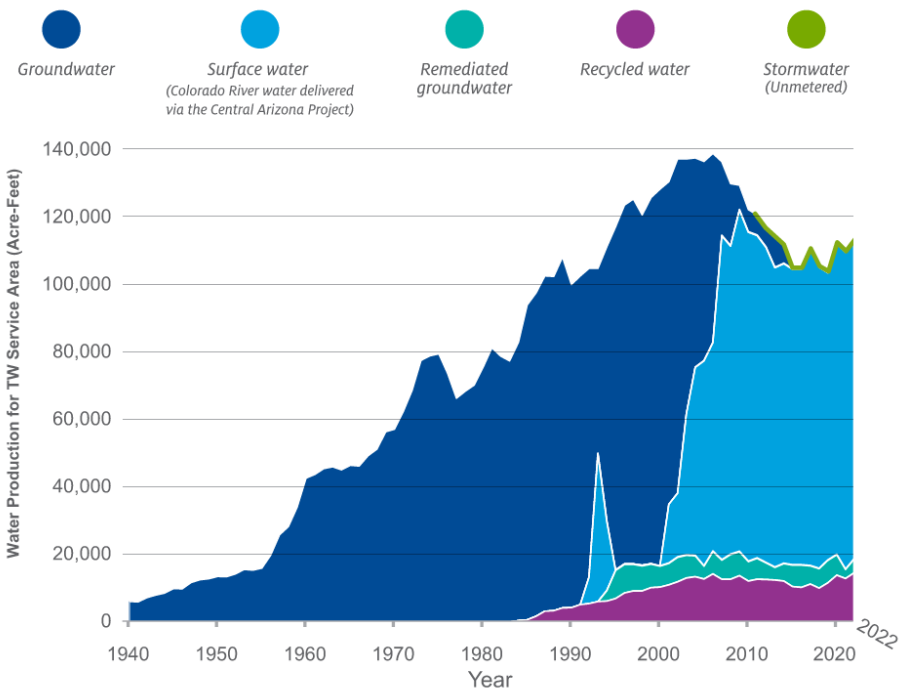


Caption: This well hydrograph shows rising water levels in an area of the Central Well Field after 2001 when Tucson Water began the long-term delivery of Colorado River water to customers and substantially reduced groundwater pumping in this area.

Figure 1.8 Well Hydrograph near Broadway Boulevard and Wilmot Road

In recent decades, the Tucson community has become known as a national leader in rainwater harvesting, water recycling, and conservation. One culmination of these efforts came in 2019, when the Santa Cruz River near downtown began to flow again after 100 years due to reclaimed water released from local water reclamation facilities at the Santa Cruz Heritage Project. Tucson Water's diverse water supply portfolio and groundwater savings makes Tucson one of the most water resilient cities in the Southwestern United States.

The evolution of Tucson Water's supply diversification history can be seen in the following figure, with a dramatic transition from its sole reliance on groundwater to a more diverse mix of water supplies in the early 2000s. The community's commitment to water conservation is also evident in the figure, with total water use declining since the early 2000s despite continued population growth in the City's service area.



Caption: While historically Tucson relied on groundwater, Colorado River water is now the main supply of potable water for Tucson. Additional water sources in Tucson Water's portfolio include recycled water, remediated groundwater, and stormwater.

Figure 1.9 Historical Use of Water Supply Sources from 1940-2020

1.4.1 Tucson Water Plan

Tucson has a history of proactive and adaptive planning, and this has been a cornerstone of the area's water security and resilience. Tucson Water updates its long range about every 10 years. In 2004, "*Water Plan: 2000-2050*" was published with a stated purpose "to initiate a dialog between Tucson Water and the community about the water resources challenges that must be addressed in the coming years". This statement reaffirmed Tucson Water's commitment to hearing the voice of the community on water issues. This commitment continues today through the development of this One Water 2100 Plan and can be seen through the wide range of community engagement activities held throughout the Plan development process.

Water Plan: 2000-2050, along with updates to the plan in 2008 and 2012, laid out the challenges and opportunities to maintain water reliability for the Tucson community. The policies identified in these plans led to positive changes in the water supply. Between 1940 and 2000, water levels in Tucson's central well field had dropped significantly. Planning and foresight reversed this and changed the trajectory of groundwater use. Reliance on non-renewable groundwater has reduced and the beneficial use of renewable sources such as Colorado River water delivered through the CAP and recycled water have expanded.

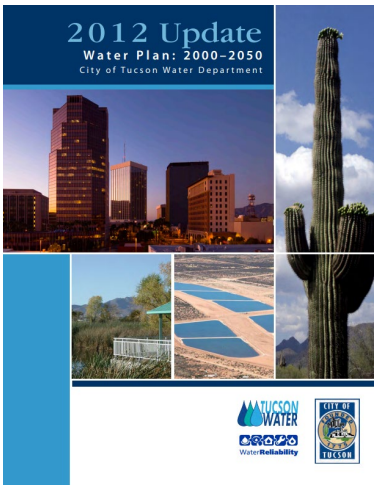


Figure 1.10 Water Plan 2000-2050 (2012 Update)

1.4.2 Drought Preparedness and Response Plan

Tucson Water's *Drought Preparedness and Response Plan* was first published in 2006. This plan outlines the City's response measures in the case of a drought on the Colorado River. Minor revisions were made to the plan in 2012 and 2017. A major revision was approved in 2020 to align the drought stages in the City's plan with the *2019 Colorado River Drought Contingency Plan*, an agreement between the seven Colorado River Compact states on how to share Colorado River water.

Response measures in the Drought Preparedness and Response Plan informed the strategies developed for the Plan. Measures focus on the City leading by example and implementing response actions before customers are asked to and developing and communicating water use guidelines to customers. The *Drought Preparedness and Response Plan* may need to be updated if the Drought Contingency Plan is no longer the operational guidance for shortage sharing on the Colorado River.

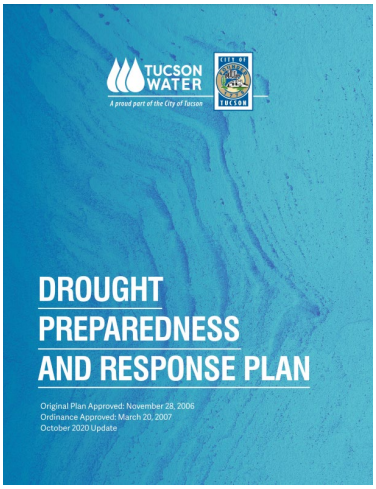


Figure 1.11 Drought Preparedness and Response Plan (2020 Update)

1.4.3 Plan Tucson

The ongoing update to the City's general plan includes multiple components united under the umbrella of *Plan Tucson* which aims to take community goals and translate them into City policies and actions. *Plan Tucson* focuses on the social, economic, built, and natural environments and information about the plan update can be found at Plan Tucson. The Plan, including its goals and strategies, will be incorporated into *Plan Tucson.* The following additional plans will also be incorporated into the general plan update:

- **Tucson Resilient Together –**This plan was adopted in March 2023 and provides a strategic pathway to reduce the City's greenhouse gas emissions to net zero by 2030. Many of the strategies and actions defined in *Tucson Resilient Together* also support guiding principles of the Plan.
- **Move Tucson –** Adopted in 2021, this city-wide Transportation Master Plan identifies hundreds of projects that focus on modernizing the transportation network, improving safety for all users, and increasing viable transportation choices and alternatives.
- **Housing Affordability Strategy for Tucson –** Adopted in 2021, this plan introduces housing concepts, key data, and policy initiatives to work toward housing affordability.
- **The People, Communities, and Homes Investment Plan –** Adopted in 2021, this plan builds on previous community plans, public outreach, and up-to-date data to create a framework for investing in vulnerable populations throughout the City.

Figure 1.12 Plan Tucson

Chapter 2

COLLABORATIVE PLAN DEVELOPMENT

The Plan was developed through an active and collaborative stakeholder-driven process. The robust community and stakeholder engagement process included the following four distinct phases:

- **Phase 1 – Setting the Foundation:** The project started in June 2019 with the collection of ideas from The City's leadership including Mayor and Council, Tucson Water's Director's Office, and the Citizens' Water Advisory Committee (CWAC). Information collected from a series of workshops, surveys, and interviews was used in planning for the engagement of a broader community stakeholder group.
- **Phase 2 – Establishing Direction:** Tucson Water conducted scenario planning engagement activities from March 2020 to June 2021 that included workshops and surveys with a diverse group of community stakeholders. These workshops were used to explore uncertainties, risks, and develop a range of potential future scenarios. Although the COVID-19 pandemic put a temporary pause on the planning process, Tucson Water was able to pivot and utilize virtual workshops to maintain momentum in the stakeholder engagement process. The areas of greatest concern were identified as future water supplies and demands.
- **Phase 3 – Community Engagement & Adoption:** The community engagement process began with a public Town Hall held in August 2022. Between September and November 2022, three additional stakeholder workshops were hosted to develop strategies and actions related to the areas of greatest concern identified during the scenario planning process. Ambassadors from Tucson Water conducted outreach through community and neighborhood events to increase awareness of the Plan. Presentations were provided upon request and interviews were conducted with several stakeholders. Additionally, a survey was conducted to collect feedback about the supply and demand strategies. An online version of the survey was posted on the City's TucsonOneWater.com website, and a statistically valid version of the survey was conducted to help inform the development of the plan. The Plan went through an extensive vetting process including reviews by Tucson Water leadership, CWAC, and Mayor and Council. Feedback from the community was incorporated into the Plan in 2023.
- **Phase 4 – Plan Implementation:** Following the adoption by the Mayor and Council, the implementation of the Plan will begin in 2024. The prioritized strategies will inform Tucson Water's Capital Improvement Program (CIP). The planning team will monitor progress and evaluate the effectiveness of the Plan through the metrics. Progress reports on the Plan relative to those metrics will be developed and shared with the community. Plan implementation is described in Chapter 6.

Caption: This timeline shows the four distinct phases of the Plan development process. The dashed line indicates where we are in the Plan process.

Figure 2.1 Planning Process

2.1 Setting the Foundation

Workshops, surveys, and interviews with Tucson Water staff, City staff, Mayor, and Council resulted in the identification of the key One Water themes (resilience, equity, stewardship, and quality of life) and five guiding principles for Tucson's water future. Together these themes led to the creation of the following vision statement.

2.1.1 Vision Statement

One Water is Tucson's commitment to resilience, equity, stewardship, and quality of life.

2.1.2 Guiding Principles

1. ***Deliver reliability*** *through water supply diversification, conservation, and innovative improvements to infrastructure.*
2. ***Reinforce resiliency*** *by planning for climate change, leading mitigation efforts, and implementing collaborative and adaptive strategies.*
3. ***Enhance the community's quality of life*** *by preserving and restoring riparian areas, increasing urban tree canopy, and supporting economic growth.*
4. ***Achieve affordability, accessibility, and social justice*** *by committing to fiscal responsibility and prioritizing equitable projects and programs.*
5. ***Ensure public confidence with safe, high-quality water supplies*** *and exceptional customer service that includes transparency and responsiveness.*

2.2 Establishing Direction

2.2.1 Scenario Planning

Scenario planning is a foresight tool used to develop flexible strategies under uncertainty, emphasizing plausible outcomes over probable outcomes. Scenario planning has been used by organizations for decades to help prepare for uncertain futures. Tucson Water used scenario planning during the development and implementation of the recharge and recovery program used to manage water received from the CAP.

In scenario planning, future worlds are explored that may look quite different from today by not just using the past as the predictor of the future, but instead evaluating the potential consequences if certain uncertainties evolve to more extreme conditions. Within this framework, today's decisions can be tested to see how resilient they may be to various combinations of the most impactful future uncertainties.

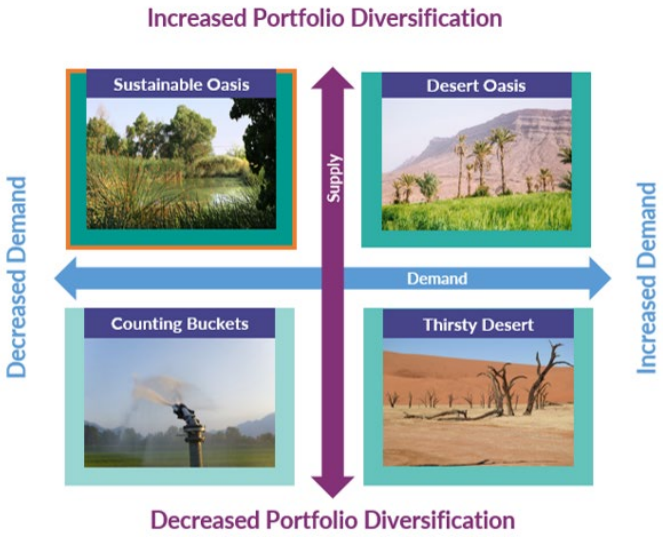
The scenario planning effort was supported by a series of deep dives on technical topics documented in TMs that are provided in the appendices. These TMs, in alphabetical order, include:

- One Water 2100 Benefits and Costs of the Reclaimed System
- One Water 2100 Climate Projections
- One Water 2100 Conservation Projections
- One Water 2100 Greenhouse Gas Emissions Inventory
- One Water 2100 Land Use Planning
- One Water 2100 Population Projections
- One Water 2100 Scenario Planning
- One Water 2100 Water Quality Management
- One Water 2100 Water Use Projections

A series of scenario planning workshops was conducted to better understand critical drivers and uncertainties for Tucson's water future and develop potential solutions for the areas of greatest concern. Participants in the scenario planning workshops included stakeholders representing various business, environmental, and community groups within the city. The participants developed a list of eight themed drivers or areas of concern that are both highly impactful and uncertain. Details for each area of concern are provided in the January 2022 TM *One Water 2100 Scenario Planning* which is included in Appendix C. The following drivers were ranked in order from greatest concern to least:

- **Water Supply Changes –** Uncertainties include the over-reliance on supply from the Colorado River, and supply reductions from climate change and political factors, as well as environmental risks and issues of groundwater quality.
- **Water Demand Changes –** Uncertainties include land uses changes due to climate and zoning, population trends, effects of water conservation, and the potential for Tucson Water to acquire other service areas.
- **System Resilience –** Uncertainties include water system reliability, improvements and threats to technology, and the effect of climate change on infrastructure.
- **Community/Educational Factor –** Uncertainties include the potential for misinformation, the possibility of widespread community engagement, and public support for increased reclaimed water use.
- **Equity and Affordability –** Uncertainties include cost of service, realization of equality, and the impact of flooding and stormwater in lower income areas.
- **Government/Policy/Regulations –** Uncertainties include policy making and regulatory trends on regional, state, and federal levels, as well as state politics.
- **Water-Energy Nexus –** Uncertainties include the ability to provide energy security, incorporate redundancy for resilience, and the ability to reduce carbon footprint.
- **Economic Variability –** Uncertainties include changes in the workforce, changes in business connections to water service, and the inability to incentivize business connections.

The workshop participants recognized that the most common, most uncertain, and most potentially impactful uncertainties were those associated directly with future supply and future demand. Future supply and demand uncertainties were combined into an overarching matrix of four future scenarios. The matrix, shown below, ranges from a future world with increased supply portfolio diversification and decreased demands (*Sustainable Oasis)* to a future with decreased supply portfolio diversification and increased demands (*Thirsty Desert).*



Caption: In this overarching matrix, plausible future scenarios depend on both portfolio diversification and water demands.

Figure 2.2 Plausible Future Scenarios

To mitigate the risks of the *Thirsty Desert* future and encourage the conditions that foster a *Sustainable Oasis*, stakeholder workshop discussions were held to propose a series of recommendations for future actions. These spanned from universal recommendations to build immunity to future uncertainty to more focused solutions looking at increasing locally controlled and distributed water resources. These recommendations are discussed in further detail in Chapters 3 and 4.

With input from stakeholders and the community, Tucson Water is planning for a future where the region's water supply portfolio is increasingly diversified and water demands are well managed. Overall, the goal of this Plan is to develop strategies that will lead us toward a *Sustainable Oasis* future and mitigate the risks of the *Thirsty Desert* scenario.

2.3 Community Engagement

In addition to the Scenario Planning workshops, the community was engaged in the Plan development through a series of community stakeholder workshops, a public town hall, public event booths, presentations, interviews, and a broad online survey that illuminated the community's priority concerns and interests regarding water management.

The community engagement process included outreach with stakeholder groups with diverse backgrounds, languages, and life experiences. These community organizations include, but are not limited to, neighborhood associations, civic groups, chambers of commerce, business associations, medical institutions, educational institutions, environmental groups, agricultural interests, social service agencies, multicultural organizations, and disability advocates. A full list of groups who participated in the engagement process is included in Appendix D. Together, these groups represent an informed constituency who are receptive to learning about current issues facing Tucson and who can assist by disseminating information to their membership and circles of influence.

Tucson Water is focused on ensuring that the Plan is representative of the needs of the community. Through a combination of online surveys, comment cards, and questions at the public Town Hall and workshops, and information gathering at community events, Tucson Water gathered a picture of community priorities and opinions from water customers. Spanish-language materials and Spanish-speaking staff were present at all community outreach events and workshops.

2.3.1 Public Town Hall

A public town hall was hosted by Tucson Water on August 16, 2022 at the Tucson Convention Center. The event served to introduce the goals and key elements of the Plan and address questions from the public. The town hall event was open to the public and welcomed nearly 300 community members with 467 views on YouTube, in addition to over 1,400 views of Instagram, Facebook, and Twitter posts, and over 200 responses to the town hall survey. American Sign Language (ASL) services were provided at the town hall along with Spanish translation headsets. Tucson Water received a number of questions and follow-up comments after the town hall that informed Plan development.

Caption: During the public town hall held in August 2022, Tucson Water introduced the Plan and its key elements to the nearly 300 in-person attendees.

Figure 2.3 Public Town Hall

2.3.2 Community Workshops

Tucson Water facilitated three workshop discussions and interactive exercises focused on One Water strategies related to conservation, demand management, water supplies, resilience, quality of life, safety, and affordability. The community stakeholders actively participated in the development of these strategies.

Caption: Stakeholders participate in a discussion about strategies for demand management during the first stakeholder workshop.

Figure 2.4 Stakeholder Workshop

2.3.3 Interviews, Speakers Bureau, and Information Sessions

Outreach to community groups included stakeholder interviews conducted with community leaders. A total of twelve interviews were conducted. Of those, two were conducted in person and ten held over video conference. Outreach also included a speakers bureau made up of a core group of speakers within the planning team that met with third party stakeholder groups, opinion leaders, and the community at large, both virtually and in person. Eleven speaker bureau events were held. Tucson Water also held multiple water rates information sessions, with separate sessions held in each of Tucson's six City Council Wards. Plan Ambassadors attended the rate sessions to show community members the work being done for their water future.

2.3.4 Citizens' Water Advisory Committee

The CWAC provides an important link between Tucson Water's planning team, stakeholders, and the community. CWAC was engaged throughout the development of the Plan. The committee was instrumental in reviewing the TMs and the draft Plan. Some members also attended the scenario planning and strategy workshops. Several members were also interviewed during the community engagement campaign.

2.3.5 Community Event Booths

To better understand the needs of our community, Tucson Water listened to voices across the City. Ambassadors from Tucson Water engaged the public at 25 community events and popular gathering places between April and December 2022, including event booths at community events. At these events, audiences ranged from dozens of people to crowds as large as 150,000 at *Tucson Meet Yourself*.

Caption: Earth Day Festival in Downtown Tucson

Figure 2.5 Earth Day

Caption: 52nd Annual Tucson Juneteenth Festival at Kennedy Park

Figure 2.6 Juneteenth Festival

Caption: The Southern Arizona Home Builders Home & Patio Show at the Tucson Convention Center

Figure 2.7 Southern Arizona Home Builders Home Association (SAHBA) Home Show

2.3.6 Public Surveys

A One Water Awareness survey was conducted to gauge public awareness regarding the Plan in the early stages of the community engagement campaign. The survey gathered input from 215 people and included questions about challenges that could affect a sustainable water future and whether respondents were aware of specific programs being implemented by Tucson Water. When asked what is needed to create a sustainable water future, conservation was the top term used by respondents. Water supply and water demand ranked among the top challenges respondents listed that could affect a sustainable water future for Tucson. The informal survey also found that of the respondents:

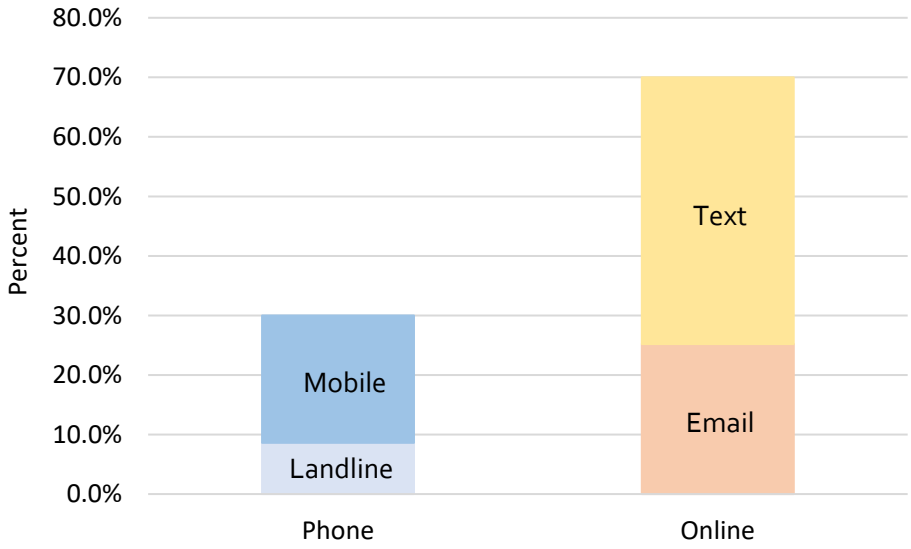
- 86 percent knew that Tucson Water customers have among the lowest water consumption rates in the Desert Southwest.
- 72 percent knew that Tucson Water has stored significant amounts of Colorado River water for future use.
- 54 percent knew that Tucson's water comes from multiple sources, with the majority of respondents identifying the Colorado River as the area's primary source of water.

Caption: Tucson Water ambassadors provide members of the public opportunities to participate in the online survey at the base of Tumamoc Hill, a popular walking tail.

Figure 2.8 Online Survey Participation at Tumamoc Hill

Another survey was conducted in December 2022 to understand the community's opinions on the proposed water management strategies considered for the Plan and to inform the plan development. The survey was conducted in two parts:

- **Statistically Valid Survey:** Tucson Water hired a national research firm to conduct a statistically valid resident opinion survey based on a demographically representative sample of residents of the Tucson Water service area. The survey included 400 participants with interviews conducted by phone, including landlines and cell phones, and online where respondents were invited to participate by email and text message. The statistically valid survey was conducted in both English and Spanish.
- **Online Survey:** An online version of the same strategy survey was posted through the Tucson One Water website in English and Spanish. Tucson Water's social media channels were used to encourage community members to participate in the online survey. Participation was also encouraged through Tucson Water's outreach at popular community events and locations, such as the base of Tumamoc Hill, as shown above. This survey gathered responses from 1,528 people.



Caption: For the statistically valid survey, interviews were conducted by phone (30 percent) and online (70 percent) modes. Phone interviews were conducted via landline (29 percent) or mobile (71 percent). Online participants were invited by email (36 percent) and text message (64 percent) for the online method.

Figure 2.9 Survey Mode for Statistically Valid Survey

2.3.7 Online Engagement

A dedicated website was launched for this Plan. This website, TucsonOneWater.com, connects visitors to the latest One Water project documents, upcoming meetings, and input opportunities, including the online survey, and online engagement platforms. It also provides an interactive online Story Map of Tucson's water resource infrastructure. There have been over 6,100 unique visitors to the site since it was launched in 2022. The website will continue to communicate progress on the implementation of the Plan.

Caption: A dedicated One Water website was created for the Plan and includes updates on the development of the Plan as well as general information including an interactive online Story Map.

Figure 2.10 Interactive Online Story Map

Tucson Water also has a One Water 2100 email list with over 2,500 subscribers. Subscribers to this email list have received regular updates about the Plan's progress.

Chapter 3

WATER SUPPLIES

3.1 Tucson's One Water Cycle

Tucson Water obtains renewable surface water from the Colorado River which originates in the high elevations of the Rocky Mountains, with a watershed that spans seven states. Colorado River water is conveyed to the region through the CAP canal. To optimize use of this resource, Tucson Water recharges its allocation of CAP water in basins in the Avra Valley to the west of Tucson and at the Pima Mine Road Recharge Project (PMRRP) where it mixes with native groundwater. This blended water is then recovered using wells and delivered to homes and businesses. Additionally, several groundwater savings facilities use raw CAP water for irrigation and create known as long-term storage credits (LTSCs) through reduced groundwater pumping. Wastewater is collected and treated at Pima County water reclamation facilities. After treatment, some of this water is sent to the Reclaimed Water System where it is reused for non-potable uses such as outdoor irrigation. A portion of the recycled water is also recharged in local aquifers for future use. Stormwater and rainwater are collected at the household and neighborhood scale throughout the Tucson Water service area to provide supplemental water for landscaping. Tucson Water also has a special class of remediated groundwater that receives additional treatment for the removal of various contaminants before being distributed through the Reclaimed Water System.

As shown in the following figure, in 2022, 83 percent of Tucson Water's supply comes from the Colorado River, which is recharged and recovered CAP water. The reclaimed water system accounted for 13 percent of the total water produced. A small percentage (about 4 percent) of supplies are produced with remediated groundwater at the Tucson Airport Remediation Project (TARP).

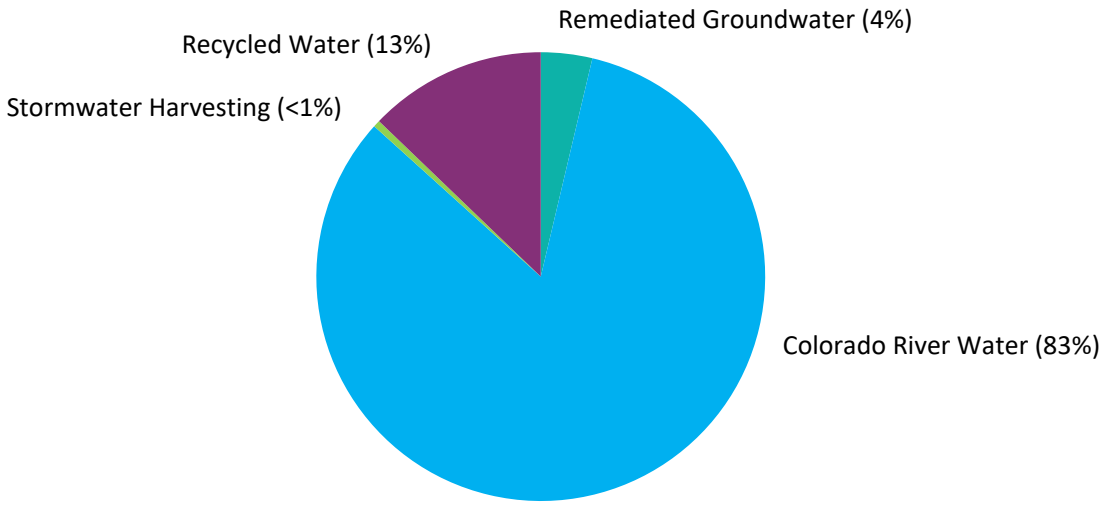


Figure 3.1 Tucson Water Supply Portfolio (2022)

3.2 Surface Water

The Tucson region is located along the Santa Cruz River and its tributaries. Prior to 1880, this was the primary water source for Tucson. With increasing development, groundwater use increased leading to declining groundwater levels, resulting in the disappearance of natural perennial surface-water flows. Today, these rivers primarily flow in response to large precipitation events and periods of snowmelt from the surrounding mountains. The Colorado River is currently the only renewable surface water source available to Tucson Water.

The Colorado River Basin has been in a prolonged drought for over 23 years, which has been exacerbated by climate change. Since the turn of the century, there has been a roughly 20 percent decline in flows on average, resulting in depleted storage conditions in both Lake Powell and Lake Mead, and the first ever shortage declaration in the Lower Colorado River Basin. A lack of precipitation is only partially to blame, as flow losses in the Colorado River have been due in part to record setting temperatures over this period. These rising temperatures have changed the Southwest water cycle and decreased snowpack has resulted in less water to the Colorado River. Further discussion of the impacts of climate change can be found in the November 2021 TM, *One Water 2100 Climate Projections* which is included in Appendix A.

Caption: In August 2022, the federal government declared a tier two water reduction on the Colorado River based on critically low elevations Lake Mead. Tiered shortage levels correspond to water levels within Lakes Powell and Mead. The Tier 2 declaration will require some states to decrease their Colorado River use.

Figure 3.2 Lake Mead Drought Conditions

The Colorado River is also over-allocated, meaning that more water is committed to the seven Colorado River Basin States and Mexico than is supplied by the river in an average year. Water users in the seven Basin States have worked to reach important agreements to voluntarily conserve water and better manage the river to mitigate the risk of water levels falling to critical levels in Lake Mead and Lake Powell. As an example, in 2022 the City entered a program to leave a large portion of its Colorado River water allocation in Lake Mead, in exchange for federal compensation. In May 2023, three lower basin states, Arizona, California, and Nevada, proposed a voluntary agreement that would conserve three million acre-feet (ac-ft) through the end of 2026. Federal compensation would be provided for most of the reductions. Tucson's Mayor and Council have expressed their support for this ongoing effort.

The 2019 *Lower Basin Drought Contingency Plan* (DCP) requires Arizona, California, and Nevada to contribute additional water at defined shortage levels based on predetermined elevations in Lake Mead. Tucson Water's preparations for these drought stages and thresholds are described in Tucson Water's *Drought Preparedness and Response Plan*. As the impacts of drought persist, the U.S. Bureau of Reclamation has announced planned water cutbacks in 2023 due to increasingly receding water levels in Lake Mead and Lake Powell. While the specific impacts of these cutbacks to Arizona are not yet defined, long-term reductions in the available Colorado River supplies are considered likely. These will almost certainly extend beyond the currently defined shortage levels in the DCP. These reductions are likely to significantly impact all Colorado River water users.

Caption: Drought conditions on Lake Powell in Utah, located upstream of Lake Mead on the Colorado River.

Figure 3.3 Lake Mead Drought Conditions

The future management of the river is being addressed through the federal reconsultation process. More information about the work of the Arizona Reconsultation Committee can be found on ADWR's website. Before the end of 2026, the U.S. Secretary of the Interior will develop new guidelines for the long-term management of the Colorado River system. The process involves multiple levels of discussion, negotiation, and coordination within Arizona and among the Basin states. Existing contracts are likely to be revisited as a part of the 2026 reconsultation process and may result in a change to Tucson Water's allocation. The supply assumptions in this Plan all test Tucson Water's resilience against long-term shortage conditions for the City's Colorado River allocation.

3.2.1 Central Arizona Project

The CAP conveys water from Lake Havasu on the Colorado River to its terminus southwest of the City. Tucson first began receiving renewable Colorado River water from the CAP in the 1990s. The CAP has a total contractual entitlement of roughly 1.415 million ac-ft from the Colorado River per year for all its customers. Of that, Tucson Water has the single largest allocation of CAP water at just over 10 percent with 144,000 acre-feet per year (AFY).

The CAP and the state of Arizona, through the Governor's Water Augmentation, Innovation & Conservation Council (GWAICC), have been actively participating in water supply augmentation and conservation projects. These project ideas include interstate cooperative efforts, such as Brock Reservoir, which improves water

supply reliability by reducing excess flows to Mexico, as well as desalination and brackish groundwater projects like the Yuma Desalting Plant, and the proposed binational desalination project with Mexico. More information about the work being done by the GWAICC can be found at GWAICC | Arizona Department of Water Resources (azwater.gov), and information on the CAP's augmentation program can be found on the CAP website. The CAP is also exploring opportunities to partner with the Southern Nevada Water Authority to develop new projects and infrastructure.

Caption: The Central Arizona Project consists of a 336-mile-long conveyance system of canals, tunnels, pipelines, and pumping stations that deliver water to Maricopa, Pinal, and Pima counties in Arizona, serving more than five million people, or more than 80 percent of the state's population.

Figure 3.4 Central Arizona Project Canal

3.2.2 Recharge and Recovery

Tucson Water's CAP allocation is managed through a process known as "recharge and recovery." There are large, shallow recharge basins and recovery wells at the following three facilities:

- Central Avra Valley Storage and Recovery Project (CAVSARP)
- Southern Avra Valley Storage and Recovery Project (SAVSARP)
- Pima Mine Road Recharge Project (PMRRP – jointly owned by the City and the CAP)

When the Colorado River water fills these basins, it infiltrates down through the pores in between sand and rock and recharges the groundwater aquifer. Through this process, the Colorado River water mixes with native groundwater, producing a blended water supply. At CAVSARP and for a portion of SAVSARP, this blended water is then recovered by groundwater wells and gets pumped through a large transmission pipeline to the Hayden-Udall Treatment Plant and then to the Tucson Water distribution system. CAP water not used to meet customer demands remains stored within the groundwater basin, providing a buffer that can help offset future drought reductions in CAP supplies. These are known as long-term storage credits (LTSCs).

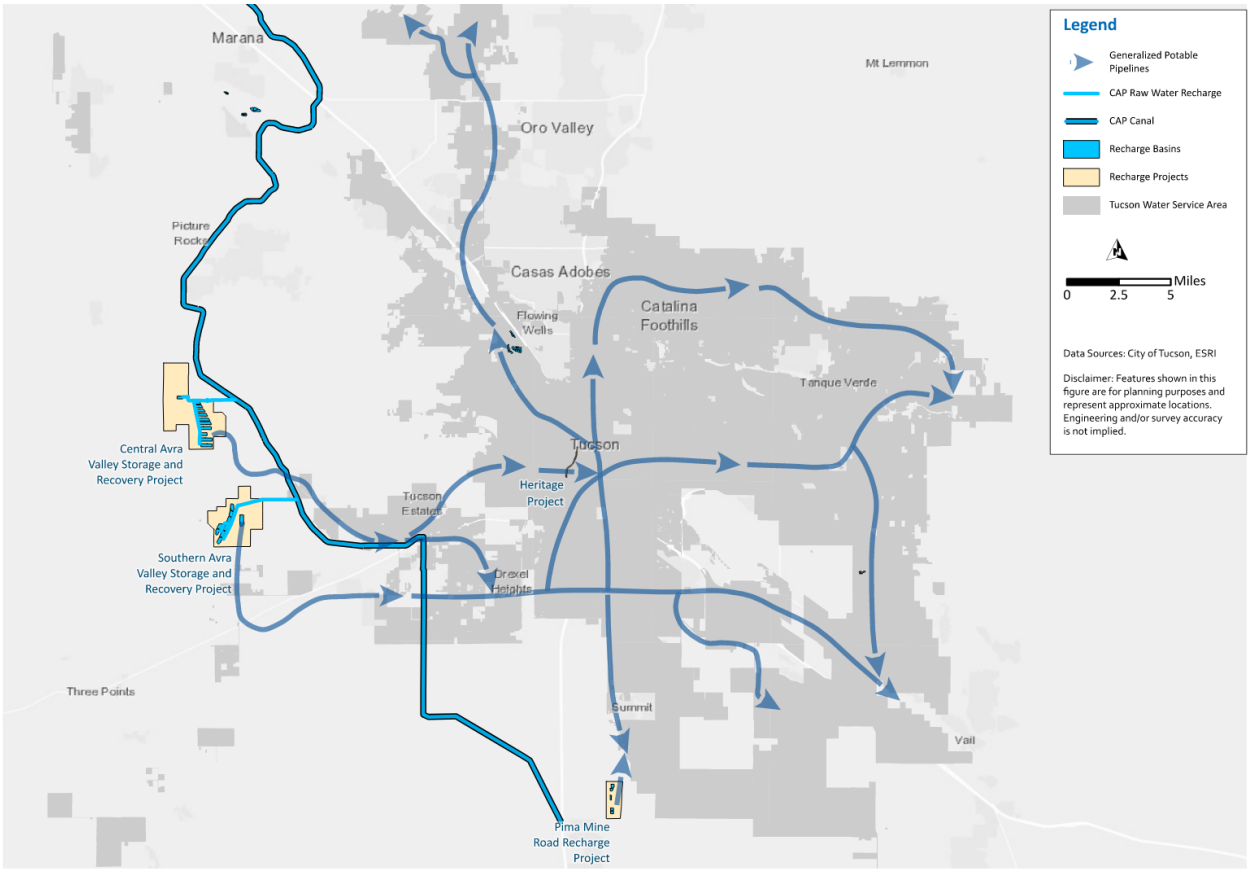
Additionally, there are also a number of groundwater savings facilities that use raw CAP water for irrigation and create LTSCs through reduced groundwater pumping. These projects are permitted agreements between Tucson Water, a CAP water allocation holder, and a recipient, usually farmers. Tucson Water delivers renewable Colorado River water to the recipient where it is used in lieu of groundwater pumping to create LTSCs for Tucson Water.

Caption: Water delivered to Tucson Water Southern Avra Valley Storage and Recovery Project facility

Figure 3.5 Water Delivered to Tucson Water SAVSARP Facility

Caption: Aerial view of Tucson Water's Central Avra Valley Storage and Recovery Project facility

Figure 3.6 Aerial View of Tucson Water's CAVSARP Facility



Caption: Tucson Water's CAP supply is managed through the use of three large storage and recovery projects.

Figure 3.7 Tucson Water Distribution and Recharge Facilities

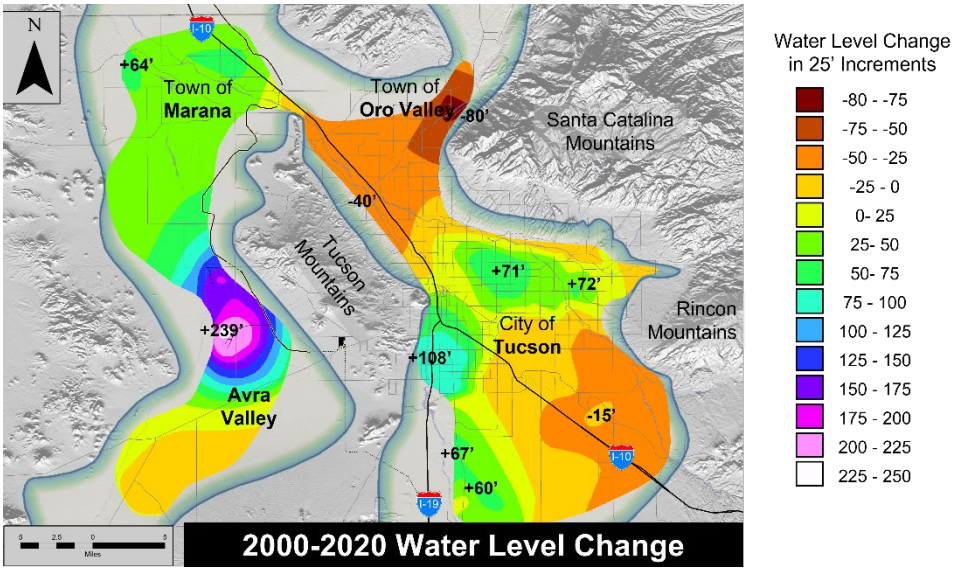
3.3 Groundwater

Prior to the introduction of water from the Colorado River, Tucson was completely dependent on groundwater for over a century. Groundwater is considered a finite or non-renewable water resource because the regional aquifers were developed on a geologic timescale and do not receive much natural recharge each year. Historic over-pumping of these groundwater aquifers resulted in significant declines in water levels.

Tucson Water's regional aquifer system includes the Tucson and the Avra Valley aquifers. Within these aquifers, Tucson Water operates several well fields, including the Central Well field, that pump native groundwater from the Tucson aquifer directly into Tucson Water's distribution system. The Central Well field underlies a large portion of the Tucson Water service area. The Avra Valley Well Field recovers surface water from the Colorado River water recharged at CAVSARP and SAVSARP. The Santa Cruz Well Field, located down gradient from PMRRP, also produces a blend of local groundwater and Colorado River water.

Today, renewable Colorado River water supplies have largely replaced groundwater supplies. Since Tucson Water transitioned to renewable water supplies, aquifer levels have been rising in some areas – especially in the vicinity of the recharge and recovery projects as seen in the following figure. Water levels have risen moderately in the north-central area due to reduced pumping in the central well field, while areas to the north and southeast of Tucson continue to experience water level declines due to groundwater pumping by others.

Despite its finite nature, groundwater continues to be a vital part of Tucson's water resource portfolio. Groundwater from the Central Well field is used to meet peak water demands during the hottest months of the year, and groundwater stored in the Avra Valley aquifer is used to provide a backup to the Colorado River during emergency interruptions and declared shortages.



Caption: Since Tucson Water transitioned to renewable water supplies, aquifer levels have been rising in the vicinity of the recharge and recovery projects and in the north-central area due to reduced pumping in the central well field.

Figure 3.8 Water Level Change in the Tucson and Avra Valley Aquifers

3.3.1 Underground Storage

Over the past two decades, Tucson Water has been developing long-range water resource plans that incorporate drought preparedness. LTSCs are the legal mechanism by which Tucson can recover recharged CAP or reclaimed water using its wells. Tucson currently uses about two-thirds of its annual allocation (144,191 AFY) of Colorado River water based on its current potable water demand. By actively saving and storing the remaining third in groundwater, Tucson Water has accumulated more than 500,000 ac-ft of LTSCs since Tucson Water began recharging its CAP allocation in 2001. This groundwater storage amount alone is enough to provide water to its customers for five years at current demand levels. The following figure shows the cumulative LTSCs accrued between 2010 and 2022.

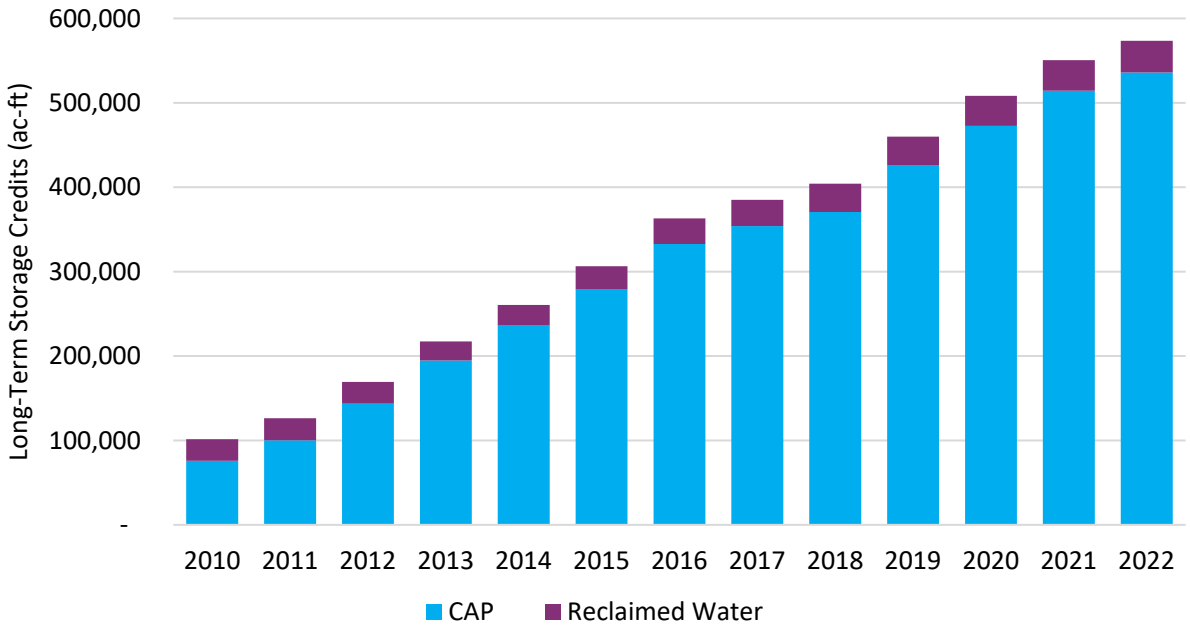


Figure 3.9 Cumulative Long-Term Storage Credit Accounts

3.3.2 Assured Water Supply

The Arizona Groundwater Management Act (Act) was established in 1980 to better manage groundwater withdrawals throughout the more populated parts of the state of Arizona. The Act laid out the Assured Water Supply (AWS) rules, which govern the amount of groundwater all water utilities within an active management area (AMA) can pump or produce with groundwater wells. The Act also created the Arizona Department of Water Resources (ADWR) which established AMAs throughout portions of the state that had experienced significantly depleted groundwater aquifers at the time of establishing the Act. The City is within the Tucson AMA, which consists of the Upper Santa Cruz Valley in the east and Avra Valley in the west, separated by the Tucson Mountains. Tucson Water is committed to meeting requirements set by ADWR's Management Plan to help the Tucson AMA achieve its goal of a sustainable yield by 2025.

A Designation of Assured Water Supply (DAWS) is a certification issued by ADWR to water providers that can demonstrate sufficient water supplies for a 100-year period. The supply assumptions used in this Plan all test Tucson Water's resilience against the groundwater resources identified in Tucson Water's 2023 application to modify its DAWS. The application identifies that Tucson Water has over 54,000 AFY of groundwater that is physically, continuously, and legally available. This includes a legal right to groundwater associated with farmland in the Avra Valley that was purchased by the City and retired from irrigation. Although this groundwater resource is not a renewable supply, this supply is included as a backup supply to account for long-term shortages conditions on the Colorado River.

3.3.3 Central Arizona Groundwater Replenishment District

Tucson is also a "Member Service Area" of the Central Arizona Groundwater Replenishment District (CAGRD), a department within the Central Arizona Water Conservation District (CAWCD) that maintains, operates, and manages the CAP and facilitates groundwater replenishment within Maricopa, Pinal, and Pima counties. The CAGRD provides a mechanism to meet increasing demands without pumping groundwater over allowable limits. For Tucson, CAGRD membership represents a "safety net" in water supply management since Tucson Water's current supply portfolio exceeds customer demands.

3.3.4 Arizona Water Banking Authority

Another institutional safeguard is the Arizona Water Banking Authority (AWBA) which stores Arizona's unused Colorado River water for use during a declared shortage. The AWBA stores renewable water supplies in groundwater recharge facilities, which in the Tucson AMA include the Lower Santa Cruz Recharge Project, SAVSARP, and PMRRP. Water stored under the Recharge Program is accounted for through LTSCs. As of December 2021, a total of 847,018 acre-feet were stored in the Tucson AMA.

3.3.5 Remediated Groundwater

Tucson also has access to a special class of groundwater through TARP and the advanced oxidation process (AOP) Facility. This groundwater receives treatment for the removal of various contaminants. Due to increasing levels of unregulated contaminants in the remediation wells serving the facility, this water began being directed to the Santa Cruz River in 2021 and is planned to begin supplementing the Reclaimed Water System in 2023.

Caption: Tucson Airport Remediation Project facility.

Figure 3.10 TARP AOP Facility

3.3.6 Water Quality

Tucson Water operates approximately 230 drinking water wells throughout its service area. Tucson Water measures more than 150 water quality parameters at 266 permanent water sampling taps located throughout its distribution systems. Tucson Water's Sentry Program has monitored unregulated and emerging contaminants for over a decade and helps Tucson Water track and proactively manage contaminants that may be regulated in the future. This extensive water quality testing verifies that Tucson Water provides high quality water supplies to customers throughout its service area. Tucson Water's robust monitoring system is well positioned to detect and manage contaminants. Additional information about

Tucson Water's water quality monitoring and management can be found in the March 2022 TM, *One Water 2100 Water Quality Management* which is included in Appendix E.

Caption: Tucson Water employees monitor water quality at Hayden Udall Treatment Plant.

Figure 3.11 Water Quality Monitoring

Groundwater Remediation

Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that are manufactured and used in a variety of industries, most notably for foams used in fighting aircraft fires, stain-and water-repellent fabrics, and nonstick products. The United States no longer manufactures certain PFAS; however, the historic use of these compounds continues to threaten Tucson's drinking water supply. Tucson Water is committed to ensuring the quality of water for Tucson's water resources and is taking steps to maintain that quality. Out of an abundance of caution, Tucson Water has removed twenty-two drinking water production wells from service due to the presence of PFAS, and an additional six wells have been placed in active-emergency status. In March 2023, the EPA announced a proposed National Primary Drinking Water Regulation for six PFAS in drinking water:

- Proposed maximum contaminant level goals (MCLG) and maximum contaminant levels (MCLs) for perfluorooctanoic acid (PFOA) and perfluorooctyl sulfonate (PFOS), as individual contaminants.
- Proposed MCLGs and MCLs for perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX Chemicals), perfluorohexane sulfonic acid (PFHxS), and perfluorobutane sulfonic acid (PFBS), as a PFAS mixture called Hazard Index (HI).

The proposed MCLs, when finalized, will supersede the previously published Health Advisory levels for PFAS (2016 and 2022). Tucson Water's operational targets are more conservative than the proposed MCLs for PFAS. Additional drinking water production wells in Tucson Water's Central Wellfield are at risk from PFAS, and Tucson Water is collaborating with the Arizona Department of Environmental Quality (ADEQ) and other agencies to protect the Central Wellfield and eventually treat affected wells. Protecting the Central Wellfield from PFAS contamination is critical for supply reliability.

3.4 Recycled Water

Recycled water refers to the beneficial use of wastewater after treatment at a water reclamation facility. Within the umbrella of recycled water are multiple types of water treatment levels for various end-uses, aka *fit-for-purpose* water. These include:

- **Reclaimed water (aka non-potable reuse or NPR)** is the portion of recycled water that has been treated to high quality standards for non-potable uses such as irrigation.
- **Indirect potable reuse (IPR)** is recycled water that passes through additional advanced purification processes and an environmental or engineered buffer (such as a groundwater aquifer or surface water reservoir) before being used to supplement drinking water supply sources. Advanced treatment can occur before or after water passes through the environmental buffer.
- **Direct potable reuse (DPR)** involves introducing advanced purified recycled water into potable water system without the use of a natural or engineered buffer.
- **Gray water** is water previously used in sinks (other than kitchen sinks), showers, baths and/or laundry washing machines that is reused for outdoor irrigation. This is commonly known as "showers-to flowers" or "laundry-to-landscape" and can be implemented on a household or building size scale.
- **Blackwater** is gray water with the inclusion of water previously used in kitchen sinks and toilet flushing.

Of the types of recycled water, the City only uses reclaimed water through the Reclaimed Water System while gray water is used at the residential level. IPR and DPR represent opportunities for expanding the use of recycled water. Additional discussion of IPR and DPR is included later in this chapter.

Caption: Signage in the Reclaimed Water System.

Figure 3.12 Signage in the Reclaimed Water System

3.4.1 Reclaimed Water System

In 1984, Tucson was one of the first cities in the country to begin recycling water by intentionally treating wastewater for irrigation and other non-potable water uses to offset historic potable demands. The first reclaimed water customer was a golf course, but now the reclaimed system serves the vast majority of parks, schools, municipal properties, and golf courses throughout the region in addition to some residential

customers. Tucson's Reclaimed Water System delivers between 11,000 and 14,000 AFY of reclaimed water to more than 900 sites via a network including approximately 200 miles of "purple pipe" distribution systems. Tucson Water also wheels approximately 3,000 AFY of reclaimed water to neighboring service areas. Purple coloring is used as an industry standard to identify non-potable water pipelines, pumps, and other fixtures, aimed at avoiding accidental cross-connections between potable and reclaimed water systems.

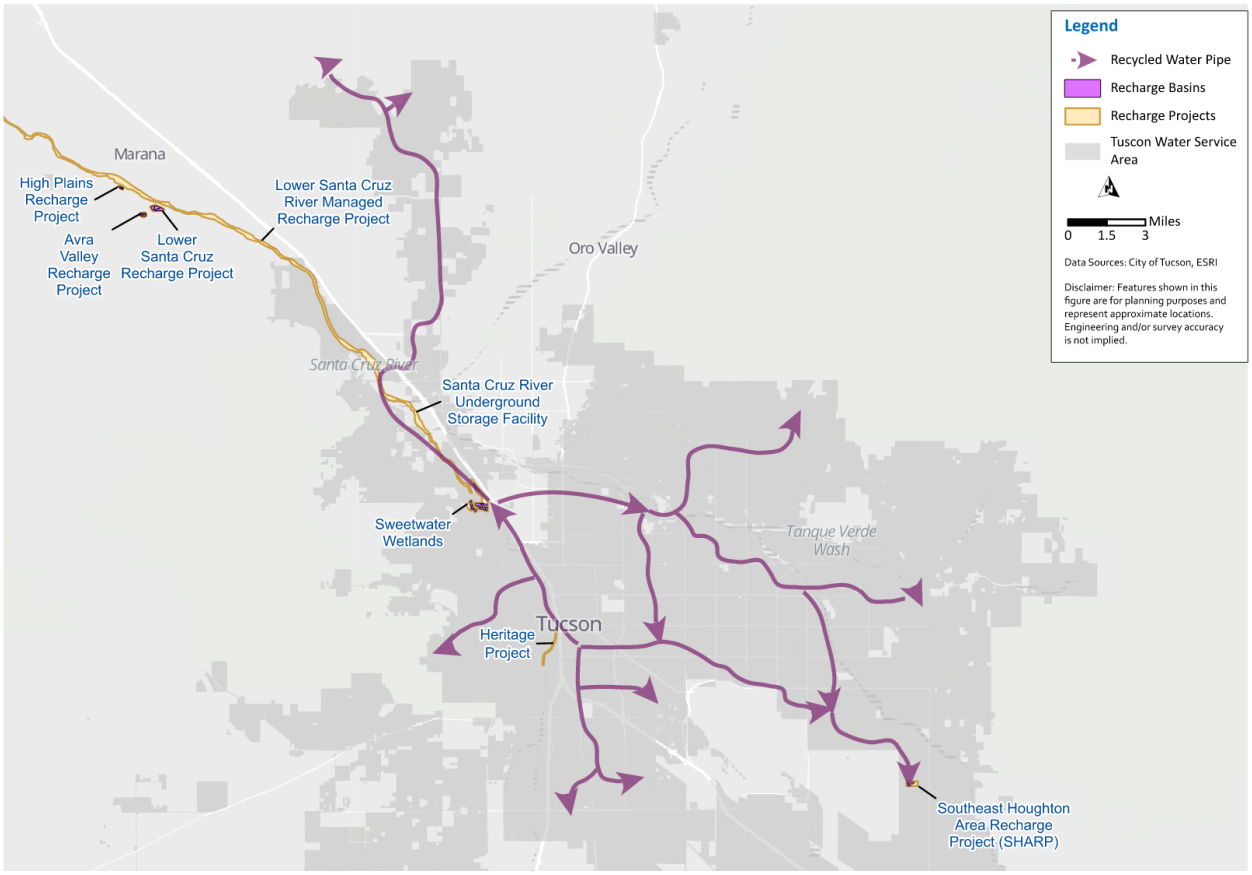
The Reclaimed Water System provides a range of benefits to residents and businesses within the Tucson region. Utilizing this resource reduces the demand for the potable water supply system. It is also a reliable and locally controlled water source that can be used to offset traditional water potable water demands. The availability of this water source helps support the destination golf sector in Tucson which provides economic value to the region.

Caption: Per industry standards, Reclaimed Water Systems are constructed with "purple pipes" to avoid cross-connections and clearly communicate the conveyance of non-potable water.

Figure 3.13 "Purple Pipes" in the Reclaimed Water System

Since most parks, schools, municipal properties, and golf courses located near the existing Reclaimed Water System are already served by reclaimed water, there are minimal opportunities for additional irrigation customers. Additionally, there is declining demand for recycled water to be used for irrigation due to outdoor water conservation practices, as well as the reduction of non-functional turf due to concerns about water waste. To help respond to decreases in non-potable water demands, new potential reclaimed water customers and end uses can be explored. Examples include the use of reclaimed water for cooling towers and toilet flushing in commercial and industrial buildings.

The supply scenarios in the Plan include only the potable water supply portfolio. Future uses of the Reclaimed Water System are captured as offsetting potable water supplies and therefore reducing the potable per capita water use.



Caption: Tucson's Reclaimed Water System delivers reclaimed water to more than 900 sites via a network of "purple pipe" distribution systems. Reclaimed water is also used for groundwater recharge through numerous recharge projects.

Figure 3.14 Tucson Water Reclaimed Water System

3.4.2 Groundwater Recharge

Demand for reclaimed water increases during the hotter months, due to increased evapotranspiration and irrigation needs, while there is excess reclaimed water supply capacity during the cooler winter months. Reclaimed water produced during the off-peak period is directed to storage and recovery at the Sweetwater Recharge Facility and Wetlands. This strategy allows Tucson Water to "recharge" reclaimed water in the aquifer and "recover" it later through groundwater wells for use in the reclaimed system. Recycled water that isn't being used in the reclaimed system is also used to replenish the aquifer through the Southeast Houghton Area Recharge Project and the Santa Cruz River Heritage Project. Water "stored" in the groundwater aquifer at these sites earns LTSCs. A portion of the City's wastewater entitlement is discharged to Santa Cruz River where much of this resource leaves the basin without earning LTSCs. This water is available to be used by Tucson Water through new recycled water projects.

Caption: Aerial view of the Sweetwater Recharge Facility and Wetlands.

Figure 3.15 Sweetwater Recharge Facility and Wetlands

3.4.2.1 Ecosystem Restoration

Tucson Water's Reclaimed Water System also provides ecosystem and social "quality-of-life" benefits for the region. In addition to recharge and recovery operations, the Sweetwater Wetlands, Santa Cruz River Heritage Project, and Southeast Houghton Area Recharge Project (SHARP) are key examples of sites providing multiple benefits for the community. These projects provide high quality recreational, aesthetic, educational, cultural, wildlife, and ecosystem restoration values to the community. This is discussed further in the May 2022 TM, *One Water 2100 Benefits and Costs of the Reclaimed System* which is included in Appendix F.

Santa Cruz River Heritage Project

The Santa Cruz River Heritage Project is an excellent example of how Tucson Water is committed to provide "fit-for-purpose" water resources for community and ecosystem benefits. The project, which launched in 2019, adds approximately 3,150 AFY of treated recycled water to the Santa Cruz River at a point south of downtown near the heart of the City. The added water brings perennial flow to this portion of the river after 80 years of no surface flow and fosters abundant native vegetation and wildlife along with recreational and economic opportunities. The flowing stretch of the river runs alongside the Chuck Huckelberry "Loop" trail, a popular bike and walking trail. The restored river is not only vital to the environment, but also to Tucson's history, culture, and identity.

Caption: The Santa Cruz Heritage Project releases treated recycled water to the Santa Cruz River at a point south of downtown near the heart of the city.

Figure 3.16 Santa Cruz Heritage Project

Sweetwater Wetlands

The Sweetwater Wetlands function as an urban wildlife habitat and an outdoor classroom at the same time. The wetland was originally constructed in 1996 to handle backwash filter water from the reclaimed water plant. The wetlands now use reclaimed water exclusively. Groundwater recharge is accomplished through the direct use of reclaimed water to supplement groundwater banking through net positive recharge that occurs in recharge basins next to the Sweetwater Wetlands.

The site spans 60 acres and contains paved and unpaved paths open to the public. Self-guided educational tours are offered through Tucson Water and Arizona Project WET (APA) where community members can use a QR code reader app to view information about the wetland. The Audubon Society holds weekly bird watching tours.

Caption: Sweetwater Wetlands is a water treatment facility, an urban wildlife habitat, and an outdoor classroom.

Figure 3.17 Sweetwater Wetlands

Caption: The Sweetwater Wetlands span 60 acres and contain paved and unpaved paths open to the public.

Figure 3.18 Sweetwater Wetlands

Southeast Houghton Area Recharge Project

SHARP is a 40-acre recycled water recharge project comprised of three recharge basins. This water soaks into an area of the aquifer that has seen continued decline in water levels due to historical groundwater pumping. In 2022, nearly 3,400 ac-ft of recycled water was delivered to SHARP, which is permitted for up to 4,000 AFY. SHARP is open to the public and provides green space for walking, running, and biking. This facility also provides educational opportunities for students through a partnership with APA.

Caption: The Southeast Houghton Area Recharge Project includes three recharge basins and is open to the public as a green space for walking and biking.

Figure 3.19 Southeast Houghton Area Recharge Project

3.4.3 Gray Water

The City's Gray Water Ordinance, passed in 2008, requires that all new single-family homes and duplexes be built with gray water system hookup capabilities. Separate plumbing or diverts are required on washing machine hook-ups and for showers and bathtubs. In 2011, the City implemented the Gray Water Rebate to

incentivize the installation of gray water systems for landscape irrigation on residential properties but participation in the program is low. Of the gray water systems that are being installed, most are "laundry to landscape" systems which allow for the recycling of 12 to 16 percent of household water use from clothes washers for outdoor irrigation purposes.

3.4.4 Onsite Reuse

Onsite reuse of recycled water refers to the practice of treating and reusing wastewater generated within a building or property for non-potable purposes, such as irrigation, toilet flushing, and cooling. Generally, onsite reuse of recycled water is most commonly used in industrial settings for uses such as cooling towers or toilet flushing within office buildings. Further development of opportunities for onsite reuse would involve new policies to address public health risks and would depend on public acceptance of onsite reuse for certain uses, such as residential developments.

3.4.5 Direct and Indirect Potable Reuse

Both IPR and DPR could expand the use of recycled water beyond just non-potable uses, such as outdoor irrigation. In Arizona, potable reuse is allowed under the rules of the ADEQ but additional state regulations for potable reuse are currently under development. Participating in state regulatory discussions, developing a public education campaign, and developing a demonstration project could all be potential steps toward implementing direct or indirect potable reuse. Both IPR and DPR are local water supply options that are drought proof, reliable, and not subject to the uncertainties of the Colorado River 2026 reconsultation process that may result in a change of Tucson Water's annual CAP allocation.

Positive public perception of recycled water is crucial for the continued utilization of this drought proof water resource. It is well known that a strong community engagement program is critical to moving these programs forward. As demonstrated in San Diego, Los Angeles, and Texas, extensive community engagement and education programs can shift public perception and help accelerate implementation of potable reuse, particularly in light of severe drought conditions. To maximize the use of recycled water in the future with either IPR or DPR, Tucson Water must also be proactive with respect to the water quality expectations of the community.

3.5 Stormwater

The City has been a national leader in desert rain and stormwater harvesting. This resource is a small but growing component of Tucson's water supply. Tucson's summer monsoons provide a renewable source of water that can be used on landscapes to reduce reliance on potable water for landscape irrigation demands. In Tucson, rain and stormwater harvesting, including green stormwater infrastructure (GSI) programs can include a combination of the following additional benefits:

- Reducing stormwater pollution
- Shading and cooling streets, sidewalks, bikeways, and parking areas
- Mitigating minor flooding
- Creating wildlife habitat and supporting biodiversity
- Beautifying the urban environment
- Providing a nature-based complement to gray infrastructure

Rain and stormwater harvesting falls into two general categories: active and passive. Active harvesting refers to a tank or cistern storing rainwater collected from roofs, which provides a means to store the rainwater for later use. Passive harvesting typically refers to directing and retaining water in the landscape using site appropriate practices such as basins, berms, terraces, swales, and infiltration trenches. Rainwater

harvesting typically refers to residential scale projects while stormwater harvesting is done in a municipal right of way.

Historically, traditional infrastructure such as gutters and pipes are used to transport stormwater away from a location. GSI helps collect and infiltrate stormwater near where it falls. GSI can also incorporate both passive and active stormwater harvesting techniques. These projects can range from an individual homeowner installing a cistern to the neighborhood scale where vegetated areas and curb cuts are designed along roadways to create areas for stormwater to be diverted, collected, and infiltrated.

Caption: Cisterns or tanks at Tucson Water East Side Service Center, a form of active rainwater harvesting, can be used to store rainwater collected from roofs for use at a later date.

Figure 3.20 Rainwater Harvesting

Caption: Green Stormwater Infrastructure, such as curb cuts can reduce flooding on streets and, often diverting that water into basins to irrigate vegetation that can shade streets and sidewalks, cooling neighborhood temperatures and creating more desirable places for biking and walking.

Figure 3.21 Curb Cuts

One of the main challenges of stormwater as a water supply is its variability in water quantity and water quality. Unlike surface or groundwater, stormwater is unpredictable in timing, quantity, and water quality. These factors have contributed to the underutilization of stormwater and are often cost-prohibitive in arid regions when just considering water supply benefits. While there are some existing guidelines, there is currently a lack of consistency in installation and maintenance practices for GSI used in the city. The absence of a unified approach to GSI contributes to the difficulty in quantifying the saving and benefits derived from these types of projects. Water quality concerns can also arise from the lack of defined project standards and regulations, as well as the wide range types and concentrations of potential contaminants. This is specifically the case for urban runoff in high density and industrial areas where stormwater may be polluted with trash, heavy metals, motor oils, and bacteria to name a few. There are many types of small scale and GSI type stormwater treatment options available, but these systems do require additional operations and maintenance (O&M) staff to keep these treatment systems functioning properly.

However, there is great potential for using stormwater as a resource, including expanding upon existing programs. Tucson Water currently has an intergovernmental agreement (IGA) with Pima County Flood Control District to develop and fund the implementation of large-scale stormwater projects. Additional areas of expansion could include integrating and standardizing policies and practices for GSI across the City. New standards, and updated strategies for stormwater use would help facilitate the implementation of large-scale stormwater projects with multiple benefits and these opportunities would help expand Tucson's stormwater harvesting resource. Another next step is the creation of a comprehensive stormwater utility for planning, design, construction, operation, and maintenance of stormwater facilities that include large scale stormwater harvesting. As stormwater is difficult to quantify, the expansion of stormwater resources is included in the supply assumptions in the Plan as an approach to reducing the long-term per capita water by offsetting potable water supplies for irrigation.

Caption: The Rincon Heights Neighborhood GSI Project after a rain event.

Figure 3.22 Rincon Heights Neighborhood GSI Project

3.5.1 Residential Rainwater Harvesting Rebate Programs

Tucson Water has been investing in residential water harvesting since 2012. The rain harvesting rebate program covers both simple, passive harvesting systems as well as more complex, active harvesting systems that can include the use of a cistern or tank. In the past five years, Tucson Water has launched programs to:

- Provide funding for street-scale stormwater harvesting projects
- Facilitate and install community-driven GSI projects
- Increase the focus on maintaining projects built, community outreach, and equity

To date, over 3,500 customers have installed water harvesting systems on their properties, including nearly 500 subsidized systems for low-income households.

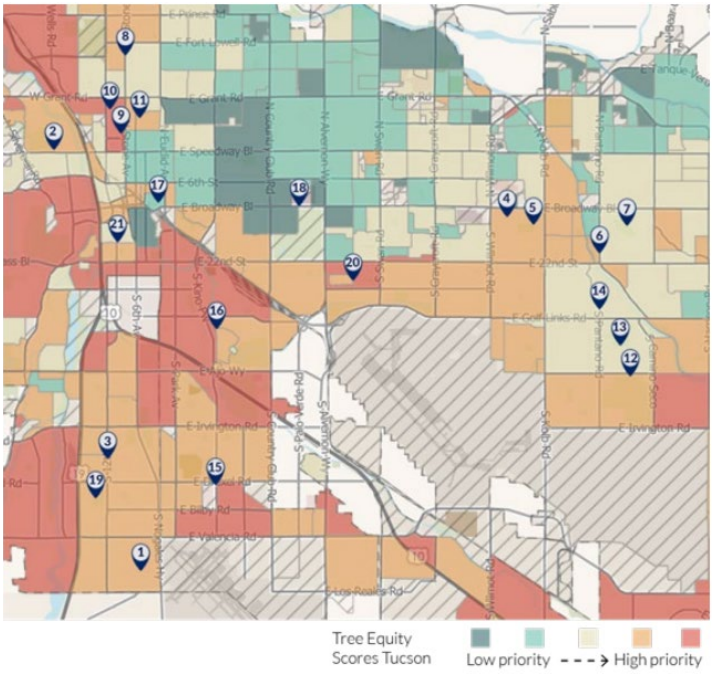
Caption: Rainwater Harvesting Cistern at the Ward 5 Council Office.

Figure 3.23 Rainwater Harvesting Cistern

3.5.2 Storm to Shade Program

The Storm to Shade (S2S) program was established in 2019 with the aim of installing and maintaining GSI features on public property, such as parks, roadways, and rights-of-ways, with a focus on the use of passive water harvesting features. The Tucson S2S program is funded by a GSI fee, which is assessed on customers based on their water consumption. The revenues generated from the fee are dedicated to fund the construction and maintenance of GSI projects citywide. The GSI Fee was initially established as a pilot program and has since been authorized as a permanent program of the City. The program has had success with leveraging other grant programs and voter-approved bonds for park and connection improvement projects.

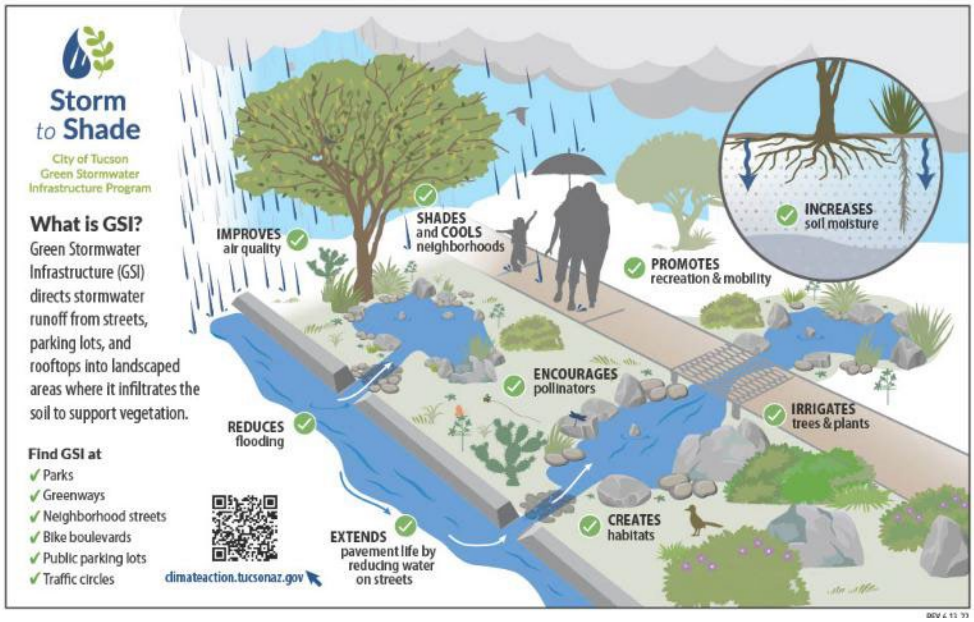
S2S has funded 22 projects to date (April 2023), with a variety of projects that divert stormwater from flowing directly into storm drains and infiltrate this water in harvesting basins that support greenways and parklets that irrigate trees and native vegetation without the need for water intensive turf. S2S utilizes a Tree Equity Score to prioritize projects in areas of Tucson that have historically received low levels of investment, are generally hotter, have less tree canopy, and house a more vulnerable population. A map of Tree Equity Scores and project locations through 2022 is shown in the following figure.



Caption: To maximize the benefits of GSI for communities most in need of additional tree canopy and green space, S2S developed a process for identifying potential projects as well as an accompanying set of selection criteria.

Figure 3.24 GSI Projects and Tree Equity Scores

S2S has also published guidelines around GSI maintenance as well as general site design guidance. The maintenance guidelines include information about common GSI features, why GSI is important, as well as tools and general maintenance steps for site upkeep including plant care. The general site design guidance document covers current best practices for the planning, design, and construction of GSI. These documents are the first steps in creating integrated and consistent policies and standards for GSI projects in the City.



Caption: Green stormwater infrastructure directs stormwater from streets and parking lots into landscaped areas that provide multiple benefits to the area.

Figure 3.25 Description of Green Stormwater Infrastructure

3.6 Future Water Supply Vulnerabilities

The scenario planning process, described in more detail in Chapter 2, identified key water supply vulnerabilities such as the over-reliance on supply from the Colorado River, the potential for the reduction of available water within each of the existing water supplies from drought, climate change, changes in water quality, and new regulations. These key vulnerabilities informed the development of the water supply strategies that are presented in Chapter 5.

3.7 Future Water Supply Opportunities

The scenario planning process also identified key opportunities associated with Tucson Water's water supply portfolio. Broadly summarized, the process included recommendations to further diversify the supply portfolio through more use of locally controlled and distributed sources and to deliberately reduce reliance on CAP water from the Colorado River. This includes increased development of recycled water, including onsite reuse, as well as rainwater and stormwater harvesting to help offset CAP supplies. The scenario planning also resulted in recommendations to protect the existing CAP supplies by remaining involved in state and federal policy and regulatory discussions, while also continuing to maximize the storage and use current CAP supplies. Finally, stakeholders recommended protecting groundwater resources by addressing issues of water quality. These recommendations informed the development of the water supply strategies that are presented in Chapter 5.

Chapter 4

WATER DEMANDS

4.1 Today's Water Uses

Today, Tucson Water serves close to 750,000 people through about 242,300 potable and reclaimed water accounts. Over 90 percent of Tucson Water's potable water accounts are residential, which includes both single and multi-family homes.

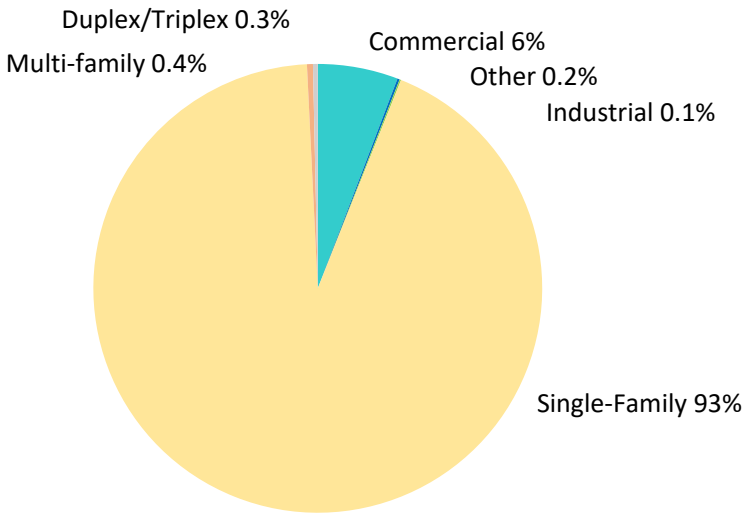


Figure 4.1 Tucson Water 2022 Customer Classes by Account Type

Although the vast majority of customer accounts are residential, single family residential customers only consume 70 percent of the water Tucson Water serves. The remaining non-residential demand includes classifications such as industrial customers, commercial customers, homeowner associations (HOAs), and institutional users such as school districts. The average annual non-residential consumption reflects approximately 30 percent of the total demand as shown in the following figure.

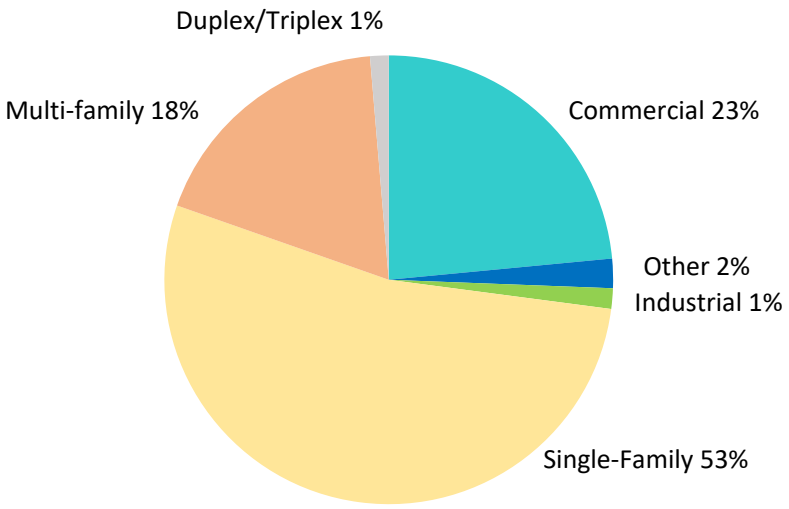
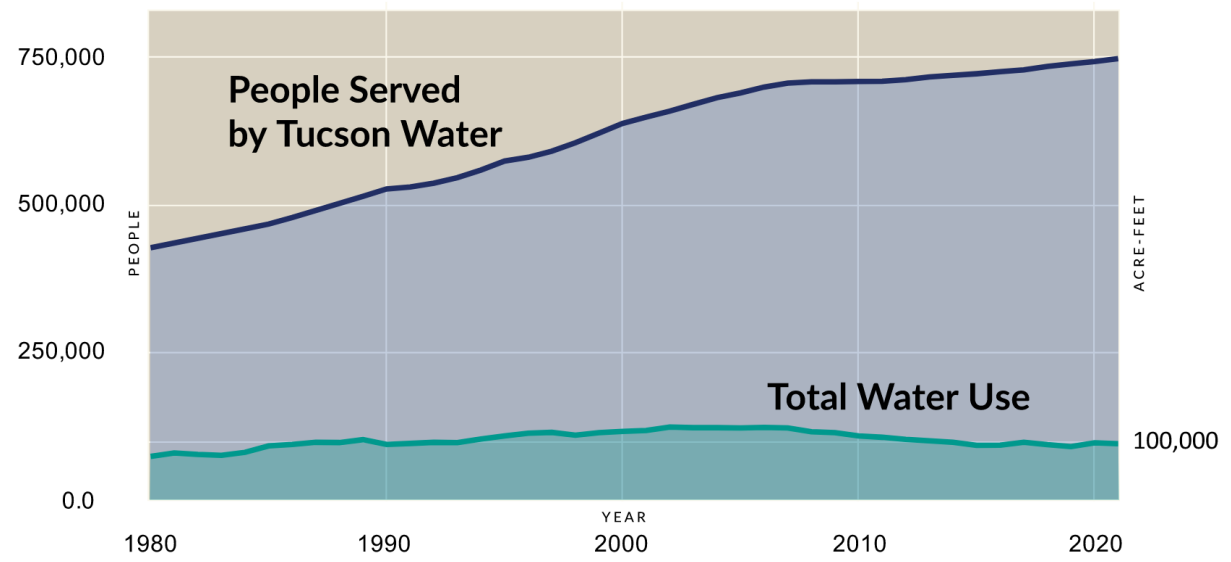


Figure 4.2 Tucson Water 2022 Potable Metered Water Use by Account Type

Tucson Water also has several wheeling agreements with regional water providers which allow them to transport a portion of their renewable water supply through Tucson Water's distribution system. These agreements do not impact Tucson Water's water supply needs but are accounted for in facility planning to confirm that the distribution system can convey these flows. Tucson Water also provides water for fire suppression and maintains the ability to provide water to emergency responders when it is needed.

4.1.1 Per Capita Water Use Trends

Tucson Water has been tracking per capita water consumption for decades. As shown in the following figure, a slight downward trend in water use has occurred since 2005, reducing the total per capita water use from roughly 180 gallons per capita per day (gpcd) to roughly 130 gpcd, with residential water use declining to about 100 gpcd. Since 2008, Tucson Water's total annual water usage has declined even though the population served has increased. This phenomenon is known as "decoupling," meaning water demand is no longer increasing along with population growth.



Caption: Since 2005, Tucson Water's total annual water usage has declined even though the population served has increased.

Figure 4.3 Tucson Population Growth vs Water Usage

Robust conservation programs and a strong conservation ethic among the community have made decoupling possible. Today, Tucson Water customers are using the same total volume of water as they were in the mid-1980s, despite the service area population increasing by over 200,000 residents over that same timeframe. Tucson has among the lowest per capita water use of the cities in the southwestern U.S.

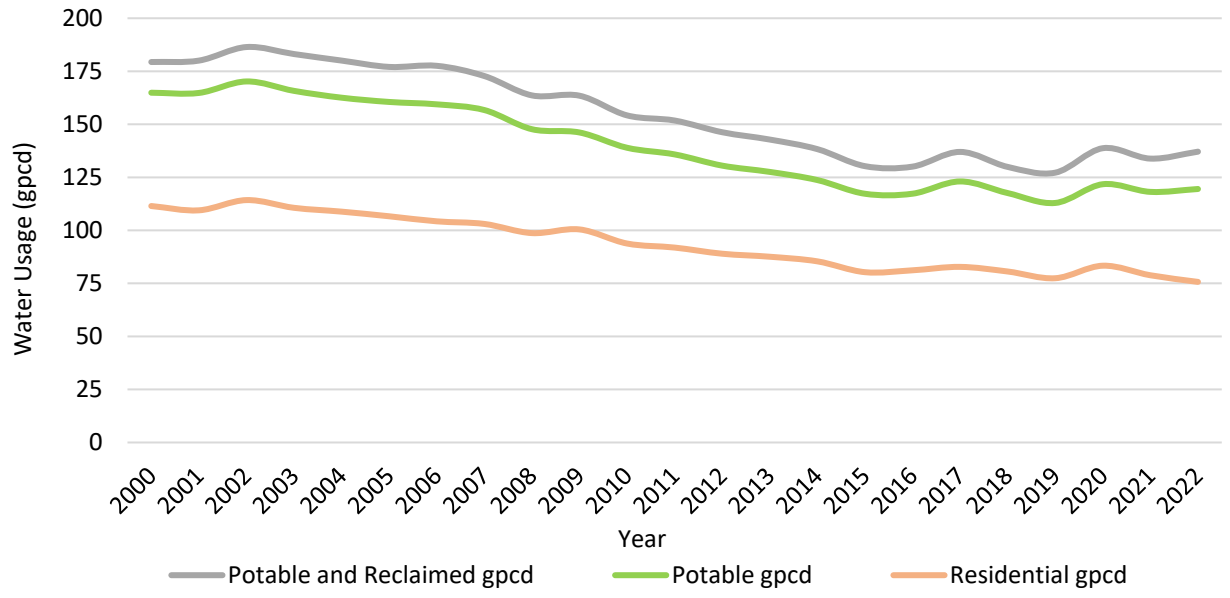


Figure 4.4 Water Service Area Water Use Trends

A historic analysis of Tucson's seasonal and non-seasonal demands was done in the August 2021 TM, *One Water 20100 Conservation Projections* which is included in Appendix G. Non-seasonal demands relate to indoor water use while seasonal demands correspond to outdoor or other temperature driven water demands. The following figure shows the annual potable season and non-seasonal water use and the percentage of water use that was considered seasonal demands. From 1985 to 2019, there has been a long-term trend of declining seasonal water use.

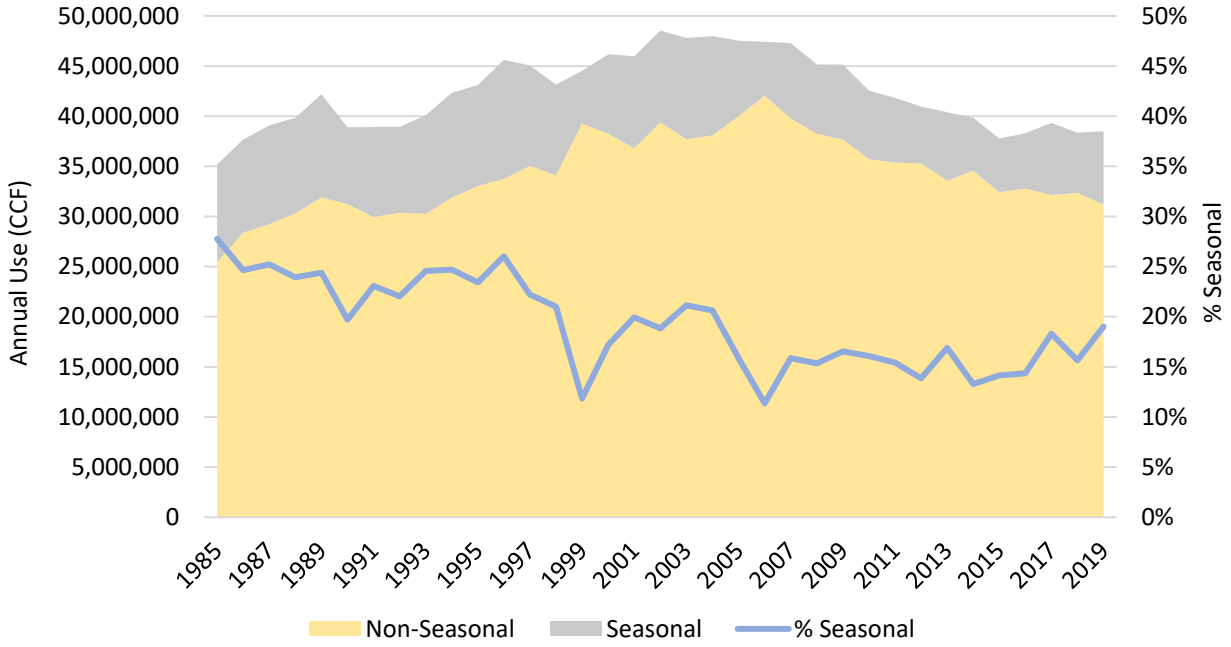
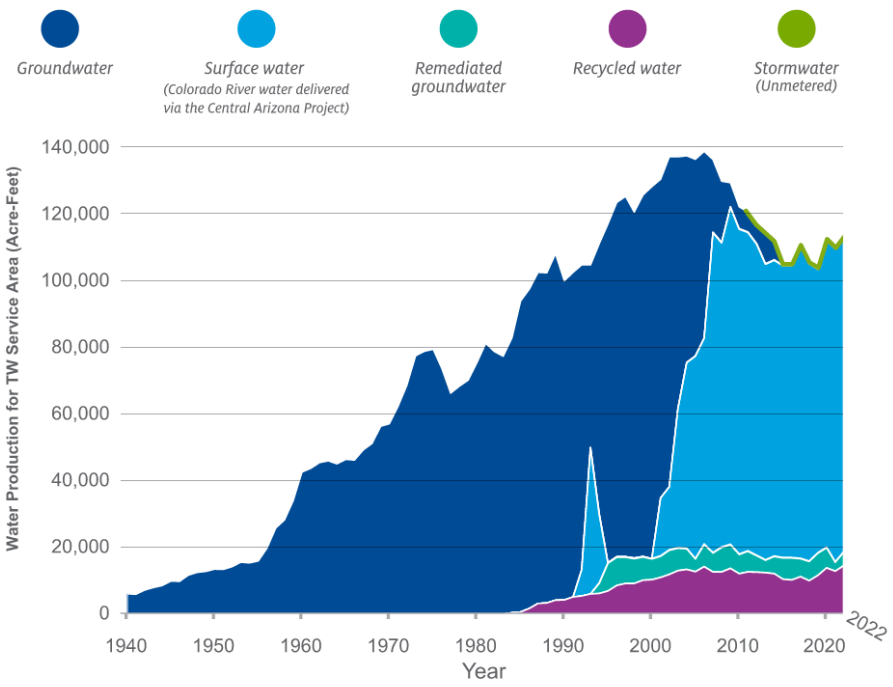


Figure 4.5 Tucson's Annual Potable Seasonal and Non-seasonal Use and % Seasonal in CCF from 1985-2019

4.1.2 Historical Water Use

The evolution of Tucson Water's supply diversification history can be seen in the following figure. Since the 2000s there has been a dramatic transition from a reliance on groundwater resource to renewable Colorado River supplies delivered via the CAP. There has also been a continued decline in total water use despite a growing population in Tucson Water's service area. By further reducing water use through demand management efforts, Tucson Water has the opportunity to reduce its reliance on the Colorado River, mitigating the risk of relying on finite groundwater resources during periods of shortages. In addition, further development of non-potable supplies such as recycled water and harvesting stormwater reduces potable demands, reducing reliance on the Colorado River and protecting groundwater resources for future generations.



Caption: Since the 2000s, Tucson has transitioned dramatically from a reliance on groundwater resources to Colorado River supplies delivered via the Central Arizona Project.

Figure 4.6 Water Production in Acre-Feet, 1940-2020

4.2 Water Conservation

Water conservation is vital to Tucson Water's long-term strategy to provide reliable water into the future. Tucson Water has one of the longest running conservation programs in the nation and the Tucson community has long embraced an ethic of water conservation. Water conservation has been one of the core components of Tucson Water's water resource planning efforts since the 1970s. Since that time, a Water Conservation Office was established within Tucson Water and a comprehensive Xeriscape Landscaping Ordinance has required the use of drought-tolerant plants in new multifamily, commercial, and industrial developments. The City also implemented a Water Waste Ordinance, plumbing code modifications, and rebates for encouraging the replacement of high-water use toilets and clothes washers.

Tucson's conservation program includes several financial incentives as well as a suite of public information and educational outreach projects. The conservation program has partnered with various organizations to inform customers about conservation programs and methods and techniques to use water more efficiently. Coupled with conservation-oriented water pricing, national plumbing codes, and the Environmental Protection Agency (EPA) WaterSense program, these programs support Tucson Water's commitment to establishing and maintaining a strong water conservation ethic in the community. Together, these incentive programs, tiered water rates, more efficient technology, increased water scarcity awareness, and associated behavioral changes have lowered the potable water consumption, typically expressed in gpcd.

Based on a review of local and national water demand trends and Tucson's current water conservation program offerings, Tucson Water prepared recommendations to consider for future conservation programs, which are documented in the August 2021 TM, *One Water 2100 Conservation Projections.* This TM is included in Appendix G. These recommendations are included in this Plan to further enhance the overall effectiveness of the Tucson Water Conservation Program to lead to continued, sustained, and equitable demand reductions across all sectors of water customers.

4.2.1 Rebates and Incentives

For the past two decades, Tucson Water has offered a range of rebate programs for both commercial and residential water users that promote water saving practices. These programs continue to be updated as new water efficient technology becomes available. Conservation efforts can be seen in reducing indoor water use through high-efficiency appliances and in reducing outdoor water use by promoting water-efficient landscaping.

- **Single-Family Residential Programs –** For single-family customers, rebates are available for installing high-efficiency toilets (HET), high-efficiency clothes washers, rainwater harvesting systems and gray water systems.
- **Multi-Family Programs –** Programs for multi-family customers include HET and customized rebates.
- **Commercial Programs –** Rebates for commercial customers include high-efficiency toilets, high-efficiency urinals, and a customized commercial rebate. The customized rebate for both multi-family and commercial properties usually involves an onsite water audit that analyzes current water use and provides customers with return-on-investment calculations.

By adjusting rebate levels and offering new rebate programs, Tucson Water can increase efficiency of fixtures and appliances for which rebates are offered and increase water savings opportunities. One example of this is new programs targeting commercial customers. Another area for further program expansion is in the continued focus on reducing outdoor water use, with emphasis on resilient, desert-adapted landscaping in lieu of grass and other high-use plants.

4.2.2 Zanjero Program Water Audits

A team of Tucson Water conservation experts provides free water audits to residential and commercial customers upon request. These Zanjero Program water audits are usually requested by customers with a high bill. The onsite audit includes a download and review of hourly, 40-day water use data recorded at the meter when available, a review of all onsite water uses, identification of leaks and additional water efficiency opportunities at the property. Rebates and incentives are shared when appropriate.

4.2.3 Low-Income Conservation Services

Tucson Water also offers several low-income conservation services. Qualifying low-income homeowners can receive free high-efficiency toilet replacements, discounted clothes washers, rainwater harvesting and gray water grants and loans in addition to the regular rebates and free emergency plumbing repairs.

Caption: This is an example of a water conserving landscape.

Figure 4.7 Example of a Water Conserving Landscaping

Caption: Current incentives include rebates for high-efficiency clothes washers.

Figure 4.8 Low Water Use Washing Machines

4.2.4 Community Education and Outreach Programs

Along with numerous rebates and conservation programs, community outreach and education are crucial to demand management. Investment in water education programs increases the awareness of water scarcity and changes community behavior around water use. Tucson Water continues to contract with several partners that provide outreach, conservation activities, and educational services throughout the service area. These include youth education programs and Smartscape, which offers adult education for landscape professionals and residents. Tucson Water partners with Arizona Project WET (APW) and Environmental Education Exchange (EEExchange) to offer these youth education programs. All programming meets Arizona Department of Education K-12 Standards.

Caption: Students participate in outdoor water education at the Sweetwater Wetlands.

Figure 4.9 Outdoor Water Education at Sweetwater Wetlands

4.2.5 Advanced Metering Infrastructure

Tucson Water recently undertook an updated analysis of the possible benefits from implementing Advanced Metering Infrastructure (AMI), an approach to "smart metering" that provides real time water consumption data to the consumer and to the utility. AMI can detect leaks in a timely manner and automatic leak detection can promptly inform customers of a leak. This information allows customers to change behavior and/or address and resolve leaks quickly, resulting in significant cost savings for the customer and reduces water waste. Also, the use of AMI meters and the consumption data it would provide would allow Tucson Water to better understand conservation measures' effectiveness and target conservation programs with customer-specific water budgets.

4.2.6 Non-Revenue Water Management Program

Non-revenue or unaccounted-for-water (aka water loss) is the difference between potable water production and customer consumption. Leaks at any point in the distribution system can contribute to the non-revenue water volume. Metering inaccuracies can also contribute to apparent levels of non-revenue water. Reducing non-revenue water is an important water conservation step for Tucson Water.

Focusing on leaks, breaks, and metering replacements helps account for and reduce non-revenue water. Tucson Water's assessment of AMI ties into its ongoing efforts to identify and implement strategies to reduce water loss as it travels through the distribution system to customers. Over the past decade, Tucson Water has been implementing programs targeted at reducing non-revenue water. This includes a reservoir rehabilitation program where tanks are inspected for leaks and upgraded as needed. There have also been pilot programs implementing leak detection testing on portions of the distribution system. To-date, these programs have only focused on portions of the Tucson Water distribution system, however, system-wide audits and repairs will become increasingly more important moving forward.

In 2021, Tucson Water started work on a system wide non-revenue water management program. This program is in the development stage and aims to significantly reduce the percentage of water lost each year. By creating and maintaining this comprehensive program, Tucson Water can work to reduce leaks throughout the system with the long-term goal of significantly reducing the yearly non-revenue percentage. These existing and latest programs highlight Tucson Water's continued commitment to internal water conservation practices.

4.2.7 Drought Preparedness and Response Plan

Following the 2020 update to the *Drought Preparedness and Response Plan*, Tucson Water prepared for current and future drought declarations on the Colorado River. The plan outlines four drought tiers, Tiers 0 through 3, which are declared based on the water levels in Lake Mead. However, it should be noted that shortages on the Colorado River do not immediately translate to shortages for Tucson's water supply as discussed in Chapter 3. Once each tier is declared, Tucson Water is required to take specific response measures, as follows:

- **Drought Tier 0 –** Tier 0 is triggered when Lake Mead water levels are between elevation 1,090 and 1,075 feet above mean sea level (msl). Tucson Water is required to develop water use guidelines. Water use guidelines or water budgets are the amount of water required for indoor and outdoor use. These guidelines are developed for residential, commercial, and reclaimed water customers based on historic consumption data.
- **Drought Tier 1 –** Tier 1 is triggered when Lake Mead water levels are between elevation 1,075 and 1,045 feet msl. Tier 1 involves providing targeted conservation information to customers who are exceeding the established water use guidelines. As a part of the Tier 1 Drought Plan measures, Tucson Water is working on a landscape water budget application that will identify commercial customers exceeding water budget targets. Educational outreach will be developed for these specific customers.
- **Drought Tier 2 –** Tier 2 is triggered when Lake Mead water levels are between elevation 1,045 and 1,025 feet msl. Audits are required for customers whose consumption exceeds the established water use guidelines.
- **Drought Tier 3 –** Tier 3 is triggered when Lake Mead water levels are below elevation 1,025 feet, or the volume of water delivered by the CAP to Tucson Water is less than annual demand. The City's Mayor and Council may consider water restrictions specific to customers who are not implementing audit recommendations or reducing water consumption within the provided guidelines.

As of 2023 the Lower Colorado River Basin is in a Tier 2a shortage. This level of shortage represents a 592,000 ac-ft reduction to Arizona's Colorado River supply, constituting 34 percent of CAP's normal supply in an average year. Tucson Water is implementing the Tier 2 response measures described above, including targeted conservation program information for customers whose consumption exceeds their specific water use guidelines, and water audit assistance for customers whose consumption continues to exceed water use guidelines.

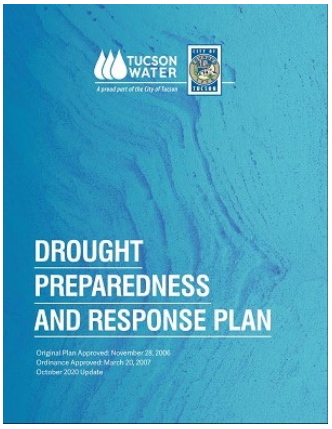


Figure 4.10 Drought Preparedness and Response Plan (2020 Update)

4.2.8 Drought Policy Responses

In October 2022, the Mayor and Council directed staff to research several water conservation management approaches, code changes, and ordinances in response to the drought emergency on the Colorado River. Tucson Water and the City's Planning and Development Services Department is currently developing the following:

- **EPA WaterSense Fixture Building Code Requirement –** This would update the current building code to require EPA WaterSense Certified fixtures in new developments. Benefits would include both water and energy savings. These fixtures and their equivalents have been tested and certified by the EPA.
- **Irrigation meter requirements for new Commercial/Industrial customers over a specific size –** Meter requirements for new commercial and industrial customers would help provide outdoor water use data that can be useful in managing peak demands and enacting drought measures.
- **Low Impact Development (LID) Ordinance –** This proposed ordinance would mandate the use of GSI in new housing developments. LID can greatly reduce the potable water demands for urban landscapes and the inclusion of GSI can create healthy green spaces full of native and drought tolerant plants.
- **Prohibition of non-functional ("ornamental") turf –** This policy would ban new ornamental turf from being approved for installation in new multifamily and commercial development projects. A complimentary rebate program could be developed to incentivize customers to remove existing turf, whether non-functional or not.

Additional policies to conserve water for new development and in the built environment are expected to emerge as conditions continue to change on the Colorado River. Research is also being conducted on Net Zero Water, an approach where all water demands for new developments are met through different offset measures. The goal of this approach is to avoid additional demands when new developments are created.

4.3 Future Water Demand Vulnerabilities

Key vulnerabilities identified through the scenario planning process included the potential for Tucson Water to acquire other service areas, population increases and land use changes, and economic factors such as the incentive programs targeting commercial customers.

4.4 Future Water Demand Opportunities

The scenario planning process also identified that continuing to prioritize water conservation can be key to moving towards future sustainability and resilience. This includes developing and implementing a consistent and effective public outreach and education campaign to build on Tucson Water's strong existing water conservation and local water management strategies.

4.5 Projected Water Use

The scenario planning process identified that while understanding current water supply vulnerabilities and opportunities is crucial to the planning process, water supply is only one part of the equation for long-term resilience and sustainability. Understanding current demands and projecting future water demands is another key consideration in achieving Tucson's One Water vision. Future demands in the Plan are estimated using a combination of Tucson Water's projected population growth and recent historical potable water use accounting for climate change impacts and future conservation.

4.5.1 Population Projections

The region's population grew rapidly in the early 20th century with the arrival of the railroad and the establishment of the University of Arizona. The City's population has continued to expand in the decades since, driven in part by a strong economy, which is anchored by industries such as aerospace, defense, and healthcare. Since 2010, the Tucson Water service area has grown by around 30,000 people or an annual growth rate of 0.3 percent. While Tucson is not growing as quickly as it has in the past, steady population growth is still expected in the future.

To project population out through 2100, the Plan was supported by a future growth analysis. Population projections can be found in the April 2020 TM, *One Water 2100 Population Projections* which is included in Appendix H. The analysis considered information on residential and non-residential growth provided by the Pima Association of Governments (PAG), Arizona's Office of Economic Opportunity, and the U.S. Census Bureau, as well as current zoning and planned and potential annexations of the Tucson Water Obligated Service Area.

Within the Tucson Water service area, the population is expected to increase by 29 percent, or about 213,000 people, to an estimated total of 947,000 by the year 2100. This equates to an average annual growth rate of 0.3 percent. The population projection in the graph below is the basis for the water demand analysis in the Plan. This projection is based on the medium growth projection by PAG. The full range of growth projections are included in the April 2020 TM, *One Water 2100 Population Projections* which is included in Appendix H. Information about potential expansions of the Tucson Water Obligated Service Area and other growth areas can be found in the February 2022 TM, *One Water 2100 Land Use Planning* included in Appendix I.

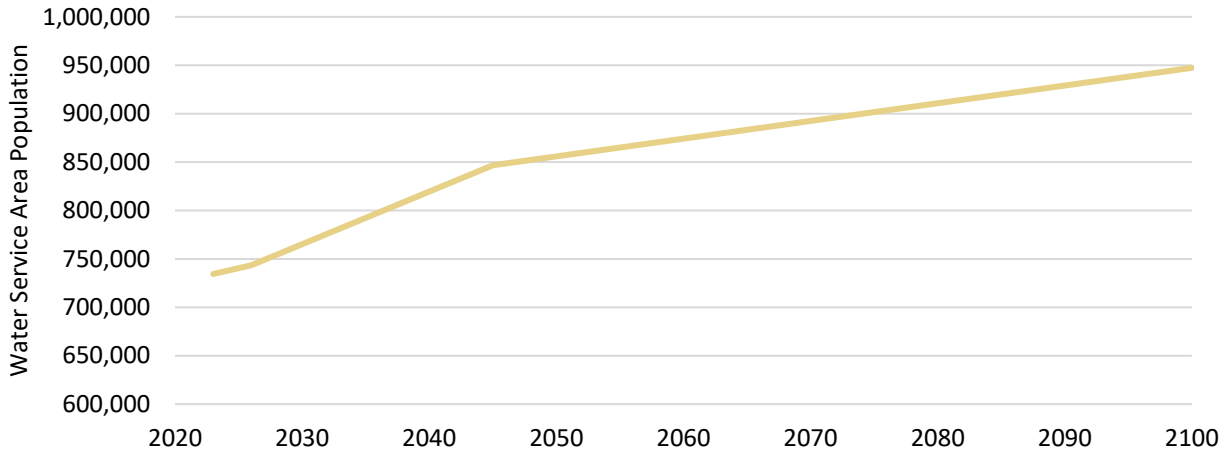


Figure 4.11 Population Projections in the Tucson Water Service Area

4.5.2 Water Use and Demand Scenarios

The Plan was further supported by a long-term potable water demand projection. The basis of this can be found in the September 2021 TM, *One Water 2100 Water Use Projections* which is included in Appendix J. The water use projections include two plausible scenarios of future water use through 2100. Descriptions of these two scenarios and the projected water demand associated with each scenario are defined below.

- **Increasing Demand:** This scenario assumes that water demand will continue to increase into the future. It is based on an increasing population with a potable per capita water use that is held

constant at the recent average value of 120 gpcd. Under the increasing demand scenario, potable water use is expected to increase by 29 percent, or just under 29,000 AFY to an estimated total of 127,000 AFY by 2100.

- **Decreasing Demand:** This scenario assumes that water demand will remain relatively flat into the future. It is based on an increasing population with a potable per capita water use that reduces by 20 gpcd to 100 gpcd by year 2100. A gradual long-term reduction of gpcd was assumed. Under the decreasing demand scenario, potable water use is expected to increase by 8 percent, or just under 8,000 AFY, to an estimated total of just under 106,000 AFY by 2100.

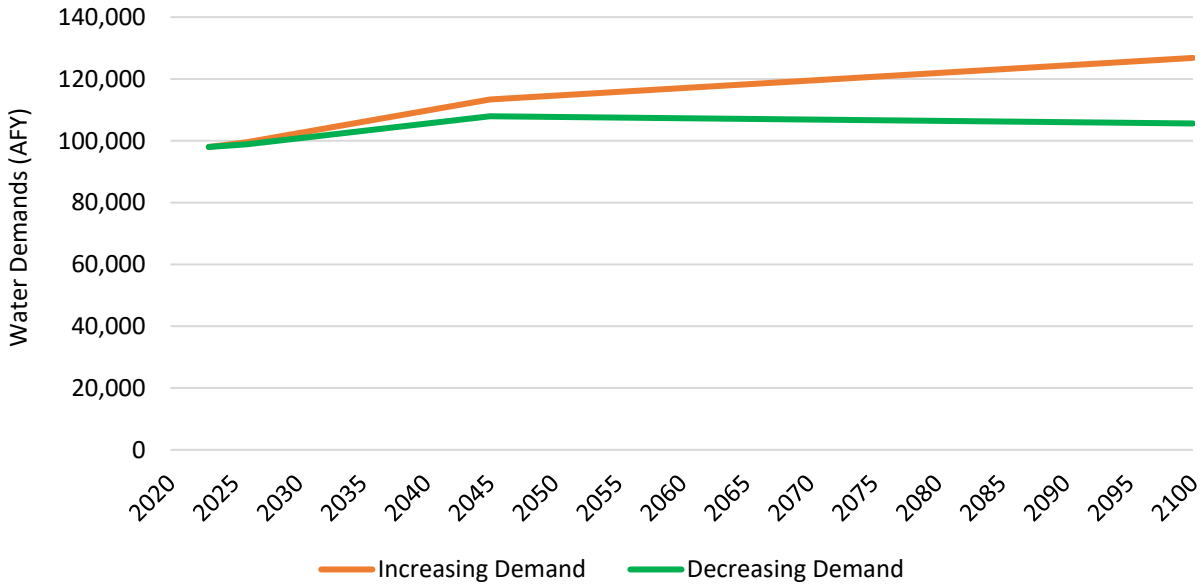


Figure 4.12 Projected Water Demand

The supply assumptions in the Plan test Tucson Water's resilience against long-term shortage conditions for the City's Colorado River allocation. Two scenarios looking at Tucson Water's future supply availability under different estimated reductions to the CAP were considered and are defined below:

- **Increasing Supply Availability:** This scenario assumes that the shortages to Tucson Water's CAP supplies will be no greater than existing shortage sharing agreements on the Colorado River. It is based on a long-term Tier 3 drought declaration under the Lower Basin DCP. Under this scenario, it is estimated that the City's CAP supply would be cut to 124,000 AFY.
- **Decreasing Supply Availability:** This scenario assumes that the shortages to Tucson Water's CAP supplies will be significantly greater than existing shortage sharing agreements on the Colorado River. It assumes a long-term 50 percent reduction in Colorado River water supplied by the CAP starting in 2026. Under this scenario, it is estimated that the City's CAP supply would be cut to 72,000 AFY.

There are inherent limitations in the planning process due to the need to make assumptions to address factors that are dynamic and to some extent, beyond Tucson Water's control. The decreasing supply availability scenario assumes a significant reduction in the available CAP supply. Existing contracts are likely to be revisited as a part of the federal reconsultation process and may result in a change to Tucson Water's allocation. While some reductions can be expected in the future, the exact amount is unknown, and it is unlikely that the outcome will be as severe as a permanent 50 percent cut. Within the federal reconsultation

process, Tucson Water is advocating for equitable sharing of the proposed cuts to Colorado River water across the basin states. Additionally, CAP is currently exploring options to augment its supplies.

Beyond CAP supplies, Tucson Water has access to several other classes of water. These include Colorado River water and effluent stored by Tucson Water as underground LTSCs, as well as additional institutional safeguards such as CAP firming of LTSCs stored by the AWBA and CAGRD. Tucson Water also has access to over 54,000 AFY of groundwater resources identified in the City's 2023 application to modify its DAWS.

4.5.3 Supply and Demand Comparison

A comparison of supply and demand projections through the year 2100 was completed for four scenarios to characterize the uncertainty related to the current water supply portfolio. The four scenarios considered are the *Sustainable Oasis*, *Desert Oasis*, *Counting Buckets*, and *Thirsty Desert* scenarios. Each scenario considers a different combination of water demand and water supply portfolio scenarios. The key assumptions and resulting annual demand-supply balance for each of these scenarios are described in the following sections.

4.5.3.1 Sustainable Oasis

In this scenario, renewable Colorado River water exceeds projected potable demands and Tucson Water can continue saving that water as LTSCs. If projected demands decrease and supply availability increases, Tucson Water's potable demand is within the CAP supply through 2100. The total available CAP supply (124,000 AFY) is estimated to exceed the projected water demand (106,000 AFY) by approximately 18,000 AFY in the year 2100. The following figure shows the supplies used to meet the water use through the year 2100.

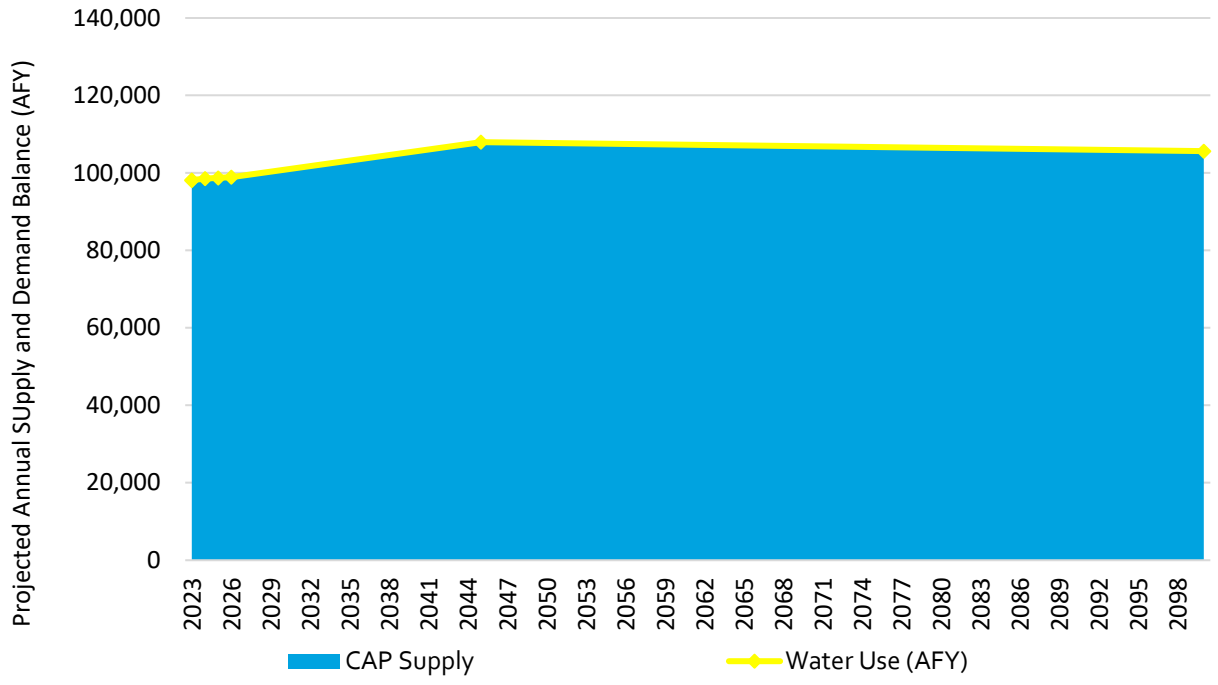


Figure 4.13 Projected Annual Supply and Demand Balance under Sustainable Oasis Scenario

4.5.3.2 Desert Oasis

In this scenario, Colorado River water exceeds projected potable demands well into the future and Tucson Water can continue saving that water as LTSCs, until those supplies are used to meet customer demands from the 2080s to year 2100. If both demand and supply availability increase, the total projected potable water demand (127,000 AFY) is estimated to exceed the City's CAP supply (124,000 AFY) by approximately 3,000 AFY in year 2100. The following figure shows the supplies used to meet the annual water demand.

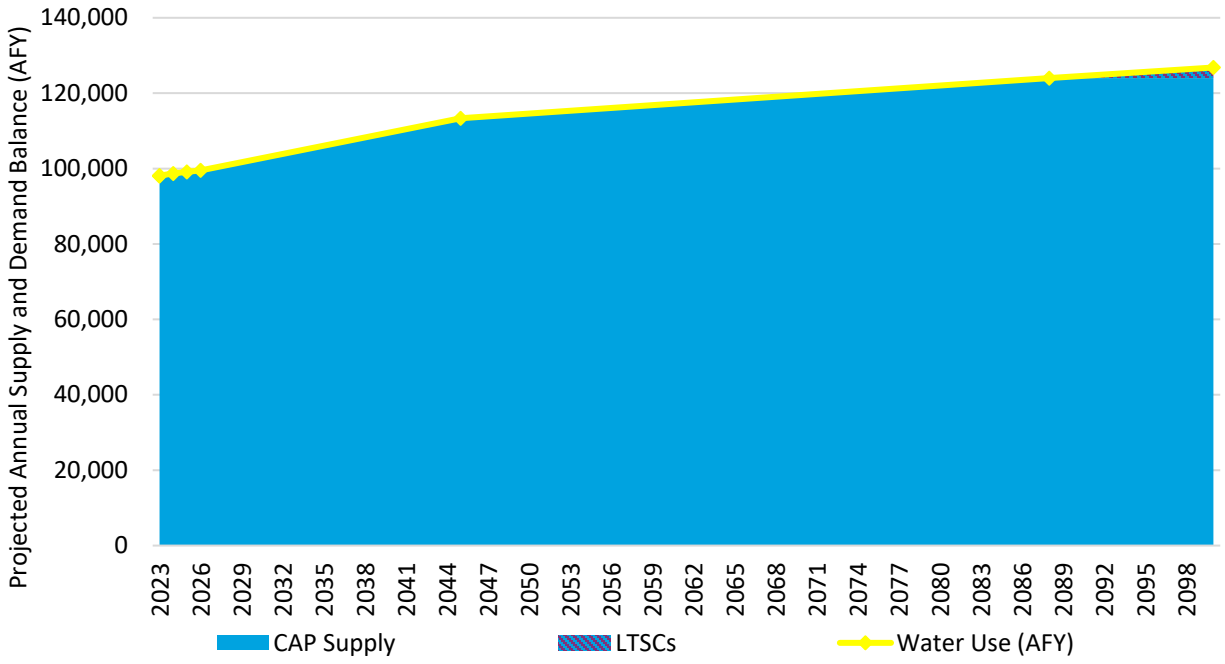


Figure 4.14 Projected Annual Supply and Demand Balance under Desert Oasis Scenario

4.5.3.3 Counting Buckets

In this scenario, potable demands exceed the available Colorado River water and Tucson Water relies on LTSCs and other groundwater accounts to meet customer demands. If projected demands and supplies both decrease, potable water demand exceed the available CAP supply in year 2026. The projected potable water demand (106,000 AFY) exceeds the CAP supply (72,000 AFY) by approximately 34,000 AFY in the year 2100. Tucson Water has sufficient available groundwater supplies through LTSCs, CAP firming, and other groundwater resources to meet the demands through the year 2100. The following figure shows the supplies used to meet the water use through the year 2100.

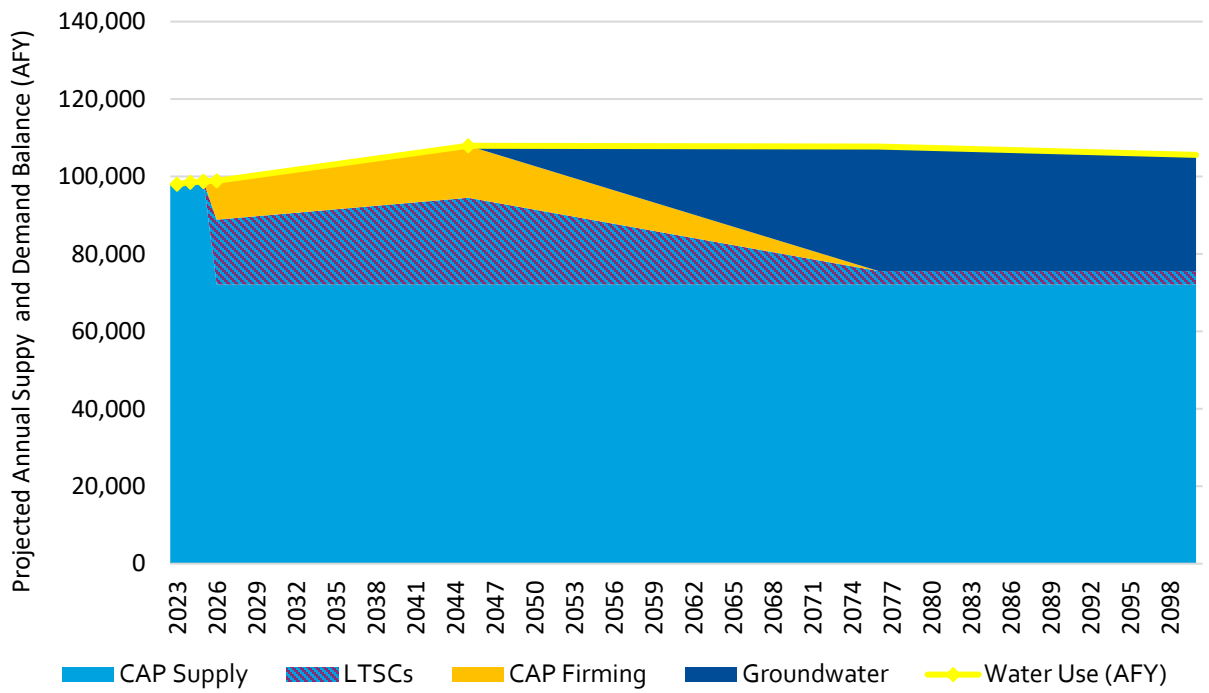


Figure 4.15 Projected Annual Supply and Demand Balance under Counting Buckets Scenario

4.5.3.4 Thirsty Desert

In this scenario, potable demands exceed Colorado River water and Tucson Water relies heavily on LTSCs and other groundwater accounts to meet customer demands. If demands increase while supply availability decreases, Tucson Water's potable demand exceeds the CAP supply in 2026. The total projected water demand (127,000 AFY) exceeds the CAP supply (72,000 AFY) by approximately 55,000 AFY in the year 2100. Tucson Water has sufficient available groundwater supplies through LTSCs, CAP firming, and other groundwater resources to meet the demands through the year 2100. The following figure shows the projected annual water use and the supplies used to meet that water use through the year 2100.

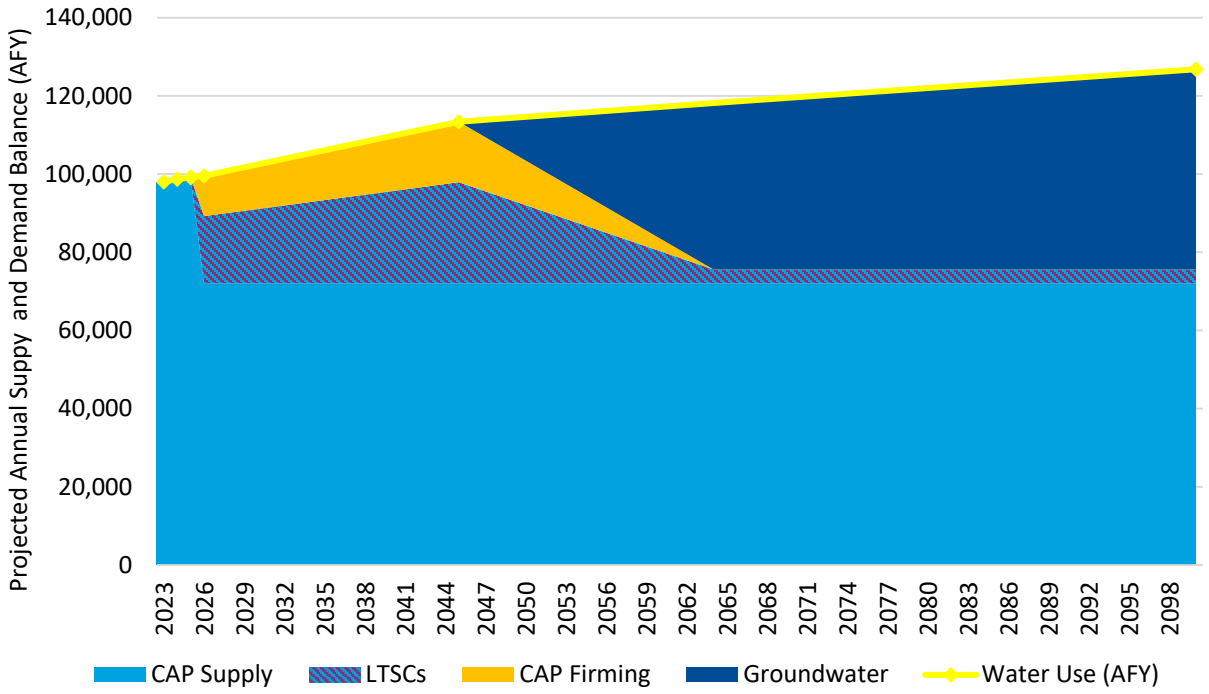


Figure 4.16 Projected Annual Supply and Demand Balance under Thirsty Desert Scenario

4.5.3.5 Scenario Summary

Tucson Water's projected cumulative supply availability for 2045 is summarized in the following figure. In the *Sustainable Oasis* and *Desert Oasis* scenarios, unused Colorado River water is stored to accrue additional LTSCs, bolstering Tucson's LTSC accounts. In the *Counting Buckets* and *Thirsty Desert* scenarios, renewable sources including stored LTSCs are committed to meet customer demands. These scenarios both assume that Tucson Water begins pulling from the groundwater resources in the Avra Valley aquifer in 2045.The groundwater shown accounts for the unused portion of the 54,000 AFY of available groundwater resources through 2045. In all four scenarios, Tucson Water has sufficient supplies to address the difference between supply and demand through the year 2045.

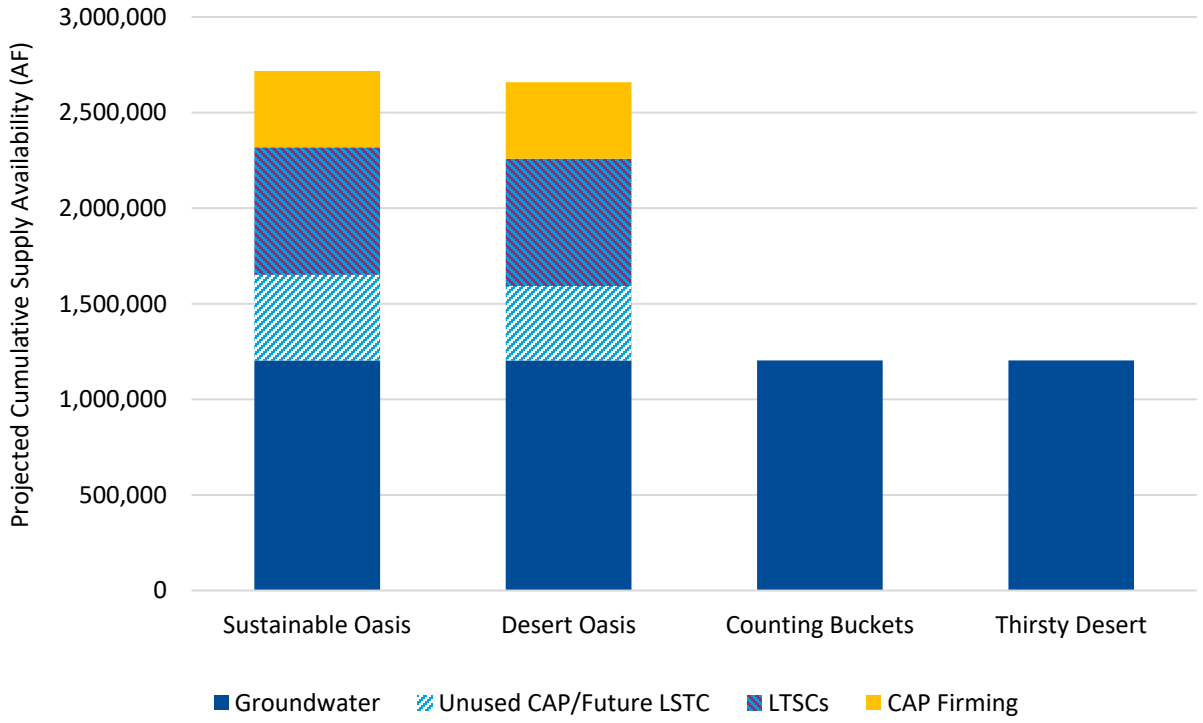


Figure 4.17 Projected Cumulative Supply Availability as of 2045

The projected cumulative supply availability as of 2100 is summarized in the following figure. In the *Sustainable Oasis* and *Desert Oasis* scenarios, unused Colorado River water continues to be stored to accrue an increase in LTSCs. In the *Counting Buckets* and *Thirsty Desert* scenarios, renewable sources, including stored LTSCs are used to meet customer demands and Tucson Water pulls from non-renewable groundwater stored in the Avra Valley aquifer. The groundwater shown accounts for the unused portion of the 54,000 AFY of groundwater resources through 2100. Even in these scenarios, Tucson Water has sufficient supplies to address the difference between supply and demand through the year 2100.

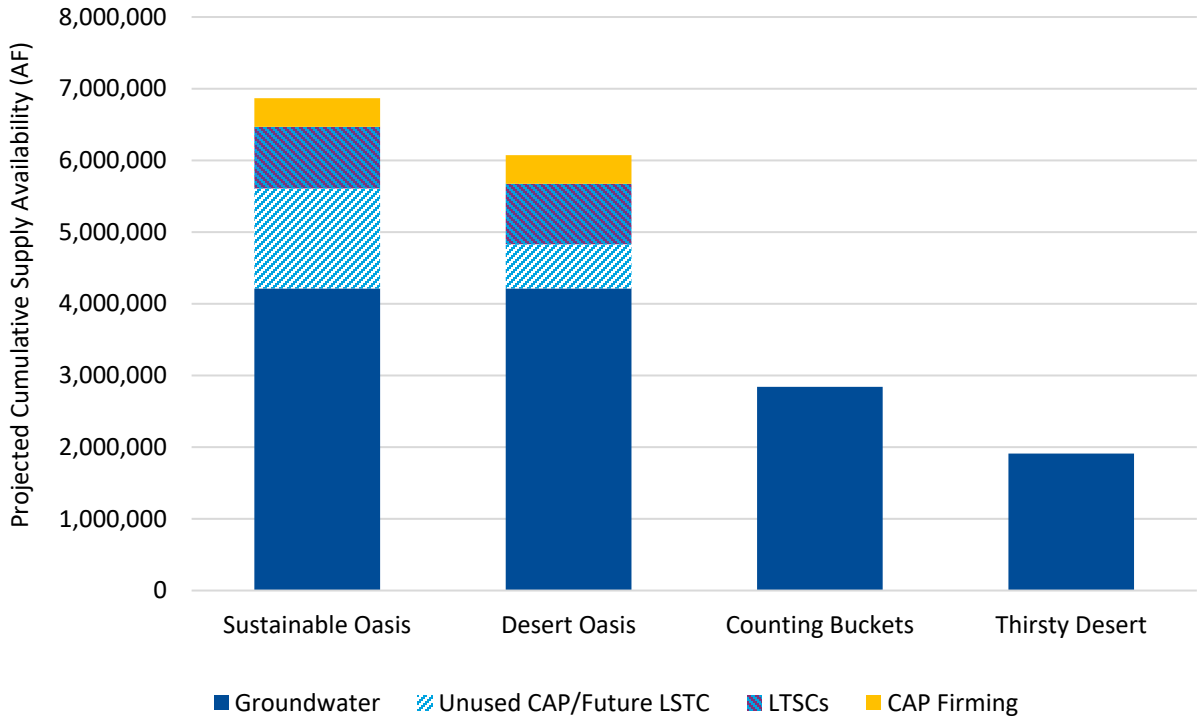


Figure 4.18 Projected Cumulative Supply Availability as of 2100

As the uncertainties and vulnerabilities around supply and demand conditions evolve over time, Tucson Water has the opportunity to take actions to mitigate the risks of the *Thirsty Desert* scenario and plan for a *Sustainable Oasis* where the water supply portfolio is increasingly diversified and water demands are well managed.

Chapter 5

TUCSON'S ONE WATER FUTURE

5.1 Introduction

This chapter describes the potential and proposed water management strategies crafted to achieve the vision and five guiding principles outlined in Chapter 2 of the Plan. Here, the first guiding principle focusing on water reliability, is divided into two parts – one for managing water supply and the other for managing water demand. These were identified as the two areas of greatest concern in the scenario planning process. The water supply strategies are further divided into four water supply categories: surface water, groundwater, recycled water, and stormwater. The water demand strategies are further divided into three categories: incentives, monitoring and mandates, and education. The remaining four guiding principles and associated strategies are covered at the end of this chapter.

An example of a stormwater strategy under Guiding Principle 1, *Water Reliability,* is provided below. The strategy is numbered S-1 to indicate that it was ranked the highest in the stormwater category. An example implementation action is also included below the strategy. The strategies include the responses from the statistically valid survey and an associated priority level – "High," "Medium," or "Low" determined by the survey results.

Table 5.1 Example Stormwater Strategy

Strategy #	Strategy	Survey Response	Priority Level
S-1	Explore opportunities for large scale stormwater projects with multiple benefits *Example: Design detention basins to control flooding, harvest stormwater, and support native landscaping.*	69%	High

Community feedback from the statistically valid survey and the online survey are both discussed in this chapter. A full summary of the results from the statistically valid survey is included in Appendix K while the online survey summary can be found in Appendix L. The results from the statistically valid survey are used to rank and prioritize the list of strategies as this survey is demographically representative of the Tucson community and was conducted by an independent third party. In the statistically valid survey, respondents were presented with a list of strategies and were asked to select which strategies were most important to them. Since a different number of strategies were shown for each question, the thresholds used to determine priority levels also varied by question.

The recommended strategies in Chapter 6 include the highest priority strategies, as well as additional strategies identified as priorities at different stages throughout the Plan development, including the scenario planning process and stakeholder workshops. These also include strategies identified by Tucson Water as having the greatest potential to increase supplies, diversify the supply portfolio, and reduce water demands.

Within the statistically valid survey, respondents also had the ability to provide written comments after each question. These comments are briefly summarized in each section. It should also be noted that some strategies developed by Tucson Water based on stakeholder and community feedback were not included in the statistically valid survey but are included in this chapter. These strategies do not have a survey response or an associated priority level.

The Plan also includes several climate-related strategies developed separately as part of *Tucson Resilient Together*. These strategies are also included in the Plan to provide consistency and alignment of these planning efforts and to reaffirm the City's commitment to improve Tucson's resilience in the face of changing climate conditions. The climate adaptation strategies included were selected to complement the vision and guiding principles of the Plan. Strategies from *Tucson Resilient Together* are shown in green tables to make them easily distinguishable from the strategies developed for this Plan.

5.2 Community Priorities

Tucson Water involved the community at each stage of the development of the Plan strategies, with feedback obtained at community events, the public town hall, stakeholder workshops, and through the surveys. The strategies presented in this chapter were initially informed by the scenario planning process where stakeholders identified risks, vulnerabilities, and opportunities. These strategies are intended to lead Tucson Water towards the "*Sustainable Oasis*" future where the region's water supply portfolio is diverse, locally controlled supplies are increased, and water demands are well managed. The strategies also mitigate the risks associated with the "*Thirsty Desert*" future in which Tucson's water resources are more limited, and demands are growing.

Caption: Tucson Water ambassadors receiving feedback from a stakeholder about Plan strategies at one of the workshops events.

Figure 5.1 Community Outreach

Three strategy workshops were hosted by Tucson Water to develop strategies and actions related to the areas of greatest concern. At these workshops, stakeholders were given the opportunity to suggest strategy language, offer feedback, and propose additional strategies. An example of some of the feedback received within a workshop for Guiding Principle 5, *Safe, High-Quality Water Supplies*, is shown below.

Caption: Sticky notes were used to gather input from stakeholders.

Figure 5.2 Feedback from Stakeholders on Guiding Principle 5 – Safe, High-Quality Water Supplies

The strategies described in this chapter are based on Tucson Water's ongoing adaptive planning efforts and feedback obtained from stakeholders at community events and workshops. By utilizing this collaborative approach, the Plan reflects the community's priorities and is poised to effectively meet the needs of the community while achieving the One Water vision to manage Tucson's finite water resources to promote long-term resilience, equity, stewardship, and quality of life.

5.3 Water Supply Strategies

*Guiding Principle 1: Deliver **water reliability** through water supply diversification, conservation, and innovative improvements to infrastructure.*

The water supply strategies will guide Tucson Water in its efforts to provide a reliable and sustainable water supply in the face of a changing climate and ongoing drought conditions on the Colorado River. The strategies presented for water supply recognize the importance and interconnectedness of each source. Going forward, water supply development will require significant investments. Regional collaboration and partnerships will also be essential for success.

To maximize the use of existing resources, the strategies proposed look to protect surface water supplies and groundwater quality, manage groundwater basins, maximize the use of recycled water, and promote the development of stormwater as a key water source. As a main aspect of supply management, many of these strategies aim to increase the amount of locally developed and controlled water supplies that make up Tucson Water's supply portfolio. Through careful planning and execution, these strategies aim to address the challenges presented by changing and uncertain conditions while also developing a reliable and sustainable water supply for future generations.

Caption: Mountain Streams in the Santa Catalina Mountains

Figure 5.3 Mountain Streams in the Santa Catalina Mountains

5.3.1 Surface Water

The strategies under Tucson Water's surface water resources are aimed at maximizing the beneficial use of Tucson's Colorado River water allocation while taking cooperative actions to promote the long-term viability of this resource for future generations. These are complex water management challenges that require institutional collaboration with a broad range of federal, state, and local partners.

In the statistically valid survey, respondents were shown four surface water strategies and were asked to select the two that were the most important to them. Strategies to maximize the benefits of our current Colorado River water and to explore additional water supplies for the CAP were ranked as the highest priority strategies. This ranking was consistent across both the online and statistically valid surveys. Advocating for Tucson's allocation of Colorado River followed closely behind these strategies. Although this strategy is ranked as medium priority, it is included in Chapter 6, as Tucson Water continues to prioritize protecting its allocation of Colorado River water through the federal reconsultation process and beyond.

Within the statistically valid survey, some respondents also submitted comments about additional surface water strategies. Support for rainwater capture and storage were the most dominant themes from these comments. Water conservation, desalination, reducing water use in new development, and purchasing agricultural land and retiring it were also common themes in the written responses.

Table 5.2 Guiding Principle 1 – Surface Water Strategies

Strategy #	Strategy	Survey Response	Priority Level
SW-1	Maximize the benefits of our current Colorado River water *Example: Continuing to store this water underground for future use.*	59%	High
SW-2	Work with the State of Arizona to explore additional water supplies for the Central Arizona Project *Example: Treat brackish water near the canal to drinking water standards so that it can be delivered to cities.*	47%	High
SW-3	Advocate for Tucson's allocation of Colorado River water through the Central Arizona Project in state and federal negotiations *Example: Tucson Water is actively participating in negotiations about how Colorado River water will be shared.*	46%	Medium
SW-4	Explore water exchanges with other water providers *Example: Las Vegas has offered to invest in a treatment plant in Southern California in exchange for additional Colorado River water.*	26%	Medium
The following strategies were not included in the statistically valid or online survey.			
SW-5	Work with Arizona State Land Department to provide Central Arizona Project allocations to development of Trust Lands *Example: Arizona State Land Department can assign a portion of their Municipal and Industrial subcontract to the City of Tucson.*		
SW-6	Support water supply firming and recharged water recovery efforts *Example: Tucson Water is actively recharging portions of the City of Phoenix's CAP allocation for recovery during droughts.*		

5.3.2 Groundwater Strategies

Groundwater continues to be a vital part of Tucson's water resource portfolio. The strategies under Tucson Water's groundwater resources include steps to maintain water quality, address emerging contaminants, and practice sustainable groundwater management to address areas in the region where groundwater levels have continued to decline. Actions for these strategies include investments in treatment technologies, regional pipeline infrastructure, and collaboration and agreements with regional partners. These and other actions will help safeguard Tucson's groundwater supplies while providing the public with confidence in groundwater quality.

Respondents to the statistically valid survey were shown four groundwater strategies and were asked to select the two that were most important to them. Strategies aimed at protecting the aquifer and accelerating groundwater cleanup were ranked as the top priority strategies. Notably, respondents in the online survey ranked investing in new treatment technologies to address unregulated, emerging water quality issues as one of the top two strategies. This strategy was identified as a priority throughout the planning process and is also included as a recommended strategy in Chapter 6.

A small number of respondents also wrote in additional strategy suggestions. Conservation and rainwater capture and storage remained high priorities among respondents to support groundwater sustainability. Some comments referred to the need to protect groundwater from pollutants and a need for ongoing education about protecting local groundwater. Additionally, agriculture, new development, and mining were the most mentioned threats to groundwater sustainability.

Table 5.3 Guiding Principle 1 – Groundwater Strategies

Strategy #	Strategy	Survey Response	Priority Level
GW-1	Partner with regional water organizations to protect the aquifer *Example: Work with other organizations to clean up contamination and ensure that the groundwater levels are balanced.*	59%	High
GW-2	Accelerate groundwater cleanup efforts to make local supplies more available *Example: Some wells have been closed until the water can be treated to safe standards.*	44%	High
GW-3	Explore and invest in new treatment technologies to address unregulated, emerging water quality issues *Example: Two examples of unregulated contaminants are pharmaceuticals and personal care products.*	42%	Medium
GW-4	Bolster sustainable groundwater management *Example: Build pipelines to bring Colorado River water to the southeast side of Tucson and reduce groundwater pumping in that area.*	38%	Medium
	The following strategy was not included in the statistically valid or online survey.		
GW-5	Expand wheeling agreements that reduce groundwater pumping *Example: Tucson Water has agreements with other regional water providers to deliver their CAP allocations through Tucson Water's distribution system.*		

5.3.3 Recycled Water

The recycled water strategies aim to maximize the use of this renewable water resource. These strategies address the onsite reuse of recycled water for non-potable purposes, such as irrigation, toilet flushing, and cooling. Strategies also include options for purifying recycled water to drinking standards, such as DPR.

Caption: Reclaimed water is used to maintain the Sweetwater Wetlands.

Figure 5.4 Sweetwater Wetlands

Tucsonans overwhelmingly supported expanding uses for recycled water. The statistically valid survey respondents were presented with three strategies and were asked to select the single strategy they felt was most important. Adopting new policies for water reuse in buildings and purifying recycled water to drinking water standards were ranked as the highest priority strategies. Investing in new treatment technologies to address unregulated, emerging water quality issues in recycled water was identified as a priority throughout the planning process and is also included as a recommended strategy in Chapter 6.

Written in comments from the statistically valid survey generally supported expanded the use of recycled water, as well as the use of gray water (also known as "laundry to landscape" or "showers to flower") for landscaping, and the use of native plants in place of turf.

Table 5.4 Guiding Principle 1 – Recycled Water Strategies

Strategy #	Strategy	Survey Response	Priority Level
RW-1	Adopt new policies for water reuse in buildings *Example: Using rainwater, recycled water, and air conditioning condensate for toilet flushing.*	39%	High
RW-2	Begin purifying recycled water to drinking water standards *Example: San Diego has begun using purified recycled water to augment their drinking water supply.*	31%	High
RW-3	Further treat recycled water for custom uses *Example: Recycled water could be used in cooling towers for large buildings.*	23%	Medium
	The following strategies were not included in the statistically valid or online survey.		
RW-4	Implement projects to retain all recycled water within the Tucson AMA *Example: Recycled water can be stored underground for future use or purified for drinking water.*		
RW-5	Partner with regional organizations to enhance wastewater treatment *Example: Collaborate with regional partners on decentralized water reclamation facilities.*		
RW-6	Implement treatment technologies to address unregulated, emerging water quality issues *Example: Implement advanced water treatment to address unregulated emerging water quality issues.*		
RW-7	Acquire other recycled water entitlements *Example: Purchase recycled water entitlements from regional partners.*		

5.3.4 Stormwater

Stormwater is a relatively new component of Tucson's water supply portfolio and there is growing interest in expanding the use of this supply. These stormwater strategies aim to integrate stormwater management into the built environment in a socially, economically, and environmentally beneficial way. This includes the areas of community education, development of additional institutional standards and practices, and support and funding. These strategies will require ongoing collaboration with other City and Pima County (County) departments with responsibilities for flood control and management.

Four strategies were shown in the statistically valid survey and respondents were asked to select two as the most important. Strategies to explore opportunities for large scale stormwater projects, and to integrate and align stormwater standards were ranked as the highest priority. These results were consistent across both surveys. The medium priority strategies also continue to be ongoing considerations for Tucson Water.

For example, the funding for the S2S program has been recently authorized as a permanent program. The continued success of this program would provide a basis for the development of a comprehensive stormwater utility. Additionally, Tucson Water will continue to offer multiple programs focused on education covering rain and stormwater uses for landscaping.

Written in comments from the statistically valid survey also indicated a strong interest in stormwater harvesting solutions. Comments included expanding stormwater capture solutions to existing homes and businesses and multiple comments expressed interest in mandating onsite capture and storage of stormwater for new businesses and developments.

Table 5.5 Guiding Principle 1 – Stormwater Strategies

Strategy #	Strategy	Survey Response	Priority Level
S-1	Explore opportunities for large scale stormwater projects with multiple benefits *Example: Design detention basins to control flooding, harvest stormwater, and support native landscaping.*	69%	High
S-2	Integrate and align stormwater standards, policies, and practices across the region *Example: Stormwater harvesting sites are not always designed and built using best practices. Creating a shared set of standards and policies would help ensure the performance of these sites.*	42%	High
S-3	Educate the community about using rain and stormwater for landscaping *Example: An advertising campaign that teaches the public about how to support native plants and trees with rain and stormwater harvesting.*	40%	Medium
S-4	Establish a comprehensive stormwater utility *Example: Expand the City's existing stormwater fee to fund services like flood control and large-scale rainwater harvesting.*	34%	Medium

5.4 Demand Management Strategies

*Guiding Principle 1: Deliver **water reliability** through water supply diversification, conservation, and innovative improvements to infrastructure.*

Tucsonans have long embraced a culture of conservation and Tucson Water continues to be a national leader in implementing water conservation policies and programs. Through decades of conservation initiatives, the Tucson Water service area has successfully reduced its overall water usage despite a growing population. As a result, the per capita water use has steadily decreased from 170 gpcd in 2002 to 130 gpcd in 2022.

Through this Plan and its supporting strategies, Tucson Water aims to assess existing conservation programs and identify opportunities for improvement while also continuing to protect vulnerable communities. By leveraging the expertise and experience gained through its past conservation efforts, and by staying committed to ongoing innovations and improvements, Tucson Water is well positioned to continue leading the way in water use efficiency measures and success.

5.4.1 Incentive Strategies

Incentive-based water management strategies aim to encourage water users to conserve and use water resources more efficiently. This could include both financial incentives, such as rebates, as well as non-financial incentives like certifications for landscape professionals or community awards. Examples of financial incentive-based strategies include water conservation rebates for high efficiency fixtures and other water savings technologies, and water rates changes to encourage conservation behaviors. Participation in incentive programs often requires an up-front expense for customers, resulting in higher participation from higher income groups. As a result, these strategies also include a focus on low-income assistance to encourage equitable participation in these programs. Similarly, changes to water rates can have unintended consequences for some water users.

In the statistically valid survey, three strategies were provided, and respondents were asked to pick which single strategy is most important. Through the statistically valid survey results, Tucsonans made it clear that water conservation is a community-wide effort and strategies should include all customers where possible. This includes a focus on assistance to low-income community members, programs targeted to renters, and increasing water saving opportunities for residential and commercial customers.

In the online survey results, respondents selected modifying the tiered rate structure as the most important strategy while increasing water saving opportunities for residential and commercial customers was ranked the lowest. Some initial work is already underway looking at the existing rate structure. The Citizens' Water Advisory Committee (CWAC) and Tucson Water staff are currently in the process of developing progressive rates for commercial customers, which is a step in working towards implementing that strategy.

Table 5.6 Guiding Principle 1 – Incentives Strategies

Strategy #	Strategy	Survey Response	Priority Level
I-1	Improve outreach for low-income assistance programs for homeowners and renters *Example: An advertising campaign that informs the public about low-income assistance such as free toilet replacement or emergency plumbing repairs.*	36%	High
I-2	Increase water savings opportunities through incentive programs for residential and commercial customers *Example: Expand rebates to include retrofits and create online applications that better target commercial customers.*	33%	High
I-3	Modify tiered rate structure to make it more progressive *Example: Currently, the more water customers use, the more they pay per unit of water. This tiered rate structure could be made more progressive, making it more expensive the more water you use.*	24%	Medium

5.4.2 Monitoring and Mandates

Monitoring and mandates are effective tools for water demand management particularly in response to drought conditions. Examples of monitoring range from "smart metering" via AMI that provides real-time water consumption data to quickly detect leaks and to provide customers with water use information such as guidelines on efficient water use, and water audits to identify areas where water is being wasted. Mandates can also be used to regulate water usage, such as implementing water conservation budgets or requiring the use of water-efficient appliances and fixtures. The effectiveness of these strategies depends on

which combination of measures are being implemented and enforcement practices meaning these strategies have unknown long-term impacts.

Five strategies were included in the statistically valid survey and respondents were asked to select a single strategy as the most important. As shown in the following table, statistically valid survey results indicate that Tucsonans widely favor implementing "smart meters" that monitor water use in real time to provide notifications of leaks and changes in water use behaviors. This was ranked as the only high priority strategy and respondents from both surveys selected this as the highest priority.

Medium priority strategies relate to ongoing Tucson Water programs. For example, the ongoing implementation of the *Drought Preparedness and Response Plan* includes the development of water use guidelines for residential, commercial, and reclaimed water customers based on historic consumption data. See Chapter 4 for additional information about the *Drought Preparedness and Response Plan.*

Table 5.7 Guiding Principle 1 – Monitoring and Mandates Strategies

Strategy #	Strategy	Survey Response	Priority Level
MM-1	Install "smart meters" that monitor water use in real time, provide leak alerts, and inform water use habits *Example: A website or application that notifies you when unusual water use is occurring.*	43%	High
MM-2	Create water use guidelines that provide an efficiency reference point specific to each customer type *Example: For commercial customers, an application could be created to provide water use guidelines from parcel-based characteristics.*	13%	Medium
MM-3	Establish mandated water conservation rules *Example: Restrictions on how often you can water your landscape.*	13%	Medium
MM-4	Expand enforcement of water waste rules for public and city-wide operations *Example: City employees contact people that allow water to run off their property and into the road.*	11%	Medium
MM-5	Expand opportunities for water audits *Example: Online guides for a step-by-step analysis of indoor and outdoor water uses.*	8%	Low

5.4.3 Education Strategies

Education-based strategies refer to programs and initiatives aimed at promoting awareness and knowledge about water management and conservation. These strategies aim to provide information and education to help people understand the importance of water resources and the steps they can take to conserve and protect water resources. Areas of education-based strategies include research to improve Tucson Water's existing conservation programs, providing landscape training, and promoting existing conservation programs. It should be noted that education and outreach are incorporated into numerous strategies. The strategies listed in the education category shown below focus specifically on education efforts related to demand management.

Four education strategies were included in the statistically valid survey and respondents were asked to select a single strategy as most important. As shown in the following table, the statistically valid survey results indicate that support was spread across multiple strategies with the highest level of support for conducting research on new technologies and approaches. In the online survey, landscape training received the highest percentage of responses. This strategy was identified as a priority throughout the planning process and is also included in Chapter 6.

Tucson Water continues to focus on improving its existing programs. Smartscape offers adult education for landscape professionals and Tucson residents. Tucson Water partners with APW and EEExchange to offer youth education programs. Additional information about current community education and outreach programs is included in Chapter 4.

Table 5.8 Guiding Principle 1 – Education Strategies

Strategy #	Strategy	Survey Response	Priority Level
E-1	Conduct research on new technologies and approaches *Example: Landscape efficiency technology solutions that are more water efficient.*	30%	High
E-2	Provide landscape training to reduce outdoor water use, with emphasis on resilient, desert-adapted landscapes *Example: Classes for homeowners and landscape professionals about water efficiency and native plants.*	28%	Medium
E-3	Continue to invest in classroom programs for children's education on conservation *Example: Presentations about water conservation, our water supplies, and the water cycles for grade schools.*	25%	Medium
E-4	Expand community outreach programs *Example: Digital advertising campaigns and websites.*	12%	Medium

5.5 Climate Resilience Strategies

*Guiding Principle 2: Build **resilience** by planning for climate change, leading mitigation efforts, and implementing collaborative and adaptive strategies that harness the water-energy nexus.*

Tucson Water is focused on building resilience by planning for climate change and leading mitigation efforts. The strategies associated with this principle aim to promote sustainable management of water resources by prioritizing the need to reduce greenhouse gas emissions and promote energy efficiency. By adopting these strategies, water resource managers can help build resilience in their communities, reduce the vulnerability of their water systems to climate impacts, and promote a reliable and sustainable water supply for future generations.

Figure 5.5 Saguaro Cacti

The strategies proposed in this section look to build climate resilience, enhance the community's quality of life, achieve affordability, accessibility, and social justice, and increase public confidence in Tucson Water's reliable delivery and stewardship of the available water resources. Through careful planning and execution, these strategies aim to address the One Water vision to promote long-term resilience, equity, stewardship, and quality of life.

In the last decade, Tucson has been moving towards including climate actions into the City's decision-making process. The Climate Action and Adaptation Plan also referred to as *Tucson Resilient Together*, outlines the City's roadmap to reducing greenhouse gas emissions and building community-wide resilience to climate change. There is considerable overlap between the Plan's guiding principles and *Tucson Resilient Together*. To avoid duplicating efforts and to make community outreach clearer, many strategies from *Tucson Resilient Together* are included in this Plan. *Tucson Resilient Together* has strategies organized into the following categories:

- Climate Leadership and Governance,
- Energy,
- Transportation and Land Use,
- Resource Recovery and Management, and
- Community Resilience.

City staff working on these two plans have coordinated to include public feedback in recommendations within both plans. While the plans were developed individually, implementation efforts will be done in tandem after the adoption of both plans. For the following sections, *Tucson Resilient Together* strategies are shown in green. See *Tucson Resilient Together* for additional details about the various strategies and the City's plans to reduce greenhouse gas emissions and adapt to climate change. Visit the City's Climate Action Hub to see what the City is doing to respond to climate change.

Several strategies from *Tucson Resilient Together* align with the Plan's vision and Guiding Principle 2. These six strategies are listed below.

Table 5.9 Guiding Principle 2 – Linked Strategies from Tucson Resilient Together

Category	Tucson Resilient Together Strategies
Energy	Decarbonize City owned and operated buildings and facilities (Energy strategy #1)
	Procure zero-emission electricity and decarbonize City and community power supply (Energy strategy #3)
	Install and promote distributed energy resources such as rooftop solar to provide local renewable energy and enhance energy resilience (Energy Strategy #4)
Governance	Monitor and report emissions performance to adapt decarbonization strategies (Governance strategy #4)
Transportation	Transition public agency fleets to zero-emission and near-zero-emission vehicles (Transportation strategy #5)
	Encourage City employees to reduce the carbon footprint of their commuting and work-related travel (Transportation strategy #6)

5.6 Quality of Life Strategies

*Guiding Principle 3: Enhance the community's **quality of life** by preserving and restoring riparian areas, increasing urban tree canopy, and supporting economic growth.*

Water resources management is essential to maintaining a high quality of life for communities. This principle recognizes the importance of balancing environmental, social, and economic needs for sustainable development. Policy tools that separate economic growth and water demand can also be used to support the quality of life guiding principle. For example, Mayor and Council have directed City staff to research a Net Zero Water policy, similar to polices currently enacted in other regions.

Several strategies from *Tucson Resilient Together* support this guiding principle and are shown below. As an example, the Tucson Million Trees initiative launched in 2020 will plant one million trees by 2030 to increase the City's tree canopy and help mitigate the effects of climate change. The program utilizes stormwater harvesting infrastructure whenever possible to capture, retain, and filter stormwater to irrigate and sustain desert shade trees.

Caption: Green Stormwater Infrastructure, can reduce flooding on streets and often divert that water into basins to irrigate vegetation that can shade streets and sidewalks.

Figure 5.6 Green Stormwater Infrastructure

Table 5.10 Guiding Principle 3 – Quality of Life Strategies

Strategy #	Strategy
GP3-1	Research and implement policy tools that separate economic growth and water demand *Example: Net Zero Water is an approach where all water demands for new developments are met through different offset measures.*

Category	Tucson Resilient Together Strategies
Resource Recovery	Encourage green infrastructure (Resource Recovery strategy #5)
Community Resilience	Deploy and maintain equitable nature-based solutions that reduce or sequester emissions, improve ecosystem health, and bolster climate resilience (Community Resilience strategy #3)
	Bolster the City's heat mitigation resources to reduce the urban heat island effect and protect vulnerable individuals and communities (Community Resilience strategy #2)
Governance	Accelerate climate action, adaptation, and resilience strategies through community and regional partnerships (Governance strategy #2)

5.7 Affordability, Accessibility, and Social Justice Strategies

*Guiding Principle 4: Achieve **affordability, accessibility, and social justice** by committing to fiscal responsibility and prioritizing equitable projects and programs.*

This guiding principle shows Tucson Water's commitment to prioritizing equitable and affordable service for all community members. Throughout the community outreach process for the Plan, Tucson Water received consistent feedback from its customers that affordability should be a key consideration. Community members prioritized equitable projects and programs, as well as improved access to low-income assistance. Addressing income-related barriers to participating in rebate programs is just one step in increasing accessibility for all customers.

Along with three *Tucson Resilient Together* strategies, two new strategies have been developed for this Plan. These strategies focus on increasing affordability and working to safeguard vulnerable populations from

adverse impacts of the City's drought responses. One strategy involves expanding the existing Community Assistance Relief Eligibility Program and taking actions to increase community awareness of this resource which could include developing new promotional materials for the program. The second strategy includes safeguards for vulnerable customers during drought responses through low-income assistance or other policies.

Table 5.11 Guiding Principle 4 – Affordability, Accessibility, and Social Justice Strategies

Strategy #	Strategy
GP4-1	Increase awareness and accessibility of the Community Assistance Relief Eligibility Program *Example: Create promotional material for the program and advocate for program participation during community events.*
GP4-2	Adopt policies to safeguard vulnerable customers from drought responses *Example: Provide low-income assistance to customers whose consumption exceeds their specific water use guidelines.*

Category	Tucson Resilient Together Strategies
Community Resilience	Bolster the City's heat mitigation resources to reduce the urban heat island effect and protect vulnerable individuals and communities (Community Resilience strategy #4)
Governance	Formalize climate action and resilience priorities in City operations, budgeting, processes, performance monitoring, and investments (Governance strategy #1)
	Accelerate climate action, adaptation, and resilience strategies through community and regional partnerships (Governance strategy #2)

5.8 Safe, High-Quality Water Supplies Strategies

*Guiding Principle 5: Ensure public confidence with **safe, high-quality water supplies** and exceptional customer service that includes transparency and responsiveness.*

This guiding principle emphasizes Tucson Water's commitment to providing safe, high-quality water supplies to all its customers. The importance of water quality was identified as a priority during the stakeholder workshops, with many community members supporting additional information and transparency regarding water quality monitoring. Water quality monitoring and communication practices are essential to promote safe and healthy drinking water for the community. Tucson Water's water quality monitoring program includes regular sampling and testing at source wells and throughout the distribution system. Tucson Water also employs a continuous online monitoring program for its primary sources of water to identify potential water quality issues quickly. To facilitate effective communication with the public, the City utilizes various channels, including social media, email, and the City website, to provide updates on water quality and any potential issues that may arise.

Along with one *Tucson Resilient Together* strategy, three new strategies have been developed as part of this Plan to support this guiding principle. As shown in the following table, these include long-term strategies to monitor emerging contaminants and continuously improve emergency preparedness and security all while providing exceptional customer service. These strategies represent programs that will be ongoing initiatives throughout the planning period and beyond. These Plan strategies all build upon existing City and Tucson Water programs. Updates to the City customer service center and how Tucson Water communicates with the public will help Tucson Water continue to provide exceptional customer service.

Caption: Tucson Water is committed to providing exceptional customer service.

Figure 5.7 Customer Service from Tucson Water

Table 5.12 Guiding Principle 5 – Safe, High-Quality Water Supply Strategies

Strategy #	Strategy
GP5-1	Provide exceptional customer service *Example: Update the City website to improve information sharing to customers and provide outreach materials on the billing process.*
GP5-2	Continue monitoring for emerging contaminants *Example: Improve communication to customers and the public on ongoing monitoring efforts and changes in water quality.*
GP5-3	Continuously improve emergency preparedness and security *Example: Maintain up to date risk and resilience assessments and emergency response plans and develop educational material for the public about emergency response measures.*

Category	Tucson Resilient Together Strategy
Community Resilience	Bolster the City's heat mitigation resources to reduce the urban heat island effect and protect vulnerable individuals and communities (Community Resilience strategy #4)

Chapter 6

IMPLEMENTATION

The Plan serves as an ambitious and informative guide to achieving a sustainable water future for the Tucson area. The City and Tucson Water are setting a course for a One Water future by proactively managing their water resources. Through the community engagement process, Tucsonans have identified water supply and demand changes as the areas of greatest concern. Through two separate public surveys, community members have shown the greatest support for water supply strategies that maximize the beneficial use of our existing water supplies and provide opportunities to expand the amount of locally controlled supplies in Tucson's supply portfolio, and demand strategies that expand conservation opportunities through innovation and technology, while promoting equitable solutions.

As the community was key in informing the Plan, it will be vital to the implementation process as well. Staff from the City and Tucson Water, the CWAC, and the Mayor and Council will work in partnership with state agencies and the community to implement the strategies and actions identified within the Plan. Additionally, this Plan, and the strategies discussed, will be incorporated into the City's upcoming general plan update, *Plan Tucson*.

6.1 Implementation Actions

Implementation actions are the specific projects, programs, policies, and/or tools that the City and Tucson Water will use to implement each of the recommended strategies. The implementation actions in the Plan were developed based on community feedback and through the stakeholder engagement process. They were refined by Tucson Water to include multiple steps and approaches to implementing each strategy. Implementation actions are included for each of the highest priority strategies identified through statically valid survey, as well as additional strategies identified as priorities at different stages through Plan development. In total, the Plan identifies 16 high priority strategies and 66 implementation actions across the water supply and demand management categories. Each of the implementation actions takes time to undertake and adaptive management may be needed to refine the next steps as appropriate.

Each strategy is accompanied by a relative expense and a relative level of effort. Each implementation action has an implementation timeline. These are defined as follows:

- **Relative Expense:** $ (low) to $$$ (high)
- **Relative Level of Effort:** 1 (low) to 3 (high)
- **Implementation Timeline:** Ongoing (0-26+years), Near Term (1–10 years), Mid-Term (11–25 years), Long-Term (26+ years)

The relative expense category is a scale from low to high and does not correspond to specific dollar amounts. This metric includes the anticipated cost of the strategy, which might include potential capital cost, O&M costs, as well as the cost-of-service costs, and costs paid by customers. Implementing new policies is considered a low relative expense, while strategies requiring large capital infrastructure or investments are considered a high relative expense. The relative level of effort considers factors such as additional work force needs to complete the strategy, possible partnerships or coordination required with other agencies, difficult negotiations, and the overall time and effort required by Tucson Water staff. Finally, the prioritized Plan strategies cannot all be implemented immediately nor concurrently. Multiple implementation actions were developed for each strategy and an approximate timeline has been established for each action. Some actions are already being taken by Tucson Water and these are considered ongoing. To further refine these estimates, next steps for implementing the recommended Plan actions may include a cost-benefit analysis, feasibility analysis, summary of resources needed, barriers to success, and a detailed implementation timeline.

6.1.1 Water Supply Implementation Actions

The recommended strategies for each water supply type and their associated implementation actions are presented in the following table. These strategies along with the others shown in Chapter 5, will help Tucson Water continue to provide reliable and sustainable water supplies while adapting to future uncertainties. The timeline for the actions needed to implement these high priority strategies ranges from ongoing to long-term, and the strategies include the full range of relative expenses and levels of effort. An example of an ongoing action is when the City's entered a program to leave a large portion of its Colorado River water allocation in Lake Mead, in exchange for federal compensation. This specifically addresses the action to work collaboratively to reduce the risk of Lake Mead falling to critical levels. Many of these strategies involve complex water management challenges that require institutional collaboration and a broad range of federal, state, and/or local partners. Strategies to develop standards, policies, and practices for stormwater onsite reuse will require support and investments from industry stakeholders and would require ongoing outreach from Tucson Water. Purifying recycled water to drinking water will require large capital expenses, but would also provide the largest new water supply resource of locally-controlled water supplies.

Table 6.1 Surface Water Implementation Actions

Strategy	Actions
SW-1 Maximize the benefits of our current Colorado River water. *Priority: High* *Relative Expense: $$* *Level of Effort: 2*	**A.** Continue to fully utilize Colorado River water with the use of CAVSARP, SAVSARP, Pima Mine Road Recharge Project, and groundwater savings facilities. *(Ongoing)*
	B. Annually update projected balance of groundwater storage credits to inform the adaptive management of Plan strategies. *(Ongoing)*
	C. Maintain and renew/replace infrastructure for storage and delivery of full CAP allocation. *(Ongoing)*
	D. Utilize groundwater storage credits as short-term transitional supplies during CAP supply shortages while additional supplies are acquired, restored, and/or developed. *(Near & Mid-Term)*
	E. Develop implementation triggers for alternative supplies and enhanced conservation measures to prepare for extended CAP supply shortages *(Near & Mid-Term)*
SW-2 Work with the State of Arizona to explore additional water supplies for the Central Arizona Project. *Priority: High* *Relative Expense: $* *Level of Effort: 1*	**A.** Collaborate with CAP, ADWR, and other Arizona utilities to improve regional cooperation on water issues. *(Ongoing)*
	B. Work proactively with CAP, ADWR, and other Arizona utilities to explore the availability, water quality, accessibility, and cost of alternative water resource options. *(Ongoing)*
SW-3 Advocate for Tucson's allocation of Colorado River water through the Central Arizona Project in state and federal negotiations. *Priority: High* *Relative Expense: $* *Level of Effort: 2*	**A.** Actively participate in negotiations about how Colorado River water will be shared. *(Ongoing)*
	B. Participate in collaborative efforts to reduce the risk of Lake Mead falling to critical levels. *(Ongoing)*

Table 6.2 Groundwater Implementation Actions

Strategy	Actions
GW-1 Partner with regional water organizations to protect the aquifer. *Priority: High* *Relative Expense: $* *Level of Effort: 2*	**A.** Partner with ADEQ and other regional utilities to characterize groundwater contamination. *(Ongoing)*
	B. Participate in regional efforts to achieve and maintain safe yield for the Tucson AMA. *(Ongoing)*
	C. Consider regional solutions to address groundwater quality restoration where feasible. *(Near-Term)*
	D. Expand groundwater monitoring network to support groundwater management activities and decision-making. *(Near-Term)*
GW-2 Accelerate groundwater cleanup efforts to make local supplies more available. *Priority: High* *Relative Expense: $$* *Level of Effort: 2*	**A.** Implement water treatment solutions to address water quality issues from emerging contaminants. *(Near-Term)*
	B. Prioritize and address areas of contamination and restore availability of groundwater wells. *(Near & Mid-Term)*
	C. Fully remediate contaminated groundwater. *(Long-Term)*
GW-3 Explore and invest in new treatment technologies to address unregulated, emerging water quality issues. *Priority: Medium* *Relative Expense: $* *Level of Effort: 1*	**A.** Monitor the development of new Federal and State water quality regulations that could affect Tucson's future groundwater utilization potential. *(Ongoing)*
	B. Continue the Tucson Water Sentry Program to monitor unregulated and emerging contaminants in groundwater supplies. *(Ongoing)*
	C. Monitor the relative risk of emerging contaminants by comparing concentrations in groundwater supplies against Drinking Water Health Advisory levels and contamination risk for additional wells. *(Ongoing)*
	D. Participate in research projects to test novel treatment technologies for emerging contaminants. *(Mid-Term)*
	E. Implement advanced water treatment to address high priority emerging water quality issues. *(Mid & Long-Term)*

Table 6.3 Recycled Water Implementation Actions

Strategy	Actions
RW-1 Adopt new policies for water reuse in buildings. *Priority: High* *Relative Expense: $* *Level of Effort: 2*	**A.** Research what other cities have done to promote, incentivize, and regulate onsite reuse for industrial, commercial, and large residential developments. *(Near-Term)*
	B. Provide regulatory and technical guidance for implementation of onsite reuse systems. *(Near-Term)*
	C. Create incentives for onsite reuse in commercial and industrial properties. *(Near-Term)*
	D. Develop a targeted outreach campaign to garner interest from commercial, industrial, and multi-family residential customers to participate in a pilot program. *(Near-Term)*
	E. Implement pilot programs for commercial and industrial customers. *(Near-Term)*
	F. Develop training programs for the operation and maintenance of onsite reuse. *(Near-Term)*
	G. Develop ordinance for onsite non-potable water programs, including design criteria, permitting, reporting, and enforcement. *(Mid-Term)*
	H. Develop criteria to require onsite reuse for certain water uses in commercial and industrial properties. *(Mid & Long-Term)*
RW-2 Begin purifying recycled water to drinking water standards. *Priority: High* *Relative Expense: $$$* *Level of Effort: 3*	**A.** Participate in the ADEQ regulation development process for direct potable reuse. *(Near-Term)*
	B. Evaluate benefits and costs for direct potable use of recycled water. *(Near-Term)*
	C. Conduct a survey to identify barriers to direct use of recycled water. *(Near-Term)*
	D. Develop a public outreach program to build public confidence and support. *(Near-Term)*
	E. Implement demonstration-scale projects to address potential customer or stakeholder concerns. *(Mid-Term)*
	F. Implement a full-scale direct potable reuse project to fully utilize effluent recycled water as a water supply. *(Mid-Term)*
	G. Beneficially use all recycled water within the Tucson AMA. *(Mid-Term)*
RW-6 Implement treatment technologies to address unregulated, emerging water quality issues. *Priority: Medium* *Relative Expense: $* *Level of Effort: 1*	**A.** Continue the Tucson Water Sentry Program to monitor emerging contaminants in recycled water. *(Near-Term)*
	B. Monitor the relative risk of emerging contaminants considering the end use. *(Near-Term)*
	C. Participate in research projects to test novel treatment technologies for emerging contaminants. *(Mid-Term)*
	D. Implement advanced water treatment to address unregulated emerging water quality issues considering the end use. *(Mid-Term)*

Table 6.4 Stormwater Implementation Actions

Strategy	Actions
S-1 Explore opportunities for large scale stormwater projects with multiple benefits. *Priority: High* *Relative Expense: $$$* *Level of Effort: 3*	**A.** Use the intergovernmental agreement with Pima County Flood Control to implement large scale stormwater projects. *(Ongoing)*
	B. Establish additional governance and funding structures and strategies necessary to implement large scale stormwater projects. *(Near-Term)*
	C. Conduct a study to identify areas that have the greatest potential for implementing large scale stormwater projects with multiple benefits. *(Near-Term)*
	D. Prioritize and implement large scale stormwater projects. *(Mid-Term)*
S-2 Integrate and align stormwater standards, policies, and practices across the region. *Priority: High* *Relative Expense: $* *Level of Effort: 2*	**A.** Develop standardized measures of water savings. *(Near-Term)*
	B. Establish a regional task force or working group consisting of representatives from local governments, water management entities, and relevant stakeholders. *(Near-Term)*
	C. Conduct an inventory and analysis of existing stormwater standards and policies across the region. *(Near-Term)*
	D. Develop a toolkit or guidance document to support local governments in adopting and implementing consistent stormwater standards and policies. *(Near-Term)*

6.1.2 Demand Management Implementation Actions

The high priority demand management strategies and associated implementation actions are included in the following tables. Through these strategies and the additional demand management strategies discussed in Chapter 5, Tucson Water aims to assess and expand existing conservation programs while protecting vulnerable communities and continuing to lead the way in water use efficiency measures. The timeline for these high priority strategies ranges from ongoing to near-term, the relative expense ranges from $ to $$, and the relative level of effort ranges from 1 and 2. Strategies include targeted outreach, education, and training programs, adjustments to incentive levels, and researching new technologies and approaches. The implementation of a city-wide "smart metering" system in strategy will require large investments in new technologies and additional staffing for customer support. Increasing investments in water conservation incentive programs will require significant investment in staff and resources to administer.

Table 6.5 Demand Management Implementation Actions

Strategy	Actions
I-1 Improve outreach for low-income assistance programs for homeowners and renters. *Priority: High* *Relative Expense: $* *Level of Effort: 1*	**A.** Continue to monitor participation in low-income assistance programs. *(Ongoing)*
	B. Conduct targeted outreach to increase low-income assistance program utilization. *(Near-Term)*
	C. Simplify the application processes for low-income assistance programs and provide customers with assistance in completing applications. *(Near-Term)*
I-2 Increase water savings opportunities through incentive programs for residential and commercial customers. *Priority: High* *Relative Expense: $* *Level of Effort: 1*	**A.** Continue to monitor participation rates, water savings, and return-on-investment for existing incentive programs. *(Ongoing)*
	B. Conduct targeted outreach to increase incentive program participation for high-demand customers such as multifamily complexes, HOAs, commercial properties, schools, and other institutional customers. *(Ongoing)*
	C. Adjust incentives, including rebates, focusing on high water use customers and customers with significant discretionary and/or outdoor water uses. *(Near-Term)*

Table 6.6 Mandates and Measures Implementation Actions

Strategy	Actions
MM-1 Install "smart meters" that monitor water use in real time, provide leak alerts, and inform water use habits. *Priority: High* *Relative Expense: $$* *Level of Effort: 2*	**A.** Conduct pilot programs to evaluate how using smart meters will affect customer consumption. *(Near-Term)*
	B. Evaluate options and recommend a systems integration approach to best leverage smart meter data. *(Near-Term)*
	C. Implement utility wide smart meter communication technology. *(Near-Term)*
	D. Develop a public education campaign to inform customers of the benefits of smart meters and how to use real-time data to monitor and manage their water use. *(Near-Term)*
	E. Use smart meter data to improve conservation measure effectiveness tracking. *(Near-Term)*
	F. Use smart meter data to create standards against which residential customers can measure their own usage. *(Near-Term)*

Table 6.7 Education Implementation Actions

Strategy	Actions
E-1 Conduct research on new technologies and approaches. *Priority: High* *Relative Expense: $* *Level of Effort: 1*	**A.** Regularly research new technology and approaches used in conservation programs in other cities with similar climates. *(Near-Term)*
	B. Collaborate with research institutions, including universities and other industry organizations, to advance knowledge and develop new water conservation measures. *(Near-Term)*
	C. Develop a process for piloting new conservation technologies and evaluating their effectiveness. *(Near-Term)*
	D. Conduct a conservation program review on a fixed frequency that includes a review of all existing programs and an evaluation process for new conservation ideas and suggestions. *(Near-Term)*
E-2 Provide landscape training to reduce outdoor water use, with emphasis on resilient, desert-adapted landscapes. *Priority: Medium* *Relative Expense: $* *Level of Effort: 1*	**A.** Continue to update and promote desert-adapted landscaping manual and landscape watering guidelines with digital distribution on City's website, brochures at landscaping stores, and in-person outreach at public events *(Ongoing)*
	B. Provide landscape training to landscapers and green industry professionals who design, install, and manage landscapes. *(Ongoing)*
	C. Partner with homeowner associations to promote water-efficient landscaping practices in common areas. *(Ongoing)*
	D. Conduct residential landscaping retrofit workshops to educate homeowners on desert adaptive landscaping practices. *(Near-Term)*

6.2 Monitoring and Evaluation

Tracking implementation progress and evaluating the effectiveness of recent programs and actions will be crucial to achieving the goals of the Plan. The metrics shown in the following table were developed to help evaluate progress toward achieving the implementation priorities. The historic water production chart will continue to be updated throughout the Plan implementation process to show the total volume produced by new water supply projects, and any changes in water production over time. The gpcd metric will also be a key indicator of whether demand is being reduced. Gathering data for each of these metrics to track trends and update graphs and figures promotes transparency to the general public.

Table 6.8 Implementation Metrics for the Plan

Metric	Metric Description
Annual Potable Production	Amount of recovered water produced and served to customers.
Annual Reclaimed Production	Amount of reclaimed water served to customers and the end uses of reclaimed water.
Annual Volume of Harvested Stormwater	The Storm 2 Shade program is developing a method for measuring the capacity of green stormwater infrastructure projects.
Annual Groundwater Savings	Projected dependance on long-term storage credits when Tucson Water's annual allocation of Colorado River water is greater than potable demand.
Historic Production Chart	Total volume of water produced by the utility annually broken down by the source of the water (surface water, groundwater, recycled water, and stormwater) as well as relative proportions of each water source
Gallons per Capita per Day	Annual gpcd, a common metric for comparing annual water use and water conservation effectiveness, is derived by dividing the number of people served by the amount of water produced.
Conservation Program Rebates and Incentives	Number of customers who take advantage of water efficiency programs (e.g. annual number of rebates or audits) and the level of water savings achieved through those programs.
Affordability	Number of low-income customers who receive assistance annually and the associated assistance funding and customer demographics.
Agency Collaboration	Number and type of collaborative efforts with other agencies and organizations, such as the number of meetings held, the level of participation, and the quantitative outcomes of the collaborations, such as number of multi-benefit projects, number of new collaboratively developed water policies.
Community Engagement	One Water 2100 feedback, presentations, and public events.
Greenhouse Gas Emissions	Tucson Water's Greenhouse Gas Emissions inventory will be shared with the team that implements *Tucson Resilient Together* (the City's Climate Adaptation and Action Plan).

Gathering data for each of these implementation metrics over time aims to provide a comprehensive view on the Plan implementation progress and provide concrete ways to evaluate that progress. By keeping track of the Plan progress over time, Tucson Water can proactively identify needs to accelerate, reprioritize or adapt any of the strategies identified in this Plan.

6.3 Adaptive Management

The implementation of Plan recommendations must adapt to changing conditions, such as ongoing drought conditions, population growth, climate change, regulatory changes, economic environments, and other factors that may continue to impact regional water availability. While near-term policies can be implemented now to address immediate needs, the mid-term and long-term strategies will be regularly reevaluated as conditions change and new information becomes available and as community priorities evolve. This approach allows for flexibility and agility in response to evolving conditions, while still maintaining a long-term vision for a resilient and sustainable water supply.

For example, changes in the long-term management of the Colorado River through the federal reconsultation process may impact many of the water supply management strategies. The outcome of this

process may require Tucson Water to pivot to different water supply programs or prioritize conservation efforts. New statewide policies around potable reuse may act as a trigger for the implementation and public acceptance of wider adoption of potable reuse projects. This adaptive approach means that future community outreach regarding updated strategies will be needed as future updates to the Plan are made.

6.3.1 Adaptive Management Approach for Water Supply Portfolio

Increasing supply portfolio diversification and reducing reliance on Colorado River water delivered via the CAP is key to moving towards a resilient future and creating conditions that foster the *Sustainable Oasis* future. Quantitative triggers were developed that will be used to identify if significant long-term reductions are made to the City's Colorado River supply, or if there are reductions within each of Tucson Water's locally controlled supplies from drought, infrastructure constraints, climate change, or other factors. If these quantitative triggers are met, the Plan implementation process will be reevaluated, and adaptive measures aimed at increasing supply diversification will be taken. Some of the metrics defined previously in this chapter will be used to support the adaptive management approach to the water supply portfolio. Metrics, quantitative triggers, and adaptive measures related to the supply portfolio are shown in the following table.

Table 6.9 Adaptive Management Approach for Water Supply Portfolio

Metric	Adaptive Management Approach
Metrics	• Annual Potable Production • Annual Reclaimed Production • Annual Volume of Harvested Stormwater • Annual Groundwater Savings
Quantitative Triggers	• Projected dependance on groundwater savings accounts due to the annual allocation of Colorado River water being less than potable demand. • Declining supply portfolio diversification, including reductions in the share of recycled water, groundwater, and stormwater resources within the portfolio.
Adaptive Measures	• Advocate for Tucson's allocation of Colorado River and support the acceleration of new water supplies for the CAP. • Identify large water supply projects that can be accelerated. • Implement treatment technologies to address water quality limitations on the supply portfolio. • Adopt innovative standards, policies, and practices in stormwater harvesting and for reuse projects in buildings.

6.3.2 Adaptive Management Approach for Water Demand Management

Water use efficiency (typically expressed in per capita water use or gpcd) and conservation program participation are key metrics for measuring the effectiveness of demand management strategies and programs. The supply and demand scenarios discussed in Chapter 4 assume either a constant gpcd over time or that the gpcd continues to decline by an additional 20 percent. Achieving these long-term reductions in gpcd are key to achieving a *Sustainable Oasis* future for Tucson Water and mitigating the risks of the *Thirsty Desert* future. Moving towards a lower gpcd will require continued water savings realized from Tucson Water's conservation program. Program innovation as well as engagement and investment throughout the community will be needed to see these continued water savings. Specific quantitative triggers related to demand management have been identified and if these quantitative triggers are met, adaptive measures aimed at increasing demand management will be taken. Additionally, some of the metrics defined previously in this chapter will be used to support the adaptive management approach for

demand management. Metrics, quantitative triggers, and adaptive measures related to demand management are shown in the following table.

Table 6.10 Adaptive Management Approach for Demand Management

Metric	Adaptive Management Approach
Metrics	• Gallons per Capita per Day • Conservation Program Rebates and Incentives • Annual Groundwater Savings
Quantitative Triggers	• Per capita water use exceeds gpcd targets over a multiple year period. • Declining participation rates in conservation programs over multiple years. • Declining water savings from conservation programs over multiple years. • Projected dependance on groundwater savings accounts due to the annual allocation of Colorado River water being greater than potable demand.
Adaptive Measures	• Enhance targeted outreach, education, and training programs. • Adjust incentive levels through increased funding. • Use smart meter data to drive additional conservation savings through innovative technologies. • Implement new technologies and approaches in conservation programs.

6.4 Reporting

As a long-term water resource planning document, many of the actions described in the Plan will involve projects spanning multiple years that will take time to fully implement. Additionally, many strategies identify actions that will become ongoing initiatives. To inform the public about the progress made towards implementing the strategies and actions within the Plan, several different approaches will be used to document and report steps taken.

Tucson Water communications, such as bill inserts, the One Water website (TucsonOneWater.com), City social media, and mailing lists from the community engagement process will all be used to communicate progress on the implementation of Plan strategies to community members. These updates will focus on progress made towards Plan goals and will provide information about upcoming events as well as new and existing resources regarding Plan actions. Opportunities for engagement with Tucson Water staff around the Plan implementation will also be highlighted.

A concise One Water 2100 Plan progress report will be produced every year and shared with the public to provide a progress update on the implementation of the Plan recommendations. These annual reports will summarize progress on the metrics described above, as well as any other Plan related activities including the completion of new projects, adoption of new policies, and community engagement activities. Actions related to the expansion and creation of incentives, rebates, and water conservation programs will also be covered in the annual Water Conservation Report by Tucson Water.

6.5 Capital Improvement Program

Tucson Water has an ongoing CIP that covers a 5-year planning horizon, with short- and medium-term lists of specific projects that Tucson Water will pursue. This data-driven program is used to vet capital projects, meet budget constraints, and promote delivery of high-quality water to Tucson Water customers. With its longer implementation timeline, this Plan will provide long-term guidance for future CIP updates. This includes incorporating specific Plan strategies and actions as well as feedback from the community engagement process into recommendations for CIP projects.

Tucson Water uses hydraulic models of its entire potable and recycled water distribution systems across its service area that include supplies, customer demands, and facilities such as booster pumps and distribution pipelines. Water system modeling helps identify infrastructure and operational needs in areas where growth is already occurring or planned to occur. The modeling results translate into recommendations and improvements to maintain sufficient pressures throughout the City's water system under a variety of demand conditions, enhance system reliability and redundancy, and improve system operations. The water demand and supply projections used in the Plan are being incorporated into ongoing CIP planning efforts. Systems operations under different scenarios such as projected future demand conditions can also be simulated using these water system models.

Figure 6.1 Tucson Water Staff at Work

Short-term gaps and improvement areas have been identified through this hydraulic analysis include conveyance system improvements, Central Well Field rehabilitation, and reclaimed water application strategies. Conveyance system improvements include rehabilitation of existing and construction of new transmission mains. This includes new transmission mains and supporting facilities to convey water to areas in the southeastern portion of the service area where much of the area's growth is occurring.

While reliance on the Central Well Field to meet water supply needs has decreased with the implementation of additional renewable supplies, the well field is still often used to meet peak demand in the summer months or when the CAP canal and assets are temporarily out of service. This infrastructure remains a valuable asset, and Tucson Water is considering implementing a comprehensive asset management program aimed at sustaining and enhancing the pumping capacity of the Central Well Field.

Finally, the CIP includes evaluating Tucson Water's reclaimed water supplies to determine the best and highest use for the supply. This would include evaluating recharge capacities, aquifer recovery well locations, expansion of the reclaimed water distribution system, and preparation for indirect or direct potable reuse.

Figure 6.2 Tucson Water Staff at Work

Chapter 7

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