



THE ELUSIVE CONCEPT OF AN ASSURED WATER SUPPLY
The Role of the CAGR and Replenishment

Kyl Center for Water Policy
Kathleen Ferris, Senior Research Fellow
Sarah Porter, Executive Director

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The Kyl Center for Water Policy at Arizona State University's Morrison Institute for Public Policy promotes research, analysis, collaboration and dialogue to build consensus on sound water stewardship for Arizona and the West.

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The ASU logo features the letters 'ASU' in a bold, maroon font. The letter 'A' is stylized with a yellow sunburst pattern behind it.

Kyl Center for Water Policy at Morrison Institute

Arizona State University

Executive Summary

For nearly 40 years in its most urban areas, Arizona has prohibited the sale of subdivision lots that lack a 100-year assured water supply. Originally, an assured water supply meant primarily surface water, which nature renews annually. But in 1993, the Legislature changed course and created a new path to show an assured water supply using groundwater--a non-renewable resource--with the promise that the groundwater would be replenished with surface water acquired after the fact by the Central Arizona Groundwater Replenishment District (CAGRDR).

This report will explain the consequences of that decision--both intended and unintended--for water management and urban development in Arizona. It is a complex and ongoing story that includes why Arizona saw the need to require an assured water supply, the role the CAGRDR was intended to play and what the past 26 years of the CAGRDR have revealed.

In brief summary, we conclude that the unexpected popularity of the CAGRDR has created serious challenges for prudent water management. Here is a sample of our principle findings:

- Enrollment in CAGRDR has grown far beyond expectations. By the end of 2024, CAGRDR staff project that nearly 383,000 member land homes will have been enrolled in (become members of) the CAGRDR and that by 2114, CAGRDR's replenishment obligation will reach 113,000 acre-feet, nearly as much as the combined yearly allocation of Central Arizona Project (CAP) water for the cities of Mesa, Glendale and Scottsdale. These projections do not include the vast urban growth anticipated for the West Valley of Maricopa County or Pinal County that will most likely rely on groundwater that would have to be replenished by the CAGRDR.

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- The CAGR will struggle to acquire sufficient water supplies for replenishment. When the CAGR was established, it was assumed there would be sufficient excess CAP water to meet the CAGR's replenishment obligations through 2046. That assumption proved incorrect as enrollment radically outpaced this supply and other entities with long-term CAP contracts used more and more of their rights. Impending shortages of Colorado River water will reduce even further the amount of CAP water available to meet CAGR's replenishment obligations. Meanwhile, CAGR's efforts to acquire rights to use Colorado River water from on-river users will continue to be met with stiff opposition from communities along the river and some of CAGR's own board members.

- Pumping groundwater from great depths poses grave consequences. Arizona's assured water supply rules allow groundwater for a new subdivision to be pumped from depths of 1,000 feet below land surface in the Phoenix and Tucson areas and from 1,100 feet below land surface in Pinal County. Studies show that the quality of groundwater at such great depths can be seriously compromised as natural and man-made pollutants concentrate in the water that remains. Moreover, as the underground water table declines, groundwater aquifers collapse and lose their capacity to store water, making their replenishment impossible.

- The disconnect between location of pumping and location of replenishment is problematic. The CAGR is not required to replenish water where groundwater is pumped for its members. When replenishment does not take place near the site of groundwater withdrawal, the replenished water will not reduce the local geological impacts of pumping and will do nothing to recharge the aquifers that CAGR members are counting on to supply groundwater.

- The CAGR's financial model is at risk. The majority of the CAGR's expenses are funded by annual assessments charged against member lands. Since 2002, the assessment rate for the greater Phoenix area has swelled from \$154 per acre-foot to \$727 per acre-foot. The CAGR's consultants have warned of a potential "financial catastrophe" as homeowners on member lands seek ways around the assessments to avoid paying greater and greater costs.

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The actions needed to address these findings, include:

- The CAGR and the Arizona Department of Water Resources (ADWR) should be required to undertake a more rigorous examination of how much water for replenishment is realistically available.
- ADWR should decrease the depth from which groundwater may be withdrawn for purposes of an assured water supply to prevent the damage caused by draining aquifers, to protect the quality and availability of groundwater for the future, and to ensure against the very real possibility that groundwater in some areas may run out.
- The CAGR should be required to replenish water in the same locations where groundwater is pumped for its members, and should be required to have the necessary facilities for such replenishment in place before new members in these locations may enroll, or as a strict prerequisite for the sale of lots in these areas.
- The CAGR should be authorized to deny membership if it runs into trouble acquiring water for replenishment, or in locating and constructing replenishment facilities.
- A comprehensive review of CAGR's financing mechanisms should be conducted to avoid a financial catastrophe and protect homeowners on CAGR member lands from skyrocketing costs.

Glossary of Terms

Acre-foot: 325,851 gallons of water, which is enough water to cover an acre of land to a depth of one foot or supply 3 single-family households in Phoenix for a year.

ADWR: Arizona Department of Water Resources

AMA: Active Management Area

Analysis: Analysis of Assured Water Supply, which is issued by ADWR for master-planned communities

CAGR: Central Arizona Groundwater Replenishment District

CAP: Central Arizona Project

CAP Indian lease: A lease with an Indian community to use a portion of the community's entitlement to CAP water

CAP NIA Water: Non-Indian Agricultural priority CAP water

CAWCD: Central Arizona Water Conservation District

Certificate: Certificate of Assured Water Supply, which is issued by ADWR for individual subdivisions

DCP: Drought Contingency Plan

Designation: Designation of Assured Water Supply, which is issued by ADWR to municipal water providers

Enrolling: Becoming a member land or member service area of CAGR

Excess CAP Water: CAP water that is available in a given year because it will not be used by CAP entitlement holders under their agreements for CAP water

Excess groundwater: The amount of groundwater that exceeds what a subdivision or municipal water provider may use under the assured water supply rules and that CAGR must replenish

Extinguishment credit: A credit that is issued by ADWR in exchange for the extinguishment of a grandfathered right, and that may be used to make groundwater use under the assured water supply rules consistent with the management goal of an AMA

LTSC: Long-term storage credit earned by storing surface water or reclaimed water underground

Member land: A subdivision that is a member of CAGR

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Member land home: A lot or home on member land

Member service area: A city, town or private water company that is a member of CAGR.

Municipal water provider: A city, town or private water company that provides water service

On-River users: Persons or entities located along the Colorado River in Arizona that have rights to use Colorado River water

Safe-yield: An AMA management goal to achieve and maintain a long-term balance between the annual amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge

Subdivision: Land that has been divided into six or more lots or parcels for sale or lease

Introduction

In 1980, representatives of agriculture, the mining industry and the cities of central Arizona convinced the Arizona legislature, as part of the Groundwater Management Act, to prohibit urban growth that lacked a 100-year assured water supply. Thirteen years later, the legislature created a way for land developers and municipal water providers to rely entirely on groundwater as proof of an assured water supply if they enrolled their lands and service areas in a new program, the Central Arizona Groundwater Replenishment District (CAGR). CAGR was required to purchase water to replenish the groundwater pumped by its members.

The inevitability of future shortages of Colorado River water over a quarter of a century later has intensified the debate over the sustainability of CAGR's "pump then replenish" approach to growth. As drought continues and competition for Colorado River water increases, less surface water will be available for replenishing groundwater, posing long-term implications for urban development and water security.

This white paper explores why Arizona saw the need to require an assured water supply. It assesses the impact of that assured water supply requirement over time. It examines crucial questions about how much surface water for replenishment is realistically available. And it addresses whether pumping groundwater for growing urban demands and projected development poses new problems for the future.

Why an Assured Water Supply?

*"It's really rather pitiful to see what's happened to people who think they've bought a chunk of paradise out here," said a Mohave County planner in 1973. "We're always having a little old couple from someplace up north walk in and say they bought a lot in one of those desert developments and now they want to build on it but can't find it. We tell them if they have a helicopter, they can probably get to it. If not, they'll just have to hike in. But they'll have to bring in plenty of water."*¹

In 1967, legendary *Arizona Republic* reporter Don Bolles, who was later murdered in a car bombing, uncovered a land swindle involving more than a thousand people across the United

States.² He linked Ned Warren, Sr., the self-proclaimed "godfather" of land fraud³ to the scandal, "documenting how Warren, in secret associations with some of Arizona's most prominent businessmen, had scammed millions of dollars from Easterners who thought they were buying a retirement home rather than a chunk of barren desert."⁴

The national spotlight on Arizona may have catapulted the state Legislature to enact the first "adequate water supply" requirement.⁵ This measure compelled the developer of a proposed subdivision to submit plans to the Arizona Water Commission⁶ demonstrating the adequacy of the water supply to meet the projected needs of the subdivision. While the Commission was required to evaluate the proposed source of water and determine its ability to meet proposed uses, a finding that the supply was inadequate did not prohibit the developer from selling subdivision lots.

In 1977, intending to strengthen water protections, the Arizona Legislature established the Groundwater Management Study Commission, charging it with the responsibility to develop a comprehensive groundwater management code for the state.⁷ The Study Commission's *Draft Report of Tentative Recommendations* proposed that groundwater management areas should be established, and in these areas the state should prohibit urban development where no assured water supply was available.⁸

The Study Commission may have been concerned about consumer protection, but its primary goal was to influence the speed and location of urban growth. As the Draft Report states:

"The general consensus among the Commission members was that it would be futile to attempt to halt urban growth absolutely in Arizona. The Commission, however, was aware that something could be done about managing the pattern or location of urban growth."⁹

The Study Commission's report noted the failure of the existing adequate water supply law to have an impact on the pattern or location of urban growth, and "decided that a stronger provision should be incorporated into current law."¹⁰ The 1980 Groundwater Management Act made this provision, an "assured" water supply, a reality.¹¹

What is an Assured Water Supply?

The Groundwater Management Act established geographical areas where the Arizona Department of Water Resources (ADWR) manages the use of groundwater. These areas are known as Active Management Areas (AMAs).¹² A person proposing to sell subdivided or unsubdivided land¹³ in an AMA must first obtain a Certificate of Assured Water Supply (Certificate) from ADWR.¹⁴ An "assured water supply" has three basic elements:

- A water supply of adequate quality must be available to satisfy the needs of the subdivision for at least 100 years.
- The projected water use of the subdivision must be consistent with the achievement of the management goal and management plan for the AMA.
- Financial capability must be demonstrated to construct a delivery system and treatment works to make the water available for the subdivision.

ADWR designates cities, towns and private water companies that have an assured water supply. A subdivision located within the service area of a designated municipal water provider is exempt from the requirement of obtaining a Certificate.

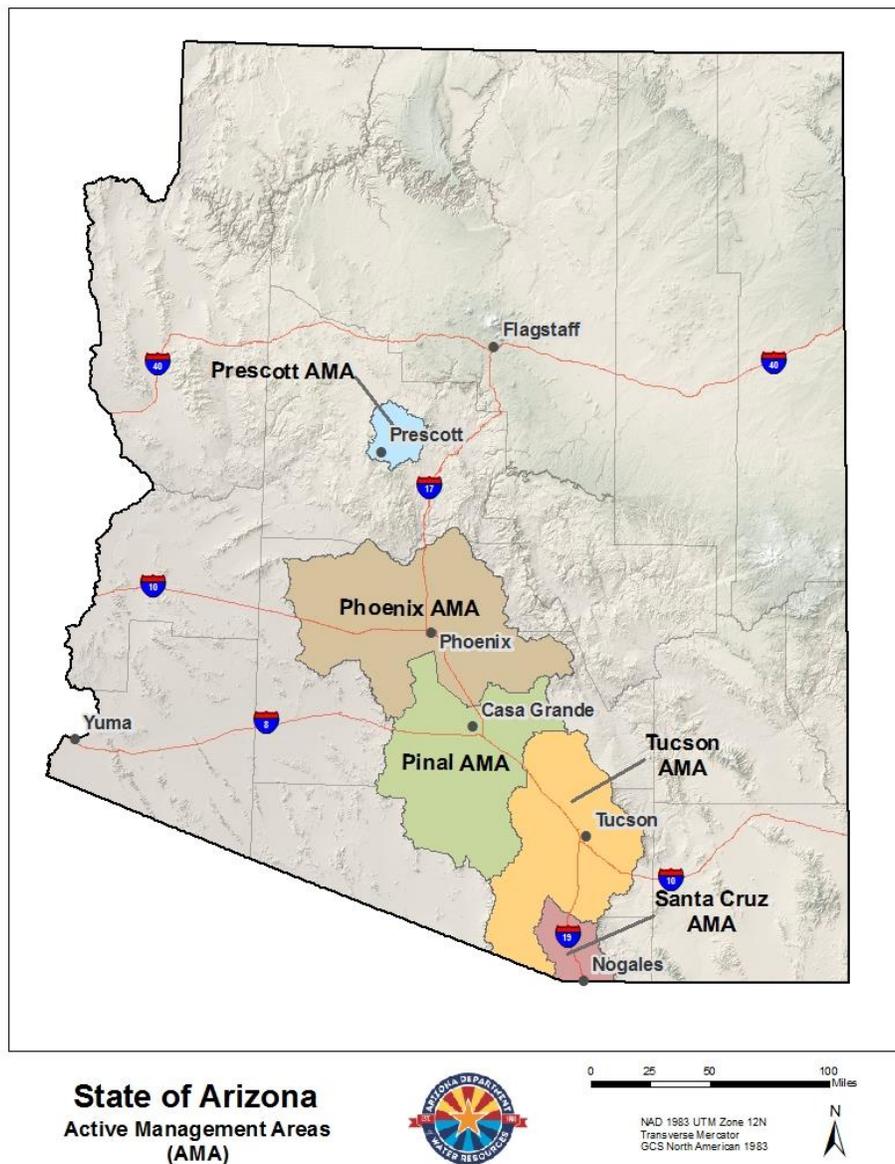
ADWR has adopted detailed rules to implement the assured water supply requirement.¹⁵ These rules specify what is necessary to demonstrate an assured water supply. Most importantly, an applicant for a Certificate or Designation must show that:

- Sufficient water supplies of adequate quality are *physically, continuously and legally available* to meet the estimated needs of the subdivision.
- If the proposed water source is groundwater, its use is consistent with the management goal for the AMA.¹⁶

Through its rules, ADWR has created the Analysis of Assured Water Supply (Analysis).¹⁷ A person who proposes to develop a master planned community in phases may apply for an Analysis and demonstrate that water is physically available for the proposed development. A Certificate is still required for each phase of the community,¹⁸ but the Analysis "reserves" groundwater for the entire proposed development for 10 years and may be extended for successive five-year periods.¹⁹

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After a hearing, ADWR may revoke a Certificate if an assured water supply does not exist and no residential lot within the subdivision has been sold,²⁰ and may revoke a Designation if it determines that the water provider has less water than the amount needed for a 100-year supply, fails to construct the necessary delivery, storage and treatment works, or has violated the AMA's management plan requirements.²¹



**What Has Been the Impact of
Designations of Assured Water Supply?**

Cities, towns and private water companies (municipal water providers) choosing to demonstrate an assured water supply must show they have the necessary water for **all** current and projected water uses within their service areas for 100 years.²² They must also show the financial capability to construct the delivery, storage and treatment works needed to make that water supply available to their customers. For a city or town, this means the adoption of a five-year capital improvement plan that provides for the construction of these works and certification by the chief financial officer that finances are available to implement the plan.²³ Once they satisfy these requirements, municipal water providers receive a Designation of Assured Water Supply (Designation). ADWR must review a Designation at least every 15 years to determine if it should be modified or revoked.²⁴ This rolling time frame guarantees that commitments for water service do not exceed available supplies.

The drafters of the Groundwater Management Act wanted to push urban growth to where water was available, and clearly, the ability of a water provider to obtain a Designation has influenced the pattern of growth in the state's AMAs. As of January 4, 2018, 35 cities, towns and private water companies were designated as having an assured water supply. These Designations, and the requirement for ADWR to review them periodically, have propelled these water providers to invest in renewable surface water supplies, such as Central Arizona Project (CAP) water, build sophisticated water treatment plants and find innovative ways to treat and use reclaimed water.²⁵ They have also developed projects to store unused CAP water and reclaimed water underground so that it will be available in times of scarcity of surface water.

A Designation allows a municipal water provider to show with certainty that it can provide the water needed to support growth. Since the Designation applies to all uses of water within a water provider's service area, a designated provider has greater ability to compete for new businesses and industrial customers. A Designation also exempts developers of subdivisions within the designated provider's service area from the burden of obtaining a Certificate, which is a rigorous and necessary, but time-consuming and expensive process.

Importantly, a Designation allows a water provider to better coordinate development within its service area. As an example, the City of Chandler adopted a policy that gives it greater control over how its water supplies are used.

"Looking to preserve water for existing customers while ensuring sufficient water for future land parcels, the City adopted a Water Allocation Policy (the first such policy in the state) that ties the terms 'water' and 'sustainable development' together. The policy established an evaluation process for future commercial and industrial projects that require large amounts of water to ensure the community receives the most benefit for the water these projects receive."²⁶

What is the CAGR and Why Was It Established?

The over-arching objective of the Groundwater Management Act is to reduce and manage the use of groundwater in the state's Active Management Areas. This objective is found in the Act's Declaration of Policy²⁷ and in the statutory management goals for the AMAs. For the Phoenix and Tucson AMAs, the management goal is safe-yield by January 1, 2025.²⁸ Safe-yield is a goal that "attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial recharge in the active management area."²⁹ In other words, it means balancing what's withdrawn with what's put back in.

It would be difficult, if not impossible, to reach safe-yield if new subdivisions could be served primarily with groundwater, because that would increase, rather than reduce, the use of groundwater. With this mandate in mind, ADWR proposed draft Assured Water Supply rules in 1988 to restrict the decline of groundwater levels in undeveloped areas of the AMAs.³⁰ This restriction would have limited residential growth in areas that lacked access to surface water supplies, essentially requiring a reduction in the number of houses that could be built.³¹

The proposed rules prompted an outcry from cities and towns without access to CAP water and from developers and the real estate industry, leading ADWR to withdraw its draft rules.³²

That did not end the matter. ADWR initiated an extensive public process and commissioned an economic impact study concluding that impacts of the proposed rules would be small if a governmental entity was created to provide new water supplies.³³ More than one idea for such an entity was advanced.

In 1991, the state enacted a new law that allowed, but did not require, the establishment of a groundwater replenishment district in the Phoenix AMA that would be mandated to levy a replenishment tax on groundwater withdrawn by its members.³⁴ Communities in the West Valley of the Phoenix AMA that depended solely on groundwater objected to the tax.³⁵

In 1992, ADWR proposed and evaluated three approaches to address how “consistency with the management goal” could be achieved for lands that lacked access to surface water supplies. The result was a preferred alternative of a “replenishment model that allowed for orderly transition to renewable water supplies.”³⁶

In 1993, the Legislature acted to make membership in the Phoenix AMA replenishment district voluntary.³⁷ At the same time, it gave the Central Arizona Water Conservation District (CAWCD), which operates the Central Arizona Project (CAP), the responsibility to acquire water to replenish groundwater pumped by certain landowners and municipal water providers within the three counties--Maricopa, Pinal and Pima--served by the CAP. This responsibility has become known as the Central Arizona Groundwater Replenishment District or CAGR. Despite being referred to as a "District," CAGR is not a legal entity.

ADWR supported the 1993 legislation, conceding that the 1991 law was never going to be implemented, but admitting that the new law was pro-development.³⁸ Larger Phoenix AMA cities lamented that they had been playing by the rules by using renewable water supplies, while the new law would unfairly allow others to use groundwater instead.³⁹

With a mechanism in place to enable groundwater-dependent areas to grow, the path was clear for ADWR to adopt final assured water supply rules. It did so in 1995.⁴⁰

How Does CAGR Work?

In order to use groundwater as an assured water supply, the developer of a subdivision or a municipal water provider must become a member of CAGR. Membership in CAGR allows a subdivision or a municipal provider to meet the assured water supply requirement that its proposed use of groundwater must be consistent with the management goal of the AMA.⁴¹ The applicant for a Certificate or Designation must still demonstrate that it satisfies all the other requirements for an assured water supply.

CAGR has two types of members: member service areas comprised of cities, towns and private water companies,⁴² and member lands,⁴³ which are individual subdivisions. Becoming a member of CAGR is known as enrolling.

Enrolling is automatic for subdivisions and water providers that meet certain statutory requirements. For subdivisions, these requirements include a recorded declaration that CAWCD may impose a lien on the real property to secure payment of assessments and fees.⁴⁴ Municipal water providers must pass a resolution that contains a binding agreement to pay replenishment taxes.⁴⁵ If a subdivision or water provider meets the statutory requirements, CAWCD cannot deny membership in CAGR.

CAGR must replenish (recharge) the amount of "excess" groundwater withdrawn by its members within three years after that groundwater is pumped.⁴⁶ Excess groundwater is the amount of groundwater that exceeds what the subdivision or municipal provider may use under the assured water supply rules.⁴⁷ CAGR may use any lawfully available source of water for replenishment, except groundwater withdrawn in an AMA.⁴⁸

CAGR must submit a Plan of Operation every 10 years to ADWR.⁴⁹ Each Plan must include:

- An estimate of CAGR's current and projected replenishment obligations for the next twenty years for current members;
- An estimate of CAGR's projected replenishment obligations for the next 100 years for current and potential members;

- A description of the water resources that CAGR plans to use for replenishment during the next twenty years, and the water resources that are potentially available during the subsequent 80 years.

The Director of ADWR must review and hold a public hearing on the Plan and make a determination whether it is consistent with achieving the management goal of each AMA.⁵⁰ If, after approving the Plan, the Director subsequently finds that the Plan no longer is consistent with achieving the management goals, all Designations based on membership in CAGR expire and no additional subdivisions may become member lands of CAGR.⁵¹

What Do the Plans of Operation Show?

Since 1993, CAGR has submitted three Plans of Operation to ADWR. The Director of ADWR has determined that all three Plans are consistent with achieving the management goals of the AMAs.

The Plans demonstrate that membership in CAGR has grown well beyond expectations. Membership grew from 184 member land homes and three member services areas in 1995, to 263,707 member land homes and 23 member service areas in 2013. At the end of 2024, it is projected that nearly 383,000 homes will have enrolled on CAGR member lands.

1994 Plan of Operation

CAGR's maiden Plan of Operation was submitted to ADWR in 1994. It projected that CAGR's annual replenishment obligation in 2014 would grow to over 37,000 acre-feet,⁵² and anticipated that CAGR could rely exclusively on excess CAP water as the source of replenishment for the first 20 years.⁵³ An acre-foot of water equals 325,851 gallons and will cover an acre of land to a depth of one foot. Excess CAP water is CAP water that is available in a given year because it is not used by CAP entitlement holders under their permanent agreements for CAP water.

In the 1990s, it was assumed that CAGRDR could depend on excess CAP water for replenishment for decades. CAWCD/CAGRDR staff determined that, "based on current projections, there will be sufficient excess CAP water available to meet CAGRDR's replenishment obligations at least through 2046."⁵⁴

This optimistic projection may have been a reflection of what was known about Colorado River water before the current decades-long drought. As CAWCD staff explained at the time:

"Water supplies on the Colorado River are abundant. The reservoirs on the River are at or near capacity, indicating that the chance of a water supply shortage in the next fifteen to twenty years is virtually non-existent."⁵⁵

But between 1995 and 2003, CAGRDR grew from four subdivisions with 184 member land homes (lots or homes on member lands) to 552 subdivisions with 124,946 member land homes, multiplying member land homes almost 700 times.⁵⁶ During that same period, member service areas increased from 3 to 19.

This rapid and unanticipated growth in CAGRDR membership meant a corresponding increase in CAGRDR's projected replenishment obligations and a need to look for water supplies for that purpose beyond excess CAP water.

2004 Plan of Operation

The 2004 Plan of Operation projected a substantial increase in CAGRDR's replenishment obligations. The estimated 20-year replenishment obligation for current members was 90,500 acre-feet per year,⁵⁷ while the estimated 100-year replenishment obligation for current members and those expected to enroll through 2015 was nearly 227,000 acre-feet per year.⁵⁸

A number of conditions had changed since the 1994 Plan was approved. CAGRDR's membership grew "well beyond expectations," and municipal water providers and Indian tribes with long-term rights to use CAP water developed infrastructure allowing them to use more of their CAP entitlements sooner.⁵⁹ Additionally, legislation extended CAGRDR's planning horizon to 100 years and required CAGRDR to develop a replenishment reserve in each AMA.⁶⁰ The 2004 Plan noted that

these increased replenishment obligations meant that CAGR could no longer rely exclusively on excess CAP water, stating:

"Excess CAP water will not be sufficient to meet all of these obligations during the next 20 years, much less the next 100 years. Therefore, CAGR will identify and acquire rights to a portfolio of water supplies over the next 20 to 25 years that can be used to meet CAGR's replenishment obligations over both the short and long term."⁶¹

The 2004 Plan summarized the water supplies that were "potentially available" to CAGR, including CAP Indian leases, CAP Non-Indian Agricultural (NIA) priority water, on-River supplies, imported groundwater and effluent.⁶²

Through the end of 2013, 1094 subdivisions, with 263,707 homes, and 23 services areas had become members of CAGR.⁶³

2015 Plan of Operation

By the 2015 Plan of Operation, the landscape had changed again. CAGR estimated its annual replenishment obligation in the year 2034 for current members and members expected to enroll through the Plan's 10-year period⁶⁴ to be 86,900 acre-feet.⁶⁵ This was similar to the 2004 Plan's estimated 20-year replenishment obligation of 90,500 acre-feet per year. But CAGR reduced its estimated 100-year annual replenishment obligation to 113,000 acre-feet, roughly half of the 100-year annual replenishment obligation of 227,000 acre-feet projected in the 2004 Plan.⁶⁶

CAGR cited a number of contributing factors for this reduction, including that many municipal providers that are member service areas have large renewable water supply portfolios and would continue to avoid pumping excess groundwater and paying replenishment costs.⁶⁷ CAGR also noted:

"Additional complexity is added because of the unprecedented volatility in the housing market since development of the 2005 (sic) Plan. This volatility has

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compounded the uncertainty of population and housing forecasts and has resulted in a large backlog of ML [member land] lots that are enrolled but not yet constructed. In the Pinal AMA alone, nearly 90 percent of enrolled lots are currently unconstructed (56,693 lots out of 63,353 enrolled). Changes in water use patterns continue to occur as well, including declines in per capita use and the utilization of a wider variety of supplies, notably increased leasing of CAP water and LTSC [long-term storage credit] accrual activity." ⁶⁸

Despite this reduction in the estimated 100-year annual replenishment obligation, 113,000 acre-feet is a significant amount of water to be acquired and replenished. It is nearly as much as the combined yearly CAP supplies of the Cities of Mesa, Glendale and Scottsdale.

According to the 2015 Plan, CAGR holds rights to an annual long-term supply of 36,534 acre-feet of water that includes CAP NIA-Priority water and long-term storage credits.⁶⁹ The Plan lists several other sources as "potentially available" water supplies, including non-CAP Colorado River water, imported groundwater from the Butler Valley and Harquahala Groundwater Basins in neighboring La Paz County, and in-state desalinated water from the Yuma and Buckeye areas. The Plan notes, however, that neither imported groundwater nor in-state desalinated water are considered to be potentially available until after 2034 because of the high cost of treating and transporting these water supplies.⁷⁰

The 2015 Plan projects a total of 988,300 acre-feet per year for 100 years of potentially available water supplies.⁷¹ Based on recent events, these projections warrant a closer look.

What Lies Ahead?

In 2006, the Water Resources Research Center at the University of Arizona analyzed CAGR and concluded:

"The AWS [assured water supply] rules and the CAGR were meant to preserve essential groundwater resources under conditions of rapid, sustained population growth. Preservation of groundwater supplies into the future continues to be an

important policy goal for Arizona. The central questions for the future include: Where will water to meet replenishment obligations come from? What effect will the CAGR's activities to obtain additional water supplies have on the plans of other entities? How much will it all cost? It is important that the public understand the role of the CAGR and the challenges it faces as Arizona continues to grow in the coming decades."⁷²

Nearly 14 years later, these questions are even more relevant in the face of the escalating growth of CAGR, competition for water supplies in a drying climate, and increasing reliance on groundwater for residential growth.

Water Supplies for Replenishment

Each Plan of Operation must identify the water supplies CAGR *plans* to use for replenishment during the 20 years following submission of the Plan and the water supplies *potentially available* to CAGR for replenishment during the subsequent 80 years.⁷³ While the word "plans" connotes that CAGR intends to use certain water supplies, the words "potentially available" would seem to mean that there is only a possibility that these supplies would be used or be available.

The 2004 Plan of Operation contained a schedule for acquiring water supplies that now appears overly optimistic.⁷⁴ Among other things, the schedule included:

- Use of long-term Indian leases in the amount of 20,000 acre-feet per year to begin in 2012;
- Use of long-term Colorado River water from on-River users in the amount of 15,000 acre-feet per year to begin in 2015; and
- Use of long-term effluent in the amount of 10,000 acre-feet per year to begin in 2008.⁷⁵

Through 2014, CAGR had acquired only 2,500 acre-feet per year of water through Indian leases and 2,400 acre-feet per year of effluent,⁷⁶ and CAGR had not acquired any Colorado River water from on-River users.

The 2015 Plan of Operation includes many of the same potentially available supplies, but does not specify desired dates for acquisition.⁷⁷ For example, the 2015 Plan projects that a low of 109,800 acre-feet per year to a high of 219,700 acre-feet per year of Colorado River water is potentially available for acquisition from on-River users between 2015 and 2034.⁷⁸

AVAILABLE WATER SUPPLIES

2015–2114

SUPPLY CATEGORY	SUPPLY LOCATION	TOTAL CURRENT SUPPLY (AF/YR, 100 YRS)	AVAILABLE WATER SUPPLIES 2015 – 2034		AVAILABLE WATER SUPPLIES 2035 – 2114	
			LOW (AF/YR, 100 YRS)	HIGH (AF/YR, 100 YRS)	LOW (AF/YR, 100 YRS)	HIGH (AF/YR, 100 YRS)
Long-Term Storage Credits	Phoenix AMA, Pinal AMA, Tucson AMA, Harquahala INA	88,900 ¹	11,000 ²	22,000	11,000	22,000
Effluent	Phoenix AMA, Pinal AMA, Tucson AMA	407,600 ³	59,600 ⁴	119,200	76,100 ⁵	152,300
Central Arizona Project	All Contracts, Subcontracts, and Unallocated Supplies	1,415,000 ⁶	279,700 ⁷	559,300	175,600	351,200 ⁸
Colorado River	Arizona Entitlements Excluding CAP Supplies	1,143,700 ⁹	109,800 ¹⁰	219,700	109,800	219,700
Imported Groundwater	Harquahala and Butler Valleys	209,000 ¹¹	0	0	101,550 ¹²	203,100
Arizona Desalination	Yuma-area, Phoenix AMA	40,000 ¹³	0	0	14,000 ¹⁴	40,000
TOTAL:		3,364,200	460,100	920,200	488,050	988,300

Table 4.2, CAGR 2015 Plan of Operation

However, between 2017 and 2018, CAGR made two attempts to acquire Colorado River water from on-River users, both of which were unsuccessful. One of the proposed transactions was a 25-year lease with the Town of Quartzsite for 1,070 acre-feet of Colorado River water. ADWR, which must review proposed transfers of Colorado River water and make recommendations to the United States Secretary of the Interior, recommended that the transfer be denied because Quartzsite had never perfected its entitlement by putting the water to beneficial use.⁷⁹

The second proposed acquisition involved the potential purchase by CAGR of about 2,200 acres of land in the Mohave Valley Irrigation & Drainage District with approximately 14,000 acre-feet of Colorado River diversion rights. That land was owned by two New York City hedge funds.⁸⁰ The

proposal was controversial, with Mohave County leaders, other on-River users, and some CAWCD Board members opposing the transfer. Public comments on the proposed transaction vividly illustrate the battle lines. As Tony Davis of the *Arizona Daily Star* reported:

"The water you seek to buy and transfer is the economic lifeblood of our rural county in Mohave Valley. It is our very future and you seek to wheel it to three far wealthier counties for your own benefit. Our citizens demand that we protect their interest and oppose this action by all means." Gary Watson, Chair of the Mohave County Board of Supervisors.

"Everyone's always known there has to be more water supplies. There's nothing secret about the fact that this is the board's charge, and we are carrying it out." Jim Holway, CAWCD Board of Directors.

"All of the very positive statements were being made then [1980s], similar to today, that it's part of our obligation, that it can be mitigated. I think we were wrong It [buying rural water farms] was an effort to move substantial amounts of future water of one area to guarantee the future of another. I don't believe that's good state policy." Terry Goddard, CAWCD Board of Directors.

"It's just the kind of proposal that's needed for cities and subdivisions that rely on the (replenishment district) so they will have meaningful access to a reliable water supply." Michelle Van Quathem, attorney for Pulte Homes.⁸¹

Ultimately, CAGR staff recommended termination of the proposed transaction.⁸² This controversy, and the opposing statements about it from CAWCD Board members, other elected officials, and developers, demonstrate the institutional conflicts that make it difficult to allow growth to occur in one part of the state based on securing water supplies from other parts of the state.

Perhaps recognizing that opposition to Colorado River transfers would continue, in 2018, the CAWCD Board of Directors, on behalf of CAGR, approved a sweeping deal for replenishment water with the Gila River Indian Community (GRIC) and Gila River Water Storage (GRWS)--a

partnership between the GRIC and the Salt River Project--that will provide a total of 900,000 acre-feet of water over 25 years.⁸³ Specifically:

- For \$95 million, CAGR will receive 375,000 acre-feet of long-term storage credits for water that has been stored underground in the Pinal AMA and 70,375 acre-feet of long-term storage credits for water stored underground in the Phoenix AMA. These credits may be used only in the AMA in which the water was stored, unless the water is pumped in that AMA and then transported to another AMA.⁸⁴
- Each year for 25 years, the GRIC will schedule 15,000 acre-feet of its CAP Indian priority water for delivery to underground storage facilities of CAGR's choosing for the benefit of CAGR. In exchange, CAGR will recover 15,000 acre-feet of Pinal AMA long-term storage credits each year for 25 years from wells located on the GRIC reservation for the GRIC's use.
- Each year for 25 years, CAGR will lease from the GRIC and order 18,185 acre-feet of CAP Non-Indian Agricultural (NIA) water for storage at GRIC underground storage facilities in the Phoenix AMA.

Not all of the 900,000 acre-feet involved in the GRIC/GRWS deal has the same reliability. CAP Indian priority water has a high priority when CAP water supplies are reduced in times of shortages of Colorado River water. CAP NIA water (which totals 454,625 acre-feet over 25 years in this deal) is subject to greater reductions in times of shortages, meaning the full amount of this supply is not likely to be available every year.

While the GRIC/GRWS deal will provide some of the water needed for future replenishment, representatives of the home-building community continue to push for permanent, long-term water supply acquisitions, including Colorado River supplies.⁸⁵ But CAGR's history has shown that acquiring Colorado River water from on-River users is a heavy lift, and the 2015 Plan's optimistic assumption about the availability of CAP water for replenishment has also drawn criticism. In the Plan, CAGR estimates that between 279,700 and 559,300 acre-feet per year of CAP water will be available for replenishment over the next 20 years. But when the Plan was under review by the Director of ADWR, several entities filed comments disagreeing with this estimate because it failed to consider potential shortages of CAP water.

"Reliance, even in part, on Colorado River supplies should include more discussion and analysis of shortage and structural deficit impact."⁸⁶ Maureen George, Mohave County Water Authority

"The probability of a CAP shortage is estimated to be 20 percent in 2016, increasing to 50 percent in 2017. Consequently, the availability of excess CAP water to meet future replenishment obligations is uncertain."⁸⁷ Jackson Jenkins, Pima County Regional Wastewater Reclamation Department

Nevertheless, the Director determined that, "Evaluation of shortage impacts on the Plan is outside the scope of the Director's review of the Plan . . . as the probability of shortage, and the calculation of its degree, duration, and impacts are too speculative at this time."⁸⁸ The Director found that a minimum of 279,700 acre-feet per year of CAP water would be available to CAGR over the next 20 years.⁸⁹

Since the Director's approval of the Plan, however, Arizona and the other Colorado River Basin states have entered into a Drought Contingency Plan (DCP) to reduce withdrawals from Lake Mead in order to keep lake elevations from dropping to catastrophic levels that would cause draconian cuts in water deliveries. DCP builds upon the 2007 Interim Shortage-Sharing Guidelines⁹⁰ agreed to by the Colorado River basin states. Under the 2007 Guidelines, CAP water is subject to reductions of up to 480,000 acre-feet per year if the elevation of Lake Mead falls to less than 1025 feet. Under the DCP, CAP water deliveries could be reduced by as much as 720,000 acre-feet per year if the lake elevation falls to that level. In either case, there would be no additional CAP water available for CAGR.⁹¹

Notably, and of relevance to the issue of water supplies available to CAGR for replenishment, the Long-Term Water Augmentation Committee of the Governor's Water Augmentation, Innovation and Conservation Council recently issued a report on long-term water augmentation options for the state. The report found only three viable water augmentation options: ocean desalination, brackish groundwater desalination and groundwater transfers from the Harquahala and Butler Groundwater Basins.⁹²

Relying on Groundwater for New Development

To be eligible for an assured water supply based on membership in CAGR, a subdivision owner or municipal water provider must first demonstrate that sufficient groundwater is physically available to meet its proposed use for 100 years. Under ADWR's assured water supply rules, groundwater is "physically available" for 100 years if it will be withdrawn from depths that do not exceed 1,000 feet below land surface in the Phoenix and Tucson AMAs and 1,100 feet below land surface in the Pinal AMA, or depth to bedrock, whichever is shallower.⁹³

But in a 2007 article in the Arizona Law Review, several respected Arizona water professionals argued against allowing groundwater to be withdrawn from such great depths to show an assured water supply.⁹⁴

"Arizona has a history of urban developments that have existed for over 100 years in core areas of Phoenix, Mesa, Tempe, Tucson, Bisbee and Prescott, but little experience with pumping the local aquifers in CAGR's service area from depths close to 1,000 feet. As a matter of sound long-term water management, then, it would be prudent to ensure that there will be stable water supplies for Arizona's urban developments even past the 100-year window that the AWS [Assured Water Supply] program contemplates. It may be optimistic at best and foolhardy at worst to expect that the water needs of urban developments can be met by pumping water from depths approximating 1,000 feet below the surface."⁹⁵

In addition to these concerns, the science of determining whether groundwater is physically available has evolved since 1980 when the Groundwater Management Act was adopted, as has our understanding of Arizona's groundwater basins. Using older "numerical" models, ADWR concluded that groundwater was physically available for several large master planned communities and issued Analyses of Assured Water Supply to the developers. Based on newer, more accurate models and updated data on groundwater conditions, however, ADWR's findings of physical availability for many of these master planned communities are now in question.

The problem appears to be most pronounced in the Pinal AMA where ADWR's newest modeling shows less groundwater is physically available than previously thought. On October 11, 2019,

ADWR presented results from its report, "2019 Pinal Model and 100-Year AWS Projection Technical Memorandum"⁹⁶ to the Arizona House Ad Hoc Committee on Groundwater Supply for Pinal County. According to the Projection and answers to questions posed by Rep. David Cook:

- There is "unmet demand" (a shortfall of groundwater available) of approximately 8.1 million acre-feet after 100 years of pumping.
- Of this amount, approximately 2 million acre-feet are associated with assured water supply determinations (i.e., Analyses, Certificates and Designations) previously issued by ADWR.
- "It is unlikely that any specific area will produce sufficient groundwater to meet assured water supply requirements for new or pending applications without negatively affecting groundwater supplies for the rest of the AMA."⁹⁷

As the *Arizona Republic* previously reported, ADWR confirmed in early 2019 that there may not be enough groundwater in the Pinal AMA for dozens of planned developments that would include more than 139,000 homes.⁹⁸ These numbers do not include twelve applications for Analyses, five applications for Certificates and one application for a Designation that are pending.⁹⁹

In short, the 2019 Pinal model (which includes most of the Pinal AMA) calculates that there is not enough groundwater to meet the demands of current users and users for which ADWR has issued assured water supply determinations, let alone the demands of pending assured water supply applications.

A similar problem could develop in the West Valley of the Phoenix AMA. ADWR's records show that ADWR has issued and extended several Analyses for large master planned communities in the Lower Hassayampa Sub-Basin of the Phoenix AMA. These Analyses include Belmont,¹⁰⁰ Douglas Ranch¹⁰¹ and Festival Ranch.¹⁰² The combined total amount of groundwater allocated for these Analyses is nearly 81,500 acre-feet per year. ADWR extended one Analysis for Belmont and Belmont has applied for a renewal of that extension, which is awaiting a decision by ADWR.¹⁰³ ADWR has issued two extensions of the Analysis for phases one through five of Douglas Ranch. Douglas Ranch has applied for an extension of phases six through nine of its development,¹⁰⁴ and that application is awaiting a decision by ADWR.

Several of these Analyses were based on a numerical groundwater flow model constructed in 2006.¹⁰⁵ ADWR added a unique provision to the Analyses for some phases of Belmont and Douglas Ranch that required the developers to submit a joint supplemental hydrologic study by March 26, 2010.¹⁰⁶ The new study was supposed to demonstrate how much groundwater is physically available to the developments for 100 years without causing groundwater levels to reach bedrock or exceed 1,000 feet below land surface, whichever is shallower. If the developers failed to submit the required study, the Analyses would expire. Unfortunately, water users do not have the benefit of that supplemental hydrologic study because, at the request of the developers, ADWR later waived the requirement to file it.¹⁰⁷

Growth in the West Valley

According to the *Arizona Republic*, an investment group controlled by Microsoft founder Bill Gates has invested \$80 million in Belmont, a 24,800-acre development near the White Tank Mountains on the western edge of Maricopa County.¹⁰⁸ Plans for Belmont include as many as 80,000 homes and office and industrial space. "When built out, Belmont would be comparable in square miles and projected population to Tempe."¹⁰⁹

Meanwhile, Jerry Colangelo, a former owner of the Phoenix Suns and the Arizona Diamondbacks, is developing Douglas Ranch in Buckeye, which he has called the West's largest planned community--some 119,000 homes and 300,000 people.¹¹⁰ Douglas Ranch is located west of the White Tank Mountains in Maricopa County and north of the developed portion of Buckeye, but it would be served by the City of Buckeye.¹¹¹ The City of Buckeye's Municipal Planning Area, with a 2016 population of 72,900, currently relies on groundwater for all of its potable water supply.¹¹² The amount of available groundwater resources has yet to be fully vetted.

Even if enough groundwater is physically available for a subdivision, the groundwater may not be relied upon to show an assured water supply unless its use is consistent with the management goal for the AMA. Consistency with the management goal is based on ADWR's assured water supply rules and depends on the AMA in which the subdivision is located.¹¹³ The rules are complicated, but, in general, most of the groundwater proposed to be used by new CAGR subdivisions will be excess groundwater.¹¹⁴ Consequently, groundwater use by the proposed new subdivisions in the Pinal AMA and the West Valley of the Phoenix AMA would add greatly to CAGR's projected replenishment obligations, increasing them far beyond what is anticipated in the 2015 CAGR Plan of Operation. In the Buckeye area alone, the City of Buckeye's hydrological consultant reports that

ADWR has already issued Analyses for approximately 120,000 acre-feet per year of potential water demand.

The entire West Valley is expected to grow dramatically, to a population of over 2 million by 2050. CAGR's consultant has stated, "it is quite evident that future growth within this area will most likely be reliant on new Member Land enrollment and the continued existence of CAGR to be able to fulfill the expectation of population growth."¹¹⁵

The question must be asked: is it realistic to assume that CAGR will be able to acquire that much water to replenish the groundwater pumping for so much growth?

Collateral Effects of Pumping Groundwater

Aside from the enormous quantity of water that will be needed for replenishment, pumping such large amounts of groundwater has well-documented environmental and health-related consequences. One major impact is land subsidence, which often results in large earth fissures that can damage roads, water mains, canals, bridges and building foundations,¹¹⁶ and also affect where flood waters flow. As explained by ADWR:

"Land subsidence in the basins of Arizona is generally due to compaction of alluvium caused by lowering of the water table. As the water table declines, pores in the alluvium once held open by water pressure are no longer supported and collapse. Collapse and subsequent lowering in elevation of the land surface is defined as land subsidence."¹¹⁷

Land subsidence often occurs decades after groundwater is pumped, and much of the subsidence Arizona is currently experiencing is the result of earlier groundwater mining. According to ADWR, "areas in Maricopa and Pinal Counties have subsided more than eighteen feet since the early 20th Century."¹¹⁸ The United States Geological Survey notes, "increasing land development threatens to exacerbate existing land-subsidence problems and initiate new ones."¹¹⁹

Aside from the millions of dollars of damage caused by land subsidence, when aquifers collapse, it's irreversible and they are no longer capable of storing water. As *Arizona Republic* columnist Joanna Allhands explained, "you can't re-inflate those collapsed sediments like a balloon."¹²⁰ In essence, land subsidence is evidence that the aquifer is dying.

Another major consequence of groundwater overdraft is new or worsening groundwater quality. According to Stanford University's Water in the West program, "as aquifer levels decline from chronic overdraft, natural and man-made pollutants can concentrate in the remaining groundwater, making it unsafe for irrigation or drinking without costly treatment. In some cases, wells must be shut down."¹²¹

Land subsidence and water quality degradation are symptoms of over pumping groundwater aquifers, but the biggest problem is that pumping groundwater in such large quantities is unsustainable. The Arizona Town Hall reported in 2015:

"Groundwater level declines are evidence that much of the approximately 2.8 million acre-feet of groundwater used annually in Arizona is non-renewable. This groundwater accumulated underground for hundreds to thousands of years and is replenished very slowly. Like a savings account, continued withdrawal will eventually lead to depletion."¹²²

Between 1940 and 2007, Arizonans depleted our groundwater in storage by nearly 75 million acre-feet, meaning less groundwater will be available to meet future demands.¹²³

This grim reality leads to a crucial question: Who will provide water to homeowners and businesses on CAGR member lands if their wells run dry? Since groundwater may be pumped to 1,000 feet below land surface in the Phoenix and Tucson AMAs and 1,100 feet below land surface in the Pinal AMA, this is not an academic question. It is a serious likelihood, with major consequences that must be considered.

Location of Replenishment

State law requires CAGRDR to replenish the amount of excess groundwater pumped by and for its members within 3 years after the excess groundwater is pumped. CAGRDR must replenish in the same AMA in which the groundwater was withdrawn for each member land or member service area.¹²⁴ According to its 2015 Plan of Operation, CAGRDR attempts to replenish in the same sub-basin in which the groundwater was withdrawn.¹²⁵

CAWCD owns six underground storage facilities that may be used for replenishment. Four of these are in the Phoenix AMA. These underground storage facilities are basins constructed on the land surface to allow the water discharged into them to percolate underground to the aquifer. CAGRDR may also replenish water at groundwater savings facilities (GSF). A GSF is an irrigation district that directly uses the replenishment water rather than pump groundwater. In the Phoenix AMA there are four GSFs available to CAGRDR.¹²⁶ While the combined storage capacity at these facilities is great enough to meet CAGRDR's current replenishment obligations, the overall location of these facilities does not allow CAGRDR to replenish in all of the locations where its future members are located.

The Phoenix AMA covers over 5,600 square miles,¹²⁷ and the seven groundwater sub-basins of the AMA are large, with unique hydrological conditions.¹²⁸ If groundwater pumping for the member land or by the member service area is not located near the site of replenishment, that replenished water will not mitigate the local impacts of groundwater pumping. Compounding this problem, ADWR reports that "most of the ideal locations for large-scale recharge facilities have already been permitted in the Phoenix AMA."¹²⁹

Many people don't understand that CAGRDR was established solely to show that its members' proposed use of excess groundwater would be consistent with the management goal of the AMA. This "consistency" is met by CAGRDR's obligation to put the same amount of excess groundwater used by its members back into the aquifers of the same AMA. But CAGRDR has no obligation to replenish water in the specific areas where it was pumped, which could leave many homeowners out of luck down the road. The fact is that CAGRDR is not a municipal water provider to its members and does not guarantee that its members will have water supplies in perpetuity. As an integrated water master plan for the City of Buckeye recognizes, becoming a CAGRDR member "does not provide Buckeye with a physical water supply."¹³⁰

Since CAGR is not required to replenish water at the sites and into the aquifers from which excess groundwater is pumped, some critics have asserted that there will be "wet" and "dry" members of CAGR: Wet members will be those located in close proximity to CAGR's replenishment infrastructure, while dry members will be located far from the storage sites.¹³¹ "In the worst case scenario, when effects of local pumping in 'dry' [member lands] are modeled incorrectly, CAGR membership offers no real assurance there will be water physically available to serve the particular subdivision in the future."¹³² Eventually, the groundwater in these dry areas will run out. But when that happens, CAGR's replenishment obligation for that land or service area will end because no excess groundwater will have been pumped, even though demand for water continues.¹³³

Importantly, the water replenished by CAGR is not saved or preserved for its members. It becomes groundwater that would be available for others with rights and physical access to pump under the provisions of the Groundwater Management Act. Ironically, a new assured water supply applicant might be able to rely on this "replenished groundwater" as part of demonstrating an assured water supply, resulting in a further demand on the AMA's groundwater supplies and an ever-increasing obligation for CAGR. This is all the more reason why replenishment needs to occur where the excess groundwater is pumped.

Funding CAGR

Under state law, CAGR must be completely funded by its members. However, CAWCD is permitted to loan funds to CAGR with interest determined by the CAWCD Board,¹³⁴ and CAGR may issue revenue bonds to develop infrastructure and acquire water to meet its replenishment obligations.¹³⁵

CAGR collects monies from its members through a combination of fees, dues, assessments and taxes that are used to acquire water, develop infrastructure and cover the costs and expenses of replenishment. These include:

- A one-time Enrollment Fee: paid by the landowner or water provider to enroll in CAGR.¹³⁶

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- A one-time Activation Fee: paid for a subdivision before the Arizona Department of Real Estate will allow lots in the subdivision to be sold.¹³⁷
- Annual Membership Dues: collected from all enrolled members.¹³⁸
- Annual Assessments and Taxes: levied by CAWCD against member lands (assessments) and member service areas (taxes).¹³⁹

CAGR computes the annual assessment for each AMA based on the projected cost to replenish the excess groundwater pumped for all member lands in the AMA. The cost for an individual owner of a parcel of member land is based on the amount of excess groundwater used by that parcel, as calculated by the municipal water provider for that parcel. Once CAWCD establishes the rate for each year, the individual counties (Maricopa, Pinal and Pima) add the assessment to each parcel's tax bill. The assessment is collected along with the property taxes for that parcel and transferred to CAGR to be used to purchase and replenish the excess groundwater that has been used.¹⁴⁰

Similarly, CAGR annually levies and collects a replenishment tax from each member service area. This tax is based on the amount of money needed to pay the cost of replenishing excess groundwater.¹⁴¹ If the member service area does not pump excess groundwater, it is not required to pay the replenishment tax.

In its early years, CAGR relied heavily on funds advanced by CAWCD. As of August 31, 1999, CAWCD had advanced about \$750,000 to CAGR.¹⁴² During that year, CAGR's revenue was about \$47,000. A contemporaneous memo noted that it was time to focus on repaying CAWCD and developing capital funds to purchase water rights and develop replenishment infrastructure.¹⁴³ An early financial model developed by CAGR/CAWCD staff assumed, among other things, that the 2000 assessment rate for the Phoenix AMA of \$60 per acre-foot (\$45 per acre-foot for the administrative component and \$15 per acre-foot for the capital component) would be held constant through 2010, and actually reduced when the advances from CAWCD had been repaid.¹⁴⁴ This assumption proved incorrect. By 2011, the assessment rate had increased to \$403 per acre-foot for the Phoenix AMA, with \$42 for the administrative component and \$170 for the infrastructure and water rights component.¹⁴⁵

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In its 2004 Plan of Operation, CAGR estimated that it would need to spend more than \$260 million over the next 25 years to fund its water supply acquisition plan.¹⁴⁶ The 2015 Plan of Operation contains no similar cost estimate. The GRIC/GRWS acquisition, however, sheds some light on potential expenditures. CAGR staff estimates the "all-in" costs of the GRIC/GRWS acquisition to be \$345 million in 2018 dollars and \$474 million in 2018-2044 dollars if there is no NIA CAP water shortage. CAGR staff further estimates that the acquisition will increase rates for CAGR's Phoenix AMA members by 11-15% over the next two to three years.¹⁴⁷ Even without this acquisition, the annual assessment rate has been steadily increasing, from \$154 per acre-foot in 2002 to \$727 per acre-foot in 2019.¹⁴⁸

Rate Year	Phoenix AMA					Pinal AMA					Tucson AMA				
	Water & Replenishment	Administrative	Infrastructure & Water Rights	Replenishment Reserve	Total Rate	Water & Replenishment	Administrative	Infrastructure & Water Rights	Replenishment Reserve	Total Rate	Water & Replenishment	Administrative	Infrastructure & Water Rights	Replenishment Reserve	Total Rate
1996	\$0	\$52	--	--	\$52	--	--	--	--	--	\$0	\$52	--	--	\$52
1997	\$125	\$52	--	--	\$177	--	--	--	--	--	\$125	\$52	--	--	\$177
1998	\$135	\$45	--	--	\$180	--	--	--	--	--	\$133	\$45	--	--	\$178
1999	\$120	\$45	\$9	--	\$174	--	--	--	--	\$0	\$118	\$45	\$9	--	\$172
2000	\$118	\$45	\$15	\$9	\$187	\$101	\$45	\$15	\$0	\$161	\$117	\$45	\$15	\$10	\$187
2001	\$120	\$45	\$15	\$9	\$189	\$101	\$45	\$15	\$0	\$161	\$117	\$45	\$15	\$11	\$188
2002	\$92	\$45	\$15	\$12	\$164	\$105	\$45	\$15	\$0	\$165	\$126	\$45	\$15	\$12	\$198
2003	\$116	\$45	\$15	\$12	\$188	\$109	\$45	\$15	\$0	\$169	\$127	\$45	\$15	\$12	\$199
2004	\$117	\$40	\$20	\$28	\$205	\$80	\$40	\$20	\$21	\$161	\$121	\$40	\$20	\$27	\$208
2005	\$101	\$40	\$40	\$31	\$212	\$81	\$40	\$40	\$31	\$192	\$115	\$40	\$40	\$31	\$226
2006	\$107	\$30	\$77	\$22	\$236	\$79	\$30	\$77	\$24	\$210	\$123	\$30	\$77	\$21	\$251
2007	\$112	\$28	\$79	\$21	\$240	\$87	\$28	\$79	\$25	\$219	\$133	\$28	\$79	\$25	\$265
2008	\$134	\$33	\$90	\$33	\$290	\$100	\$33	\$90	\$31	\$254	\$143	\$33	\$90	\$39	\$305
2009	\$143	\$33	\$101	\$41	\$318	\$107	\$33	\$101	\$38	\$279	\$153	\$33	\$101	\$46	\$333
2010	\$140	\$38	\$131	\$47	\$356	\$110	\$38	\$131	\$45	\$324	\$155	\$38	\$131	\$53	\$377
2011	\$140	\$42	\$170	\$51	\$403	\$116	\$42	\$170	\$53	\$381	\$155	\$42	\$170	\$60	\$427
2012	\$137	\$44	\$204	\$52	\$437	\$117	\$44	\$204	\$56	\$421	\$161	\$44	\$204	\$65	\$474
2013	\$160	\$45	\$245	\$58	\$508	\$140	\$45	\$245	\$65	\$495	\$183	\$45	\$245	\$75	\$548
2014	\$172	\$45	\$294	\$63	\$574	\$155	\$45	\$294	\$70	\$564	\$196	\$45	\$294	\$80	\$615
2015	\$179	\$45	\$353	\$67	\$644	\$160	\$45	\$353	\$75	\$633	\$202	\$45	\$353	\$85	\$685

Pollack Report, Table 2.5-1

This dramatic increase in assessment rates and taxes over the years has led some CAGR members to find ways to avoid pumping excess groundwater. One mechanism is the extinguishment credit. The Assured Water Supply rules allow the owner of a grandfathered groundwater right¹⁴⁹ to extinguish the right in exchange for credits to pump groundwater that may be pledged to an application for an assured water supply.¹⁵⁰ Groundwater pumped pursuant to an extinguishment credit is not categorized as excess groundwater and, therefore, is not required to be replenished.

As of April 16, 2019, the amount of extinguishment credits that had not been pledged to an application for an assured water supply totaled over 1.3 million acre-feet, with more than 1 million in the Phoenix and Tucson AMAs.¹⁵¹

The Town of Queen Creek, a member service area, has established a five-year goal to reduce its reliance on CAGR that includes acquiring 175,000 acre-feet of groundwater extinguishment credits.¹⁵² Similarly, the City of El Mirage has acquired the right to purchase up to 29,280 acre-feet of extinguishment credits,¹⁵³ while the Town of Florence has also agreed to purchase extinguishment credits for what it notes is "a fraction" of the amount of the current CAGR assessment rate.¹⁵⁴

Extinguishment Credits

The amount of groundwater that may be pledged pursuant to an extinguishment credit to an application for an assured water supply varies from AMA and management period. In the Phoenix and Tucson AMAs, any grandfathered right that has not been extinguished in exchange for credits as of January 1, 2025 may no longer be extinguished.

Extinguishment credits have historically been treated differently in the Pinal AMA because its management goal is not safe-yield, but preserving the AMA's agricultural economy as long as feasible while ensuring water supplies for future M&I uses. In 2007, the Department amended its rules to implement a gradual reduction in the amount of the credit depending on the year of extinguishment. Stakeholders in the Pinal AMA repeatedly sought a delay in the implementation of the 2007 rules, fearing premature extinguishment of grandfathered rights. After repeatedly postponing implementation, ADWR adopted new rules governing extinguishment credits for that AMA on December 11, 2018. The new amendments calculate all extinguishment credits in the same way regardless of the year of extinguishment.¹⁵⁵

Long-term storage credits have also been used to reduce reliance on CAGR. Long-term storage credits are earned when CAP water or treated wastewater is stored underground for later use.¹⁵⁶ Long-term storage credits may be sold, and the credits may be pumped from any location in the same AMA in which they were earned. In late 2015, CAGR staff became concerned that third parties were marketing their long-term storage credits to homeowners associations (HOAs) within CAGR member lands.¹⁵⁷ The water provider serving the HOA pumps and "delivers" the credit

water to the HOA, relieving the HOA from using excess groundwater and paying an annual replenishment assessment to CAGR. CAGR, however, remains on the hook for administering the replenishment program and acquiring water to meet the member's long-term replenishment obligation.

Concerned about what this practice might mean for the long-run, CAGR engaged a consultant to study the issue, who reported in 2017:

"[A]ll of CAGR's variable costs (\$6.2 million) and more than two-thirds of its fixed costs (\$15.8 million) in 2015 were recovered through annual replenishment assessments, which are generated via rates that are charged against the members' reported use of excess groundwater. Thus, any activity that impacts how CAGR members report excess groundwater use will have a corresponding impact on CAGR's ability to generate revenues necessary to cover its fixed costs." ¹⁵⁸

"[I]t is conceivable that under a worst-case scenario, 100% of CAGR Member Lands in the Phoenix AMA could participate in a LTSC [long-term storage credit] purchase/recovery program and stop paying CAGR annual replenishment assessments altogether as long as LTSCs remain available for purchase. This would result in an estimated loss of nearly \$12 million in fixed cost revenues from CAGR Member Land assessments in the Phoenix AMA in 2017 alone. Based on CAGR's current funding structure, such a scenario extended over even just a few years would be financially catastrophic."¹⁵⁹

Hoping to avoid that financial catastrophe, the consultant recommended that ADWR reverse its decision on how it accounts for the use of long-term storage credits by member lands so that they could not use these credits to avoid being charged for pumping excess groundwater. Alternatively, the study recommended that CAGR seek legislation allowing it to revise its method of collecting revenues from member lands.¹⁶⁰ While neither of these recommendations has been implemented, the study demonstrates the vulnerability of the CAGR financing model.

In reality, homeowners on member lands pay for their water twice--once for the groundwater delivered for their use, and again for the water CAGR purchases to replenish that groundwater. As member land enrollment in the AMA increases and replenishment costs go up, the

replenishment assessment increases collectively for all homeowners on member land in that AMA. Consequently, as replenishment costs continue to escalate, it is reasonable to assume that homeowners and HOAs will look for ways to reduce their excess groundwater replenishment obligations, and that may put the CAGRDR financial model further at risk.

Developers have also seen significant increases in CAGRDR fees over the years. Ultimately, however, they are able to pass these costs on in the purchase price of lots in member land subdivisions, meaning another CAGRDR-related cost for the homeowner. In 2011, the enrollment fee was \$138 per housing unit and the activation fee was \$136 per housing unit.¹⁶¹ In 2019, the enrollment fee is \$1,094 per housing unit and the activation fee for the Phoenix AMA is \$1,080 per housing unit.¹⁶² These aggressive increases in enrollment and activation fees were prompted by stakeholder concern that dramatically increasing replenishment obligations would affect CAGRDR's ability to acquire the necessary water supplies. The Board directed its staff to evaluate CAGRDR's funding structure to collect more money sooner.¹⁶³ For fiscal years 2020 through 2023, CAGRDR staff is recommending an activation fee increase of 9% per year.¹⁶⁴

Both the 2004 and 2015 Plans of Operation state that "CAGRDR will always be able to meet its statutory obligations using funds collected exclusively from its members."¹⁶⁵ However, dramatic increases in enrollment and corresponding increases in replenishment obligations have required dramatic increases in CAGRDR's replenishment assessments and taxes, which will continue to rise. These aggressive increases have caused members to look for ways to avoid pumping excess groundwater, which in turn, leads to concerns that CAGRDR will be unable to collect the funds from its members needed to acquire the water to meet its long-term replenishment obligations. As more subdivisions enroll in CAGRDR and replenishment assessments escalate, homeowners on member lands may become more aware of the costs they are being asked to pay, and there may be greater resistance to additional enrollment or to the current CAGRDR financial model.

CAGRDR Governance

When the Legislature was debating whether to give replenishment responsibilities to the CAWCD, it may have been influenced by testimony that a new bureaucracy would thereby be avoided.¹⁶⁶ The relationship between CAGRDR and CAWCD has been debated ever since. An early document

prepared by CAWCD/CAGR discusses this debate.¹⁶⁷ The document notes that those in favor of the relationship argue that:

- CAWCD is fully staffed and can support the establishment of CAGR.
- CAWCD is in the best position to determine how CAGR fits into the CAP system without affecting CAP contractors.
- CAWCD's service area coincides with the Phoenix, Pinal and Tucson AMAs.
- CAWCD may use funds to establish CAGR without an increase in taxes.

According to the document, opponents of combining CAGR and CAWCD expressed concern that:

- CAWCD may give CAGR preferential treatment in water pricing and access to CAP facilities.
- CAGR will eventually compete with CAP contractors for water and CAP canal capacity.
- CAWCD would use monies from CAP contractors and subcontractors (e.g., cities, towns and private water companies) to make loans to CAGR.
- It will be difficult to keep CAGR and CAWCD funds completely segregated.

The memo concludes: "for all of these reasons, CAWCD must take great care to ensure that it responds appropriately and equitably to all situations arising from its operation of the CAGR."

Today, concerns remain about whether CAWCD has an inherent conflict of interest in managing CAGR, which may ultimately end up competing for water supplies and canal capacity with CAP contractors. This places the Board of Directors in a difficult position when making decisions that may affect both CAGR members and CAP water users. Ultimately, the Board must avoid even the appearance of a conflict and new guardrails may be necessary to guide the Board's decisions.

Impacts of CAGR on Urban Growth

The drafters of the Groundwater Management Act intended the assured water supply requirement to influence the pattern and location of urban growth. Had access to renewable water supplies

remained a requirement for demonstrating an assured water supply, growth in the AMAs would have proceeded quite differently. Instead, CAGR has enabled development of land that would otherwise have remained vacant or that would have been developed only by the incremental expansion of municipal water provider service areas that already had an assured water supply.

A report commissioned by the Home Builders Association of Central Arizona touts the development benefits of CAGR, including:

"The regions that CAGR has provided water solutions for is expansive, including many cities and towns. Nearly all of the populated areas of Pima County . . . have been allowed to develop utilizing CAGR. High growth areas of Maricopa County also rely on CAGR. . . . Additionally, Pinal County, with anticipated growth of over 600,000 residents in the next few decades, has many regions serviced by CAGR.¹⁶⁸

The report concludes that, without CAGR, over 350,000 homes, equating to over 925,000 residents, would not otherwise have been built. But the report did not take into account whether some or all of that growth would have taken place anyway, just at different locations within the AMAs. CAGR is not the only way growth can happen. It does allow growth where land is cheaper, instead of in areas where renewable water supplies and infrastructure are already in place. The Home Builders' report also failed to consider the environmental impacts of growth on lands far away from established metropolitan centers and neglected to address transportation costs, air quality effects, potential land subsidence from groundwater pumping and disruption of natural desert lands.

Most of CAGR's replenishment obligation occurs from groundwater pumped to serve member lands, as opposed to groundwater pumped by member service areas--cities, towns and private water companies. Many member service areas have their own renewable supplies. CAGR's consultant has pointed out:

"Thus, excess groundwater use (and a corresponding CAGR replenishment obligation) within Member Service Areas is generally low. On the other hand, water providers serving Member Lands often don't have access to their own renewable

water supplies, so most of the water they have historically delivered to their customers has been excess groundwater that creates a replenishment obligation for CAGR. "¹⁶⁹

The infrastructure necessary to deliver municipal water supplies on a reliable basis is vast. The collective infrastructure of the major cities in Central Arizona "consists of 30 water treatment plants, over 18,000 miles of water lines, 142,000 fire hydrants and more than one million water meters."¹⁷⁰ This infrastructure is also expensive. In 2019, the City of Phoenix approved a six percent increase in water rates for both 2019 and 2020. These increases will allow Phoenix to invest \$3.2 billion dollars in aging infrastructure and build the huge transmission mains and pump stations needed to move water to where it is needed.¹⁷¹

If groundwater is no longer physically available because it is too expensive to pump and treat or simply runs out, what infrastructure will be available to deliver alternative water supplies to member lands, and how will it be financed? This is not a hypothetical question. In 1977, before the Groundwater Management Act, Arizonans were annually consuming 2.5 million acre-feet more water than was replenished.¹⁷² As one Arizona water expert commented in the Arizona Law Review:

"At this rate, the Phoenix-area aquifers would be dry in 100 years. Does the present generation have a stewardship obligation to future generations not to exhaust a supply bequeathed by past generations?"¹⁷³

Relationship to AMA Management Goal

For the Phoenix and Tucson AMAs, the Groundwater Management Act set a management goal of "safe-yield" — balancing the amount of groundwater withdrawn with the amount of annual and natural recharge. In theory, CAGR is required to replenish the excess groundwater pumped by its members so that their use of groundwater would be consistent with this management goal. In practice, however, development on lands without a past history of water use is dramatically increasing groundwater use in the Phoenix AMA, making safe-yield harder to achieve. ADWR's draft management plan for the 4th management period for the Phoenix AMA states:

“A key assumption of the Code was that urban growth would largely occur on retired agricultural land, with the water no longer needed by farms being available to serve new houses and industries. In fact, much of the new growth is occurring on native desert land rather than on retired farmland. Development on desert land does not result in one type of demand replacing another; it results in a new demand being added to the existing demands, resulting in significantly greater demand than originally assumed.”¹⁷⁴

According to ADWR, the “achievement of safe-yield will require additional reductions in groundwater pumping and increased use of renewable supplies beyond current levels.”¹⁷⁵

The Role of ADWR in the Plan of Operation

CAWCD does not have authority to refuse to enroll new members, even in the face of rapidly escalating replenishment obligations. CAGR proponents often point to ADWR's oversight of the CAGR Plan of Operation to assure critics that CAGR's replenishment obligations will never get out of hand. After determining that a Plan is consistent with the management goal of an AMA, the Director of ADWR may later reverse that decision, but only after following a long process.

First, between years 2 and 8 of the Plan, the Director must find that there has been an unexpected increase in CAGR's replenishment obligations or an unexpected decrease in water available to CAGR to meet those obligations.¹⁷⁶ After that, the Director must require CAGR to submit a revised Plan of Operation, which CAGR has one year to do. Then the Director must hold a hearing on the revised Plan. If, following the hearing, the Director determines that the Plan is no longer consistent with the management goal of an AMA, CAGR has sixty days to satisfy the Director's concerns. If it fails to do so, the Director's earlier determination that the Plan is consistent with the management goal expires.

If the Plan is no longer consistent with the management goal of the AMA, all Designations in that AMA based on membership in CAGR expire, and no additional land may become a member of CAGR.¹⁷⁷

Is this enough protection? As discussed earlier, the excess groundwater replenishment obligation for member service areas is generally low. Thus, many member service areas may be able to obtain their designations again by proving they have renewable water supplies and don't need to rely on excess groundwater. For example, Tucson, Avondale, Gilbert, Scottsdale, Goodyear, Surprise, El Mirage, Oro Valley and the Chaparral City Water Company all have rights to renewable water supplies and have developed the necessary infrastructure to deliver that water, at least to portions of their service areas.¹⁷⁸

But what about subdivisions that are already member lands? Membership in CAGR occurs *before* any homes are built, meaning member land subdivisions are not affected by a subsequent determination that the Plan is no longer consistent with the management goal of an AMA. While ADWR may revoke a Certificate if an assured water supply no longer exists, it may not do so if *any* of the residential lots within the subdivision have been sold.¹⁷⁹ So, contrary to what one might expect in terms of water protection, even if a Plan has expired, homes within enrolled subdivisions in which at least one residential lot has been sold may continue to be built and sold. According to the 2015 Plan of Operation, in the Pinal AMA alone, nearly 90 percent of enrolled lots are currently unconstructed. That's 56,693 lots out of the 63,353 enrolled.¹⁸⁰ As of 2019, "there remains a large inventory of enrolled, but unconstructed lots" in CAGR.¹⁸¹ Because of the way current law is structured, a great number of these lots may still be developed, despite a determination that the Plan is no longer consistent with the management goal of the AMA in which the lots are located.

The 2015 Plan also projects that subdivisions representing an additional 119,000 new member land housing units will enroll during the Plan period.¹⁸² These subdivisions would also not be affected if they enrolled prior to the Director determining that the Plan is no longer consistent with the management goal and at least one residential lot within the subdivision has been sold. All of these enrolled but unconstructed lots could greatly increase the need for water in the affected areas.

With so much at stake, it is unclear what it means for a Plan to expire without another Plan to take its place.¹⁸³ Moreover, placing sole responsibility on the Director to stop continued enrollment puts the Director in the difficult position of seeming to stand in the way of growth. Such a decision will be met with stiff resistance from interested parties and will be politically difficult.

The State's Role in Growth

For a century, Arizona has regulated the use of water within its boundaries. In 1919, the state enacted laws governing the diversion and use of water from intrastate rivers and streams. Under these laws, waters flowing in streams and other natural channels "belong to the public" and may be appropriated and beneficially used in conformance with these laws.¹⁸⁴ The state has further decided that if two or more applications to appropriate surface water conflict and the supply is not sufficient for all applications, preference must be given first to domestic and municipal uses before any other uses.¹⁸⁵

In passing the Groundwater Management Act, the Legislature declared that, "it is in the best interest of the general economy and welfare of this state and its citizens that the Legislature evoke its policy power to prescribe which uses of groundwater are most beneficial and economically effective."¹⁸⁶

In upholding the constitutionality of the Groundwater Management Act, the Arizona Supreme Court held that landowners do not own the groundwater beneath their lands prior to capturing and withdrawing it from the common supply. The Court further found "that the overdraft of groundwater in this state is a serious problem which has no chance of correcting itself, and that it is necessary for comprehensive legislation to both limit groundwater use and allocate its use among competing interests."¹⁸⁷

These rulings establish that the state has clear responsibility and authority to regulate groundwater and intrastate surface water, even if it results in a diminution of property value. As the Arizona Supreme Court noted, "the United States Supreme Court has on numerous occasions upheld under the state's police power regulations of land use which have virtually destroyed private interests."¹⁸⁸

When ADWR proposed assured water supply rules in 1988, developers and municipal water providers without access to surface water complained that the rules would result in a reduction of the number of houses that could be built. Lawsuits would likely have ensued if these rules had become effective. Yet, under the state's authority to regulate water use for the general economic

welfare of the state and its citizens, it is doubtful a court challenge to the rules would have been successful.

Growing Smarter

Many believe Arizona should do more to "control" growth. The state's effort to manage growth in 1998 is instructive. That year a coalition of environmental groups launched an initiative drive to put before the voters a proposition requiring strict growth measures, including mandating that every city and county adopt an urban growth boundary to limit the expansion of development and city and county services.¹⁸⁹ In a direct attack on the proposed initiative, Governor Jane Hull and the Legislature developed a rival law, "The Growing Smarter Act."¹⁹⁰

The Growing Smarter Act stated that its reforms were in conflict with the "Citizens' Growth Management Act" being pushed by the environmental community and called for the defeat of the initiative.¹⁹¹ To encourage that defeat, the legislature created Proposition 303, known as the Preserve Arizona Initiative, giving \$20 million a year in state funds to purchase open space from the State Land Department *if* the citizens' initiative failed.¹⁹² In the end, the environmental community was unable to gather enough signatures to put its initiative on the ballot and the Growing Smarter Act became law.

According to the Act's statement of intent:

"The Growing Smarter Act consists of comprehensive municipal, county and state land department land use planning and zoning reforms, provides for the acquisition and preservation of open spaces and establishes a program for continuing study and consideration of pertinent issues relating to public land use policies, all in order to further the best interests of our citizens by protecting our natural heritage and wisely managing the growth of our communities."¹⁹³

But the statement of intent also makes clear that the Act must not be construed to "allow a taking of private property," or to allow a city or county to downzone or rezone property to a more intensive use.¹⁹⁴ The Act's drafters were giving the courts a clear message that the Legislature would not tolerate such efforts.

Little has been written about whether the Act has been successful in wisely managing the growth of Arizona communities. One survey by the Sonoran Institute found that while cities and counties were adopting more holistic plans for growth, some elements of the Act's requirements were chronically ignored or inadequately addressed, including projected future demand for water and how that demand will be met.¹⁹⁵

But should the state facilitate water for growth? In 2010, the Arizona Legislature established the Water Resources Development Commission, tasking it with assessing Arizona's demand for water and the supplies needed to meet this demand for the next 25, 50 and 100 years.¹⁹⁶ The Commission found that there will be significant "unmet" demands in all parts of Arizona in the future and recommended that the Legislature authorize the formation of regional water augmentation authorities to help local communities and water users develop regional water solutions. It also recommended that the state's Water Supply Development Revolving Fund be available to augmentation authorities for low-interest loans.¹⁹⁷

These recommendations were met with stout opposition from those who claimed they were a conspiracy of urban areas to take water from Yuma area farmers, and legislation to implement the recommendations never made it out of committee. That experience demonstrates the difficulty of facilitating growth in one part of the state if other areas feel threatened.

More recently, Governor Ducey established the Governor's Water Augmentation, Innovation and Conservation Council to investigate strategies for long-term augmentation, innovation and conservation for sustainable water supplies for Arizona.¹⁹⁸ It remains to be seen what recommendations will be forthcoming from this Council and whether the Legislature will take action on them.

The Future: A Tale of Two Cities¹⁹⁹

The heart of the Salt River Valley was a natural location for early Arizona settlers. The City of Phoenix was incorporated in 1881 with a population of approximately 2,500,²⁰⁰ and officially began delivering tap water in 1907 when it purchased the Phoenix Water Company. By 1920, Phoenix had turned its focus to surface water, constructing a redwood pipeline to bring Verde River water to its customers. Over time, the City grew organically as agricultural lands within the City urbanized. These lands have rights to water from the Salt and Verde Rivers, and the City contracted with the Salt River Project to receive, treat and deliver this water. Phoenix later signed a subcontract with the federal government for 122,204 acre-feet of CAP municipal and industrial priority water each year. As of March 2019, Phoenix had approximately 264,000 acre-feet of long-term storage credits earned by storing treated wastewater and unused CAP water underground.²⁰¹

Today, with a population of more than 1.6 million,²⁰² spread across a service area of over 540 square miles,²⁰³ Phoenix is one of the largest water utilities in the country. Its infrastructure, which includes eight treatment plants and 7,000 miles of water lines, would cost about \$15 billion to replace.²⁰⁴ Phoenix has long been designated as having an assured water supply based on its renewable water supplies. Under its current designation, the City's total 2025 water supplies are over 510,000 acre-feet.²⁰⁵

In contrast to the City of Phoenix, the City of Buckeye's municipal planning area covers 642 square miles, including 200 square miles that are still under the jurisdiction of Maricopa County.²⁰⁶ Just 19 years ago, Buckeye was a small farming community with a population of only 6,500. By 2016, the City's municipal planning area had grown to about 73,000 persons, and the Maricopa Association of Governments projects that Buckeye could reach a population of over 310,000 by 2040, a 326 percent increase.²⁰⁷ There are 27 approved master planned communities within the planning area-- 26 of which were approved by the City--that, at build out, are projected to add an additional 800,000 residents.

All of Buckeye's potable water needs are currently met with groundwater. Buckeye does not have a Designation of Assured Water Supply, although it applied for a Designation in 2008. In 2017, the City created an integrated water master plan to identify the actions it could take to strengthen its water resources portfolio.²⁰⁸ That water master plan contains several important considerations and recommendations, including:

- In order to obtain a Designation, the City will need to become a member service area of CAGR.
- At a population of 246,000, Buckeye's estimated water demand would be 36,459 acre-feet per year.
- Even if Buckeye joins CAGR, it is unlikely that CAGR will be able to acquire the replenishment water to meet the City's projected water demand at build out. "Current CAGR replenishment agreements with other MSAs [member service areas] are on the order to 10,000 - 20,000 acre-feet per year, which will support approximately 20 percent of Buckeye's projected ultimate population [of approximately one million people]."²⁰⁹

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- CAGR's replenishment costs by 2031 would be between \$1,450 and \$2,900 per acre-foot per year. By 2041, those costs would be between \$2,360 and \$7,550 per acre-foot per year. At these rates, the annual CAGR assessment to the City is estimated to be \$47.2 million by 2042.
- The City should be prepared to recover these costs through water rates before a designation is finalized.

The water master plan discusses Buckeye's options to acquire its own renewable supplies but notes that these options are few and expensive. They include:

- CAP water. The City could sign a subcontract for its proposed allocation of CAP NIA water in the amount of 2,786 acre-feet per year. The City could also lease water from an Indian community. The plan notes that the infrastructure to transport, treat and deliver CAP water to Buckeye would be significant and that the infrastructure would sit idle when CAP NIA water allocations are reduced due to shortage. Unless the City obtains a Designation, it would not gain long-term credits for storing CAP water underground.
- Groundwater from the Harquahala Irrigation Non-Expansion Area outside of the Phoenix AMA. The costs for importing this water would be significant.
- Groundwater extinguishment credits. These credits are significantly less expensive than CAGR replenishment assessments, but they may be used only once and are not a long-term solution.
- Long-term storage credits based on CAP water stored underground by other municipal water providers. Without a Designation, the City would not be able to acquire and use these credits.

The water master plan demonstrates the obstacles Buckeye faces to meet growth demands without sufficient renewable water supplies that belong to the City. The plan shows a path for Buckeye to follow to meet some of its projected water demands, but it doesn't discuss how the City could ever provide water service to over one million people. Yet, there are 27 large master planned communities within the City's municipal planning area. Without access to renewable water supplies, subdivisions will enroll in CAGR and, if ADWR determines that groundwater is physically

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available, will be allowed to sell lots. In that event, the City would still be required to provide water service or abdicate this role to a private water company.

Some might think it unfair to compare these two cities--one established over a century ago and one in its infant stages. Yet Buckeye is the fastest growing city in the United States according to population estimates of the U.S. Census Bureau.²¹⁰ And the Tale of Two Cities comparison demonstrates a key consideration in any discussion about growth and water that goes back to the Arizona Groundwater Management Study Commission: whether the state should manage the pattern and location of urban growth.

Findings

1. In 1988, the Arizona Department of Water Resources (ADWR) proposed Assured Water Supply rules that would have limited residential growth in areas of the AMAs that lack access to renewable water supplies.
2. In 1993, in response to these proposed rules, the Arizona Legislature created a path to show an assured water based on groundwater that would be replenished later. The replenishment responsibility was given to the Central Arizona Water Conservation District (CAWCD), which operates the Central Arizona Project (CAP), and has become known as the Central Arizona Groundwater Replenishment District (CAGR).
3. CAGR has achieved the Legislature's intended purpose of allowing an assured water supply to be demonstrated based on groundwater and membership in CAGR. Membership is open to subdivisions, known as member lands, and to municipal water providers, known as member service areas. Membership allows an applicant for a Certificate or Designation to meet the Assured Water Supply requirement that its proposed use of groundwater is consistent with the management goal of the AMA. Members pay CAGR to replenish the amount of "excess groundwater" they pump and use, which is most of the groundwater pumped for member lands.
4. Membership in CAGR has grown well beyond expectations -- from 184 member land homes and 3 member services areas in 1995, to 263,707 member land homes and 23 member service areas in 2013. CAGR's 2015 Plan of Operation estimates that another 119,000 member land homes will enroll by the end of 2024.
5. Many member service areas have renewable water supplies and can avoid pumping excess groundwater, so the majority of CAGR's replenishment obligations -- and most of its revenues -- are based on excess groundwater pumped for member land subdivisions.
6. CAGR cannot deny membership, which is automatic for subdivisions whose developers agree to a property lien to guarantee the payment of CAGR assessments. Because of this open-ended model, as long as ADWR determines that groundwater is "physically available"

for new subdivisions that satisfy the other requirements of obtaining a Certificate, CAGR's replenishment obligations will continue to grow.

7. The 2015 Plan of Operation projects CAGR's future replenishment obligations for current members and those expected to enroll in CAGR by the end of 2024. These projections do not include most of the massive urban growth projected for the West Valley of Maricopa County--a population of two million by 2050--that will most likely rely on groundwater (if it is physically available) that would have to be replenished by CAGR.
8. When CAGR was established, it was assumed that there would be sufficient excess CAP water available to meet CAGR's replenishment obligations at least through 2046. That assumption proved to be incorrect. CAGR grew well beyond expectations, and CAP long-term contractors and subcontractors used more of their entitlements sooner than expected, reducing the amount of excess CAP water.
9. Impending shortages of Colorado River water supplies, coupled with greater use of CAP water by long-term contractors and subcontractors with permanent rights to this water, will reduce even further the amount of CAP water available to meet CAGR's replenishment obligations.
10. CAGR's efforts to acquire rights to use non-CAP Colorado River water will continue to be met with stiff resistance from communities along the Colorado River and some CAWCD Board members.
11. CAGR will need to find other innovative solutions, such as the GRIC/GRWS deal, to acquire the necessary water supplies to fulfill its replenishment obligations. In finding these solutions, CAGR should ensure that the acquired water can physically and legally be used for replenishment in the areas where most of its member lands are located.
12. Under ADWR's Assured Water Supply rules, groundwater is physically available for 100 years if it will be pumped from depths that do not exceed 1,000 feet below the land surface in the Phoenix and Tucson AMAs and 1,100 feet below land surface in the Pinal AMA. Pumping groundwater from such great depths is untested and contrary to the Legislature's

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finding in passing the Groundwater Management Act that withdrawal of groundwater in excess of safe annual yield "is threatening to do substantial injury to the general economy and welfare of this state and its citizens."

13. Groundwater quality at greater depths is seriously compromised and groundwater "mining" creates collateral damage, such as land subsidence, which in turn destroys the ability of aquifers to store water, making replenishment of these aquifers impossible.
14. If CAGRDR replenishment does not take place near the location of groundwater withdrawals for CAGRDR members, the replenished water will not mitigate the local impacts of groundwater pumping or recharge the aquifers that those CAGRDR members count on to supply groundwater to them indefinitely.
15. The majority of CAGRDR's costs are paid for with annual replenishment assessments charged against member lands for their use of excess groundwater. Aggressive increases of these assessments to pay for higher replenishment costs have led homeowners and homeowner associations on member lands to look for other water supplies rather than pump excess groundwater, putting CAGRDR's funding structure at risk.
16. Subdivisions that are already enrolled in CAGRDR would not be affected by a future decision that a Plan of Operation is no longer consistent with the management goal of an AMA as long as one residential lot in the subdivision has been sold. Despite a lack of consistency with the management goal, homes within these subdivisions may continue to be built and sold even though the Plan has expired.
17. Concerns remain about whether CAWCD has an inherent conflict of interest in managing the CAGRDR, which may ultimately end up competing for water supplies and canal capacity with CAP contractors. This places the Board of Directors in a difficult position when making decisions that may affect both CAGRDR members and CAP water users.
18. Developing on native desert land rather than on retired farmland does not result in a reduction of groundwater use and places significantly greater demands on the groundwater

supplies of an AMA, contrary to the management goals of the Groundwater Management Act.

19. Requiring ADWR to decide that a Plan of Operation is no longer consistent with the management goals of the AMAs is not an effective solution to over-reliance on CAGR. Such a decision will be politically difficult, will not stop the sale of previously enrolled but unconstructed lots, and will not address CAGR's continuing replenishment obligations for its current members.

Recommendations

1. The CAGR and ADWR should be required to undertake a more rigorous examination of how much water for replenishment is realistically available.
2. ADWR should decrease the depth from which groundwater may be withdrawn for purposes of showing that it is "physically available" to prevent the collateral damage caused by draining aquifers, to protect the quality and availability of groundwater supplies for the future and to ensure against the very real possibility that groundwater in some areas will run out.
3. The CAGR should be required to replenish water in the same locations where groundwater is pumped for its members, and should be required to have the necessary facilities for such replenishment in place before new members in these locations may enroll, or as a strict prerequisite for the sale of lots in those areas.
4. There should be a moratorium on new and extended Analyses of Assured Water Supply, which are issued for master planned communities, until ADWR determines whether to discontinue the practice of issuing and extending these Analyses, which fuel the growth of CAGR.
5. A comprehensive review of the CAGR's financing mechanisms should be conducted to avoid a "financial catastrophe" (as warned in the CAGR's own consultant's report) and to protect homeowners on CAGR member lands from skyrocketing costs.

6. The CAGR should be authorized to deny membership if it runs into trouble acquiring water for replenishment or in locating and constructing replenishment facilities.
7. Given the extraordinary growth of the CAGR and increasing competition for water supplies, Arizona must ensure that procedures are in place to avoid even the appearance of a conflict of interest between CAWCD's CAP duties and its CAGR responsibilities.
8. If the Director of ADWR determines that a Plan of Operation is no longer consistent with the management goal of an Active Management Area (AMA), there should be a suspension of building and selling lots in enrolled subdivisions, until it is clear that CAGR will be able to acquire and replenish water to replace the groundwater pumped for those lots.

¹ MICHAEL F. WENDLAND, *THE ARIZONA PROJECT: HOW A TEAM OF INVESTIGATIVE REPORTERS GOT REVENGE ON DEADLINE 1* (1977).

² *Id.* at 4.

³ Robert Lindsey, *Swindlers in Arizona Said to Make Millions*, N.Y. TIMES, May 21, 1979, at A1.

⁴ Wendland, *supra* note 1, at 5.

⁵ Ariz. Rev. Stat. § 45-108 (2014). (Enacted as 1973 Ariz. Sess. Laws, 31st Legislature, 1st Regular Sess., Chapter 94, Section 3, 583-84.) The statute was originally numbered Ariz. Rev. Stat. § 45-513 and renumbered in 1980 as § 45-108.

⁶ The Arizona Water Commission was the predecessor of the ADWR, which was established in 1980.

⁷ 1977 Ariz. Sess. Laws, 33rd Legislature, 1st Regular Sess., Chapter 29, Section 7, 80-82.

⁸ Groundwater Management Study Commission, *Draft Report of Tentative Recommendations*, V-16 (Ariz. 1979).

⁹ *Id.* at V-16.

¹⁰ *Id.* at V-17.

¹¹ 1980 Ariz. Sess. Laws, 34th Legislature, 4th Special Sess., Chapter 1, § 86 (Codified as Ariz. Rev. Stat. § 45-401. et seq.)

¹² Ariz. Rev. Stat. § 45-411.

¹³ These terms are defined by the state real estate code in Ariz. Rev. Stat. § 32-2101. Most developments seeking an assured water supply are subdivided lands. Subdivided lands means lands divided into six or more lots or parcels for sale or lease.

¹⁴ Ariz. Rev. Stat. § 45-576.

¹⁵ Ariz. Admin. Code Title 12, Chapter 15, Article 7 (2019). Originally effective February 7, 1995, these rules were amended effective September 12, 2006.

¹⁶ *Id.* R12-15-704.

¹⁷ *Id.* R12-15-703.

¹⁸ ARIZ. DEP'T OF WATER RESOURCES, ASSURED AND ADEQUATE WATER SUPPLY, <https://new.azwater.gov/aaws/frequently-asked-questions> (last visited Oct. 8, 2019).

¹⁹ Ariz. Admin. Code R12-15-703.

²⁰ *Id.* R12-15-709.

²¹ *Id.* R12-15-711.

²² A "service area" is the area of land served by the municipal provider plus additions to that area that contain an operating water distribution system. Ariz. Rev. Stat. § 45-402(31). A service area may expand as the operating distribution system expands, consistent with the Assured Water Supply requirements.

²³ Ariz. Admin. Code R12-15-720.

²⁴ *Id.* R12-15-711.

²⁵ Warren Tenney, *Assured Water Supply Program: Protecting Homebuyers while Ensuring Responsible Growth*, AMWUA BLOG (Apr. 1, 2019), <http://www.amwua.org/blog/assured-water-supply-program-protecting-homebuyers-while-ensuring-responsible-growth>.

²⁶ City of Chandler, Arizona, *Sustainability*, <https://www.chandleraz.gov/government/city-managers-office/sustainability> (last visited Oct. 8, 2019).

²⁷ Ariz. Rev. Stat. § 45-401.

²⁸ *Id.* § 45-562.

²⁹ *Id.* § 45-561.

³⁰ CENTRAL ARIZ. WATER CONSERVATION DIST., CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT 2015 PLAN OF OPERATION, I-2 (2014), <http://www.cagrd.com/documents/plan-of-operations/2015-CAGR-Plan-of-Operation.pdf> [hereinafter 2015 PLAN OF OPERATION].

³¹ Robert Jerome Glennon, *'Because That's Where the Water Is': Retiring Current Water Uses to Achieve the Safe-Yield Objective of the Arizona Groundwater Management Act*, 33 ARIZ.L. REV. 89, 106 (1991).

³² *Id.* at 106; see also JUSTIN FERRIS, SHARON B. MEGDAL & SUSANNA EDEN, AN INTRODUCTION TO THE CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT 3 (2006), <https://cals.arizona.edu/arec/sites/cals.arizona.edu/arec/files/publications/2006-03ferrismegdaleden.pdf>.

³³ 2015 PLAN OF OPERATION, *supra* note 30, at I-3.

³⁴ *Id.* at I-3; 1991 Ariz. Sess. Laws, 40th Legislature, 1st Regular Sess., Chapter 211.

³⁵ Lori Baker & Susan Felt, *Water Law Undergoes Change*, ARIZ. REPUBLIC, Northwest Community section, May 7, 1993, at 1.

³⁶ 2015 PLAN OF OPERATION, *supra* note 30, at 1-3.

³⁷ *Id.* at 1-3.; 1993 Ariz. Sess. Laws, 41st Legislature, 1st Regular Sess., Chapter 200. A groundwater replenishment district was never established but the statutes have not been repealed and are codified as Chapter 27 of Title 48, Arizona Revised Statutes.

³⁸ Baker & Felt, *Water Law Undergoes Change*, *supra* note 35.

³⁹ *Id.*

⁴⁰ ADWR was required to adopt the rules by January 1, 1995. 1993 Ariz. Sess. Laws, 41st Legislature, 1st Regular Sess. Chapter 200.

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⁴² Ariz. Rev. Stat. § 48-3780.

⁴³ *Id.* § 48-3774.

⁴⁴ *Id.* § 48-3774.

⁴⁵ *Id.* § 48-3780.

⁴⁶ *Id.* § 48-3771.

⁴⁷ *Id.* § 48-3701.

⁴⁸ *Id.* § 48-3771.

⁴⁹ *Id.* § 45-576.02.

⁵⁰ *Id.* § 45-576.03.

⁵¹ *Id.* § 45-576.06.

⁵² CENTRAL ARIZ. WATER CONSERVATION DIST., CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT PLAN OF OPERATION (JUNE 1, 1994; revised Feb. 7, 1995) 22, http://www.cagr.com/documents/plan-of-operations/CAGR-1994-Plan_of_Operation.pdf [hereinafter 1994 PLAN OF OPERATION].

⁵³ *Id.* at 34.

⁵⁴ CENTRAL ARIZ. WATER CONSERVATION DIST., CAGR INFORMATION AND POLICY MANUAL, Tab 4L [hereinafter CAGR INFORMATION AND POLICY MANUAL] (on file with authors).

⁵⁵ *Id.* at Tab 4K.

⁵⁶ CENTRAL ARIZ. WATER CONSERVATION DIST., CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT PLAN OF OPERATION, SUBMITTED DRAFT, 14 (Nov. 8, 2004), <http://www.cagr.com/documents/plan-of-operations/Plan-of-Operation.pdf> [hereinafter 2004 PLAN OF OPERATION].

⁵⁷ *Id.* at 33.

⁵⁸ *Id.* at 35.

⁵⁹ *Id.* at 41.

⁶⁰ *Id.*

⁶¹ *Id.* at 37.

⁶² *Id.* at 47.

⁶³ 2015 PLAN OF OPERATION, *supra* note 30, at 2-7 & 2-9.

⁶⁴ *Id.* at 3-17 ("Overall, 119,000 new ML housing units are projected to enroll during the Plan period.")

⁶⁵ *Id.* at 4-1.

⁶⁶ *Id.* at 3-17.

⁶⁷ *Id.* at 3-14.

⁶⁸ *Id.* at 3-1.

⁶⁹ *Id.* at 4-6.

⁷⁰ *Id.* at 4-12 & 4-14.

⁷¹ *Id.* at 4-14.

⁷² Ferris, Megdal & Eden, *supra* note 32, at 9.

⁷³ Ariz. Rev. Stat. § 45-576.02.

⁷⁴ 2004 PLAN OF OPERATION, *supra* note 56, at 49.

⁷⁵ *Id.* at 49.

⁷⁶ 2015 PLAN OF OPERATION, *supra* note 30, at 4-2.

⁷⁷ See *id.* at 4-5. The Plan does specify that CAGR will need to acquire approximately 50,370 AF per year of additional water supplies over the next 20 years to meet its 2034 replenishment obligation of 85,900 AF per year.

⁷⁸ *Id.* at 4-14.

⁷⁹ Letter of Thomas Buschatke, Director, Ariz. Dep't of Water Resources, to Hon. Ryan Zinke, Secretary, U.S. Dep't of the Interior 2 (May 24, 2018), https://new.azwater.gov/sites/default/files/2018-05-24_Ltr-to-Secretary-Zinke-with-CAWCD-Quartzsite-Evaluation.pdf (last visited Oct. 8, 2019).

⁸⁰ Tony Davis, *Mohave County fighting CAP proposal to buy, move water to Tucson, Phoenix suburbs*, ARIZ. DAILY STAR (October 5, 2017), https://tucson.com/news/local/mohave-county-fighting-cap-proposal-to-buy-move-water-to/article_f3fdf3de-49d3-5a6e-8660-5c297ebfa965.html.

⁸¹ *Id.*

⁸² CENTRAL ARIZ. WATER CONSERVATION DIST., CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT 2017 ANNUAL OPERATIONS REPORT 15 (2018), <https://www.cagr.com/documents/annual-reports/CAGR-2017-Annual-Operations-Report.pdf>.

⁸³ Central Ariz. Water Conservation Dist., *Regular Meeting of the Board of Directors 4-5* (November 1, 2018), <https://www.cap-az.com/documents/meetings/2018-11-01/1722-SIGNED-110118-Meeting-Minutes.pdf>; see also Central Ariz. Water Conservation Dist., Board Meeting Packet, 78-97 (November 1, 2018), <https://www.cap-az.com/documents/meetings/2018-11-01/1722-110118-WEB-Final-Board-Packet-3.pdf>.

⁸⁴ Ariz. Rev. Stat. § 45-832.01.

⁸⁵ Central Ariz. Water Conservation Dist., Board Meeting Packet, *supra* note 83, at 95 (Comments of Rob Anderson on behalf of Homebuilders Association of Central Arizona and Southern Arizona Homebuilders).

⁸⁶ Letter of Maureen Rose George, General Counsel, Mohave County Water Authority to Sharon M. Scantlebury, Docket Supervisor, Ariz. Dep't of Water Resources (Mar. 24, 2015), http://www.cagr.com/documents/plan-of-operations/public-comments/Mohave_Coutny_Water_Authority.pdf.

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⁸⁸ Central Arizona Groundwater Replenishment District's Plan of Operation for the Phoenix Active Management Area Submitted on December 29, 2014, Decision and Order Determining that the Plan of Operation is Consistent with Achieving the Management Goal of the Phoenix Active Management Area 10 (Ariz. Dep't of Water Resources, Aug. 5,

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2015), <http://www.azwater.gov/azdwr/WaterManagement/documents/201508-05CAGR2015PlanofOperationDecisionandOrderforthePhoenixAMA.pdf>.

⁸⁹ *Id.* at 11.

⁹⁰ ARIZ. DEP'T OF WATER RESOURCES & CENTRAL ARIZ. WATER CONSERVATION DISTRICT, JOINT BRIEFING: LOWER BASIN DROUGHT CONTINGENCY PLAN 27 (June 28, 2018), <http://www.cap-az.com/documents/departments/planning/colorado-river-programs/LBDCP-Master-Presentation.pdf>

⁹¹ *Id.* at 31.

⁹² CAROLLO ENGINEERS, LONG TERM WATER AUGMENTATION OPTIONS FOR ARIZONA 5-7 (Aug. 2019), <https://new.azwater.gov/sites/default/files/Long-Term%20Water%20Augmentation%20Options%20final.pdf>.

⁹³ Ariz. Admin Code R12-15-716.

⁹⁴ Chris Avery, Carla Consoli, Robert Glennon & Sharon Megdal, *Good Intentions, Unintended Consequences: The Central Arizona Groundwater Replenishment District*, 49 ARIZ. L. REV. 339 (2007).

⁹⁵ *Id.* at 352.

⁹⁶ ARIZ. DEP'T OF WATER RESOURCES, 2019 PINAL MODEL AND 100-YEAR ASSURED WATER SUPPLY PROJECTION TECHNICAL MEMORANDUM (October 11, 2019), http://infoshare.azwater.gov/docushare/dsweb/Get/Document-11793/2019_Pinal_Model_and_100-Year_AWS_Projection-Technical_Memorandum.pdf.

⁹⁷ ARIZ. DEP'T OF WATER RESOURCES, ADWR ANSWERS TO REPRESENTATIVE COOK'S QUESTIONS (October 8, 2019) https://new.azwater.gov/sites/default/files/20191008_ADWR_Answers_to_Representative_Cook_Questions.pdf

⁹⁸ Dustin Gardner, "A recipe for disaster": Pinal County might not have enough water for 139,000 planned homes, ARIZ. REPUBLIC, (Feb. 28, 2019; updated March 5, 2019), <https://www.azcentral.com/story/news/local/arizona-environment/2019/02/28/drought-contingency-plan-pinal-county-colorado-river-lake-mead-arizona-water-shortage-groundwater/2915799002/>.

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¹⁰⁴ See Letter from Linda Cheney, *supra* note 101.

¹⁰⁵ See Letter of Stephen D. Noel, Pres., Southwest Ground-water Consultants, Inc., to Doug Dunham, Office of Assured & Adequate Water Supply, Ariz. Dep't of Water Resources (Nov. 16, 2006), <https://infoshare.azwater.gov/docushare/dsweb/Get/AAWSDoc-2132/266.pdf>

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¹¹⁰ Tony Davis, *One family makes sense of losing its Colorado River water*, HIGH COUNTRY NEWS (Feb. 21, 2019) <https://www.motherjones.com/environment/2019/02/this-is-how-one-family-tries-to-makes-sense-of-losing-its-colorado-river-water/>.

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¹¹³ Ariz. Admin. Code R12-15-722.

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¹²² KATHLEEN FERRIS ET AL., ARIZONA TOWN HALL: KEEPING ARIZONA'S WATER GLASS FULL 12 (Nov. 2015).

¹²³ *Id.*

¹²⁴ Ariz. Rev. Stat. § 48-3771. In the Phoenix AMA, CAGR must replenish "to the extent feasible" in the west and east portions of the AMA in proportion to the groundwater withdrawn in each portion. Ariz. Rev. Stat. § 48-3772.

¹²⁵ 2015 PLAN OF OPERATION, *supra* note 30, at 6-1.

¹²⁶ *Id.* at 6-3.

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¹²⁸ ARIZ. DEP'T OF WATER RESOURCES, DRAFT PHOENIX ACTIVE MANAGEMENT AREA FOURTH MANAGEMENT PLAN 2-6 (Sept. 19, 2019). A sub-basin encloses "a relatively, hydrologically distinct body of groundwater within a groundwater basin." Ariz. Rev. Stat. § 45-402.

¹²⁹ *Id.* at 11-5.

¹³⁰ CAROLLO ENGINEERS, CITY OF BUCKEYE: INTEGRATED WATER MASTER PLAN 2017 at 2-6 (June 2017) <https://www.buckeyeaz.gov/Home/ShowDocument?id=2340>.

¹³¹ Chris Avery, Carla Consoli, Robert Glennon & Sharon Megdal, *Good Intentions, Unintended Consequences: The Central Arizona Groundwater Replenishment District*, *supra* note 94, at 351.

¹³² *Id.* at 352.

¹³³ Ariz. Rev. Stat. § 48-3771 requires CAGR to replenish in an amount equal to the obligation created by the member land or member service area. If no excess groundwater is pumped, no replenishment obligation is incurred.

¹³⁴ Ariz. Rev. Stat. § 48-3713.

¹³⁵ Ariz. Rev. Stat. § 48-3772.

¹³⁶ Central Ariz. Water Conservation Dist. Board, *CAGR Enrollment Fee and Activation Fee Policy*, (Nov. 5, 2015), <https://www.cap-az.com/board/policies?view=download&fileId=83>.

¹³⁷ Ariz. Rev. Stat. § 48-3772.

¹³⁸ Ariz. Rev. Stat. § 48-3779.

¹³⁹ Ariz. Rev. Stat. §§ 48-3778 & 48-3781.

¹⁴⁰ 2015 PLAN OF OPERATION, *supra* note 30, at 7-5.

¹⁴¹ Ariz. Rev. Stat. § 48-3781.

¹⁴² CAGR INFORMATION AND POLICY MANUAL, *supra* note 54, at Tab 5W.

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ Central Ariz. Water Conservation Dist., *Central Arizona Groundwater Replenishment District Final 2013/14 – 2014/15 Rate Schedule* (June 6, 2013) <https://www.cagr.com/documents/rates-fees/Approved%202014-2015%20CAGR%20Water%20Rate%20Schedule.pdf>. The Board has established four rate components: (1) Water and Replenishment based on the cost to purchase and replenish in each AMA; (2) Administrative to cover administrative costs; (3) Infrastructure and Water Rights based on the costs to secure water rights and develop replenishment infrastructure; and (4) Replenishment Reserve based on requirement to maintain a replenishment reserve for each AMA. 2015 PLAN OF OPERATION, *supra* note 30, at 7-4 & 7-5.

¹⁴⁶ 2004 PLAN OF OPERATION, *supra* note 56, at 50.

¹⁴⁷ Central Ariz. Water Conservation Dist., Board of Directors Action Brief (Discussion and Consideration of Action to Approve a Water Supply Acquisition and Association Agreements between CAGR, Gila River Indian Community (GRIC) and Gila River Water Storage (GRWS)) (Nov. 1, 2018), <http://www.cap-az.com/documents/meetings/2018-11-01/1722-110118-WEB-Final-Board-Packet-3.pdf>.

¹⁴⁸ Central Ariz. Water Conservation Dist., *Central Arizona Groundwater Replenishment District Final 2018/19 – 2023/24 Rate Schedule* (June 7, 2018), <http://www.cap-az.com/documents/departments/finance/Final-2019-2024-CAGR-Water-Rate-Schedule-06-07-18.pdf>.

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¹⁵⁰ Ariz. Admin. Code R12-15-723.

¹⁵¹ Ariz. Dep't of Water Resources, 2019 AMA Unpledged Extinguishment Credits (Apr. 16, 2019) (on file with the authors).

¹⁵² Richard H. Dyer, *Groundwater credits policy revised by Queen Creek Town Council*, QUEEN CREEK INDEP. (Mar. 28, 2019), <https://queencreekindependent.com/news/groundwater-credits-policy-revised-by-queen-creek-town-council/>. As of April 16, 2019, the Town of Queen Creek has acquired 175,471 AF of extinguishment credits.

¹⁵³ City of El Mirage, *Press Release: City of El Mirage Solves Water Problem!* (Sept. 18, 2014) <http://www.cityofelmirage.org/DocumentCenter/View/11792/WaterPressreleaseSeptember2014?bidId>.

¹⁵⁴ Town of Florence, Council Meeting Minutes 8-9 (Sept. 17, 2018), <http://www.florenceaz.gov/wp-content/uploads/2018/08/September-17-2018-Minutes.pdf>.

¹⁵⁵ Ariz. Dep't of Water Resources, Notice of Final Rulemaking (filed Dec. 11, 2018), <https://new.azwater.gov/sites/default/files/SOS%20Received%20NFRM.pdf>.

¹⁵⁶ Ariz. Rev. Stat. Title 45, Chapter 3.1.

¹⁵⁷ THIRD-PARTY LTSC REPORT, *supra* note 115, at 16.

¹⁵⁸ *Id.* at 13.

¹⁵⁹ *Id.* at 16.

¹⁶⁰ *Id.* at 22-23.

¹⁶¹ Central Ariz. Water Conservation Dist., *Central Arizona Groundwater Replenishment District Final 2013/14 – 2014/15 Rate Schedule*, *supra* note 145.

¹⁶² Central Ariz. Water Conservation Dist., *Central Arizona Groundwater Replenishment District Final 2018/19 – 2023/24 Rate Schedule*, *supra* note 148.

¹⁶³ Gary Given, Discussion on CAGR Activation Fee Schedule (2020/2021 – 2023/2024) 1 (Mar. 21, 2019), <http://www.cap-az.com/documents/meetings/2019-03-21/1741-032119-WEB-Final-Packet-CAGR.pdf>

¹⁶⁴ Central Ariz. Water Conservation Dist., Minutes of CAGR and Underground Storage Committee 1 (Mar. 21, 2019), <http://www.cap-az.com/documents/meetings/2019-04-18/1752-041819-WEB-Final-Packet-3-CAGR.pdf>

¹⁶⁵ 2004 PLAN OF OPERATION, *supra* note 56, at 70; 2015 PLAN OF OPERATION, *supra* note 30, at 7-6.

¹⁶⁶ Minutes of House Natural Resources, Agriculture and Rural Development Committee, (Mar. 24, 1993) (on file with the authors).

¹⁶⁷ *CAGR Information and Policy Manual*, *supra* note 54, at Tab 7E.

¹⁶⁸ ELLIOTT D. POLLACK & CO. & CLIFF NEAL CONSULTING, LLC, THIRD-PARTY LONG TERM STORAGE CREDIT SALES TO MEMBER LANDS OF CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT – IMPACT REPORT, *supra* note 115, at i.

¹⁶⁹ *Id.* at 9.

¹⁷⁰ Warren Tenney, *Infrastructure: Building Beyond Tomorrow*, AMWUA BLOG (MAY 13, 2019), <http://www.amwua.org/blog/infrastructure-building-beyond-tomorrow>.

¹⁷¹ City of Phoenix, *Water and Sewer Rates and Charges*, <https://www.phoenix.gov/waterservices/customerservices/rateinfo> (last visited October 15, 2019)

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¹⁷³ Robert Jerome Glennon, *'Because That's Where the Water Is': Retiring Current Water Uses to Achieve the Safe-Yield Objective of the Arizona Groundwater Management Act*, *supra* note 31, at 92.

¹⁷⁴ ARIZ. DEP'T OF WATER RESOURCES, DRAFT PHOENIX ACTIVE MANAGEMENT AREA FOURTH MANAGEMENT PLAN, *supra* note 128, at 11-6-11-7.

¹⁷⁵ *Id.* at 11-1.

¹⁷⁶ Ariz. Rev. Stat. § 45-576.03.

¹⁷⁷ Ariz. Rev. Stat. § 45-576.06.

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¹⁸⁰ 2015 PLAN OF OPERATION, *supra* note 30, at 3-1.

¹⁸¹ Ken Seasholes, Report on CAGR Mid-Plan Review: Enrollment & Obligation (Part 1) 7 (May 16, 2019), <http://www.cap-az.com/documents/meetings/2019-05-16/1757-051619-WEB2-Final-Packet-CAGR.pdf>.

¹⁸² 2015 PLAN OF OPERATION, *supra* note 30, at 3-17.

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¹⁸⁴ Ariz. Rev. Stat. § 45-141.

¹⁸⁵ Ariz. Rev. Stat. § 45-157.

¹⁸⁶ Ariz. Rev. Stat. § 45-401.

¹⁸⁷ *Town of Chino Valley v. City of Prescott*, 131 Ariz.78, 83, 638 P.2d 1324, 1329 (1981).

¹⁸⁸ *Id.*

¹⁸⁹ John Dougherty, *Why Growing Smarter Will Grow Old Fast*, PHOENIX NEW TIMES (Oct. 22, 1998), <https://www.phoenixnewtimes.com/news/why-growing-smarter-will-grow-old-fast-6421750>

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¹⁹¹ *Id.* at 2.

¹⁹² John Dougherty, *Why Growing Smarter Will Grow Old Fast*, *supra* note 189.

¹⁹³ 1998 Ariz. Sess. Laws, 43rd Leg., *supra* note 190, at 1.

¹⁹⁴ *Id.* at 2.

¹⁹⁵ JULIE WITHERSPOON, IS ARIZONA GROWING SMARTER? A REVIEW OF THE GROWING SMARTER STATUTES AND RECOMMENDATIONS FOR IMPROVING GROWTH MANAGEMENT IN ARIZONA 2 (2008), <https://sonoraninstitute.org/files/pdf/is-arizona-growing-smarter-growing-smarter-statutes-and-recommendations-for-improving-growth-management-in-arizona-10022008.pdf>

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- ²⁰⁷ *Id.* at 2-17.
- ²⁰⁸ CAROLLO ENGINEERS, CITY OF BUCKEYE: INTEGRATED WATER MASTER PLAN 2017, *supra* note 130.
- ²⁰⁹ *Id.* at 2-8.
- ²¹⁰ Jessica Boehm, *Buckeye, Phoenix are fastest growing cities in the United States*, *supra* note 202.