

**A RATHER DRY TOPIC: CAN ARIZONA’S GROUNDWATER
MANAGEMENT STRATEGY BE APPLICABLE IN ASSISTING WATER
SECURITY IN SOUTH AFRICA?**

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TABLE OF CONTENTS

I. INTRODUCTION218

II. LEGAL BACKGROUND.....222

 A. Hydrologic Background222

 1. What is Groundwater?.....222

 2. Groundwater in the United States and Arizona.....223

 3. Hydrology and Groundwater in South Africa.....223

 B. Laying the Groundwork: The Statutory Framework for Groundwater
 Management in Arizona224

 1. Active Management Areas.....225

 2. Irrigation Non-Expansion Areas227

 3. Service Areas227

 4. Groundwater Rights228

 a. Rights in AMAs228

 b. Rights Outside of AMAs229

 c. Rights in INAs230

 5. Groundwater Withdrawal Permits.....230

 6. Management Goals and Enforcement231

 7. Water Sources Beyond Groundwater.....231

III. LEGAL COMPARATIVE ANALYSIS.....232

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A. South African Water Law Overview232

 1. National Water Act of 1998233

 a. Background of the Act233

 b. Act Provisions.....233

 c. Water Rights236

 2. The Water Services Act of 1997237

 a. Background on the Act237

 b. Water Services Act provisions.....237

B. Ground Water Management in South Africa238

C. Sources Beyond Groundwater240

IV. SUGGESTIONS241

 A. What can South Africa Learn from Arizona?.....241

 1. Similarities in Frameworks241

 2. Lessons to be Learned.....243

V. CONCLUSION246

I. INTRODUCTION

A warm breeze swept across the parched landscape, swirling the dust in a miniature twister around the crowds that had begun to gather. They would wait hours just for the chance to fill jugs at struggling springs.¹ Businesses all around town were shutting off faucets and only a limited number of toilets flushed.² As panic permeated the populous, officials limited daily water intake to fifty liters (thirteen gallons) per person.³ “Day Zero” was quickly approaching.⁴ For three years, the landscape was facing what experts described as a drought so severe it only occurred every 311 years.⁵ Conservation efforts tightened as police began patrolling the city and issuing water waste citations.⁶ Just as all hope seemed lost,

¹ Bret Walton, *How Cape Town got to the Brink of Water Catastrophe*, CITYLAB (July 18, 2018), <https://www.citylab.com/environment/2018/07/how-cape-town-got-to-the-brink-of-water-catastrophe/564800/>.

² *Id.*

³ *Id.*

⁴ *Id.*

⁵ Piotr Wolski, *How Severe is Cape Town’s Draught? A Detailed Look at the Data*, NEWS24 (Jan. 23, 2018), <https://www.news24.com/SouthAfrica/News/how-severe-is-cape-towns-draught-a-detailed-look-at-the-data-20180123>.

⁶ Walton, *supra* note 1.

it rained.⁷ “Day Zero” would come another day.⁸ This is not the plot summary of a post-apocalyptic fantasy novel, this is Cape Town, South Africa in 2018.⁹

While Cape Town is certainly an extreme example, the looming possibility of water scarcity is a reality for many nations around the globe.¹⁰ The United Nations estimates that by 2025, 1.8 billion people will be living in water-scarce conditions.¹¹ By 2030, the growing population, coupled with the effects of climate change, will force half of the world’s citizens into water-stressed conditions.¹² With this startling future in mind, authorities must begin implementing water policy in new and creative ways.¹³ Leaders in Cape Town are now beginning to wrestle with the problem of how to augment their urban water supply.¹⁴ Inspiration could lie in the United States, where Arizona is one of the states leading the charge in water management

By necessity, Arizona has forged new channels of water management innovation.¹⁵ The state is, after all, facing its own impending “Day Zero” situation: Lake Mead, which provides about 40% of the state’s water supply, is starting to dry up.¹⁶ Water usage cuts are likely to be made as soon as 2020, with a 25% chance of severe cuts necessitated by 2026.¹⁷ On the surface, the future of water resources seems bleak. However, an available solution may lie just underground.¹⁸

⁷ *Id.*

⁸ *Id.*

⁹ *Id.*

¹⁰ U.N. Department of Economic and Social Affairs [UNDESA], *Water Scarcity*, (last updated Nov. 24, 2014), <http://www.un.org/waterforlifedecade/scarcity.shtml>.

¹¹ *Id.*

¹² *Id.* (“An area is experiencing water stress when annual water supplies drop below 1,700 m³ per person. When annual water supplies drop below 1,000 m³ per person, the population faces water scarcity, and below 500 cubic meters “absolute scarcity”. [sic]).

¹³ See generally Walton, *supra* note 1 (steps taken to conserve water included taking out bathroom sinks and installing only hand sanitizer dispensers).

¹⁴ See generally Emma Luker & Leila M. Harris, *Developing new urban water supplies: investigating motivations and barriers to groundwater use in Cape Town*, 35 INT’L J. WATER RES. DEV. 917 (2018).

¹⁵ See Joanna Allhands, *A water shortage is in Arizona’s future, like it or not. Here’s how to survive it*, AZ CENTRAL (Sept. 11, 2018, 7:05 AM), <https://www.azcentral.com/story/opinion/op-ed/joannaallhands/2018/09/11/lake-mead-water-shortage-arizona-drought-contingency-plan/1255229002/>.

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ See generally CHRIS AREND ET AL., *Arizona’s Water Future: Colorado River Shortage, Innovative Solutions, and Living Well with Less*, WESTERN RESOURCE ADVOCATES 34 (2017), <https://westernresourceadvocates.org/publications/arizonas-water-future-colorado-river-shortage-innovative-solutions-living-well-less/> (advocating for seven possible solutions including protecting the state’s groundwater resources).

To understand the future of water security in Arizona, one must look back to the Groundwater Management Act of 1980.¹⁹ Before 1980, the desert state went through many experiments of trial and error.²⁰ The first experiment in groundwater management came in 1944, with the adoption of Arizona's first groundwater code.²¹ This Code had very little teeth, however, and merely required the registration of wells.²² In 1948, Arizona amended the Code to forbid the drilling of new irrigation wells in ten areas identified as "critical groundwater areas."²³ However, nothing was done to cap the amount of pumping occurring at existing irrigation wells.²⁴

In 1950, in response to criticism of the 1948 Code, Arizona formed a Groundwater Study Commission whose recommendations were ignored, and the institution was ultimately disbanded.²⁵ Another round of amending, studying, and recommending began in the 1970s.²⁶ The adoption of these recommendations led to landmark legislation in 1980.²⁷ As the first of its kind in the United States, the Groundwater Management Act imposed a more rigorous means of regulation and enforcement.²⁸ For the most part, Arizona's ambition has proven to be successful.²⁹ The Act's success has spurred the creation of other innovative water management initiatives, and even inspired other states to create legislation of their own.³⁰

Now, despite population growth of almost 500% since 1957, Arizona uses three percent less water.³¹ Part of this achievement can be attributed to the Groundwater Management Act, as well as to the reuse, storage, and exchange

¹⁹ *AZ's Groundwater Management Act of 1980*, AZWATER.GOV (November 18, 2016), <https://new.azwater.gov/news/articles/2016-18-11>.

²⁰ Desmond D. Jr. Connall, *A History of the Arizona Groundwater Management Act*, 1982 ARIZ. ST. L.J. 313, 314 (1982) ("Water problems are not new in Arizona. Arizona's groundwater overdraft has been steadily increasing since the 1930s. Numerous legislative attempts were made in the past to arrest the overdraft, and they all failed.").

²¹ *Arizona Department of Water Resources*, ST. OF ARIZ. RES. LIBR., https://azlibrary.gov/sla/agency_histories/arizona-department-water-resources (last visited February 20, 2020).

²² *Id.*

²³ *Id.*

²⁴ *Id.*

²⁵ *Id.*

²⁶ *Arizona Department of Water Resources*, *supra* note 21.

²⁷ *Id.*

²⁸ Joanna Allhands, *What you don't know about the water law that saved Arizona*, AZ CENTRAL (Jan. 4 2018), <https://www.azcentral.com/story/opinion/op-ed/joannaallhands/2018/01/04/lessons-groundwater-management-act-saved-arizona/1000061001/>.

²⁹ *See generally id.* ("Arizona avoided this fate, despite being a far drier place, largely because we had something California didn't: the Groundwater Management Act of 1980.").

³⁰ *AZ's Groundwater Management Act of 1980*, *supra* note 19 ("The law has helped spur innovation. See: The Arizona Water Banking Authority, a novel, credit-based system of storing water underground for future use that arose from Arizona's commitment to protect and manage its aquifers.").

³¹ *Id.*

programs for surface water.³² Despite Arizona's achievements and leadership, criticism and concern for the future remain.³³ Specifically, critics point out that provisions within the Act need serious updates and reconsiderations to meet the goal of 100 years of water supply security.³⁴ Others opine that rural water use needs to undergo the same thorough examination as urban water use.³⁵ Nevertheless, Arizona's groundwater management serves as a valuable guide for communities struggling with water security, and can easily be adapted for use in other regions.

Good groundwater management is vital in the struggle for water security in arid climates like South Africa, with Cape Town's Mayor recognizing that "groundwater is the key immediate, and cost-effective option for navigating [the] crisis."³⁶ The question therefore becomes when – and how – can Cape Town, and South Africa as a whole, utilize groundwater as a stepping stone toward water security.³⁷

This Note examines the possibility of applying Arizona's innovate water management system in South Africa, a nation facing comparable issues concerning water security. Part I examines what groundwater is, as well as the availability of water in Arizona and South Africa. Part I additionally addresses the statutory framework of groundwater management and how it has been implemented and enforced in the state of Arizona. Part II examines and compares the regulatory framework of water management in South Africa. Part III offers a comparison of the benefits and weaknesses of each scheme. Finally, this Note concludes that although South Africa has lofty and envelope-pushing aspirations, it lacks the administrative capacity to see them through.³⁸ Arizona's framework offers a few practical solutions that may help in preventing a countdown to "Day-Zero" as Cape Town had. Ultimately, global collaboration and the sharing of innovation are needed to address the water crisis that will eventually affect the entire world.

³² Robert Glennon, *6 innovative water policies that helped Arizona during a drought*, AZ CENTRAL (April 10, 2018), <https://www.azcentral.com/story/opinion/op-ed/2018/04/10/arizona-water-policy-innovative-groundwater-conservation-glennon/499898002/>.

³³ Karen Smith, *35 Years Later, Arizona still Pumps Too Much Water*, AZ CENTRAL (March 5, 2015) <https://www.azcentral.com/story/opinion/op-ed/2015/03/05/arizona-groundwater-management/24464443/>.

³⁴ *AZ's Groundwater Management Act of 1980*, *supra* note 19.

³⁵ *Id.*

³⁶ Luker, *supra* note 14, at 2.

³⁷ *See id.*

³⁸ *See generally* Barbara Schreiner, *Viewpoint- Why has the South African National Water Act Been so Difficult to Implement?* 6 WATER ALTERNATIVES 2, 239-245 (2013) ("Actual implementation however remained in the hands of the civil servants, with all the challenges arising from lack of experience, lack of technical capability and high staff turnover.").

II. LEGAL BACKGROUND

A. Hydrologic Background

1. What is Groundwater?

In the vast, complicated water cycle, it is easy to focus exclusively on the visible surface water.³⁹ However, in spite of its visibility, surface water only makes up 1.2% of the world's freshwater supply.⁴⁰ In the United States, most federal laws regarding water involve issues exclusively with surface water, as well as state laws governing the allocation of rights.⁴¹ Despite this, there is one hundred times more groundwater than water in rivers and lakes, with groundwater making up 30.1% of the world's freshwater supply.⁴² Groundwater accumulates when precipitation lands on the ground surface, is absorbed into the subsurface, and settles in saturated rock material.⁴³ Although the slow-moving groundwater may eventually end up in rivers, lakes, and oceans;⁴⁴ until then, much of the groundwater is stored in aquifers, water-bearing rocks that transfer water to springs and wells.⁴⁵ Aquifers can be located close to the earth's surface or several hundred feet below.⁴⁶ Water stored in aquifers can move as quickly as several meters a day or as slowly as a few centimeters a century.⁴⁷ Unfortunately, groundwater has been associated with over-exploitation across the globe in many different contexts,⁴⁸ as well as drawdown and "specific contamination threats in some areas."⁴⁹ Moreover, unregulated groundwater pumping has serious environmental consequences that impact water availability in many ways.⁵⁰

³⁹ *The Water Cycle*, USGS (November 15, 2017), <https://water.usgs.gov/edu/watercycle.html>.

⁴⁰ *Id.*

⁴¹ See Brad Reid, *A Brief Introduction to Water Law*, HUFFPOST (August 2, 2017), https://www.huffingtonpost.com/brad-reid/a-brief-introduction-to-w_b_11295926.html.

⁴² *The World's Water*, USGS (December 2, 2016), <https://water.usgs.gov/edu/earthwherewater.html>.

⁴³ *What is Groundwater?*, USGS (December 2, 2016), <https://water.usgs.gov/edu/earthgw.html>.

⁴⁴ *Id.*

⁴⁵ *Aquifers and Groundwater*, USGS (March 20, 2018), <https://water.usgs.gov/edu/earthgwaquifer.html>.

⁴⁶ *Groundwater Basics*, PA ST. EXTENSION (September 3, 2014), <https://extension.psu.edu/groundwater-basics>.

⁴⁷ *Aquifers and Groundwater*, *supra* note 45.

⁴⁸ Luker, *supra* note 14, at 3 (notable high-profile examples include: "the Oglalla aquifer in the United States, aquifers in the Indo-Gangetic Basin, and the Murray– Darling Basin in Australia.").

⁴⁹ Luker, *supra* note 14, at 2.

⁵⁰ See generally Robert Glennon, *Tales of French Fries and Bottled Water: The Environmental Consequences of Groundwater Pumping*, 37 *Environmental Law* 3 (February 2007), <https://poseidon01.ssrn.com/delivery.php?ID=pdf>.

2. Groundwater in the United States and Arizona

Groundwater in the United States is tapped largely for drinking water and agricultural purposes,⁵¹ and is most commonly accessed using a well.⁵² More than 42 million people in the U.S. utilize a well for personal water supply.⁵³ As the population has grown, groundwater pumping has increased, resulting in a lowering of the water table, and a reduction of water recharging streams, lakes, and rivers.⁵⁴ In Arizona specifically, 40% of the current water supply is groundwater.⁵⁵ However, what places Arizona in a more precarious position than the rest of the nation is its yearly average precipitation of only eight inches.⁵⁶ Arizona's major aquifers are concentrated primarily in the southeastern and Upper Colorado River regions of the state.⁵⁷ Most aquifers depend primarily on mountain-front recharge rather than precipitation.⁵⁸ In arid regions, mountain-front recharge, runoff from snowpack, or precipitation from the mountain top to the basin below often contributes up to four times more water to the basin than the precipitation falling directly on the basin floor.⁵⁹ Data from 2003 to 2005 indicates that most groundwater in Arizona lies between 200 and 500 feet below the surface.⁶⁰

3. Hydrology and Groundwater in South Africa

South African hydrology is driven primarily by the highly variable patterns of precipitation.⁶¹ The average rainfall for the entire country is 450 mm

⁵¹ *Groundwater Depletion*, USGS (December 9, 2016) <https://water.usgs.gov/edu/gwdepletion.html>.

⁵² *What is a Well?*, GROUNDWATER FOUND. (last accessed January 4, 2019), <https://www.groundwater.org/get-informed/basics/wells.html>.

⁵³ *Id.*

⁵⁴ *Groundwater Depletion*, *supra* note 51.

⁵⁵ *Arizona's Water Supplies*, ARIZ. WATER FACTS (last accessed December 13, 2019), <http://www.arizonawaterfacts.com/water-your-facts..>

⁵⁶ CLIMATE ARIZ., <https://www.usclimatedata.com/climate/arizona/united-states/3172> (last accessed February 21, 2019).

⁵⁷ *Arizona Water Atlas Volume 1, Executive summary*, 12, ARIZ WATER (September 2010) [https://infoshare.azwater.gov/docushare/dsweb/Get/](https://infoshare.azwater.gov/docushare/dsweb/Get/Document-10426/Atlas_Volume_1_web.pdf)

Document-10426/Atlas_Volume_1_web.pdf (For the purposes of the atlas project, Arizona was divided into seven regional planning areas based on regional groundwater basins).

⁵⁸ *Id.* at 16.

⁵⁹ John L. Wilson & Haude Guan, *Mountain-Block Hydrology and Mountain - Front Recharge*, in 9 GROUNDWATER RECHARGE IN A DESERT ENVIRONMENT: THE SOUTHWESTERN UNITED STATES 113, 115.

⁶⁰ *Arizona Water Atlas Volume 1*, *supra* note 57, at 18 (For the purposes of the atlas project, Arizona was divided into seven regional planning areas based on regional groundwater basins).

⁶¹ *Hydrology of Southern Africa*, LIMPOPO RIVER AWARENESS KIT (last accessed January 4, 2019), http://www.limpopo.riverawarenesskit.org/LIMPOPORAK_

(17.7 in) per year — roughly half the global average of 860 mm (33.85 in) per year.⁶² The southern and western portions of South Africa receive the least amount of rainfall, while precipitation consistency and volume increase toward the northern regions closer to the equator.⁶³ Because most rainfall takes place in warmer seasons in short, intense downpours, rain often falls and runs off faster than can be absorbed as groundwater recharge.⁶⁴ As such, the vast majority of rivers are small and perennial.⁶⁵ To prevent wasteful runoff, water is often stored in dams to meet societal needs.⁶⁶ There are 4,000 dams in South Africa, 350 of which are government-owned.⁶⁷ The geology of the country further limits groundwater capacity; most of it is rock, which allows for very little water-carrying capacity.⁶⁸ The four most productive aquifer systems are the Botleg Dolomite Aquifer, Gauteng Dolomites, Houdenbrak Basement Aquifer, and the Dinokana-Lobatse Transboundary Dolomite Aquifer.⁶⁹ Because of the historical focus on surface water and dam development, groundwater has been perceived as a water source for emergencies, rural communities, and small towns.⁷⁰

B. Laying the Groundwork: The Statutory Framework for Groundwater Management in Arizona

For many years, Arizona operated under a bifurcated system of water management, subjecting surface water and groundwater to different common-law doctrines to determine ownership.⁷¹ Surface water was subject to the doctrine of

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HTM.

⁶² Dr. Paul Roberts, *Dams in South Africa*, SANCOLD (last accessed January 4, 2019), <http://www.sancold.org.za/index.php/about/about-dams/dams-in-south-africa>.

⁶³ *Hydrogeology of South Africa*, *supra* note 61.

⁶⁴ *Id.*

⁶⁵ *Id.*

⁶⁶ Roberts, *supra* note 62.

⁶⁷ Tom Head, *Less than 10% of SA's Dams are Available to the Public* *Hlomane Chauke*, THE SOUTH AFRICAN (February 8, 2018), <https://www.thesouthafrican.com/mp-plans-to-nationalise-dams-sa/>.

⁶⁸ Roberts, *supra* note 62.

⁶⁹ Kevin Pietersen, Hans E. Beekman, Martin Holland, *South African Governance Case Study*, *Water Research Commission*, iii (June 2011), http://www.groundwatergovernance.org/fileadmin/user_upload/groundwatergovernance/docs/Country_studies/GWGovernanceRSA.pdf.

⁷⁰ Roberts, *supra* note 62; *see also* Emma Luker, Leila M. Harris, *Developing new urban water supplies: investigating motivations and barriers to groundwater use in Cape Town*, *International Journal of Water Resources Development*, 12 (Sept. 26, 2018), <https://doi.org/10.1080/07900627.2018.1509787>.

⁷¹ L. William Staudenmair, *Arizona Groundwater Law*, 1 *The Water Report* (November 15, 2006), https://www.swlaw.com/assets/pdf/publications/2006/11/15/TheWaterReport_ArizonaGroundwaterLaw_StaudenmairWEB.pdf.

prior appropriation.⁷² This doctrine, traditionally utilized in western states, purports that anyone first in time is first in right.⁷³ Conversely, groundwater was subject to the doctrine of beneficial use, which lacked the timing limitations when determining who had the right.⁷⁴ Because there were no limitations, unrestrained groundwater pumping grew to be an issue.⁷⁵

Invoking the theory of general police power, the Arizona legislature declared that it was in the best interest of the welfare and economy of the state to regulate groundwater, and determined the statutory scope to be within the “withdrawal, transportation, use, conservation, and conveyance of rights.”⁷⁶ Boundaries for groundwater basins and sub-basins were created, and a system was set in place for reviewing and modifying the boundaries, if necessary.⁷⁷ The Department of Water Resources was created to administer the Groundwater Management Act (“the Act”) at the state level.⁷⁸ The Act provides for a judicial appointment process and reviews standards for challenged decisions.⁷⁹

1. Active Management Areas

The Act created four Active Management Areas (“AMA”) in central Arizona that encompassed 80% of the state’s population and accounted for 69% of groundwater overdraft.⁸⁰ These areas were designated in the Tucson, Phoenix, Prescott, and Pinal areas, with underlying hydrological considerations in mind.⁸¹ A fifth AMA in Santa Cruz was carved out of the Tucson area in 1994 to reflect changing conditions.⁸² Portions of the state that are not located in a designated AMA are not subject to the requirements of the Groundwater Management Act.⁸³ However, counties and municipalities outside the AMAs can voluntarily set up

⁷² *Id.*

⁷³ *Id.*

⁷⁴ *Id.*

⁷⁵ Sharon B. Megdal, Arizona Groundwater Management, 1 *The Water Report* (October 15, 2012), <https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/AZgroundwater-management.pdf>.

⁷⁶ Ariz. Rev. Stat. Ann. § 45-401(b) (2018).

⁷⁷ *Id.* § 45-403,404.

⁷⁸ Kyl, Jon L., *Arizona’s New Groundwater Statute: 1980 Groundwater Management Act: Outline*, (1981). Water Resources Allocation: Laws and Emerging Issues: A Short Course (Summer Conference, June 8-11). Paper 11, 6, <http://scholar.law.colorado.edu/water-resources-allocation-laws-and-emerging-issues/11>.

⁷⁹ Ariz. Rev. Stat. Ann. § 45-405-407 (2018).

⁸⁰ Kyl, *supra* note 78, at 7.

⁸¹ Ariz. Rev. Stat. Ann. § 45-411(A)(2018); *see also* Sharon B. Megdal, Arizona Groundwater Management, *The Water Report* (October 15, 2012), <https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/AZgroundwater-management.pdf>.

⁸² Megdal, *supra* note 75; *see also* Ariz. Rev. Stat. Ann. § 45-411.02-.411.03 (2018) (Maps of these areas are kept on file at the Department for general land use).

⁸³ Megdal, *supra* note 75.

more rigorous groundwater management systems.⁸⁴ For example, the towns of Clarkdale and Patagonia, and the counties of Cochise and Yuma have voluntarily set up 100-year supply requirements similar to the AMAs.⁸⁵

Each AMA must set management plans and conservation goals for all groundwater pumpers, including municipal, industrial, and agricultural users.⁸⁶ These plans are subject to public input and must be approved by the Director of the Arizona Department of Water Resources (ADWR).⁸⁷ Through this procedural oversight, the plans have the force and effect of an administrative rule.⁸⁸ The Phoenix, Tucson, and Prescott AMAs contain a cumulative population that represents roughly 85% of the state's total population and continues to grow.⁸⁹ The primary management goal in those areas is centered around the attainment of a "safe-yield" by the year 2025.⁹⁰ A "safe-yield" is "a long-term balance between the annual amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge."⁹¹ In the Santa Cruz AMA, the goal is a safe yield plus the prevention of long term water table decline.⁹² In the primarily agrarian Pinal County AMA, the goal is to maximize water for irrigation to depletion, meaning complete utilization of all groundwater for irrigation.⁹³

Developers located within an AMA face additional restrictions.⁹⁴ Before land for sale or lease is marketed to the public, the developer must demonstrate that there is an assured supply of water to the ADWR.⁹⁵ An assured water supply is a 100-year supply, with the financial ability to transport and treat the water at a rate of use consistent with the current management plan.⁹⁶ To earn the "assured water supply certificate", the developer must prove three things:

[1.] Water of sufficient quantity and quality is available to sustain the proposed development for 100 years[;] 2. The proposed use is consistent with the management plan (e.g., it adheres to

⁸⁴ Haley Paul, *10 Things You Should Know About Arizona's Groundwater Management Act*, WESTERN WATER NEWS (October 2, 2018), <https://www.audubon.org/news/10-things-you-should-know-about-arizonas-groundwater-management-act>.

⁸⁵ *Id.*

⁸⁶ Megdal, *supra* note 75.

⁸⁷ *Id.*

⁸⁸ *Id.*

⁸⁹ Lay person's guide to Arizona Water, 13, https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Layperson%27s_Guide_to_Arizona_Water.pdf.

⁹⁰ *Overview of the Arizona Groundwater Management Code*, AZWATER.GOV, https://new.azwater.gov/sites/default/files/media/Arizona%20Groundwater_Code_1.pdf (last visited October 6, 2018).

⁹¹ *Id.*

⁹² *Id.* at 2.

⁹³ *Id.* at 2.

⁹⁴ *Id.*

⁹⁵ *Overview of the Arizona Groundwater Management Code*, AZWATER.GOV, https://new.azwater.gov/sites/default/files/media/Arizona%20Groundwater_Code_1.pdf.

⁹⁶ Kyl, *supra* note 78, at 12.

conservation requirements) and achievement of the AMA management goal (e.g., it does not hinder achievement of safe-yield)[;] and 3. The water provider has the financial capability to construct water delivery and treatment systems to serve the proposed development.⁹⁷

Beginning in 2012, the Director of Water Resources was granted the authority to appoint Area Directors to further administrative efficiency.⁹⁸

2. Irrigation Non-Expansion Areas

In addition to designating management areas, the Act also grants the Director authority to declare land not already in an AMA as an Irrigation Non-Expansion Area (“INA”).⁹⁹ Two such parcels were established by statute in Douglas and Joseph City groundwater areas.¹⁰⁰ Another INA was established in Harquahala by the ADWR in 1982.¹⁰¹ INAs may be created when the Director determines that, “[t]here is insufficient groundwater to provide a reasonably safe supply for irrigation of the cultivated lands in the area at the current rates of withdrawal,” and that establishment of an AMA is unnecessary.¹⁰² Only acres that were previously irrigated within five years of INA designation may continue to be irrigated.¹⁰³ Irrigating additional acres within these regions is forbidden.¹⁰⁴ However, exceptions are made for fields up to two acres, or where “substantial capital investment” was made.¹⁰⁵ “Substantial capital investment” is defined to include “on-site irrigation distribution facilities and a well or wells the drilling and construction of which were substantially commenced before the date of the notice of the initiation of designation procedures.”¹⁰⁶

3. Service Areas

Established towns, cities and water companies within the state can draw and transport groundwater so long as the water is within its area.¹⁰⁷ While service areas

⁹⁷ *Overview of the Arizona Groundwater Management Code*, *supra* note 90.

⁹⁸ Ariz. Rev. Stat. Ann. § 45-418 (2018).

⁹⁹ *Id.* § 45-432.

¹⁰⁰ *Id.* § 45-431.

¹⁰¹ *Overview of the Arizona Groundwater Management Code*, *supra* note 90.

¹⁰² *Irrigation Non-Expansion Area FAQs*, AZWATER.GOV, //http. www.azwater.gov/azdwr/documents/INAFQAforweb_000.pdf (last visited October 6, 2018).

¹⁰³ *Id.*

¹⁰⁴ *Id.*

¹⁰⁵ *Id.*

¹⁰⁶ *Id.*

¹⁰⁷ Ariz. Rev. Stat. Ann. § 45-591 (2018); *see also* Kyl, Jon L., *Arizona’s New Groundwater Statute: 1980 Groundwater Management Act: Outline*, (1981). Water

are allowed to expand to service a growing population, they cannot grow to encompass a well field, expand irrigation acres for a single customer, or provide a disproportionate amount of water to a single customer.¹⁰⁸ Irrigation districts located outside an AMA are also subject to the limitations of a service area.¹⁰⁹

4. Groundwater Rights

a. Rights in AMAs

Determining who has a right to pump and utilize groundwater is one of the most important elements of the groundwater management framework. To pump groundwater, there must be an existing right or permit, unless the well is exempt.¹¹⁰ A well is only exempt if it has a thirty-five gallon per minute maximum pump capacity.¹¹¹ If not exempt, a well has to have an existing right attached to it or it will have to be permitted.¹¹² These rights offer use and storage so long as the activity is in compliance with the Act.¹¹³ The two types of rights that exist within an AMA are service rights and grandfathered rights.¹¹⁴

Service rights allow towns, municipalities, and irrigation districts to pump water in order to serve their customers.¹¹⁵ However, there are several limitations on this right, including a prohibition on forming private water companies, extending the service area, and distributing water in a disproportionate manner out of accord with the management plan.¹¹⁶ “Grandfathered rights” are those derived from individual water use prior to the passing of the Act.¹¹⁷ These rights fall into three categories: (1) irrigation grandfathered rights; (2) Type 1 non-irrigation grandfathered rights; and (3) Type 2 non-irrigation grandfathered rights.¹¹⁸ Any individual wishing to claim a grandfathered right is statutorily required to undergo an application for a certificate.¹¹⁹ If land within an AMA was irrigated with groundwater in the five years preceding the establishment of the Act, that right

Resources Allocation: Laws and Emerging Issues: A Short Course (Summer Conference, June 8-11). Paper 11 at 13.

¹⁰⁸ Staudenmair, *supra* note 71, at 7.

¹⁰⁹ Ariz. Rev. Stat. Ann. § 45-494 (2018); *see also* L. William Staudenmair, Arizona Groundwater Law, 7 The Water Report (November 15, 2006), https://www.swlaw.com/assets/pdf/publications/2006/11/15/TheWaterReport_ArizonaGroundwaterLaw_StaudenmaierWEB.pdf.

¹¹⁰ *Overview of the Arizona Groundwater Management Code, supra* note 90.

¹¹¹ *Id.*; *See also* Ariz. Rev. Stat. Ann. § 45-454 (2018).

¹¹² *Overview of the Arizona Groundwater Management Code, supra* note 90.

¹¹³ Ariz. Rev. Stat. Ann. § 45-451 (2018).

¹¹⁴ *See generally id.*

¹¹⁵ *Overview of the Arizona Groundwater Management Code, supra* note 90; *see also* Ariz. Rev. Stat. Ann. § 45-491(2018).

¹¹⁶ Ariz. Rev. Stat. Ann. § 45-493 (2018).

¹¹⁷ *Overview of the Arizona Groundwater Management Code, supra* note 90.

¹¹⁸ *Id.*

¹¹⁹ Ariz. Rev. Stat. Ann. § 45-476-781 (2018).

would be grandfathered in.¹²⁰ “Irrigate,” as it’s understood in this portion of the Act, means applying water on two or more acres for plants produced for human or animal consumption.¹²¹ The Director is then in charge of how much groundwater may be allocated per farm unit.¹²² That quantity is also subject to management plans crafted by the Department of Water Resources.¹²³ A grandfathered irrigation right cannot be sold or leased separate from the land.¹²⁴

A Type 1 right is generally associated with land that has been converted from farming into some other activity.¹²⁵ This right is also only conveyable with the land.¹²⁶ After retirement from agriculture and approval from ADWR, the right may then be used for non-irrigation uses subject to some restrictions imposed by the Groundwater code.¹²⁷ A Type 2 right encompasses historic ground water pumping for non-irrigation purposes.¹²⁸ These activities can include industry, livestock watering, and golf courses.¹²⁹ In contrast to the other types of grandfathered rights, a Type 2 right can be conveyed separately from the land, making it a valuable right in the market due to its flexibility.¹³⁰

b. Rights Outside of AMAs

In a non-designated area, all groundwater is subject to the reasonable and beneficial use doctrine, and no permit is required.¹³¹ The doctrine of reasonable use, which started as a common law principle before its formal adoption by the Arizona Supreme Court, states that as long as the extracted water is put to some beneficial use, a right is established.¹³² Therefore, outside of an AMA, groundwater pumpers face few restrictions on pumping activity so long as the water is put to a beneficial use.¹³³ A use is “beneficial” when the water is utilized in “making reasonable use of the land.”¹³⁴ There are however, restrictions on transportation of

¹²⁰ *Id.* § 45-465 (2018).

¹²¹ *Overview of the Arizona Groundwater Management Code, supra* note 90.

¹²² Ariz. Rev. Stat. Ann. § 45-465 (2018).

¹²³ Staudenmair, *supra* note 71, at 6.

¹²⁴ *Overview of the Arizona Groundwater Management Code, supra* note 90.

¹²⁵ *Id.*

¹²⁶ Ariz. Rev. Stat. Ann. § 45-470 (2018).

¹²⁷ Staudenmair, *supra* note 71, at 6.

¹²⁸ *Overview of the Arizona Groundwater Management Code, supra* note 90.

¹²⁹ *Id.*

¹³⁰ *Id.*; *see also* Ariz. Rev. Stat. Ann. § 45-471 (2018); *see also* Staudenmair, *supra* note 71, at 6.

¹³¹ Ariz. Rev. Stat. Ann. § 45-453 (2018).

¹³² Staudenmair, *supra* note 71, at 2.

¹³³ *Id.* at 9.

¹³⁴ *Id.* at 2.

water, though the groundwater code does provide liberalized rules on the transportation of water from outside an AMA into an AMA.¹³⁵

c. Rights in INAs

The use of rights in INAs are subject only to the area's expansion restrictions.¹³⁶ In most INA's, this means that only the acres that have been irrigated in the past five years preceding the establishment of the area, may continue to be irrigated from groundwater wells.¹³⁷

5. Groundwater Withdrawal Permits

With the exception of the circumstances outlined in § 45-452 of the Arizona Revised Statutes, a person may not draw water from a nonexempt well in an AMA.¹³⁸ However, there are seven types of permits available depending on the intent of the water use.¹³⁹ The Director has the authority to issue permits if the applicant meets the specific requirements of the particular permit category.¹⁴⁰ The Director is required to give all applicants notice, and, in the case of permit denials, provide reasons why the application was not granted.¹⁴¹ A person wishing to appeal a permit decision may seek judicial review at superior court.¹⁴² The Director also reserves the right to revoke the permit if the conditions are violated.¹⁴³

Groundwater may be transported within a sub-basin of an AMA without fines so long as it is done by an individual with a grandfathered right or permit, or by a city, town, or private water company.¹⁴⁴ If water is being transported away from a sub-basin or away from an AMA, certain restrictions apply and there may be fines associated with the transportation.¹⁴⁵

¹³⁵ Ariz. Rev. Stat. Ann. § 45-453 (2018); *see also*. Staudenmair, *supra* note 71, at 9.

¹³⁶ Ariz. Rev. Stat. Ann. § 45-453 (2018).

¹³⁷ *Irrigation Non-Expansion Area FAQs*, *supra* note 102.

¹³⁸ Ariz. Rev. State. Ann. § 45-512 (2018).

¹³⁹ *Id.*

¹⁴⁰ *Id.* §§ 45-513-519.

¹⁴¹ *Id.* §§ 45-523-525.

¹⁴² *Id.* § 45-526.

¹⁴³ *Id.* § 45-528.

¹⁴⁴ Ariz. Rev. State. Ann. § 45-541 (2018).

¹⁴⁵ *Id.* §§ 45-542-547.

6. Management Goals and Enforcement

The Director is authorized by the Act to develop a management plan for each of the AMAs over five management periods.¹⁴⁶ Every three years, the Director must issue a report detailing per capita water use and conservation efforts in the AMAs.¹⁴⁷ The state is currently in the fourth management period, with the Act requiring promulgation to have begun for the fifth management period in 2019.¹⁴⁸ Additionally, the Act provides definitions and conditions for wells in AMAs.¹⁴⁹ Specifically, new and replacement wells in the active management areas require permitting compliance.¹⁵⁰

Most AMA users are subject to recordkeeping requirements, as well as annual reports regarding the use, transportation, and pumping of groundwater.¹⁵¹ Wells are also subject to inspection.¹⁵² If a person is suspected to be in violation of the permit or the Act, the Director can send a cease and desist order or offer an opportunity for a hearing.¹⁵³ A person found in violation may be assessed a civil penalty based on the category of the offense.¹⁵⁴

7. Water Sources Beyond Groundwater

While the Groundwater Management Act is frequently pointed to as a grand success, Arizona's ability to diversify and augment its water sources is also a crucial component of the State's journey toward water security.¹⁵⁵ Beyond the intrastate ground and surface water, the major metropolitan areas also depend upon the Central Arizona Project (CAP) to deliver water from the interstate Colorado River.¹⁵⁶ The CAP water in particular has provided a powerful supplement to groundwater pumping, specifically in the city of Tucson.¹⁵⁷

¹⁴⁶ *Id.* § 45-563.

¹⁴⁷ *Id.* § 45-563.01.

¹⁴⁸ *Id.* § 45-567-568.

¹⁴⁹ *Id.* § 45-591.

¹⁵⁰ Ariz. Rev. State. Ann. § 45-598 (2018).

¹⁵¹ *Id.* § 45-632.

¹⁵² *Id.* § 45-633.

¹⁵³ *Id.* § 45-634.

¹⁵⁴ *Id.* § 45-635.

¹⁵⁵ *See* Glennon, *supra* note 32.

¹⁵⁶ *See id.*

¹⁵⁷ *See id.*

III. LEGAL COMPARATIVE ANALYSIS

A. South African Water Law Overview

South Africa underwent many changes of power and periods of unrest throughout its early history and well into the 20th century.¹⁵⁸ In the early 1600s, the East Indian Trading Company set up a port in Cape Town, introducing Dutch-Roman forms of laws.¹⁵⁹ In the 1800s, the British took control, and while they preserved much of the existing framework, the English common law still influenced the court systems.¹⁶⁰ Water law in South Africa through the early 1900s, had evolved into “an unlikely amalgam of Roman law and American common law.”¹⁶¹ The creation of the Union of South Africa in 1910 brought with it legislation that reimagined and consolidated the legal regime surrounding water.¹⁶² The Water Act 54 of 1956 created a complex distinction between “public” and “private” water as well as expanding state control over water in certain circumstances.¹⁶³ In 1994, the end of apartheid signaled the beginning of a new political era and yet another approach to water law.¹⁶⁴ This history culminated in present-day South African law and policy.¹⁶⁵ Some of the key, formative post-apartheid water policy initiatives include: Water Services Policy (white paper, 1994), Water Services Act (1997), National Water policy of 1997, National Water Act of 1998, and the National Water Resources Strategy (2004).¹⁶⁶

¹⁵⁸ See Daniel Malzbender, Jaqui Goldin, Anothony Turton, Anton Earle, *Traditional Water Governance and South Africa's "National Water Act" – Tension or Cooperation?*, 4, (written for International Workshop on ‘African Water Laws: Plural Legislative Frameworks for rural water Management in Africa) (Jan. 26, 2005) (Summarizing evolution of water rights and governance in South Africa); see generally Michael Kidd, *South Africa: The Development of Water Law in The Evolution of the Law and Politics of Water*, 87, 88 (Josphph W. Dellapenna, Joyeeta Gupta, ed. 2009); see also H. Karodia and D. R. Weston, *South Africa's New Water Policy and Law*, [http://publications](http://publications.iwmi.org/pdf/H029111.pdf)

[.iwmi.org/pdf/H029111.pdf](http://publications.iwmi.org/pdf/H029111.pdf) (“The far-reaching political and social changes that swept across South Africa during the early 1990s only added to the tension caused by the chasm between outdated policy and the realities of resource management.”).

¹⁵⁹ Michael Kidd, *South Africa: The Development of Water Law in The Evolution of the Law and Politics of Water*, 87, 88 (Josphph W. Dellapenna, Joyeeta Gupta, ed. 2009).

¹⁶⁰ *Id.*

¹⁶¹ *Id.*

¹⁶² *See id.* at 89.

¹⁶³ *See id.* at 90-91.

¹⁶⁴ *See id.* at 91.

¹⁶⁵ *See generally* H. Karodia and D. R. Weston, *South Africa's New Water Policy and Law*, <http://publications.iwmi.org/pdf/H029111.pdf> (“However, change has become part and parcel of South Africa and, in many ways, its people see a bright future amidst all the changes that have swept across this beautiful land.”).

¹⁶⁶ Kevin Pietersen, Hans E. Beekman & Martin Holland, *South African Groundwater Governance*, 5 (June 2011), <http://www.groundwater>

1. National Water Act of 1998

a. Background of the Act

In 1997, a white paper was produced outlining the underlying policy decisions that would become the National Water Act (“the Act”).¹⁶⁷ Some of the key policy proposals included: recognition of water as an indivisible national resource; establishment of the government as the custodian of water in a public trust; and the treatment of all water, no matter the state of the water cycle, as protected under trust.¹⁶⁸ The Act was also premised on the goal of improving access and infrastructure to previously underserved communities.¹⁶⁹ The white paper and resulting Act hinged on four principles:

First, the government must be the custodian of national water resources in order to manage effectively a critical strategic resource. Second, there must be equitable access to water by all. Third, the hydrological cycle is a single system and the water needs of the environment are crucial for the healthy operation of that cycle. Fourth, the international dimensions of South Africa’s water resources and the rights of neighboring countries are recognized.¹⁷⁰

After its inception, the National Water Act of 1998 “was hailed by the international community as one of the most progressive pieces of water legislation of its time.”¹⁷¹

b. Act Provisions

The Preamble of the National Water Act outlines many ambitious principles to guide South Africa’s modern approach to water management.¹⁷² The first principle recognizes that water is a part of a complex cycle and should be

governance.org/fileadmin/user_upload/groundwatergovernance/docs/Country_studies/GWGovernanceRSA.pdf.

¹⁶⁷ See Kidd, *supra* note 159, at 92.

¹⁶⁸ White Paper on a National Water Policy for South Africa, 4 (1997) <http://www.dwa.gov.za/Documents/Policies/nwpwp.pdf>.

¹⁶⁹ Kidd, *supra* note 159, at 105.

¹⁷⁰ *Id.* at 92-93.

¹⁷¹ Barbara Schreiner, Viewpoint- Why has the South African National Water Act Been so Difficult to Implement? 6 *Water Alternatives* 239, 239 (2013); see also John Dini, *Twenty years on, has our National Water Act failed us?*, Daily Maverick (Oct. 4, 2018), <https://www.dailymaverick.co.za/article/2018-10-04-twenty-years-on-has-our-national-water-act-failed-us/> (“It won Kader Asmal [the Minister of Water Affairs and Forestry at the time] the prestigious Stockholm Water Prize in 2000. Other countries have modelled their water laws on it.”).

¹⁷² See Leonie Berjak, *Water Management in South Africa*, 15 (2003) (unpublished Master of Laws thesis, University of Natal, Pietermaritzburg).

managed as a whole not as separate parts.¹⁷³ The second addresses the history of inequalities to access of water and seeks to leave those practices in the past.¹⁷⁴ Finally, the last principles state that it is the responsibility of the government to manage the resource in a sustainable way for the benefit of all citizens.¹⁷⁵

The first part of the National Water Act establishes the Public Trust function of the government as it relates to water.¹⁷⁶ The Act gives the Minister of Water Affairs and Forestry the power to act on behalf of the national government as trustee of water resources.¹⁷⁷ The mission of the Minister is rather broad, and encompasses interests for private individuals as well as industry and agriculture.¹⁷⁸ This mission also includes the underlying principle of “equitable allocation of water and its beneficial use in the public interest and for promoting environmental values, including sustainability.”¹⁷⁹

The second part of the Act can be examined as two parts:¹⁸⁰ (1) The National Water Resource Strategy (NWRS), and (2) The Catchment Management Agencies.¹⁸¹ The NWRS deals with resource use and allocation at the national level.¹⁸² This includes a framework for the “water resources classification system, involving determination of the class of the water resource and resource quality objectives.”¹⁸³ Central to the national scheme of water management is the principle of the “reserve.”¹⁸⁴ Section One of the Act defines “reserve” as:

the quantity and quality of water required — (a) to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act for people who are now or who will, in the reasonably near future, be— (i) relying upon; (ii) taking water from; or (iii) being supplied from, the relevant water resource; and (b) to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.¹⁸⁵

The reserve requirement is applicable regardless of whether it is surface water or contained in an estuary or aquifer.¹⁸⁶

¹⁷³ *Id.*

¹⁷⁴ *Id.* at 15-16.

¹⁷⁵ *Id.* at 16.

¹⁷⁶ *Id.* at 18.

¹⁷⁷ Kidd, *supra* note 159, at 93.

¹⁷⁸ Berjak, *supra* note 172, at 18-19.

¹⁷⁹ Kidd, *supra* note 159, at 93.

¹⁸⁰ Berjak, *supra* note 172, at 20.

¹⁸¹ *Id.*

¹⁸² *Id.*

¹⁸³ Kidd, *supra* note 159, at 93.

¹⁸⁴ *Id.*

¹⁸⁵ *Id.* at 93-94.

¹⁸⁶ *Id.* at 94.

The Catchment Management Agencies (CMAs), on the other hand, are the local cooperative strategies implemented in each designated Catchment area.¹⁸⁷ The NWA designated “19 delineated Water Management Areas (WMAs),” with Catchment management areas being established within the various WMAs.¹⁸⁸ Although the Act is designed to create a national framework for water resource management, the Catchment areas allow for a “workable strategy for the area” to be developed as well.¹⁸⁹ This approach reflects the current global consensus amongst water resource managers that water is often best managed within a river basin or analogous catchment area.¹⁹⁰

The third part of the Act fleshes out regulations for water use.¹⁹¹ The 11 types of uses are considerably broader than simple water consumption.¹⁹² Specifically, the Act defines use as:

(a) taking water from a resource; (b) storing water; (c) impeding or diverging the flow of water in a water course; (d) engaging in a stream flow reduction activity contemplated in section 36; (e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall, or other conduit; (g) disposing of waste in a manner which may detrimentally impact a water resource; (h) disposing in any manner water which contains waste from, or which has been heated in, any industrial or power generation process; (i) altering the bed, banks, course or characteristics of a water course; (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and (k) using water for recreational purposes.¹⁹³

It is assumed that any of these uses will require licensing, with the exception of general, non-consumption-type activities.¹⁹⁴

The Act also contains several financial provisions as well as the authority for the Minister to set up advisory committees and a water tribunal.¹⁹⁵ The advisory

¹⁸⁷ *Id.* at 95; *see also* Leonie Berjak, *Water Management in South Africa*, 21 (2003) (Unpublished Master of Laws thesis, University of Natal, Pietermaritzburg).

¹⁸⁸ Malzbender et al., *Traditional Water Governance and South Africa's “National Water Act” – Tension or Cooperation?*, 4 (written for International Workshop on ‘African Water Laws: Plural Legislative Frameworks for rural water Management in Africa’) (Jan. 26, 2005).

¹⁸⁹ Berjak, *supra* note 172, at 21.

¹⁹⁰ Malzbender, *supra* note 188, at 4.

¹⁹¹ Berjak, *supra* note 172, at 24.

¹⁹² *Id.*

¹⁹³ *Id.*

¹⁹⁴ *Id.*

¹⁹⁵ *Id.* at 27; *see also* Kidd, *supra* note 159, at 87.

committees deal with very specific issues surrounding water management, such as the Committee on Dam Safety and Water Advisory.¹⁹⁶ The water tribunal handles dispute resolution and appeals.¹⁹⁷ Finally, the Act creates criminal penalties to aid enforcement.¹⁹⁸ Failure to comply with use requirements and pollution are both criminal offenses, with the act of pollution carrying a mandatory fine or five-year prison sentence even for first-time offenders.¹⁹⁹

c. Water Rights

The passage of the National Water Act in 1998 marked the end of the Roman-Dutch and English method of determining water rights, and marked the beginning of the public trust era.²⁰⁰ In this era, water use can be authorized in three ways: Schedule 1 authorization, general authorization, and water use licenses.²⁰¹ Schedule 1 authorization encompasses small amounts of water, typically for domestic use, while general authorization exempts licensing for other limited uses of water.²⁰² Individuals not operating under the license exceptions may obtain licensed use rights,²⁰³ which include extraction, storage, change or reduction in stream flow, and pollution.²⁰⁴ The issuance of a permit is determined by a variety of factors, such as existing use, public benefit, racial and gender equality, strategic importance of the water, and duration of use.²⁰⁵

While certainly superior to the previous system, the current system of water rights in South Africa is not without its own drawbacks.²⁰⁶ Because the state is acting as the trustee, the administrative burden is enormous for water right allocation, management, and enforcement.²⁰⁷ Additionally, the licenses are temporary and cannot be passed on to a successor,²⁰⁸ such as with grandfathered rights. This may have a potential chilling effect on land development as well as long-term investment in water infrastructure.²⁰⁹

¹⁹⁶ Berjak, *supra* note 172, at 36.

¹⁹⁷ Kidd, *supra* note 159, at 95.

¹⁹⁸ *Id.*

¹⁹⁹ *Id.*

²⁰⁰ G.J. Pienaar & E. van der Schyff, *The Reform of Water Rights in South Africa*, 3/2 L., ENV'T & DEV. J. 8 (2007).

²⁰¹ DD Tewari, *A detailed analysis of evolution of water rights in South Africa: An account of three and a half centuries from 1652 AD to present*, 704 (Oct. 5, 2009) <http://www.scielo.org.za/pdf/wsa/v35n5/a19v35n5.pdf>.

²⁰² *Id.*

²⁰³ Pienaar, *supra* note 200.

²⁰⁴ *Id.*

²⁰⁵ *Id.*

²⁰⁶ Tewari, *supra* note 201.

²⁰⁷ *See id.* at 703-4.

²⁰⁸ *Id.* at 705.

²⁰⁹ *Id.* (“This is especially important with respect to irrigation where an owner may lose interest in developing his/her land. This may decrease long term investment in water infrastructure, in particular in that which is in private hands.”).

2. The Water Services Act of 1997

a. Background on the Act

Working in tandem with the Water Act, the Water Services Act addresses water access as a constitutional right.²¹⁰ It provides the regulatory framework specifically for “water services institutions—water services authorities, water services providers, water services intermediaries, water boards, and water services committees.”²¹¹ This Act is more specific in its goals than the National Water Act, as it indirectly manages the resource through the regulation of the water delivery systems.²¹² It recognizes in the sixth principle of the preamble that “the provision water supply services and sanitation services, although an activity distinct from overall management of water resources, must be undertaken in a manner consistent with the broader goals of water resource management.”²¹³

b. Water Services Act provisions

The introduction of the Water Services Act lays out the objects grounded in the constitutional guarantee of the people’s access to water.²¹⁴ It also grants the Minister of Water Affairs and Forestry authority to administer the provisions of the Act.²¹⁵

Chapter two of the Act provides the regulatory framework for water services standards and tariffs.²¹⁶ Section nine of this chapter gives the Minister authority to set standards for water provision, quality, “effective and sustainable use,” as well as requirements for installations.²¹⁷ In setting these standards, the Act lays out several things for the Minister to consider, including:

- (a) the need for everyone to have a reasonable quality of life;
- (b) the need for equitable access to water services;
- (c) the operational efficiency and economic viability of water services;
- (d) any norms and standards for applicable tariffs for water services;

²¹⁰ Berjak, *supra* note 172, at 49.

²¹¹ Kidd, *supra* note 159, at 95.

²¹² Berjak, *supra* note 172, at 49.

²¹³ *Id.* at 50.

²¹⁴ *Id.* at 49.

²¹⁵ *Id.* at 52.

²¹⁶ Kidd, *supra* note 159, at 95; *see also* Berjak, *supra* note 172, at 53.

²¹⁷ Berjak, *supra* note 172, at 53.

- (e) any other laws or any standards set by other governmental authorities;
- (f) any guidelines recommended by official standard-setting institutions;
- (g) any impact which the water services might have on the environment; and
- (h) the obligations of the National Government as custodian of water resources.²¹⁸

When setting tariffs, the Minister must collaborate with the Minister of Finance.²¹⁹ These tariffs cannot vary from “prescribed norms and standards.”²²⁰

The second part fleshes out the duties of water authorities, and a variety of service providers.²²¹ Water Service Authorities (WSAs), are assigned by a municipality to provide water supplies.²²² The Act places the duty of providing “efficient, affordable, economical, and sustainable access to water services” on these WSAs.²²³ The provisions in this section are also designed to “link directly” into the Catchment Management System in terms of how the resource is allocated and delivered.²²⁴ Water Service Providers (WSPs) are more localized or rural in nature and could be community owned.²²⁵ These WSPs must be approved by the Water Service Authority.²²⁶

Because the purpose of the Act is to ensure that the people of South Africa have an adequate supply of water,²²⁷ the Act demands that there be a “provision of a minimum of twenty-five [pounds] of potable water per person per day, or six [kilograms] per household per month, at a minimum flow rate of not less than ten [pounds] per min[ute] within 200 [miles] of a household and with no consumer going without a supply for more than seven full days in any year.”²²⁸

B. Ground Water Management in South Africa

While groundwater constitutes less than 13% of South Africa’s total water supply, it is critical to more than 300 small towns and settlements,²²⁹ as 60% of

²¹⁸ Water Services Act of 1997 § 9(3)(a)-(h) (S. Afr.).

²¹⁹ Berjak, *supra* note 172, at 54.

²²⁰ Water Services Act of 1997 § 10(4) (S. Afr.).

²²¹ Kidd, *supra* note 159, at 96.

²²² Berjak, *supra* note 172, at 55 n.146.

²²³ *Id.* at 55-56.

²²⁴ *Id.* at 56.

²²⁵ *Id.* at 57.

²²⁶ *Id.*

²²⁷ Kidd, *supra* note 159, at 96.

²²⁸ *Id.*

²²⁹ Martin Zhuwakinyu, Water 2012: A review of South Africa’s water sector, Research Channel Africa (May 2012), <http://pmg-assets.s3-website-eu-west-1.amazonaws.com/120904review.pdf>.

those communities depend upon it as the sole source of water for their basic needs.²³⁰ Geographically, the major and minor aquifers that exist are concentrated in the southern and central portion of the country.²³¹ The aquifers that do exist to the northwest are classified as “poor,” meaning the yields are low or negligible and of moderate to poor water quality.²³² The depth that has to be drilled in order to find water is often a concern.²³³ In most parts of the country, the drill depth ranges from 30-60 m, or roughly 98.4–196.85 ft.²³⁴ However, due to the deep sand cover in other regions, wells have to be drilled up to 120 m, or 393.7 ft., in order to reach the groundwater.²³⁵

Water management in South Africa takes a full hydrological cycle approach that naturally encompass groundwater.²³⁶ In the past, most of the resource management attention has focused on surface water; however, increasingly more interest has been placed on groundwater as South Africa develops.²³⁷ While subject to the national legal framework, which includes registration and permitting, it is important for local governments to encourage stakeholder engagement and compliance as well as overseeing enforcement.²³⁸

South Africa attempted a more comprehensive attempt at groundwater governance in 2010 by enacting the Groundwater Strategy (GS).²³⁹ This strategy grew out of a 2007 document published by the Department of Water Affairs that was meant to supplement a second edition of the National Water Resource Strategy.²⁴⁰ However, due to a lack of public consultation and stakeholder participation, it was ultimately scrapped and remade into the National Groundwater Strategy (NGS) in 2016.²⁴¹ A system was proposed based upon the Global

²³⁰ Groundwater Strategy 2010, Department; Water Affairs Republic of South Africa, 3 (2010) http://www.dwa.gov.za/Groundwater/Documents/GSDocument%20FINAL%202010_MedRes.pdf.

²³¹ Aquifer Classification of South Africa, Department of Water Affairs (Aug. 2012), <http://www.dwa.gov.za/Groundwater/documents/Aquifer%20Classification.pdf>.

²³² *Id.*

²³³ See Groundwater Strategy 2010, *supra* note 230, at 13.

²³⁴ *Id.* at 16.

²³⁵ *Id.*

²³⁶ Kidd, *supra* note 159, at 92-93.

²³⁷ See Eberhand Braune et al., *20 Years of Groundwater Research, Development and Implementation in South Africa*, 118.1 S. AFR. J. OF GEOLOGY Aug. 2014, at 5, 6.

²³⁸ *Id.* at 9.

²³⁹ Dep't of Water Affairs, NATIONAL GROUNDWATER STRATEGY (NGS) - 2016, [hereinafter NATIONAL GROUNDWATER STRATEGY] <http://www.dwa.gov.za/Groundwater/NGS2016.aspx>.

²⁴⁰ Abdikadir Hussein Ali, *Groundwater Law in South Africa and Mainland Tanzania: A Comparative Study*, 47 (2012) (Unpublished Master of Philosophy Thesis, University of the Western Cape) (Noting that the second edition of the National Resource Strategy was delayed).

²⁴¹ National Groundwater Strategy, *supra* note 239.

Groundwater Governance Framework.²⁴² This framework revolves around local context guiding the decisions of local, regional, and national water management actors.²⁴³ The Strategy points out that while the focus should center around stakeholder involvement, several major issues including proper valuation of the resource, scientific understanding and data, and local education represent hurdles that must be overcome before implementation.²⁴⁴ The Strategy then maps out 12 interrelated themes in a trickle down formation that will form the governance framework.²⁴⁵

While there is ongoing conversation and strategizing, concrete steps have not been taken to enact or enforce a system of groundwater specific management.²⁴⁶ In particular, poor groundwater borehole identification and monitoring, a critical first step in any groundwater management scheme, has been identified as one of the chief barriers to efficient management as well as poor groundwater monitoring networks.²⁴⁷

C. Sources Beyond Groundwater

While certainly an important source, groundwater alone would not be sufficient to meet the water needs of a developing South Africa.²⁴⁸ Aquifer recharge is difficult as water lost during evaporation and evapotranspiration prevents any effective recharge from occurring.²⁴⁹ Surface water is a main supply source, but the arid nature of the region makes flow predictability difficult.²⁵⁰ It has been found that only about “10% of the mean annual streamflow (runoff) can be relied upon to be available during any year.”²⁵¹ Because of this, dams have become of the utmost importance in South Africa, with the major reservoir storage representing about “70% of the mean annual runoff.”²⁵²

²⁴² Dep’t of Water and Sanitation Strategy, NATIONAL GROUNDWATER STRATEGY 31 (2016), http://www.dwa.gov.za/Groundwater/Documents/NGS_Draft-Final_04012017.pdf.

²⁴³ *Id.* at 32.

²⁴⁴ *Id.* at 27.

²⁴⁵ *Id.* at 33.

²⁴⁶ See Gaathier Mahed, *Southern African Nations Need to Up Their Groundwater Management Game*, THE CONVERSATION, (Dec. 10, 2018), <https://theconversation.com/southern-african-nations-need-to-up-their-groundwater-management-game-107614..>

²⁴⁷ Luker, *supra* note 14, at 921.

²⁴⁸ See Roberts, *supra* note 62.

²⁴⁹ *Hydrology of Southern Africa*, *supra* note 61.

²⁵⁰ Roberts, *supra* note 62.

²⁵¹ *Id.*

²⁵² *Id.*

IV. SUGGESTIONS

A. What can South Africa Learn from Arizona?

1. Similarities in Frameworks

If Cape Town represents the first domino to fall in South Africa's quest for water security, it may be time for policy makers to take creative water policy seriously.²⁵³ But diving off the deep end could prove fatal, as academics and consultants have "stressed that the groundwater plans for [Cape Town] are unrealistic in their timelines for abstraction because of the large planned volumes of water and subsequent infrastructure requirements."²⁵⁴

While their respective approaches to water management are different, South Africa and Arizona share a few common ideas. These similar concepts were implemented with varying degrees of success.²⁵⁵ Arizona monitors and plans ground water use through the establishment of Active Management Areas; by contrast, South Africa has designated 19 Water Management Areas.²⁵⁶ Whereas Arizona designated AMAs around population centers, the WMAs in South Africa were meant to serve as the starting point for Catchment Management Systems.²⁵⁷ The chief critique of Arizona's approach is that the state has not gone far enough.²⁵⁸

²⁵³ See Luker, *supra* note 14 ("These cities also offer cautionary tales. Both have experienced tumultuous social and environmental effects even with efforts to implement clear water management frameworks.").

²⁵⁴ *Id.*

²⁵⁵ See *Arizona Department of Water Resources supra* note 21 (Arizona shifted from a common law system to a statutorily required permit system); see also Guide to the National Water Act, Department of Water Affairs and Forestry, <http://www.dwaf.gov.za/Documents/Publications/NWAguide.pdf> ("the National Water Act . . . protects and allocates water differently. It recognizes that water is a natural resource that belongs to all people in South Africa.").

²⁵⁶ See Ariz. Rev. Stat. Ann. § 45-411(2018); see also National Water Act Ch 2 Pt 1 6 (c)-(f) (1998), Kevin Pieterse, Hans E. Beekman, Martin Holland, South African Governance Case Study, Water Research Commission, 16 (June 2011), http://www.groundwatergovernance.org/fileadmin/user_upload/groundwatergovernance/docs/Country_studies/GWGovernanceRSA.pdf.

²⁵⁷ See Jon L. Kyle, *Arizona's New Groundwater Statute: 1980 Groundwater Management Act: Outline*, (1981); see also Water Resources Allocation: Laws and Emerging Issues: A Short Course (Summer Conference, June 8-11). Paper 11. <http://scholar.law.colorado.edu/water-resources-allocation-laws-and-emerging-issues/11>; see also Daniel Malzbender, Jaqui Goldin, Anthony Turton, Anton Earle, *Traditional Water Governance and South Africa's "National Water Act" – Tension or Cooperation?*, 4 (written for International Workshop on 'African Water Laws: Plural Legislative Frameworks for rural water Management in Africa) (Jan. 26, 2005).

²⁵⁸ See Smith, *supra* note 34 ("The act has been largely successful, but recent years have shown slippage in progress toward meeting the goal of safe yield. Some of these problems have existed since the act was passed, a result of negotiated concessions among

While AMAs operate within a strict set of regulations, a large category of exempt wells, as well as areas of the state outside of AMAs, face no requirements.²⁵⁹ However, AMAs are at least established and functional.²⁶⁰ In South Africa, while the overarching Water Management Areas that encompass the entire nation have been established, Catchment Areas remain unestablished over two decades after the passing of the National Water Act.²⁶¹

Arizona and South Africa both set up a framework for quantifying and registering water users.²⁶² Arizona has registered, and in certain areas, prevented the expansion of drilling and irrigation.²⁶³ South Africa has attempted a similar registration framework.²⁶⁴ In the first water registration drive, over “20[,000 users were registered with a total registered volume of 2.4 billion [meters cubed per acre].”²⁶⁵ Despite what appeared to be an initial success, only an estimated 20% of groundwater users are accounted for, and the exact number and use of boreholes remains unaccounted for.²⁶⁶ Licensing processes remain unclear and are hindered by backlog and administrative inefficiencies.²⁶⁷

Both systems attempt to assure an adequate supply for the future. Arizona places the pressure on developers to provide a 100-year assured supply for new development projects.²⁶⁸ South Africa proves to be more ambitious, with a principle

the mines, farms and cities. Others are of our own making, in attempting to continue to do business in old ways the act meant to change.”).

²⁵⁹ See *id.* (“Finally, it is time to address the “third rail” of water management: exempt wells that have no obligation to contribute to safe yield.”).

²⁶⁰ See *Arizona Department of Water Resources supra* note 21.

²⁶¹ See Schreiner, *supra* note 38 (“[O]nly two out of a proposed nine CMAs have been established since 1998, and the transformation of irrigation boards, which was to take six months according to the act, has not yet been completed.”).

²⁶² See *Ariz. Rev. State. Ann.* § 45-512 (2018); see also Leonie Berjak, *Water Management in South Africa*, 24 (2003) (Unpublished Master of Laws thesis, University of Natal, Pietermaritzburg).

²⁶³ See *Ariz. Rev. State. Ann.* § 45-591, 598 (2018).

²⁶⁴ Berjak, *supra* note 172, at 24.

²⁶⁵ Eberhard Braune, Shafick Adams, & Fanus Fourie, *20 Years of Groundwater Research, Development and Implementation in South Africa 1994-2014*, 26 (Aug. 2014).

²⁶⁶ See Kevin Pietersen, Hans E. Beckman, & Martin Holland, *South African Governance Case Study*, Water Research Commission, 11 (June 2011), http://www.groundwatergovernance.org/fileadmin/user_upload/groundwatergovernance/docs/Country_studies/GWGovernanceRSA.pdf.

²⁶⁷ Schreiner *supra* note 38 (“The process of issuing licenses to water users has seen serious challenges and delays, hampering much needed economic growth in the country. It has been found that prior to a recent project aimed specifically at removing the backlog in water use licenses, some license applications had been with the department for up to eight years without being finalized. In parallel, the system of registering water use across the country is not up to date and reflects incorrect water use figures, resulting in significant billing and revenue collection challenges and difficulties in ensuring compliance with registered water use.”).

²⁶⁸ See *Overview of the Arizona Groundwater Management Code*, AZWATER.GOV, http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf (last visited Oct. 6, 2018).

of supplying a resource for both human use and the environment.²⁶⁹ Despite its best intentions, around 60% of rivers and wetlands are “ecologically threatened”, and South Africa has failed to quantify how much would be in the reserve and how enforcement would function.²⁷⁰

2. Lessons to be Learned

Regardless of steps in the right direction toward a sustainable system of water management that encompasses the entirety of the hydraulic cycle, South Africa’s greatest challenge seems to be its own complex history.²⁷¹ Building a functional government in a post-apartheid state has proved to be challenging on many levels, including addressing environmental concerns such as water.²⁷² Several problems derive not from the lack of law, but rather from little to no enforcement,²⁷³ the latter of which is often due simply to lack of infrastructure, knowledge, or data.²⁷⁴ It is unfortunate that “the visionary aspirations of South African water law have yet to be fulfilled.”²⁷⁵ Despite the specific intricacies and differences, there are takeaways from the Arizona method of groundwater management that could be useful as South Africa continues to develop.²⁷⁶

The first practice that could easily be adopted is the requirement of water assurance for new urban development.²⁷⁷ For example, the then-developing city of Cape Town was warned as far back as the 1990s that the city would run out of

²⁶⁹ Kidd, *supra* note 159, at 93-94.

²⁷⁰ See David Takacs, *South Africa and the Human Right to Water: Equity, Ecology and the Public Trust Doctrine*, 34 BERKELEY J. INT’L LAW 55, 82 (2016).

²⁷¹ Larry A. Swatuk, *The State and Water Resources Development through the Lens of History: A South African Case Study*, 3 WATER ALTERNATIVES 521, 521 (2010).

²⁷² *Id.* (“The post-apartheid challenge comprises a Gordian knot of five interrelated factors: (i) use the power of the state in support of the needs of the majority, (ii) address the environmental consequences of unreflective modernization, (iii) generate the income to do so, (iv) achieve buy-in from the dominant economic and political actors in the country, (v) without alienating hegemonic global forces.”).

²⁷³ Mike Muller, *South Africa needs good water management - not new water laws*, The Conversation (Feb. 6, 2018) <https://theconversation.com/south-africa-needs-good-water-management-not-new-water-laws-91253>.

²⁷⁴ *Id.* (“It may seem simple to allocate water between competing users, but it requires a great deal of work to know how much water is available and how much water is currently being used, by whom.”).

²⁷⁵ Takacs, *supra* note 270, at 82.

²⁷⁶ See Stacy Pigott, *Cape Town’s Water Crisis: Could It Happen in Arizona?*, UA News (Mar. 20, 2018)(comparing Cape Town’s reliance on surface water and Tucson’s reliance on groundwater).

²⁷⁷ Janny Choy, *7 Lessons in Groundwater Management from the Grand Canyon State* (June 1, 2015), http://waterinthewest.stanford.edu/news-events/news-press-releases/7-lessons-groundwater-management-grand-canyon-state_

water.²⁷⁸ In spite of the forewarning, big-money development was encouraged in the wealthy city center.²⁷⁹ An assurance model could be adapted to the surface water-dependent urban areas, though it could also be argued that more stringent enforcement of South Africa's own codified strategy is better than dreaming up a new scheme.²⁸⁰

Another aspect of water management to be learned from Arizona is its system of enforceable water rights.²⁸¹ While the Arizona model is not perfect, its system of rights allows stakeholders to acquire a limited understanding of what they can and cannot do, and would allow the government to better track usage by the right holder.²⁸² A more permanent rights structure could encourage long-term investment in infrastructure and development.²⁸³

Additionally, much like Arizona's designated AMA's, Catchment areas need to be on the cutting edge of water management within its designated boundaries.²⁸⁴ Steps can be taken within the Catchment areas to address many water issues.²⁸⁵ Specifically, some research has suggested focusing on Strategic Water Source Areas within Catchment areas.²⁸⁶ Identifying these areas in relation to groundwater can be instrumental in tracking recharge and mitigating shortages.²⁸⁷

²⁷⁸ Richard Poplack, *What's Actually Behind Cape Town's Water Crisis*, The Atlantic (Feb. 15, 2018), <https://www.theatlantic.com/international/archive/2018/02/cape-town-water-crisis/553076/>.

²⁷⁹ *Id.*

²⁸⁰ Mike Muller, *South Africa needs good water management - not new water laws*, THE CONVERSATION (Feb. 6, 2018), <https://theconversation.com/south-africa-needs-good-water-management-not-new-water-laws-91253> ("The current laws set out technical and administrative processes that need to be followed if there's no longer enough water to go around, or if there isn't enough to meet new needs. These allow water to be reallocated between existing users and those seeking water for the first time.").

²⁸¹ See Ariz. Stat. Ann. § 45-171-176 (2018).

²⁸² W.V. Pitman, *Overview of water resource assessment in South Africa: Current state and future challenges* (Sept. 1, 2011), http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1816-79502011000500007. ("He lays the blame for the failure to define water rights, to enforce monitoring, to interpret readily available information and to enforce compliance on the 'crumbling capacity within the DWA.'").

²⁸³ See Tewari, *supra* note 201, at 705.

²⁸⁴ Berjak, *supra* note 172, at 24.

²⁸⁵ See generally David Le Maitre, et al., *Strategic Water Source Areas: Management Framework and Implementation Guidelines for Planners and Managers*, Report to Water Research Commission (July 2018), <https://water.cer.org.za/wp-content/uploads/2019/03/Management-framework-and-implementation-guidelines-for-planners-and-managers.pdf>.

²⁸⁶ *Id.* at 4 ("Strategic Water Source Areas (SWSAs) are areas of land that either: (a) supply a disproportionate amount of mean annual surface water runoff in relation to their size and are considered nationally important; or (b) have high groundwater recharge and are locations where the groundwater forms a nationally important resource; or (c) are areas that meet both criteria (a) and (b).").

²⁸⁷ *Id.* at 8-11.

Increasing understanding and awareness may also identify where groundwater could be utilized as a national resource rather than just meeting local needs.²⁸⁸

Finally, regardless of how the nation chooses to manage it, South Africa's approach needs to include groundwater if it is to achieve the same success as Arizona in diversifying the portfolio of water availability.²⁸⁹ Urban areas in Arizona were able to blossom and flourish even in the desert because of a closely managed groundwater system supplemented by the available surface water.²⁹⁰ Even the fast-growing city of Tucson was able to cut back on groundwater usage through the use of water from the Central Arizona Project.²⁹¹ South Africa is also facing a period of growth, with an estimated 19 major dams needing to be built by 2025 to meet its rising water needs.²⁹² By adding groundwater, the urban supply could be augmented so long as pumping is managed and monitored in an efficient way.²⁹³

Water management legislation in South Africa is not lacking in ambition;²⁹⁴ in fact, it is arguably one of the most modern and progressive attempts in the world.²⁹⁵ This push has allowed for collaboration within the scientific community in developing effective systems of management at the local level.²⁹⁶ The greatest challenge South Africa faces is simply gaining the knowledge and infrastructure needed to effectively manage groundwater resources.²⁹⁷ The Act itself relies upon an admirable undertaking that cannot realistically be implemented immediately.²⁹⁸ Specifically at the local level, the national guidance on groundwater is either not being incorporated into local plans, or is being largely ignored.²⁹⁹ Even with the push for registration, there is still much that is unknown, as domestic use and stock water fall under an exception that does not require registration.³⁰⁰

²⁸⁸ *Id.* at 8.

²⁸⁹ See Glennon, *supra* note 32 (“Water exchanges – that is, the substitution of one type of water for another, such as Colorado River water delivered through the CAP for groundwater – have become a reliable tool to solve intractable engineering challenges.”).

²⁹⁰ See *id.* (“recent developments offer fresh examples of the creativity of Arizona lawyers and water managers to craft workable solutions to water shortage problems.”).

²⁹¹ *Id.* (“A wonderful example is the Tucson/Phoenix Exchange, crafted in 2017. Tucson Water’s wellfields have twice the capacity to store recharged water as the utility needs. Phoenix, by contrast, has excess CAP water but lacks places to store it.”).

²⁹² Roberts, *supra* note 62.

²⁹³ See Luker, *supra* note 14, at 925 (“diversifying our resources mix, putting more emphasis on groundwater surely can help us in terms of resilience.”).

²⁹⁴ Kidd, *supra* note 159, at 102.

²⁹⁵ Braune, *supra* note 265, at 5.

²⁹⁶ *Id.*

²⁹⁷ *Id.* at 18.

²⁹⁸ Kidd, *supra* note 159, at 102.

²⁹⁹ Braune, *supra* note 256, at 14.

³⁰⁰ *Id.* at 14-15.

V. CONCLUSION

Humanity has a surprisingly short memory when it comes to water. During a drought, water conservation is first and foremost on every individual's mind.³⁰¹ However, as soon as the rain falls and the drought ends, it is often back to business as usual in the realm of water policy.³⁰² Mankind can no longer afford a "business as usual" mindset about water as the population grows into a world plagued by climate change.³⁰³

Cape Town has remembered its lessons and has rebounded, for the most part, despite many reports in 2018 indicating that it would be the first major city in the world able to claim that it ran out of drinking water.³⁰⁴ "Day-Zero" scare tactics inspired rapid response, setting "a great example for the rest of the world on how to manage a crisis situation like this."³⁰⁵ The numbers are beginning to turn around as "[t]he average water level for all dams in the Western Cape currently stands at 38.6% (compared to 18.2% [at this time in 2018]).³⁰⁶ Dams supplying the City of Cape Town stand at an average of 50.6% (compared to 21.8% [at this time in 2018])."³⁰⁷ Water restrictions are being lifted.³⁰⁸ While water features and fountains still are not allowed, irrigation restrictions are now relaxed, and citizens can top off or fill swimming pools.³⁰⁹ Even with Day Zero now in the rearview mirror, locals have a new sense of caution when it comes to the use of the resource.³¹⁰ The next drought may not be that far into the future.³¹¹

³⁰¹ See Robert Glennon, *UNQUENCHABLE: AMERICA'S WATER CRISIS AND WHAT TO DO ABOUT IT*, 179 (Island Press, 2009) ("programs urge citizens voluntarily to reduce their water use in times of crisis, such as drought. These programs usually work because Americans are by nature a generous people, willing to contribute to the well-being of the community. But there needs to be a real crisis, and the duration had best not be too long, for we're also an impatient lot.").

³⁰² See generally Robert Glennon, Does Arizona have enough water? Why that is such a tough question to answer, *AZ CENTRAL* (April 8, 2018), <https://www.azcentral.com/story/opinion/op-ed/2018/04/08/does-arizona-have-enough-water-glennon/484149002/> ("In short, business as usual is no longer a viable option.").

³⁰³ See generally *id.*

³⁰⁴ *Cape Town dams: Latest water levels for Monday 25 March*, *THE SOUTH AFRICAN*, (Mar. 25, 2019).

³⁰⁵ Sertan Sanderson, One year after the water crisis, Cape Town recovers from tourism drought, *www.dw.com* (Mar. 21, 2019), <https://www.dw.com/en/one-year-after-the-water-crisis-cape-town-recovers-from-tourism-drought/a-47966335> (quoting Jeff Levy, owner of "Head South Lodge.").

³⁰⁶ Cape Town dams, *supra* note 304.

³⁰⁷ *Id.*

³⁰⁸ *Id.*

³⁰⁹ *Id.*

³¹⁰ Sanderson, *supra* note 305.

³¹¹ *Id.* ("Even though the water restrictions were lifted last year, it's now become our new way of life. And it had to because we don't know when the next drought is going to hit us.").

In South Africa, access to water is a daily miracle; only around 50% of homes have freshwater piped directly into the house.³¹² As the 39th driest country in the world, South Africa has less water per person than Botswana and Namibia.³¹³ As a fairly new democracy, the country has more than its fair share of kinks to work out when it comes to productive water management.³¹⁴ The nation continues to learn just how multi-faceted and complicated providing a safe, secure water supply can be.³¹⁵ A world away, yet not completely dissimilar, Arizona faces challenges on multiple fronts involving water security.³¹⁶ With a drought on one front and plummeting lake and river levels on the other, some predict that the state will be feeling the strain of shortage as soon as 2020.³¹⁷

South Africa and Arizona have taken distinctive approaches, with different results. South Africa adopted an ambitious public trust approach encompassing the hydraulic system.³¹⁸ While great on paper, this approach to water security was met with strains on administrative feasibility and a lack of knowledge with which to base regulations upon.³¹⁹ Arizona, on the other hand, may have a workable framework, but is arguably not ambitious enough.³²⁰ With the clock constantly ticking, water security should be the first and foremost issue on everyone's mind. In the case of South Africa and Arizona, there is much to be learned from the other's successes as well as mistakes. With a little bit of innovation, creativity, and luck, "Day-Zero" might just get pushed back one more day.

³¹² #5facts: *Water in South Africa*, africacheck.org (Feb. 2, 2018), <https://africacheck.org/reports/5facts-water-south-africa/>.

³¹³ *Id.*

³¹⁴ Kidd, *supra* note 159, at 91.

³¹⁵ See generally Jason Hollowes, Eskom and the deepening water crisis in South Africa, [dailymaverick.co.za](https://www.dailymaverick.co.za/article/2019-04-05-eskom-and-the-deepening-water-crisis-in-south-africa/) (Apr. 5, 2019), <https://www.dailymaverick.co.za/article/2019-04-05-eskom-and-the-deepening-water-crisis-in-south-africa/> ("This means in a water scarce country such as South Africa the management of water and energy should be done in an integrated fashion.").

³¹⁶ Planning for a Sustainable Arizona Water Future, [arizonawaterfacts.org](http://www.arizonawaterfacts.org) (last accessed Jan. 4, 2019) <http://www.arizonawaterfacts.com/do-we-have-enough>.

³¹⁷ *Id.*

³¹⁸ Kidd, *supra* note 159, at 93.

³¹⁹ See Swatuk, *supra* note 271; see also Mike Muller, *South Africa needs good water management - not new water laws*, *The Conversation* (Feb. 6, 2018), <https://theconversation.com/south-africa-needs-good-water-management-not-new-water-laws-91253>.

³²⁰ See Karen Smith, Former water director: We still pump too much, [azcentral.com](https://www.azcentral.com/story/opinion/oped/2015/03/05/arizona-groundwater-management/24464443/) (Mar. 5, 2015), <https://www.azcentral.com/story/opinion/oped/2015/03/05/arizona-groundwater-management/24464443/>.

