ARIZONA IN DROUGHT—REEXAMINING THE COLORADO RIVER COMPACT

Carlos Lopez†

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† J.D., Drake University Law School, 2023; Dual Major B.A., Public Administration and Law Enforcement Management, Northern Arizona University, 2015, born and raised on the Colorado River. The Author dedicates this Note to his wife, family, and friends, with special consideration to his father, Peter Lispio, who helped him create a science fair project that sparked a lifelong interest in southwestern aquifers and water rights. The Author would also like to extend his sincerest thanks to those who work and manage the water flow that provides life to the American Southwest.

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I. INTRODUCTION

Is the glass half empty, or is it half full? When the water reservoirs that power life in the American Southwest start to run dry, how will we analyze this question? How will the southwestern states share the most precious resource of all, the Colorado River, moving forward through the twenty-first century? Standing in the southwestern heat,[1] legislators are already attempting to tackle these questions as renegotiation for Colorado River water allocation looms in 2026.[2] The hard truth is that southwestern cities like Phoenix are drying up due to prolonged drought, and it's happening faster than our water supply can handle.[3] Arizonians are no strangers to dry and arid survival, but when the state is expected to lose 18% of its supply of water from the Colorado River by 2022, the future by all accounts seems "sobering."[4]

Luckily for Arizona, there is hope. In 2026, legislators from Arizona, Utah, Colorado, Wyoming, Nevada, and New Mexico will come together to renegotiate

1. *See* Jasmine Wright, *Harris Makes the Case for Biden's Climate Priorities in Visit to Rapidly Draining Lake Mead*, CNN (Oct. 18, 2021, 6:34 PM EDT), https://www.cnn.com/2021/10/18/politics/kamala-harris-lake-mead-climate-resilience/index.html [https://perma.cc/CXV5-FX4L].

2. Ariana Brocious et al., *A Colorado River Showdown is Looming. Let the Posturing Begin*, ARIZ. PUB. MEDIA (Mar. 23, 2021), https://news.azpm.org/p/newsfeature/2021/3/23/191619-a-colorado-river-showdown-is-looming-let-the-posturing-begin/ [https://perma.cc/J99Q-7B4D].

3. *See generally* Rob Odell & Ian James, *Arizona Has Tried to Safeguard Groundwater Beneath Its Big Cities. But Things Are About to Change*, AZCENTRAL (Dec. 15, 2019, 7:13 PM), https://www.azcentral.com/in-depth/news/local/arizona-environment/2019/12/05/arizona-groundwater-rules-water-tables-declining-parts-phoenix-tucson/3949004002 [https://perma.cc/A6S2-5DMT].

4. Ian James & Zayna Syed, *First-ever Water Shortage on the Colorado River Will Bring Cuts for Arizona Farmers*, AZCENTRAL (Aug. 16, 2021, 8:17 PM), https://www.azcentral.com/story/news/local/ arizona-environment/2021/08/16/colorado-river-shortage-bring-water-cuts-arizona-farmers/8150901002/ [https://perma.cc/KEN3-WW7B].

management guidelines for the Colorado River Compact;[5] a nearly 100-year-old treaty between these states that allocated water amongst them.[6] Some states such as Utah have not used their full allocation of water, which could be a potential source to draw from.[7] Negotiators and legislators on either side are also committed to finding solutions between the states to work together through the southwestern drought.[8] Additionally, Arizona lawyers and professors within the state are publishing works on the topic while proposing long-term solutions through water regulatory management.[9]

As such, there is hope for Arizona to continue to thrive despite the current drought and water shortages within the southwest – primarily through renegotiation of the Colorado River Compact. This note will analyze the Colorado River Compact through the lens of Arizona's interests, while also exploring the history and effects this treaty had upon Arizona law. This note will also discuss the importance of the Colorado River within the Arizona water system, and how this prolonged drought is expected to hurt the state. Finally, this note will recommend laws and renegotiation tactics in order to preserve Arizona's water interests well into the future.

II. WHERE DOES ARIZONA'S WATER COME FROM AND WHAT IS IT USED FOR?

Before analyzing the Colorado River Compact and its impact upon Arizona, it is important to first understand where Arizona gets its water. To analyze and review all aspects of Arizona water law would exceed the scope of this note. However, major aspects of Arizona's water sources and accompanying law will be briefly examined to fully analyze the effect of the Colorado River Compact. According to Arizona State University, the majority of Arizona's "water supply comes from three major sources: The Colorado River, groundwater, and in-state

5. Brocious et al., *supra* note 2.

6. Mark Armao, *The Colorado River is Drying Up. Here's How that Affects Indigenous Water Rights*, GRIST (Oct. 6, 2021), https://grist.org/equity/colorado-river-drought-indigenous-water-rights/ [https://perma.cc/9Y43-6Q4F].

7. Brocious et al., *supra* note 2.

8. Kyle Dunphey, *On the River with Mitt Romney and Michael Bennet: Politicians, Industry Heads Talk Drought, Climate Change in the West*, DESERETNEWS (Sept. 18, 2021, 11:15 PM CDT), https://www.deseret.com/utah/2021/9/18/22681355/utah-senator-mitt-romney-michael-bennet-talk-drought-climate-change-on-colorado-river-trip [https://perma.cc/N8HG-39NZ].

9. ROBERT GLENNON, UNQUENCHABLE: AMERICA'S WATER CRISIS AND WHAT TO DO ABOUT IT 319 (2009).

rivers."[10] Approximately 36% of Arizona's water comes from the Colorado River.[11] The remaining 64% of Arizona's total water supply is made from instate rivers such as the Gila River or Salt Verde Watershed, groundwater aquifers, and reclaimed water sources.[12] Because of this "diverse portfolio" of water supply, Arizona has a number of different options in managing drought conditions.[13]

This management is dependent upon water use, as agriculture makes up 72% of Arizona water usage, while industry and municipal use make up the remaining 28%.[14] Although Arizona is only expected to lose 18% of its allocated share of the Colorado River in 2022,[15] this 18% plays a major impact on Arizona's economy as some farmers expect to lose 25% to 35% of their farmable land due to the river cutbacks.[16] Thus, all water matters, and how Arizona manages this life sustaining resource, especially the Colorado River, is crucial to the sustainability of the state.

III. THE COLORADO RIVER—LIFEBLOOD OF THE SOUTHWEST

The Colorado River is often described as the "lifeblood of the southwest"[17] in that, it travels through seven different states and provides drinking water to at least 40 million Americans.[18] Between the seven states, more than four million acres of farmland are irrigated by The Colorado River alone.[19] At its inception point located within the Rocky Mountains, the river starts as a "cold mountain trout stream" that cuts its way through jagged gorges and deep canyons spanning

10. *Arizona's Most Precious Resource*, ARIZ. STATE UNIV. (Oct. 4, 2022, 11:48 AM), https://asu.maps.arcgis.com/apps/Cascade/index.html?appid=a44299ef542a479d8a63b72c348dd1ba [https://perma.cc/B63R-SQZN].

11. *Arizona's Water Supplies*, ARIZ. WATER FACTS (Sept. 30, 2022, 2:38 PM), http://www.arizonawaterfacts.com/water-your-facts [https://perma.cc/B2BA-8Q8J].

12. *Id.*

13. *Id.*

14. *Id.*

15. James & Syed, *supra* note 4.

16. *See Mandatory Cutbacks in Colorado River Water Supply to Hammer Arizona Farmers*, CBS NEWS (Aug. 16, 2021, 5:15 PM), https://www.cbsnews.com/news/mandatory-cutbacks-in-colorado-river-water-supply-will-hammer-arizona-farmers/ [https://perma.cc/2MQG-VNPA] [*Mandatory Cutbacks in Colorado River*].

17. *Lower Colorado River*, AM. RIVERS (Jan. 13, 2022, 5:18 PM), https://www.americanrivers.org/endangered-rivers/lower-colorado-river-az-ca-nv/ [https://perma.cc/VGR2-A6MT].

18. *See* U.S DEP'T OF THE INTERIOR, COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY 2–3 (2012).

19. *Colorado River Management*, ARIZ. DEP'T OF WATER RES. (Sept. 30, 2022, 2:40 PM), https://new.azwater.gov/crm [https://perma.cc/6CZZ-Z3XX].

approximately 1,450 miles.[20] The management of the river is divided between the lower and upper basins which is separated at the dividing line of Lees Ferry, Arizona.[21]

A. Upper Basin

The Upper Basin of The Colorado River primarily consists of four states: Colorado, Utah, New Mexico, and Wyoming.[22] Much of the water that flows through The Colorado River as a whole is due to the snowpack received by these four states which melts and replenishes the river each year.[23] The water flows through many tributaries in the Upper Basin including the Green, Escalante, Deloros, Gunnisuon, and San Juan Rivers.[24] The total amount of land managed within the Upper Basin is approximately 109,800 square miles.[25]

B. Lower Basin

The Lower Basin, on the other hand, encompasses nearly all of Arizona, California, and Nevada's share of the Colorado River while also reaching small portions of New Mexico and Utah through its tributaries.[26] The major tributaries that make up the Lower Basin include the Little Colorado, Bill Williams, Virgin, Paria, and Gila Rivers.[27] Although The Colorado River itself is supposed to flow from the top of the lower basin at Lees Ferry, Arizona and into Mexico, the water way runs dry before ever reaching the Gulf of California.[28] For years, the Colorado River delivered approximately 17 billion cubic meters of freshwater into the Sea

20. *Colorado River*, AM. RIVERS (Sept. 30, 2022, 2:41 PM), https://www.americanrivers.org/river/colorado-river/ [https://perma.cc/9CAX-MXP2].

21. *Upper Basin of the Colorado River*, AM. RIVERS (Sept. 30, 2022, 2:42 PM), https://www.americanrivers.org/river/upper-basin-colorado-river/ [https://perma.cc/B3XE-G8DB].

22. *Id.*

23. *Id.*

24. BRENDAN BOEPPLE, THE COLORADO RIVER BASIN: AN OVERVIEW 26 (Sept. 30, 2022, 6:24 PM), https://www.coloradocollege.edu/dotAsset/e57e7c73-2983-477b-a05d-de0ba0b87a00.pdf [https://perma.cc/J297-SUG8].

25. *Id.* at 25.

26. *Id.* at 25 fig.1.

27. *Id.* at 26.

28. *Lower Basin of the Colorado River*, AM. RIVERS (Sept. 30, 2022, 2:43 PM), https://www.americanrivers.org/river/lower-basin-colorado-river/ [https://perma.cc/Q6NC-XJJM].

of Cortez.[29] Today, the only water that reaches the Sea from the Lower Basin is salty agricultural runoff which threatens the marine life dependent upon the fresh-water flowing from The Colorado River to thrive.[30]

Unlike the Upper Basin, the Lower Basin waterways run dry much more often. Shockingly enough, the second largest tributary to the Colorado River, the Gila River, which runs through both basins is "mostly bone dry" towards its end in southern Arizona.[31] Many rivers that start within Arizona and connect into The Colorado River through tributary formations have either become seasonal flood ways or have stopped flowing altogether.[32] How did this come to be? Much of the water usage that causes these waterways to run dry is due to the agricultural needs of sustaining population growth.[33] Another factor is the management of The Colorado River between the Upper and Lower Basin states. There are multiple water diversion systems within the Lower Basin, such as dams, canals, and pipelines that divert water from the natural flow to the basin states.[34] The management of this water flow is determined by The Colorado River Compact, the treaty which was negotiated and ratified by the seven basin states in 1922 and is still in effect today.[35]

IV. THE LAW OF THE RIVER

A. The Formation of the Law of the River

The Colorado River Compact, often referred to as the cornerstone to the "Law of the River," originally divided the basins into the two portions we have today.[36] On August 19, 1921, Congress authorized the ability of the seven states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming to form an agreement for the management and distribution of the water from The Colorado

29. *Restoring the Colorado River Estuary*, SONORAN INST. (Sept. 30, 2022, 2:43 PM), https://sonoraninstitute.org/card/restoring-the-colorado-river-estuary/ [https://perma.cc/BJ42-WV3R].

30. *Id.*

31. Jonathan Waterman, *The American Nile*, NAT'L GEOGRAPHIC (Oct. 4, 2022, 12:12 PM), https://www.nationalgeographic.com/americannile/ [https://perma.cc/B5S9-M2UZ].

32. *Id.*

33. *Id.*

34. *See The Law of the River*, U.S. DEP'T OF THE INTERIOR (Sept. 30, 2022, 2:47 PM), https://www.usbr.gov/lc/region/g1000/lawofrvr.html [https://perma.cc/4Z6K-M6DX].

35. *Id.*

36. *Colorado River Compact*, WATER EDUC. FOUND. (Sept. 30, 2022, 2:48 PM), https://www.watereducation.org/aquapedia-background/colorado-river-compact [https://perma.cc/4MQM-SQTF].

River.[37] Approximately one year later on November 24, 1922, the states signed their agreement for the purpose of providing "equitable division and apportionment" amongst them.[38] Key to their compromise included the requirement of defining Upper and Lower Basin portions in order to allocate management and distribute the then existing 7,500,000 acre-feet of water available from the Colorado River to each basin.[39] This accomplishment was no easy task however, as the states could not initially agree with how the apportionment would be distributed.[40] Additionally, Arizona was highly opposed the apportionment initially drafted and thus did not sign the agreement until much later in 1944.[41]

Key to debate amongst the states before the passing of The Colorado River Compact was the question of who gets priority rights to the water. In the early 1920s, California was rapidly developing and requiring more water than the rest of the surrounding states.[42] At that time,[43] most of the western states followed California in adopting prior appropriation for water use.[44] Prior appropriation is a doctrine in conventional water law that maintains that the earliest user of a water source has "the right to take all they can use before anyone else has a right to it."[45] This rule applies only between people or entities whose properties border that waterway.[46] In contrast, the riparian water doctrine, the rule that declares that "owners of land bordering on a waterway have equal rights to use the water passing through or by their property,"[47] was used more in reference to the Pacific Ocean and in great plains states.[48]

37. 43 U.S.C. § 6171.

38. *Id.* (approving and referring to the Colorado River Compact, 1922, available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf).

39. *Id.*

40. *Colorado River Compact*, *supra* note 36.

41. *Id.*

42. *See generally* Lawrence J. MacDonnell, Arizona v. California *Revisited*, 52 NAT. RES. J. 363, 367 (2012).

43. Donald J. Pisani, *Enterprise and Equity: A Critique of Western Water Law in the Nineteenth Century*, 18 W. HIST. Q. 15, 35 (1987).

44. Michael Arthur et al., *Doctrine of Prior Appropriation*, PA. ST. UNIV. (Sept. 30, 2022, 2:47 PM), https://www.e-education.psu.edu/earth111/node/948 [https://perma.cc/RA3K-STZM] ("The Prior Appropriation Doctrine grew out of the California gold rush, and the need for gold miners to establish some system of mining claims and water use because of the limited water resources available."); *see also* Pisani, *supra* note 43, at 35 ("Riparian rights were not the only casualty of the corporate irrigation boom of 1877.").

45. *Prior-Appropriation Doctrine*, BLACK'S LAW DICTIONARY (11th ed. 2019).

46. *Id.*

47. *Riparian-Rights Doctrine*, BLACK'S LAW DICTIONARY (11th ed. 2019).

48. Pisani, *supra* note 43, at 35.

B. Prior Appropriation and the California Scare

Since most of the arid western states recognized prior appropriation over the riparian doctrine in application to water law, concern grew in the 1920s regarding rights to The Colorado River.[49] The seven basin states feared that California would use prior appropriation to establish "priority rights" for use of the river's water.[50] This fear eventually became reality under the 1922 Supreme Court ruling of *Wyoming v. Colorado,* where the Court concluded that the prior appropriation doctrine of "first in time, first in right" would apply to use of The Colorado River between the states.[51] The Court specifically held that "priority of appropriation gives superiority of right . . . [and e]ach of these States applies and enforces this rule in her own territory."[52] Thus, under this new precedent, California and its booming population could lay claim to the water shared along its border with Arizona.[53] Not only could California claim the water, but federal surveys at the time also called for a dam to be placed in Boulder Canyon which would further enable and give California access to modify the Colorado River to its own use at the expense of the other states.[54] Southern California was also notorious at the time for unreputable water dealings, further fueling the fear amongst the states.[55] Thus, the message was clear, either Arizona and the basin states could come together and finalize an agreement over the Colorado River, or, the states could be left to their own battles of prior appropriation.

C. Early Compact Formations

Prior to the ruling in *Wyoming v. Colorado*, the seven basin states were already discussing the need for a compact regulating water use.[56] The first attempt at a compact between the states created the "League of the Southwest" in 1919 which called for the federal government to develop and establish water resources for the region.[57] In either response to the League's resolutions to the government, or out of Congress' own democratic processes, President Harding appointed

49. Joe Gelt, *Sharing Colorado River Water: History, Public Policy and the Colorado River Compact*, 10 THE UNIV. OF ARIZ. WATER RES. RSCH. CTR. 1, 2 (1997).

50. *Colorado River Compact*, *supra* note 36.

51. MacDonnell, *supra* note 42, at 367.

52. Wyoming. v. Colorado, 259 U.S. 419, 470 (1922).

53. *See generally* Gelt, *supra* note 49.

54. *Id.*

55. Robert Glennon & Jacob Kavkewitz, *"A Smashing Victory"?: Was* Arizona v. California *a Victory for the State of Arizona?*, 4 ARIZ. J. ENV'T L. & POL'Y 1, 5 (2013).

56. *Id.*

57. *Id.*

Secretary of Commerce Herbert Hoover to oversee a commission between the seven states for the purpose of regulating the Colorado River.[58]

In January of 1922, five months prior to the holding of *Wyoming*, the seven states convened in Washington, D.C. to discuss the formation of a compact, with Herbert Hoover acting as chairman.[59] During that time, the states fiercely disagreed over the distribution of water amongst them.[60] The upstream states feared that the downstream states, namely California, would take up the "lion's share of the water."[61] At that time, it was not feasible to determine appropriations between the states which further created divide.[62] In response, "Hoover suggested that the water be divided between the [U]pper and [L]ower [B]asins, without attempting to determine individual state quotas."[63] This only further widened the rift; instead of the states arguing amongst each other for individual allocations, the states began arguing based on group allocation.[64] Despite the objections, the states agreed with Chairman Hoover's plan of splitting the basins by region and distributing 7.5 million acre-feet of water to each basin.[65]

V. THE COLORADO RIVER COMPACT

On November 9, 1922, only a few months after the Supreme Court's decision in *Wyoming*, the states met in Santa Fe, New Mexico to ratify The Colorado River Compact.[66] The Compact was signed by all seven states less than three weeks later.[67] The Compact, although only four pages in text, had 11 articles that defined the parameters of management within The Colorado River Basin.[68] The provisions are summarized as follows:

58. *Id.*

59. *Colorado River Compact*, *supra* note 36.

60. Spencer Howard, *Herbert Hoover and Hoover Dam*, NAT'L ARCHIVES (Aug. 19, 2020), https://hoover.blogs.archives.gov/2020/08/19/herbert-hoover-and-hoover-dam/ [https://perma.cc/886S-TCQ4].

61. *Id.*

62. Gelt, *supra* note 49, at 3.

63. Howard, *supra* note 60.

64. Gelt, *supra* note 49, at 3.

65. Howard, *supra* note 60.

66. *Colorado River Compact*, *supra* note 36.

67. *See id.*

68. 43 U.S.C. § 6171 (referring to and approving the Colorado River Compact, art. I-XI (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

A. Article I

Article I states the purposes of the compact which detail both intangible and tangible goals.[69] Accordingly, the major intangible purposes of the Compact are to provide fair apportionment of the use of the waters within The Colorado River, "promote interstate comity," and end controversy between the states regarding water use.[70] The tangible purposes of the Compact are to secure agricultural and industrial development within the basin, create storage for its water, and protect the entire basin against floods.[71]

B. Article II

Article II generally defines the terms used within the Compact and what areas are attributable to management within The Colorado River basins.[72] This article defines the basins and sets the dividing line between the basin's as being Lees Ferry, Arizona.[73] Domestic use, as defined under this provision includes the use of water "for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power."[74]

C. Article III

Article III lays out the substance of the compact. This article apportions 7.5-million-acre feet of water from the Colorado River per year to both the Upper and Lower Basin.[75] To imagine this sort of apportionment, one acre foot equates to roughly 326,000 gallons of water – enough to cover a football field one foot deep.[76] The Lower Basin has the right to increase its use of water by 1-million-acre feet per year.[77] The Upper Basin is not allowed to cause the flow of the water at Lees

69. *See generally id.* (referring to and approving the Colorado River Compact, art. I (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

70. *Id.*

71. *Id.*

72. *See generally id.* (referring to and approving the Colorado River Compact, art. II (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

73. *Id.*

74. *Id.*

75. *Id.* (referring to and approving the Colorado River Compact, art. III(a) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

76. *What's an Acre-Foot*, WATER EDUC. FOUND. (Sept. 30, 2022, 2:54 PM), https://www.watereducation.org/general-information/whats-acre-foot [https://perma.cc/3BCS-WDA8].

77. 43 U.S.C. § 6171 (referring to and approving the Colorado River Compact, art. III(b) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

Ferry to be "below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years."[78] Further, the Upper Basin is not allowed to withhold water, and the states within the Lower Basin cannot request delivery of water for means other than domestic and agricultural use.[79] Apportionment between the basins can be modified under this article at any time *after* (1) October 1, 1963, and (2) when either basin reaches "its total beneficial consumptive use."[80] Subsection (g) of this Article lists the requirements for states to meet in seeking reapportionment.[81] This article also outlines rules and guideline requirements for water apportionment to Mexico.[82]

D. Article IV

Article IV states that if The Colorado River becomes unnavigable for commercial purposes and such commercial purposes would limit development within the basins, the use of the water for agricultural and domestic purposes will be greater than the need for commercial use.[83] The basin states may use The Colorado River for generating electrical power, but such use will not be dominant to the need for domestic and agricultural use.[84] This article also states that in the event Congress disagrees with this provision of the Compact, the other provisions will remain intact.[85] Additionally, this article is not meant to interfere or apply to state laws regarding distribution, use, and appropriation of water interstate.[86]

78. *Id.* (referring to and approving the Colorado River Compact, art. III(d) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

79. *Id.* (referring to and approving the Colorado River Compact, art. III(e) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

80. *Id.* (referring to and approving the Colorado River Compact, art. III(f) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

81. *Id.* (referring to and approving the Colorado River Compact, art. III(g) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

82. *Id.* (referring to and approving the Colorado River Compact, art. III(c) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

83. *Id.* (referring to and approving the Colorado River Compact, art. IV(a) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

84. *Id.* (referring to and approving the Colorado River Compact, art. IV(b) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

85. *Id.* (referring to and approving the Colorado River Compact, art. IV(a) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

86. *Id.* (referring to and approving the Colorado River Compact, art. IV(a)–(c) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

E. Article V

Article V lays out who is charged with roles in administration of water appropriation.[87] The "chief official" of each state, together with the Director of Reclamation Services and the Director of Geological Surveys are tasked with determining the flow, appropriation, use, and effects from water use within the basins.[88] These officials are also required to publicize their findings of annual water flow at Lees Ferry, Arizona, as well as any other duties consented to by the states.[89]

F. Articles VI and VII

Article VI declares that if any "claim or controversy arises" between the states regarding: meaning; performance; allocation; delivery; construction of dams or sites along the river; diversion; or any issue not covered within the Compact, the Governors of the states affected can appoint commissioners "with power to consider *and* adjust [as] such."[90] This power however is limited by the requirement of the legislatures of the affected states to ratify such findings.[91] Additionally, this article does not prevent the adjustment of a claim by any method *or* by direct *future* "legislative action [by] the interested states."[92] Article VII acknowledges that the Compact does not affect the obligations of the United States to Indian Tribes.[93]

G. Article VIII

Article VIII allows the states to continue their beneficial uses of The Colorado River Systems if such use was established through prior perfected rights.[94] This article also states that appropriators or users claiming rights to the water from The Colorado River can satisfy their claims from a 5,000,000-acre feet storage

87. *Id.* (referring to and approving the Colorado River Compact, art. V (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

88. *Id.* (referring to and approving the Colorado River Compact, art. V(a) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.)

89. *Id.* (referring to and approving the Colorado River Compact, art. V(b)–(c) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

90. *Id.* (referring to and approving the Colorado River Compact, art. VI(a)–(e) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

91. *Id.* (referring to and approving the Colorado River Compact, art. VI(e) (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

92. *Id.*

93. *Id.* (referring to and approving the Colorado River Compact, art. VII (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

94. *Id.* (referring to and approving the Colorado River Compact, art. VIII (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

area, if such a storage area exists, and is not in conflict with Article III.[95] If no such area exists, then claims can only be satisfied from the water allocations in the basins the claim is brought within.[96]

H. Articles IX and XI

Article IX gives the states the unhindered right to bring actions against each other for the protection or enforcement of any of the Compact's provisions.[97] Article X also gives the states the right to terminate the compact based on a unanimous agreement of the original signatory states.[98] If the compact is terminated, rights established while the compact was controlling are unimpaired by the termination and shall continue.[99] Finally, Article XI says that the compact is binding upon the states when the state legislatures of the signatories and Congress of the United States approve the agreement.[100] Article XI also lists how matters of approval should be handled.[101]

VI. ARIZONA BEFORE AND AFTER THE COLORADO RIVER COMPACT

Although Arizona was a part of the seven states that signed the compact during the Santa Fe meeting in 1922, it would not ratify the compact as required by the state legislature under Article XI until 1944.[102] The reason for this holdout was largely due to the previous concern over water scarcity between the Lower Basin states, and for the most part, Arizona was right. Hydrologic surveys prior to the Santa Fe meeting concluded that there was an annual flow of 16.4 million acre feet within The Colorado River which was more than enough to split the 15 million acre feet between the two basins as required under Article III.[103] At that time however, Arizona was not done conducting their own surveys of water flow within tributaries interstate and believed that the 7.5 million acre feet allotment to be shared with the other basin states was not enough to sustain its own future

95. *Id.*

96. *Id.*

97. *Id.* (referring to and approving the Colorado River Compact, art. IX (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

98. *Id.* (referring to and approving the Colorado River Compact, art. X (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

99. *Id.*

100. *Id.* (referring to and approving the Colorado River Compact, art. XI (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

101. *Id.*

102. *See Colorado River Compact*, *supra* note 36.

103. *See id.*

population growth.[104] Future surveys would ultimately conclude that the Colorado River at Lees Ferry would fluctuate between 4.4–22 million acre feet annually, creating the chance that the Lower Basin could not reach its full apportionment between the states.[105] To counter the fear that Arizona would be without water in the future, W.S. Norviel, Arizona's compact delegate, tried to negotiate that the compact should require the Lower Basin states to receive "all the water of their tributaries" in state and half of the river's flow through Lees Ferry.[106] The Arizona legislature through Norviel argued that it didn't make sense for the Lower Basin states to share apportionment of tributaries such as the Gila River when the river primarily ran through one state – Arizona.[107]

Additionally, Arizona's first Governor, George P. Hunt, took issue with the Compact's lack of firm apportionment to the states.[108] Arizona argued that the Compact only relieved the Upper Basin states' concerns over California's water use, as the compact only protected Upper and Lower Basin state apportionment.[109] Regardless of whether Arizona ratified the Compact or not, they would still have to battle with California over prior appropriation use of the Colorado tributaries since both were Lower Basin states.[110] As stated under Article VIII of the compact, "perfected rights to the beneficial use of waters" were unhindered by the formation of the compact unless those rights hindered the apportionment between the two basins as given under Article III.[111] Prior appropriation would then still apply between Arizona and California claims, and with the other Upper Basin states being satisfied as to their protections of water supply against California, Arizona would once again be alone in stopping California from damming The Colorado River for their beneficial use.[112]

Thus, Arizona went without ratifying the compact in 1922 and instead concentrated its efforts in designing a way for the Colorado River to be canaled

104. Glennon & Kavkewitz, *supra* note 55, at 7.

105. *See Colorado River Compact*, *supra* note 36.

106. Gelt, *supra* note 49, at 3.

107. Glennon & Kavkewitz, *supra* note 55, at 7–8.

108. Gelt, *supra* note 49, at 4.

109. Glennon & Kavkewitz, *supra* note 55, at 8.

110. Josh Patashnik, Arizona v. California *and the Equitable Apportionment of Interstate Waterways*, 56 ARIZ. L. REV. 1, 7 (2014).

111. 43 U.S.C. § 6171 (referring to and approving the Colorado River Compact, art. VIII (1922), available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

112. Patashnik, *supra* note 110, at 7.

towards the inner part of the state.[113] The other basin states ratified the Compact, and California immediately started probing federal interest in a dam to canal The Colorado River for the benefit of Los Angeles in accordance with Article VII.[114] Between 1923 and 1928, there were many attempts to obtain Arizona's ratification of the compact between the basin states and Arizona – all of which failed.[115] By 1928, California received federal approval to build its canal through the Swing-Johnson Bill which would later become known as the Boulder Canyon Project Act.[116] The Act allowed California to build the later known Hoover Dam, a reservoir for the dam (Lake Mead), and a canal leading into Imperial Valley from the Colorado River providing that California regulated its draw of basin water to a maximum of 4.4 million acre feet per year.[117] The Act also gave Arizona exclusive right to the Gila River, and any surplus water flowing from the Colorado to be split between Arizona and California equally.[118] Despite the guarantees, Arizona vehemently opposed the construction of the dam and canal.[119] By 1930, only three years after the approval of the Boulder Canyon Project Act, Arizona filed in the original jurisdiction of the Supreme Court to enjoin the construction of both.[120] This action started a domino of cases known commonly as the *Arizona v. California* cases which ultimately lasted decades.[121]

A. Arizona v. California

Although it is beyond the scope of this note to fully analyze the arguments, holdings, and effects of the many different *Arizona v. California* cases that were tried before the Supreme Court, it is important to understand key details about these cases to fully grasp Arizona's position in accepting and moving forward from the Colorado River Compact. Under the 1931 case of *Arizona v. California*, Arizona argued that its rights as a quasi-sovereign state were infringed when California, through the Boulder Canyon Project Act, started construction of a dam and canal interstate without approval of the Arizona government.[122] The Supreme

113. Joshua Gilmore et al., *Central Arizona Project*, SALT RIVER STORIES (Sept. 30, 2022, 2:54 PM), https://saltriverstories.org/items/show/82?tour=27&index=10 [https://perma.cc/4S27-9Z8U].

114. Glennon & Kavkewitz, *supra* note 55, at 12.

115. *See id.* at 11–13.

116. Patashnik, *supra* note 110, at 8.

117. *Id.*

118. *Id.* at 15.

119. MacDonnell, *supra* note 42, at 369.

120. *Id.*

121. *See* Patashnik, *supra* note 110, at 5.

122. Arizona v. California, 283 U.S. 423, 451 (1931).

Court held that the United States, through its commerce power, "may perform its functions without conforming to the police regulations of a State."[123] Furthermore, regardless of the intentions of California, both the Compact and the Boulder Canyon Project Act conferred the right to maintain and create reservoirs for the purpose of regulating water flow from the states to Congress, making the construction of the Hoover Dam a federal interest.[124]

Ultimately, Arizona lost the first of these cases as the Hoover Dam's construction was allowed to continue throughout the 1930s.[125] This outcome, however, did not stop Arizona from trying to block future constructions of dams, creating further tension between Arizona and California. By 1934, California required more water towards the southern end of the state and another dam was contracted to begin construction along the Colorado River at the current site of the Parker Dam.[126] Furious and afraid of losing more water rights to California, Governor Moeur of Arizona sent the Arizona National Guard to the site of the dam to "take possession of the territory around the dam site."[127] The United States then filed an action against Arizona asking the Supreme Court to enjoin Arizona from interfering in the construction of the dam.[128] Because there was no proper authorization by the President, Congress, or even a preliminary survey by the Chief of Engineers, the complaint against Arizona was dismissed.[129]

Months later in 1935, the River and Harbors Bill passed, authorizing the construction of the Parker Dam and bittering the temporary victory for Arizona.[130] Having lost the fight on the Hoover and Parker dams, Arizona once again filed against California in the Supreme Court asking for an "equitable share" of the Colorado River while still withholding from compact ratification.[131] The Court denied Arizona's petition and reminded the state that any right of theirs is subordinate to that of the federal government, and that the United States must consent to being a party when deciding matters relating to federal interests.[132] Again, Arizona was defeated in the highest court while California again claimed more right to The

123. *Id.*

124. *Id.*

125. MacDonnell, *supra* note 42, at 369.

126. *California: Parker Dam*, NAT'L PARK SERV. (Jan. 13, 2017), https://www.nps.gov/articles/california-parker-dam.htm [https://perma.cc/ADR8-HJAJ].

127. *Id.*

128. *See generally* United States v. Arizona, 295 U.S. 174, 174 (1935).

129. *Id.* at 192.

130. *California: Parker Dam*, *supra* note 126.

131. Arizona v. California, 298 U.S. at 559–60.

132. *Id.* at 571–72.

Colorado River flowing within Arizona's borders. With the addition of the Parker Dam, California's total amount of water to be syphoned into Imperial Valley totaled about 5.3 million-acre feet annually.[133] To make matters worse, the 1936 holding in *Arizona v. California* created the condition precedent that the United States could *only* be sued on Arizona's Colorado River claims if it *consented* to being sued, leaving Arizona few options over these claims.[134]

B. But If You Can't Beat Them, Join Them

With population steadily increasing throughout the state, Arizona stopped fighting and ratified the Colorado River Compact in 1944.[135] Almost immediately thereafter, Arizona focused on securing water for the future through contracting with the federal government for the delivery of 2.8 million acre feet of water per year from the Bolder Canyon Project Reservoir.[136] With a need to transport more water interstate by the 1950s, Arizona would use the California strategy of proposing bills to federally fund their canals.[137] The only problem was that California would object to these bills claiming that the already existing projects mainly supplying California growth left no water for Arizona to draw from.[138] These obstructions by California were masterfully political in that California would object to Arizona's Senate approved bills by claiming the need for an allocation agreement between the Lower Basin states which California had no intention of taking part in.[139] Understanding this, Arizona would again file suit in the Supreme Court with federal consent to formally determine an equitable apportionment between the states.[140]

C. An Equitable Share?

It was not until 1963, over 40 years after the Compact's signing that the Supreme Court finally determined Arizona's equitable share.[141] Under the 1963 case of *Arizona v. California*, the Supreme Court had to determine: (1) whether the Compact and Boulder Canyon apportionment was made up of both mainstream and tributary flow, or just that of the main Colorado River, (2) whether perfected

133. *See* Glennon & Kavkewitz, *supra* note 55, at 15.
134. Arizona v. California, 298 U.S. at 568.
135. Patashnick, *supra* note 110, at 10.
136. *See* MacDonnell, *supra* note 42, at 370.
137. Patashnick, *supra* note 110, at 10.
138. MacDonnell, *supra* note 42, at 371.
139. Patashnick, *supra* note 110, at 10.
140. *Id.*
141. *See* Arizona v. California, 373 U.S. 546, 577 (1963).

prior appropriations override congressional power, and (3) the proper authority to decide apportionment when shortages occur.[142] According to the Court, the valid apportionment of water given under the Boulder Canyon Project Act equated to the mainstream flow of The Colorado River, assigning 4.4 million acre feet to California, 2.8 million acre feet to Arizona (aside from the Gila River Right), and 300,000 million acre feet to Nevada.[143] When any apportionment shortage occurs, or when a state takes from the flow of a tributary out of state, the Secretary of the Interior must decide apportionment or charge states accordingly for their use.[144] Finally, the Secretary of the Interior, through the power vested by Congress, is not bound by "judicial doctrine[s] of equitable apportionment or by the law of prior appropriation."[145] "These principles . . . are not binding upon the Secretary where . . . Congress . . . has provided that the waters of a navigable stream shall be harnessed, conserved, stored, and distributed through a government agency."[146]

The significance of this holding stripped California of any chance to claim rights to other Colorado River tributaries within Arizona's borders or object to the Secretary of the Interior assignments of projects without the necessary funds of water.[147] After what historians would claim as a victorious defeat of California,[148] Arizona would finally have the ability to create the inner canal project that was vaguely being mentioned back in the 1920s. In 1968, the Colorado Basin Project Act was passed allowing the Central Arizona Project, a canal from The Colorado River towards inner Arizona, to be realized.[149] Unfortunately, despite Arizona's victory, the ghost of California's influence through prior appropriation would seep into the fabric of Arizona water law to further exacerbate the drought crisis of the last decade.

VII. CURRENT ARIZONA WATER LAW

A. Prior Appropriation, Reasonable Use, and Management

Like the rest of the west, Arizona uses the doctrine of prior appropriation through beneficial use for surface waters of "streams, canyons, ravines or other

142. *See generally id.*
143. *Id.* at 592.
144. *Id.* at 589–93.
145. *Id.* at 593–94.
146. *Id.* at 594.
147. Glennon & Kavkewitz, *supra* note 55, at 15.
148. *Id.*
149. *The Law of the River*, *supra* note 34.

natural channels."[150] Where Arizona differs is in its use of groundwater systems in that Arizona applies the doctrine of "reasonable use" for waters percolating beneath the surface.[151] What this means is that Arizona bifurcates its application of law between surface and ground water management, complicating legal analysis under the theory that water flows both on the surface and through porous aquifers simultaneously.[152]

Although it is beyond the scope of this note to delve into the major legal issues of Arizona ground water itself,[153] it is necessary to understand that the added complexity of Arizona ground water management further frustrates the legal consensus of hydrologic reality.[154] Many streams, like the Colorado tributaries in Arizona, are perennial; meaning that the flow of surface water connects to the subsurface aquifer, while others only do so intermittently or not at all.[155] Additionally, ground water runoff can support the flow of surface water availability,[156] while pumping groundwater adjacent to running streams can drain surface water flow.[157] Likewise, withdrawal or pollution of surface water streams can both degrade or deplete aquifer availability.[158] Regardless of prior appropriation or reasonable use, both doctrines affect the other and with an increasing population in cities like Phoenix requiring more water to survive, it is important to analyze how Arizona manages both systems.

Both Arizona surface and groundwater applications are regulated by the

150. *See* Ariz. Rev. Stat. Ann. § 45–141 (West 2021).

151. Bristor v. Cheatham, 255 P.2d 173, 180 (Ariz. 1953).

152. John D. Leshy & James Balenger, *Arizona Law Where Ground and Surface Water Meet*, 20 ARIZ. ST. L.J. 657, 660 (1988).

153. *See generally* Joeseph M. Feller, *The Adjudication That Ate Arizona Water Law*, 49 ARIZ. L. REV. 405 (2007) (summarizing the In Re Adjudication cases that plagued Arizona water law for decades which also dealt with groundwater subflow).

154. Leshy & Balenger, *supra* note 152, at 657.

155. *See* Joe Gelt, *Managing the Interconnecting Waters: The Groundwater-Surface Water Dilemma*, WATER RES. RSCH. CTR. (Dec. 1994), https://wrrc.arizona.edu/publications/arroyo-newsletter/managing-interconnecting-waters-groundwater-surface-water-dilemma [https://perma.cc/K56N-ER4J].

156. Aaron Citron, *Working Rivers and Working Landscapes: Using Short-Term Water Use Agreements to Conserve Arizona's Riparian and Agricultural Heritage*, 1 ARIZ. J. ENV'T L. & POL'Y 7, 15 (2010).

157. Kirsten Engel et al., *Arizona's Groundwater Management Act at Forty: Tackling Unfinished Business*, 10 ARIZ. J. ENV'T L. & POL'Y 187, 211 (2020).

158. THOMAS C. WINTER, ET AL., GROUND WATER AND SURFACE WATER A SINGLE RESOURCE, U.S. DEP'T OF THE INTERIOR 3 (1998), https://pubs.usgs.gov/circ/circ1139/pdf/circ1139.pdf [https://perma.cc/TRG3-285B].

Arizona Department of Water Resources (ADWR).[159] The director of the ADWR has significant power to formulate, survey, and investigate plans to manage water within the state.[160] The director is authorized to cooperate with the Secretary of the Interior of the United States in respect to delivery and Arizona's allocation of the Colorado River.[161] The director is also required to submit an annual public report to the governor on the department's operations which may suggest legislation or amendments to current law.[162]

There are a number of diversion canal systems and water banking projects managed by the ADWR. The two largest canals that service almost all of Arizona are the Central Arizona Project (CAP) and the Salt River Project (SRP).[163] The Central Arizona Project is a 336 mile canal system that pumps 1.6 million acre feet of Colorado River allocation from northern to central and southern Arizona, serving more than 80% of the state's population.[164] Over 40% of the state's agricultural water is driven through the CAP.[165] The Salt River Project also canals water throughout the state, intermixing Colorado River flow with Salt River and Reservoir water, spanning more than 131 miles.[166] Understanding that Arizona's future supply of water may be jeopardized by shortages on the river, Arizona implemented a water storage and banking system in 2006 to protect future consumptive use.[167] Currently, there are over six reservoirs within Arizona that have the capability of storing more than 1.6 million acre feet of water.[168]

As previously mentioned, groundwater is subject to its own set of laws and regulations. Arizona currently allows the director of the ADWR to manage all

159. Ariz. Rev. Stat. Ann. § 45–103 (2022).

160. § 45–105.

161. § 45–107.

162. § 45–111.

163. Tyler Tisinger & Peter Ni, *How We Get Water in Arizona*, STORYMAPS (Jan. 17, 2020), https://storymaps.arcgis.com/stories/c052ab378886493aae9 99f7104110ee2 [https://perma.cc/QNY2-XN9T].

164. *Highlighting Key Features of the CAP System, an Engineering Marvel*, CENT. ARIZ. PROJECT (Sept. 30, 2022, 6:08 PM), https://storymaps.arcgis.com/stories/b7b28dd4c36a413e8d533ba540f998cb [https://perma.cc/7RWQ-4TYK] [hereinafter *Highlighting Key Features*].

165. *Id.*

166. *Where Central Arizona's Water Comes From*, SRP (Sept. 30, 2022, 3:03 PM), https://www.srpnet.com/water/source.aspx [https://perma.cc/U5LF-FZ3L].

167. *See* Ariz. Rev. Stat. Ann. § 45–2401 (2006).

168. *See generally Watershed Connection*, SRP (Sept. 30, 2022, 3:04 PM), https://streamflow.watershedconnection.com/Dwr [https://perma.cc/UDP2-U8UE].

groundwater aquifers within set basins.[169] Some basins are set within active manage areas (AMA's)[170] where citizens may draw water from groundwater reservoirs in compliance with the management plans of that specific area.[171] Management plans are often necessary in order to preserve groundwater for future growth or prevent sub flow degradation.[172] Each management area has an advisory council whose members represent the interests of groundwater users within their area.[173] Outside set AMA's, withdrawal of groundwater from groundwater basins can only be taken for beneficial use, transportation, or irrigation subject to the Arizona Code.[174]

B. The Ghost of Prior Appropriation

Despite the previous altercations with California over prior appropriation and The Colorado River Compact, Arizona still uses the doctrine for surface water today. Unappropriated water may be appropriated by any person for a wide variety of means, including: personal, "domestic, municipal, irrigation, stock watering, water power, recreation, wildlife", and mining uses.[175] The person or entity first appropriating said water will have the better claim to it, and may construct or maintain dams, canals, and ditches with respect to the Arizona Code.[176] When scarcity occurs, the owner of lands according to dates of appropriation or occupation will have precedence over other water claims.[177]

Prior appropriation, in theory, may solve issues of claims rather quickly based on occupation or ownership, but history shows that the doctrine creates more problems than initially realized. Adjudications for unportioned water sources or those sources that the ADWR has requested to be reviewed are allowed within the superior courts of those counties where the largest number of potential claimants reside.[178] With the current shortage on The Colorado River, many farmers who had previously shared water with other farmers through canals and runoff have had to

169. Ariz. Rev. Stat. Ann. § 45–403 (2022).
170. § 45–411.
171. § 45–451.
172. § 45–412.
173. § 45–420.
174. § 45–453.
175. § 45–151.
176. *Id.*
177. § 45–175.
178. § 45–252.

prioritize their sources, leading to litigation.[179] What this leads to is known as the "tragedy of commons" which refers to "a situation in which individuals with access to a shared resource (also called a common) act in their own interest and, in doing so, ultimately deplete the resource."[180] What prior appropriation does in these scenarios is incentivize water entrepreneurialism, and yet ensure over rapid consumption through growth.[181] A great example of this can be found with the current disappearance of Arizona's San Pedro River and the interconnectedness of groundwater and surface flow.[182] Although much of the San Pedro River's drying stems from over pumping groundwater,[183] sub flow, which is technically groundwater adjacent to a stream, is actually governed by surface water prior appropriation law.[184] With such a loophole in place, and given that an appropriator only needs a reasonable use in order to register groundwater claims, it is no wonder that investors are buying up rural farmland containing water rights to distribute water for profit.[185] The problem comes full circle – when groundwater AMAs start to run dry, the CAP replenishes through The Colorado River.[186] Whether it is surface water, groundwater, or The Colorado River, all water systems are, and will continue to be, affected by the current drought.

179. *See* Stefanie Smallhouse, *Ask the Right Water Question*, ARIZ. CAPITOL TIMES (Sept. 23, 2021), https://azcapitoltimes.com/news/2021/09/23/ask-the-right-water-question/ [https://perma.cc/UV6N-HSVE].

180. Alexandra Spiliakos, *Tragedy of the Commons: What is it and 5 Examples*, HARV. BUS. SCH. (Feb. 6, 2019), https://online.hbs.edu/blog/post/tragedy-of-the-commons-impact-on-sustainability-issues [https://perma.cc/2KA8-T6K3].

181. Robert Haskell Abrams, *Prior Appropriations and the Commons*, 32(2) J. ENV'T SCI. 141, 188 (2019).

182. Ian James, *On the San Pedro River, Water Use is Drying Up Stretches of a Biodiverse 'Ribbon of Green'*, AZCENTRAL (Sept. 13, 2021, 12:26 PM), https://www.azcentral.com/in-depth/news/local/arizona-environment/2021/09/07/arizona-san-pedro-river-faces-growing-threats-groundwater-use/5395305001/ [https://perma.cc/DR4D-BFSX].

183. *Id.*

184. *See In re Gen. Adjudication of All Rts. to Use Water in Gila River Sys. and Source*, 857 P.2d 1236, 1245 (Ariz. 1993) ("Thus, if a well is drawing water from the bed of a stream, or from the area immediately adjacent to a stream, and that water is more closely related to the stream than to the surrounding alluvium, as determined by appropriate criteria, the well is directly depleting the stream.").

185. *See* Ian James & Geof Hing, *Investors Are Buying Up Rural Arizona Farmland to Sell the Water to Urban Homebuilders*, AZCENTRAL (Nov. 26, 2021, 11:08 AM), https://www.azcentral.com/story/news/local/arizona-environment/2021/11/25/investors-buying-up-arizona-farmland-valuable-water-rights/8655703002/ [https://perma.cc/X4SA-NYZ3].

186. Caitln Ochs, *People in Arizona Are About to Face the West's First Major Water Crisis*, BUZZFEED (Oct. 27, 2021, 6:22 PM), https://www.buzzfeednews.com/article/caitochs/colorado-river-shortage-arizona-drought [https://perma.cc/ZLY4-QHHZ].

VIII. DROUGHT ON THE RIVER: IMPACT ON ARIZONA

A. Drought and Global Warming

Currently, the Southwest is experiencing a historic drought that is impacting both policy and procedure among the states. Researchers claim that the Southwest has been gripped by severe drought since 2000 with conditions being as bad or worse than other droughts seen in the past 1,200 years.[187]According to the Environmental Protection Agency, every part of the Southwest has experienced higher average temperatures up to a two degree increase between 2000 and 2020.[188] Globally, the average temperature has increased 1.8 degrees from 1901 and research groups expect higher temperatures over the next few decades.[189] Although drought is a natural part of the climate cycle, "climate change is making droughts more frequent, severe, and pervasive."[190] Secondary effects of drought include wildfires, heatwaves, and low river flow, with The Colorado River being no exception.[191]

The combination of severe drought and high temperatures has reduced flow volume within The Colorado River by approximately 4-million-acre feet over the past century.[192] Current monitoring systems indicate that 100% of both Colorado River basins are abnormally dry, with more than 50% of the basin as a whole (upper and lower) showing indications of severe drought.[193] Side effects of severe drought include water shortages which can certainly be seen through the loss of water volume at Lake Mead.[194] "Since 2000, Lake Mead on the Colorado River has fallen 130 feet (40 m) and lost 60% of its volume as a result of drought"

187. Harry Fountain, *Southwest Drought Rivals Those of Centuries Ago, Thanks to Climate Change*, N.Y. TIMES (April 16, 2020), https://www.nytimes.com/2020/04/16/climate/drought-southwest-climate-change.html [https://perma.cc/B8TS-XLD4].

188. *A Closer look: Temperature and Drought in the Southwest*, ENV'T PROT. AGENCY (April 2021), https://www.epa.gov/climate-indicators/southwest [https://perma.cc/Y4VD-LRDZ].

189. U.S. GLOBAL CHANGE RSCH. PROGRAM, THE CLIMATE REPORT, U.S. GOV'T PRINTING OFFICE 65 (2018) (on file with Journal).

190. Sofie Bates, *Drought Makes its Home on the Range*, NASA (Sept. 21, 2021), https://climate.nasa.gov/news/3117/drought-makes-its-home-on-the-range/ [https://perma.cc/2QGC-NAR8].

191. Joe Lisonbee et al., *Preparing for Long-Term Drought and Aridification*, 103 AM. METEOROLOGICAL SOC. 3, 3 (2022).

192. *See* THE CLIMATE REPORT, *supra* note 189, at 152.

193. *Colorado River Basin Current Conditions*, NIDIS (Sept. 30, 2022, 3:19 PM), https://www.drought.gov/watersheds/colorado [https://perma.cc/H7D9-N8CF].

194. *Id.*

conditions.[195] As of the summer of 2021, Lake Mead hit its lowest volume point since the 1930s during the reservoir's construction, leveling off at 1071.56 feet.[196] Water storage within the Lower Basin reservoirs alone have reduced more than 10% in the last year with less than 40% of total capacity remaining overall.[197]

B. Contingency Plans for Water Shortage

So, what does this mean for Arizona? As a result of the drought conditions impacting The Colorado River, the federal government announced mandatory cutbacks of water allocation for Lower Basin states as part of a contingency plan to protect The Colorado River for 2022 and onwards.[198] Of the 2.8-million-acre feet of water allocated to Arizona as part of the Boulder Canyon Project Act, Arizona is expected to lose 512,000-acre feet (roughly 18% of annual allocation) driven through the CAP.[199] If Lake Mead falls lower than 1,500 feet of water, tier 2 reductions would occur, further reducing Arizona's allocation between 80,000 and 128,000 acre-feet (roughly 23% of annual allocation).[200] As previously stated, water from the CAP fuels 40% of agriculture within the state,[201] with 70% of CAP water going to Arizona farms,[202] and if Arizona is expected to lose more than 18% of its water allocation from Lake Mead, impacts could be severe for in state agriculture.[203]

195. THE CLIMATE REPORT, *supra* note 189, at 150.

196. Gia Yetikyel, *Hoover Dam's Lake Mead Hits Lowest Water Level Since 1930s*, SMITHSONIAN MAG. (June 18, 2021), https://www.smithsonianmag.com/smart-news/hoover-dams-lake-mead-hits-lowest-water-level-1930s-180978022/ [https://perma.cc/ARP9-NQ3W].

197. *See* LOWER COLORADO WATER SUPPLY REPORT, BUREAU OF RECLAMATION (2022), https://www.usbr.gov/lc/region/g4000/weekly.pdf [https://perma.cc/FEZ9-FUZG].

198. Harry Fountain, *In a First, U.S. Declares Shortage on Colorado River, Forcing Water Cuts*, N.Y. TIMES (Aug. 27, 2021), https://www.nytimes.com/2021/08/16/climate/colorado-river-water-cuts.html [https://perma.cc/EU86-VZCL].

199. COLORADO RIVER SHORTAGE FACT SHEET, CENT. ARIZ. PROJECT 1 (Sept. 30, 2022, 6:21 PM), https://new.azwater.gov/sites/default/files/media/CAP-FactSheet-CoRiverShortage-042721.pdf [https://perma.cc/CB85-L8D9].

200. *See* Joanna Allhands, *Lake Mead Could Be in a Tier 2 Shortage by 2023. What's That Mean for Arizona*?, AZCENTRAL (May 21, 2021, 9:20 AM), https://www.azcentral.com/story/opinion/oped/joannaallhands/2021/05/20/lake-mead-likely-tier-2-shortage-2023-impact-arizona/5183361001/ [https://perma.cc/VA6E-4EQX].

201. *Highlighting Key Features*, *supra* note 164.

202. Greta Forslund, *Cutbacks in Water for Central AZ Farmers Expected,* ARIZ. CAPITOL TIMES (April 26, 2021), https://azcapitoltimes.com/news/2021/04/26/cutbacks-in-water-for-central-az-farmers-expected/ [https://perma.cc/WDQ6-MBRU].

203. *See Mandatory Cutbacks in Colorado River*, *supra* note 16.

C. Drought and Arizona Agriculture

Arizona's agriculture industry generates $23 billion for the state economy and supports 138,000 jobs.[204] "Arizona is the 3rd largest producing state for fresh market vegetables, and it is 4th in the country in acres of organic vegetables."[205] Additionally, Yuma County is known as the "Winter Salad Bowl" capital of the United States, producing over 90% of all leafy greens in the nation.[206] Dairy, ranching, and farming are also important to the state, generating $12.4 billion annually through over 97% family operated ranches.[207] It is safe to say that agriculture is important to the economy of the state, but with water cutbacks expected in 2022 and beyond, Arizona's agricultural industry may face hardship for the foreseeable future. Take the Caywoods for example, a family outside of Casa Grande who, for the last 90 years, have produced cotton and alfalfa on their 400 acre ranch.[208] Due to the cutbacks, the San Carlos Irrigation District was not able to sell them water for their crops, forcing the family to only use 125 of their 400 acres, killing both their alfalfa and cotton production.[209]

Unfortunately, the Caywoods are not alone, as Pinal County as a whole expects a $104 million loss on agriculture and a loss of 200 jobs from the cutbacks.[210] Farmers across the state have also switched from water intensive crops like citrus and alfalfa to other less intensive types, trying to salvage their farms by investing time, energy, and savings into new agriculture.[211] Will Thelander, a fourth generation Arizona farmer accentuates this idea, opting to forgo planting corn on 3,000 acres of managed land for other types of crop in the future.[212] This type of

204. ARIZ. DEP'T OF AGRIC., GUIDE TO ARIZONA AGRICULTURE 8 (2018), https://agriculture.az.gov/sites/default/files/AZDA_GuideToAZAg-R5.pdf [https://perma.cc/TR6U-NVRS].

205. *Id.*

206. *Id.*

207. *5 Arizona Agriculture Facts You Can't Live Without!,* ARIZ. FARM BUREAU (Jan. 21, 2013), https://www.azfb.org/Article/5-Arizona-Agriculture-Facts-You-Cant-Live-Without [https://perma.cc/7PX6-DGYQ].

208. Brad Poole, *Colorado River Shortage to Hit Central Arizona Farmers Hardest*, COURTHOUSE NEWS SERV. (Aug. 7, 2021), https://www.courthousenews.com/colorado-river-shortage-to-hit-central-arizona-farmers-hardest/ [https://perma.cc/H22B-LR8T].

209. *Id.*

210. *Id.*

211. *See generally* David Hernandez, *Arizona Agriculture Explores Ways to Reduce Water Use*, U.C. DAVIS (Sept. 30, 2022, 3:26 PM), https://watershed.ucdavis.edu/education/classes/files/content/flogs/hernandezdavid_147963_2935533_HernandezDavid_BlogEntry.pdf [https://perma.cc/PR4D-FNMR].

212. *See* Felicia Fonseca, *First Water Cuts in US West Supply to Hammer Arizona*

management, also known as "fallowing," creates its own problems, as fallowed cropland adds dust and pollution to the air creating both an environmental problem and an economic one.[213] Other farmers have looked towards drilling for groundwater, but labor shortages have caused drilling to be "slow to unfold."[214] Regardless of new groundwater systems, wells cannot make up for the loss of The Colorado River,[215] nor can the chance of creating sinkholes from over pumping aquifers be taken lightly.[216] So what then can solve this issue? If The Colorado River is drying, and Arizona agriculture cannot expect groundwater to save the industry, how can Arizona position itself to best tackle these problems moving forward in the twenty-first century?

IX. ARIZONA WATER AND THE FUTURE OF THE COLORADO RIVER COMPACT

A. The 2026 Interim Contingency Deadline

In 2026, interim guidelines controlling Lower Basin water shortages for states within The Colorado River Compact are expected to expire.[217] These guidelines which were implemented in 2007 to reduce drought water shortage within the basin, created an agreement of tier reductions for state allocation based on volume levels related to The Colorado River reservoirs.[218] A secondary purpose related to the interim guidelines forced the states to consult the other basin states and the Department of the Interior before bringing litigation concerning water allocation.[219] With 2026 around the corner, Arizona, Nevada, and California have voluntarily agreed to reduce their Colorado River consumption by 500,000 acre feet

Farmers, AP NEWS (Aug. 12, 2021), https://apnews.com/article/business-science-environment-and-nature-arizona-climate-change-7cf4c472fa64fe57be4b8823c5423fc0 [https://perma.cc/G5HB-FCYD].

213. *See* Brandon Loomis, *In Pinal County, Colorado River Shortage is Forcing Growers to Plant Fewer Acres*, AZCENTRAL (Jan. 3, 2022, 7:00 AM), https://www.azcentral.com/story/news/local/arizona-environment/2022/01/03/colorado-river-water-cutbacks-farmers-plant-less/8475916002/ [https://perma.cc/V7Z4-UEWA].

214. *Id.*

215. *Id.*

216. Hernandez, *supra* note 211.

217. U.S. DEP'T OF THE INTERIOR, REVIEW OF THE COLORADO RIVER INTERIM GUIDELINES FOR LOWER BASIN SHORTAGES AND COORDINATED OPERATIONS FOR LAKE POWELL AND LAKE MEAD, BUREAU OF RECLAMATION 1 (2020), https://www.usbr.gov/ColoradoRiverBasin/documents/7.D.Review_FinalReport_12-18-2020.pdf [https://perma.cc/EA7N-6GPR].

218. *See Agreement Concerning Colorado River Drought Contingency Management and Operations*, BUREAU OF RECLAMATION, 1 (May 20, 2019), https://www.usbr.gov/dcp/docs/final/Companion-Agreement-Final.pdf [https://perma.cc/Q5HE-CWLL].

219. *See id.* at 6.

"or enough to serve 1 million to 1.5 million households annually depending on water usage and conservation."[220] The problem with this incremental approach however is that as much as the Lower Basin states may want to reduce their draw on the river, incrementalism alone does not solve the problems of state consumption or equitable allocation between the states or the basins.

B. Arizona Leadership and Future Water Management

As such, solving water consumption, climate management, and the oddities in water law should be priority for Arizona moving into the 2026 guideline negotiations to tackle the root of The Colorado River Shortage – the drought. Prior to the first set of guideline implementations, Arizona was a national leader in developing strategies to combat climate change which pushed other states in the basin towards greener energy measures as well.[221] Today, instead of governmental leadership on the issue, the Arizona legislature has largely left their cities responsible for climate policies which has allowed the state to increase its carbon emissions by 36.5% since 1990.[222]

If the carbon emissions are linked to higher temperatures,[223] and higher temperatures exacerbate droughts,[224] then it is only logical to attempt to decrease carbon emissions. For years, despite the need for water in a drought, Arizona allowed a generating station that pumped SRP water,[225] to burn "22,000 tons of coal a day . . . contributing to the very climate change that" exacerbated the drought.[226]

220. Brittany Peterson & Felicia Fonseca, *States Volunteer to Take More Cuts in Colorado River Water*, AP NEWS (Dec. 15, 2021), https://apnews.com/article/science-environment-and-nature-las-vegas-arizona-california-105d0d18579dc99c81896c0177113f20 [https://perma.cc/6QTM-YGMZ].

221. Erin Stone, *From Hero to Zero: Arizona Was a Leader in Climate Policy 15 years Ago. What happened?*, AZCENTRAL (Sept. 25, 2021, 7:00 AM), https://www.azcentral.com/story/news/local/arizona-environment/2020/09/25/arizona-was-once-climate-policy-leader-in-west-what-happened/5841376002/ [https://perma.cc/KTP6-YQTL].

222. *Id.*

223. NAT'L OCEANIC AND ATMOSPHERIC ADMIN., U.S DEP'T OF COMMERCE, TEMPERATURE CHANGE AND CARBON DIOXIDE 1 (2021), https://www.ncei.noaa.gov/sites/default/files/2021-11/8%20-%20Temperature%20Change%20and%20Carbon%20Dioxide%20Change%20-%20FINAL%20OCT%202021.pdf [https://perma.cc/2ETH-7T93].

224. THE CLIMATE REPORT, *supra* note 189, at 152.

225. Jariel Avrin, *After Decades of Activism, the Navajo Coal Plant has been Demolished*, VOX (Dec. 19, 2020, 6:00 PM), https://www.vox.com/2020/12/19/22189046/navajo-coal-generating-station-smokestacks-demolished [https://perma.cc/TW98-LEA9].

226. Abraham Lustgarten & Naveena Sadasivam, *Holy Crop: How Federal Dollars are Financing the Water Crisis in the West*, PROPUBLICA (May 27, 2015),

Thankfully, the generating station was closed in 2019, leading to new renewable energy taking its place, but it is worth noting that the station closed due to operating costs, not for any climate related reason.[227] If Arizona wishes to end the drought that is causing its water issues, the state must lead the way. Currently, Arizona is ranked second in the nation for solar energy potential and yet only has one solar thermal power plant as of 2021.[228] Finding renewable sources of energy to power both the state and water supplies in the future should be a key Arizona interest ahead of the 2026 negotiations.

C. Arizona Water Law—Changes and Ideas

Changes in water law and consumption can also help Arizona and could influence other states within the basin to fight the drought. The first step in analyzing what to change would be to first understand consumption. Since agriculture makes up 72% of Arizona's water use, tackling weakness in Arizona agriculture could create savings.[229] One of the biggest issues stemming from water and agriculture deals with what is planted and how much water is used. As of 2017, hay, alfalfa, and cotton dominated Arizona crops totaling 490,000 acres in terms of irrigated land in state.[230] The problem with these types of crops stems from the amount of water needed to maintain the vegetation, as both alfalfa and cotton consume more water than most other crops.[231] Studies from the University of Arizona concluded that when cotton is watered towards the growing season's end (August and September), farmers actually irrigate the crop more than they are actually worth.[232] Having the Arizona government promote new vegetation and irrigation methods via collaborative efforts of grants or subsidies to family ranchers could improve water consumption in the future.[233]

Policy changes in water law are also recommended ahead of the 2026 water

https://projects.propublica.org/killing-the-colorado/story/arizona-cotton-drought-crisis [https://perma.cc/S9CT-2K5U].

227. Avrin, *supra* note 225.

228. *Arizona State Profile and Energy Estimates*, U.S. ENERGY INFO. ADMIN. (April 21, 2022), https://www.eia.gov/state/analysis.php?sid=AZ [https://perma.cc/C6CE-ZQUD].

229. *Arizona's Water Supplies*, *supra* note 11.

230. TIMOTHY LAHMERS AND SUSANNA EDEN, UNIV. OF ARIZ. WATER RES. RSCH. CTR., WATER AND IRRIGATED AGRICULTURE IN ARIZONA 2 (2nd ed. 2018), https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/attachment/Arroyo-2018-revised.pdf [https://perma.cc/P526-JURS].

231. ROBERT GLENNON, UNQUENCHABLE: AMERICA'S WATER CRISIS AND WHAT TO DO ABOUT IT 274–76 (2009).

232. *Id.* at 276.

233. WATER AND IRRIGATED AGRICULTURE IN ARIZONA, *supra* note 230, at 15.

negotiations. As previously stated, the juxtaposition between groundwater and surface water law does not frame Arizona water flow accurately.[234] Prior appropriation creates a system whereby those who have first rights to contract water have priority claims, effectively controlling downstream apportionment.[235] Additionally, many contracts of greater priority stem back as far as 1968.[236] Instead of prior appropriation, Arizona should use the unique idea of separating water rights from land and place more emphasis on reasonable use criteria across all water allocations.[237] By allowing such rights to be separated from the land, farmers could consider the opportunity to sell off surplus water to other farmers for beneficial use while also incentivizing conservative water management.[238] Allowing farmers to contract would also detract corporations from buying up land just to get to the water underneath.[239] Finally, by adding more laws requiring greater reasonable use and an approval to contract water, Arizona could effectively control priority claims, and in turn, prioritize water sold between agricultural users if the state wished.

D. Arizona's Position to Lead Compact Negotiations

By tackling water and climate management instate ahead of 2026, Arizona will put itself in a position to lead the basin states on the ultimate issue of negotiation – conservation. Unfortunately, self-interest among the states may cause conflict before conservation talks even start.[240] The bubbling of these conflicts can already be seen as the Lower Basin states impose voluntary conservation methods while the Upper Basin states search for full apportionment use.[241] Worse yet, some of the Upper Basin states may already be drawing water at a deficit if current

234. Leshy & Balenger, *supra* note 152, at 657.

235. WATER AND IRRIGATED AGRICULTURE IN ARIZONA, *surpa* note 230, at 9.

236. *Id.*

237. Mark A. McGinnis, *A Carrot or a Stick? Promoting Water Conservation in Arizona Agriculture*, 1 SAN JUAQUIN AGRIC. L. REV. 33, 49 (1991).

238. *Id.*

239. *See* James & Hing, *supra* note 185.

240. Tripp Baltz, *Water Shortages Run Risk of Dividing States Using Colorado River*, BLOOMBERG LAW (Aug. 20, 2021, 5:01 AM), https://news.bloomberglaw.com/environment-and-energy/water-shortages-run-risk-of-dividing-states-using-colorado-river [https://perma.cc/3WE3-5MMP].

241. Gary Pitzer, *Can a Grand Vision Solve The Colorado River's Challenges? Or Will Incremental Change Offer Best Hope For Success?*, WATER EDUC. FOUND. (Dec. 13, 2019), https://www.watereducation.org/western-water/can-grand-vision-solve-colorado-rivers-challenges-or-will-incremental-change-offer [https://perma.cc/Y2DE-RSSX].

measurement values of The Colorado River are to be considered.[242] What is fair conservation for some might not be fair for all, which may cause tribalism to set in amongst the states instead of viewing the Colorado River as a collaborative effort for water management.[243] This is exactly where Arizona should step in to lead.

For the last century, Arizona fought the self-interested battle against the basin states of trying to control their portion of the river and failing at every turn.[244] From the inception of the compact, to the later battles of *Arizona v. California*, Arizona learned through time that the better route is to work through negotiation and compromise. This mentality, as it did in 2007, should spur Arizona to lead the states towards the future of compact management.[245] History should not repeat itself and the lessons Arizona learned over the past century should be applicable for all of the basin states today. The only question that remains is: should the compact be renegotiated itself, or should guideline management be continually updated?

X. OUR GLASS, OUR VISION—HALF FULL

Regardless of a grand revision of the compact or incremental changes through annual control, one thing certain: The Colorado River is not what it was 100 years ago. Current estimates of the river flow show a decrease from the 15-million-acre feet of 100 years ago to that of just 12.3-million-acre feet from 2000-2021.[246] Additionally, both systems have their drawbacks. Renegotiating the entire Colorado River Compact scares political leaders,[247] and while managing guidelines intermittently may seem like the answer, the current Compact would still allow the Lower Basin states to increase their water allocation under Article III, even if there

242. UTAH RIVERS COUNCIL, A FUTURE ON BORROWED TIME COLORADO RIVER SHORTAGES & THE NEW NORMAL OF CLIMATE CHANGE 7 (2021), https://static1.squarespace.com/static/5a46b200bff2007bcca6fcf4/t/61b678ae088ad458939d92c4/1639348411964/ The+Colorado+River+A+Future+on+Borrowed+Time.pdf [https://perma.cc/78X5-DQD7].

243. *Id.* at 2.

244. *See* Glennon & Kavkewitz, *supra* note 55, at 15.

245. Stone, *supra* note 221.

246. Douglas E. Beeman, *As the Colorado River Shrinks, Can The Basin Find An Equitable Solution In Sharing The River's Waters?*, WATER EDUC. FOUND. (Jan. 14, 2022), https://www.watereducation.org/western-water/colorado-river-shrinks-can-basin-find-equitable-solution-sharing-rivers-waters [https://perma.cc/M8FY-DCDB].

247. *See* Luke Runyon, *The 1922 Agreement That Governs the Colorado River is Flawed. Why not Fix It?*, ELEMENTAL (Nov. 16, 2018), https://elementalreports.com/water/2018/11/16/colorado-river-compact-flawed-negotiations-to-fix/ [https://perma.cc/Q9DS-AN2P].

is scientifically no water to draw from.[248] As best stated by Anne Castle, a previous Assistant Secretary for water science at the Department of the Interior under the Obama Administration: "the best way to proceed is to have an articulated visionary goal with specific incremental steps . . . . The vision is needed to guide choices along the way, but it's not either desirable or realistic to suddenly make big changes in operations on the river."[249]

What is needed is a commonsense solution with science. Understanding the current measurement of the Colorado River, what the states realistically need to operate, and planning a collaborative goal for management along with steps to improve is key. Water savings within the Upper Basin do not have reservoirs like the Lower Basin, and as such, the basin states should, just as Arizona did with the CAP, plan with the Upper Basin states in the creation of reservoir systems for their states.[250] By allowing such measures to be put in place, future allocations of water between the states might not be so controversial if the Upper Basin states have water savings they can draw from. Additionally, if all states work against the drought and collaborate not only on water management guidelines, but climate and energy friendly goals as well, the entirety of The Colorado River might see savings.[251]

As The Colorado River ebbs and flows through the seven states, it should be noted that our collective policies should reflect the natural flow. Although Arizona can get ahead of the 2026 negotiations to lead by history and example, saving our water will take a long-term collaborative effort from all of the basin states.[252] Going back to the original question, whether the glass is half empty or half full, we need look no further than our reservoirs. When our forefathers built these water banking systems—these giant bowls of water that to us look and operate like natural lakes—did they ask themselves if the glass was half empty when filling the bowl? In 1983, when Lake Powell filled for the first time, did water managers

248. *See* 43 U.S.C. § 6171 (referring to and approving the Colorado River Compact, 1922, available at https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.).

249. Pitzer, *supra* note 241.

250. *See* Heather Sackett, *Dropping Reservoirs Create 'Green Light' For Sustainability on Colorado River*, THE ASPEN TIMES (Jan. 17, 2022), https://www.aspentimes.com/news/dropping-reservoirs-create-green-light-for-sustainability-on-colorado-river/ [https://perma.cc/495Z-3GK9].

251. AMERICAN RIVERS, THE HARDEST WORKING RIVER IN THE WEST: COMMON SENSE SOLUTIONS FOR RELIABLE WATER FUTURE FOR THE COLORADO RIVER BASIN 35 (2014), https://www.americanrivers.org/conservation-resource/hardest-working-river-west/ [https://perma.cc/5REX-J227].

252. *Id.* at IV–V.

proclaim job well done?[253] No. The glass is half full, and as long as the basin states put aside their differences and work together to find modern solutions to fix the drought and our water vein that breathes life into all these great southwestern states,

the glass,

will never,

be empty.

253. *See* John D. Anna, *For a While In 1983, Sheets Of Plywood Were All That Kept the Mighty Glen Canyon Dam From Overflowing*, AZCENTRAL (Aug. 8, 2019, 3:48 PM), https://www.azcentral.com/story/news/local/Arizona-environment/2019/07/18/1983-arizona-glen-canyon-dam-lake-powell-almost-overflowed-colorado-river/1662234001/ [https://perma.cc/ZFS3-6L33].