William & Mary Environmental Law and Policy Review

Volume *48 (2023-2024)*
Issue 2

Article 6

1-2024

Race to the Bottom: How Equitable Apportionment Could Encourage Overdrafting of Aquifers

Emily Wells

RACE TO THE BOTTOM: HOW EQUITABLE APPORTIONMENT COULD ENCOURAGE OVERDRAFTING OF AQUIFERS

EMILY WELLS*

ABSTRACT

Groundwater is a vital source of water for drinking and irrigation in the United States. However, it was unclear what legal doctrine would apply to apporting interstate groundwater between the states. This changed in *Mississippi v. Tennessee*, when the Supreme Court ruled that equitable apportionment would the controlling doctrine. The Court though declined to clarify how the doctrine would be applied to groundwater. This Note discusses how equitable apportionment has historically been applied to rivers and hypothesizes how the Court may apply equitable apportionment to groundwater.

---

* JD Candidate, William & Mary Law School, 2024. I would like to thank the *William & Mary Environmental Law and Policy Review* for all their work in editing and publishing my Note. I would also like to thank my family for all their support during law school.

INTRODUCTION

Groundwater, water that exists in the saturated zones below the surface of the earth, is an essential resource.[1] Around thirty percent of liquid freshwater is considered groundwater.[2] However, not all groundwater is usable. According to the U.S. Geological Survey, water located in aquifers is the only source of usable groundwater.[3] Aquifers are highly valuable resources, and the United States relies on aquifers for half its water supply, including agricultural and drinking water.[4] A single aquifer, the Ogallala Aquifer, supplies water to twenty-seven percent of the farmland in the United States.[5] At least eight states rely on aquifers

---

[1] *See* Water Sci. Sch., *Aquifers and Groundwater*, U.S. GEOLOGICAL SURV. ("USGS") (Oct. 16, 2019), https://www.usgs.gov/special-topics/water-science-school/science/aquifers-and-groundwater [https://perma.cc/R8G2-RDX7]; *What Is Groundwater?*, USGS, https://www.usgs.gov/faqs/what-groundwater [https://perma.cc/8BHW-7J2V] (last visited Feb. 8, 2024).
[2] Becky Oskin, *Aquifers: Underground Stores of Freshwater*, LIVE SCI. (Oct. 17, 2018), https://www.livescience.com/39625-aquifers.html [https://perma.cc/2DP3-ATZR].
[3] Water Sci. Sch., *supra* note 1.
[4] Warigia M. Bowman, *Dustbowl Waters: Doctrinal and Legislative Solutions to Save the Ogallala Aquifer Before Both Time and Water Run Out*, 91 U. COLO. L. REV. 1081, 1087 (2020).
[5] *Id.* at 1086.

for half their drinking water.[6] Because aquifers are drought-resistant, states become increasingly reliant on aquifers during water shortages.[7] For example, California withdraws sixty percent of its drinking water from aquifers during droughts.[8] Unfortunately, aquifers are slow to recharge and "can take thousands of years to replace what humans extract in a few days."[9] Because of climate change, population growth, and the slow recharge rate of aquifers, America's aquifers are being overdrafted, and many will be gone by the next generation or sooner.[10]

One may assume that public policy would encourage conservation of this vital resource for future generations. The opposite is true. The U.S. Supreme Court held in *Mississippi v. Tennessee* that interstate aquifers should be allocated between states using the same equitable apportionment doctrine that was historically used to allocate river water.[11] While the Court did not elaborate on how this doctrine will be specifically applied to aquifers, the equitable apportionment doctrine historically prioritizes current beneficial use over future use.[12] As a result, states are encouraged to use the water in an interstate aquifer, even if only to stake their claim. This competition between states to maximize use of a limited resource is what some may recognize as a classic tragedy of the commons.[13]

This Note intends to outline what aquifers are, how they have been historically used, and how the equitable apportionment doctrine has traditionally been applied to rivers. This Note will also extrapolate from current case law to hypothesize how the Supreme Court might apply the equitable apportionment doctrine to aquifers and why these applications may encourage states to overly rely on aquifers for short-term gain to the detriment of conservation and long-term economic interests. This Note will also discuss potential alternatives to the equitable apportionment doctrine as it applies to aquifers.

---

[6] *Id.* at 1097–98.
[7] *See* Jessica Fu, *How a Federal Drought Relief Program Left Southern Oregon Parched—and Contributed to the Ongoing Groundwater Crisis in the West*, COUNTER (Nov. 23, 2021), https://thecounter.org/federal-drought-relief-southern-oregon-groundwater-crisis-farmers-klamath-project [https://perma.cc/CFG2-JU6X].
[8] Bowman, *supra* note 4, at 1087.
[9] *Id.* at 1092.
[10] *See id.* at 1088.
[11] Mississippi v. Tennessee, 595 U.S. 15, 23 (2021).
[12] *See id.* at 26; New Jersey v. New York, 283 U.S. 336, 343 (1931); Colorado v. New Mexico (*Colorado I*), 459 U.S. 176, 184 (1982).
[13] *See generally* Tony Wohlers, Aaron Mason, John Wood & Eric Schmaltz, *Tragedy of the Commons Meets the Anti-Commons: Water Management and Conflict on the Southern Plains of the United States*, J. ENV'T ASSESSMENT POL'Y & MGMT., Mar. 2014, at 1, 1.

I. WHAT ARE AQUIFERS?

Aquifers are "the saturated area[s] beneath the water table."[14] There are various types of aquifers. Unconfined aquifers are aquifers exposed to atmospheric pressure, thus rising and falling from atmospheric pressure and subject to climate change.[15] America's largest aquifer, the Ogallala Aquifer, is considered an unconfined aquifer.[16] Aquifers trapped between two impermeable layers of rock are called confined aquifers.[17] Confined aquifers are highly valued because the layer of impermeable rock makes them drought resistant and sometimes naturally pressurized.[18] Both types of aquifers—but particularly confined aquifers—can act as giant water storage tanks for states to access when other water sources are running low.[19] Principal aquifers are either confined or unconfined aquifers that are large, often cross state lines, and are potential sources of potable water.[20] Principal aquifers contain billions of gallons of water that are generally safe to drink without any treatment[21] and are usually affordable and highly reliable sources of potable water.[22] They are also ideal for rural areas and agriculture.[23] Principal aquifers allow

---

[14] Water Sci. Sch., *supra* note 1.

[15] *See What Is the Difference Between a Confined and an Unconfined (Water Table) Aquifer?*, USGS, https://www.usgs.gov/faqs/what-difference-between-confined-and-unconfined-water-table-aquifer [https://perma.cc/T9HG-W5WK]; Daisy Dunne, *Climate Change's Impact on Groundwater Could Leave 'Environmental Timebomb'*, CARBON BRIEF (Jan. 21, 2019), https://www.carbonbrief.org/climate-change-impact-groundwater-environmental-timebomb [https://perma.cc/JR7Q-BVU9].

[16] Edward C. Rhodes, Humberto L. Perotto-Baldivieso, Evan P. Tanner, Jay P. Angerer & William E. Fox, *The Declining Ogallala Aquifer and the Future Role of Rangeland Science on the North American High Plains*, 87 RANGELAND ECOLOGY & MGMT. 83, 83, 85 (2023).

[17] *See What Is the Difference Between a Confined and an Unconfined (Water Table) Aquifer?*, *supra* note 15.

[18] *See id.*

[19] *See* Fu, *supra* note 7.

[20] *See* Water Res. Mission Area, *Principal Aquifers of the United States*, USGS (Mar. 8, 2021), https://www.usgs.gov/mission-areas/water-resources/science/principal-aquifers-united-states [https://perma.cc/X8WF-R6SF].

[21] *See* LESLIE A. DESIMONE, PETER B. MCMAHON & MICHAEL R. ROSEN, USGS CIRCULAR 1360, THE QUALITY OF OUR NATION'S WATERS: WATER QUALITY IN PRINCIPAL AQUIFERS OF THE UNITED STATES, 1991–2010, at 1 (2014), https://pubs.usgs.gov/circ/1360/pdf/circ1360report.pdf [https://perma.cc/4UNG-6HXN] (explaining that water from aquifers can become contaminated from both sediments and through surface chemicals, which makes them no longer safe to drink).

[22] *See* Fu, *supra* note 7.

[23] *See id.*

state and local governments to save money on water treatment and piping for water distribution.[24] When principal aquifers cross state borders, they become subject to federal law and are treated differently from aquifers confined in state borders.[25] This Note shall only address principal aquifers that cross state borders.

A. *Why Aquifers Are Nonrenewable for Practical Purposes*

Aquifers are referred to as "fossil water" because the water can be trapped undisturbed for thousands or millions of years.[26] While water is constantly entering aquifers through a process known as aquifer recharge, this process is slow and "can take thousands of years to replace what humans extract in a few days."[27] Not all aquifers recharge at the same rate. Some aquifers receive negligible amounts of recharge, while some can take thousands of years for rainwater to even enter an aquifer while it permeates through the soil.[28] The Ogallala Aquifer, the largest aquifer in the United States, has an annual recharge rate of one inch per year but drops a foot per year from human consumption, the equivalent of the annual rate of eighteen Colorado Rivers.[29]

Removing water from aquifers may appear to have minimal effects on the surface. Even so, removing water can lower the pressure in

---

[24] *See* DESIMONE ET AL., *supra* note 21 (explaining that if aquifers are contaminated, they require treatment just like other sources of water).

[25] *See* Mississippi v. Tennessee, 595 U.S. 15, 26 (2021) (citing Kansas v. Colorado, 206 U.S. 46, 93 (1907), Wyoming v. Colorado, 259 U.S. 419, 464, 466 (1922), and Hinderlider v. La Plata River & Cherry Creek Ditch Co., 304 U.S. 92, 102 (1938)); *Sustainable Groundwater Management Act (SGMA)*, CAL. DEP'T OF WATER RES., https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management [https://perma.cc/2T44-ADG5] (last visited Feb. 8, 2024).

[26] John Misachi, *What Is Fossil Water?*, WORLDATLAS (Aug. 17, 2018), https://www.worldatlas.com/articles/what-is-fossil-water.html [https://perma.cc/525G-6TVH].

[27] Bowman, *supra* note 4, at 1092. *See* Water Sci. Sch., *supra* note 1.

[28] *See* Cal. Water Sci. Ctr., *Aquifer Storage and Recovery*, USGS (Nov. 20, 2018), https://www.usgs.gov/centers/california-water-science-center/science/aquifer-storage-and-recovery [https://perma.cc/5LXU-7WHJ]; David Grossman, *Climate Change Could Turn Earth's Aquifer's into a Time Bomb*, POPULAR MECHS. (Jan. 22, 2019), https://www.popularmechanics.com/science/environment/a25997069/climate-change-aquifers-time-bomb [https://perma.cc/L6P6-2GPZ] (noting aquifers under the Sahara are only now reacting to "'climate change from 10,000 years ago'"). *See, e.g.*, Don Comis, *The Ogallala Aquifer: Gauging, Protecting the Aquifer's Health*, AGRIC. RSCH., Apr. 2008, at 4, 7.

[29] David Condos, *Ogallala Aquifer Dropped 12+ Inches in 2021. Land Value Could Lose Billions as Water Source Runs Dry.*, TOPEKA CAP. J. (Apr. 9, 2022), https://www.cjonline.com/story/news/2022/04/09/western-kansas-land-value-could-lose-billions-water-levels-decrease-ogallala-aquifer-drought/9504181002 [https://perma.cc/RY4A-3G5F]; Bowman, *supra* note 4, at 1087.

the aquifer.[30] When enough water is removed, the ground can sink in a process known as subsidence.[31] Subsidence can cause damage to buildings when it is inconsistent and can permanently reduce the storage capacity of an aquifer.[32] Subsidence can be avoided by simply allowing aquifers to receive more or equal water than is withdrawn. This can occur naturally over time or artificially by human effort to reinject aquifers with water.[33] When principal aquifers cross state lines, a state withdrawing water may cause water levels to drop in another state, along with all the issues and conflict that can result from that.[34] The dispute may be as simple as the extra cost needed to dig deeper wells as the pressure and water levels drop or as serious as the permanent loss of the aquifer for the state.[35]

II. REGULATION OF WATER IN THE UNITED STATES

A. Historical Regulation of Aquifers

Because the amount of water in aquifers was difficult to measure and viewed as an inexhaustible resource, aquifers have historically been unregulated[36]—states and individuals could pump as much water as they desired.[37] As populations grew, however, the demand for aquifer water increased, and as the scientific understanding of aquifers improved, some

---

[30] *See* Va. & W. Va. Water Sci. Ctr., *Aquifer Compaction and Land Subsidence*, USGS (Aug. 8, 2022), https://www.usgs.gov/media/images/aquifer-compaction-and-land-subsidence [https://perma.cc/M96Q-VT63].

[31] *Id.*

[32] *See* Water Sci. Sch., *Land Subsidence Completed*, USGS (June 5, 2018), https://www.usgs.gov/special-topics/water-science-school/science/land-subsidence [https://perma.cc/52SW-98H9]; Land Subsidence in Cal., *Aquifer Compaction Due to Groundwater Pumping*, USGS (Oct. 18, 2018), https://www.usgs.gov/centers/land-subsidence-in-california/science/aquifer-compaction-due-groundwater-pumping [https://perma.cc/8ZJA-E964].

[33] *See* Cal. Water Sci. Ctr., *supra* note 28.

[34] *See* Mississippi v. Tennessee, 595 U.S. 15, 18, 20 (2021).

[35] *See, e.g.*, Fu, *supra* note 7 (providing an example of wells running dry); Jayme Lozano Carver, *Texas Farmers Are Worried One of the State's Most Precious Water Resources Is Running Dry. You Should Be, Too.*, TEX. TRIB. (June 20, 2023), https://www.texastribune.org/2023/06/20/texas-ogallala-aquifer-farming-climate-change [https://perma.cc/DG6X-UFNF].

[36] *See* Bowman, *supra* note 4, at 1109–10; Cheryll A. Borgaard, *Consultant: Mint Farm Aquifer Inexhaustible*, DAILY NEWS (Jan. 21, 2010), https://tdn.com/news/local/consultant-mint-farm-aquifer-inexhaustible/article_ff06866a-0726-11df-a7f6-001cc4c03286.html [https://perma.cc/VZ8U-J7DX]; Robinson Meyer, *The Earth's Evaporating Aquifers*, ATLANTIC (June 17, 2015), https://www.theatlantic.com/technology/archive/2015/06/earth-running-out-water-aquifiers/396152 [https://perma.cc/N237-LUNT].

[37] *See* Bowman, *supra* note 4, at 1109–10.

states began requiring permits to access aquifers.[38] Unfortunately, in reality many of these permits are simply a seldom-enforced formality or only a recommendation of usage.[39]

As water in aquifers continued to be withdrawn, states began questioning the ownership of the water. This question was left unaddressed until 2005 when the State of Mississippi sued the City of Memphis, Tennessee, for withdrawing water from the Middle Claiborne Aquifer.[40] Mississippi claimed Memphis caused the aquifer level in Mississippi to drop and, by its lawsuit, raised the issue: who owns the water?[41]

Memphis is a unique major metropolitan area because all its drinking water comes from aquifers.[42] The city saves money and resources by not having to purify surface water.[43] At the same time, the city abuts the Mississippi border.[44] The facts were clear, as Memphis withdrew water, the water levels in the Mississippi portion of the aquifer were dropping.[45] Mississippi claimed the sinking aquifer levels inside its borders was a wrongful taking and requested over $615 million in damages.[46] The U.S. Supreme Court rejected Mississippi's claim and held that aquifers are not substantially different from rivers and will be treated under the same doctrine as rivers—the equitable apportionment doctrine.[47]

B. How the Equitable Apportionment Doctrine Is Generally Applied

In *Mississippi v. Tennessee*, the Supreme Court stated:

---

[38] *See Groundwater Permit Guidance*, MISS. DEP'T OF ENV'T QUALITY, https://www.mdeq.ms.gov/permits/water-availability-and-use/forms/groundwater-permit-guidance [https://perma.cc/5X2Q-LQ2S] (last visited Feb. 8, 2024); *Water Withdrawal Permits*, N.Y. DEP'T. OF ENV'T CONSERVATION, https://www.dec.ny.gov/lands/86935.html [https://perma.cc/S9FN-J329] (last visited Feb. 8, 2024).

[39] Dionne Searcey & Delger Erdenesanaa, *A Tangle of Rules to Protect America's Water Is Falling Short*, N.Y. TIMES (Nov. 2, 2023), https://www.nytimes.com/interactive/2023/11/02/climate/us-groundwater-depletion-rules.html [https://perma.cc/MM4K-YJF8].

[40] Mississippi v. Tennessee, 595 U.S. 15, 20–21, 22 (2021).

[41] *Id.*

[42] Erin Thomas, *Breakdown: Why Memphis' Water Supply Is So Unique*, ACTION NEWS 5 (Dec. 5, 2021), https://www.actionnews5.com/2021/12/05/breakdown-why-memphis-water-supply-is-so-unique [https://perma.cc/HEV2-NMLJ].

[43] *See Mississippi*, 595 U.S. at 18.

[44] *See 2021 Memphis Map & Tourist Guide*, MEMPHISTRAVEL (2021), https://www.memphistravel.com/sites/default/files/2021-01/21_MEM_OVG_52-53_City%20Map%20%282%29.pdf [https://perma.cc/YDJ9-YWWY].

[45] *Mississippi*, 595 U.S. at 19–20.

[46] *Id.* at 22.

[47] *Id.* at 23.

> [E]quitable apportionment "stands alone as the federal common-law principle for disputes over interstate water . . . ."
>
> . . . .
>
> Equitable apportionment aims to produce a fair allocation of a shared water resource between two or more States. The doctrine's "guiding principle" is that States "have an equal right to make a reasonable use" of a shared water resource. . . .
>
> . . . .
>
> . . . [A] "State seeking equitable apportionment under [the Supreme Court's] original jurisdiction must prove by clear and convincing evidence some real and substantial injury or damage."[48]

To show damage, the Court stated in an earlier opinion that the complainant state bears a "burden that is 'much greater' than the burden ordinarily shouldered by a private party seeking an injunction."[49] This is because respect must be shown to the "sovereign status and 'equal dignity' of [s]tates."[50] Damages "will not be granted against something merely feared as liable to occur at some indefinite time in the future."[51] To claim damages under equitable apportionment, a state must show it has been deprived access for a "beneficial use" and not staking a "barren claim."[52] Only good faith and diligence can maintain a state's claim.[53]

Historically, the Supreme Court has "strictly applied the rule of priority when apportioning water between States [by] adhering to the

---

[48] *Id.* at 23–24, 28 (internal citations omitted).
[49] Florida v. Georgia, 138 S. Ct. 2502, 2514 (2018) (citing Connecticut v. Massachusetts, 282 U.S. 660, 669 (1931)).
[50] *Id.*
[51] Connecticut v. Massachusetts, 282 U.S. 660, 674 (1931).
[52] Washington v. Oregon, 297 U.S. 517, 527 (1936) (citing Seaweard v. Pac. Livestock Co., 88 P. 963 (Or. 1907); *In re* Water Rts. in Silvies River, 237 P. 322 (Or. 1925); *In re* Hood River, 227 P. 1065 (Or. 1924); State *ex rel.* Ham v. Super. Ct. of Grant Cnty., 126 P. 945 (Wash. 1912)).
[53] *Id.*

prior appropriation doctrine, and has departed from that rule only to protect an existing economy built upon junior appropriations."[54] The Court held that priority would not be strictly applied to equitable apportionment.[55] Instead, "all the factors which create equities in favor of one State or the other must be weighed."[56] Some of these factors include:

> [P]hysical and climate conditions, the consumptive use of water in the several sections of the river, the character and rate of return flows, the extent of established uses, the availability of storage water, the practical effect of wasteful uses on downstream areas, [and] the damage to upstream areas as compared to the benefits to downstream areas if a limitation is imposed on the former.[57]

While it is permitted, the Court has set a high bar to obtain apportionment based on future use. A state must show that "the benefits of the diversion [for future use] substantially outweigh the harm that might result."[58] A state must show specific measures another state could take to preserve water and not general statements for redistribution.[59] The Court stated, "[s]ociety's interest in minimizing erroneous decisions in equitable apportionment cases requires that hard facts, not suppositions or opinions, be the basis for interstate diversions."[60] The state requesting reapportionment for future use must show analysis and planning for long-range use to reduce uncertainties.[61]

C. *How Equitable Apportionment Is Applied to Rivers*

The Supreme Court has stated, "the Middle Claiborne Aquifer would be 'sufficiently similar' to past applications of the [equitable apportionment] doctrine to warrant the same treatment."[62] While the equitable apportionment doctrine applies to all interstate water sources, the vast

---

[54] *Colorado I*, 459 U.S. 176, 184 (1882).
[55] *Id.* at 188.
[56] Florida v. Georgia, 138 S. Ct. 2502, 2514 (2018) (quoting Colorado v. Kansas, 320 U.S. 383, 392 (1945)) (emphasis omitted).
[57] *Id.* (quoting Nebraska v. Wyoming, 325 U.S. 589, 618 (1945)).
[58] Colorado v. New Mexico (*Colorado II*), 467 U.S. 310, 313 (1984).
[59] *Id.* at 319.
[60] *Id.* at 320–21.
[61] *See id.* at 321–22.
[62] Mississippi v. Tennessee, 595 U.S. 15, 24 (2021).

majority of case law relates to rivers.[63] When dividing river water, the Court historically addresses: (1) the amount of water in the water source and (2) how the water will be apportioned.[64]

To determine the amount of water in a water source, a special master is appointed who also recommends whether the current apportionment is not equitable and makes recommendations. The Court typically uses these numbers to determine whether the current apportionment is equitable and if reapportionment would unduly harm the defending state.[65] In that process, various measurements are used. The first quantified measurement is the average annual flow of the river.[66] This number is the average amount of water that flows through the river each year.[67] The Court uses the annual flow to determine the next measurement, the dependable flow of the river.[68] The dependable flow is usually the annual flow minus the water lost to evaporation.[69] This is the amount of water the Court considers apportionable to the states.[70]

The Court and special master sometimes use an alternative method called the average daily flow or cubic feet per second to determine the amount of water in the river.[71] This is similar to the average annual flow but is based on a daily or per-second amount.[72] This measurement is usually applied only when requested by a state.[73]

Once the dependable flow or daily flow is established, the Court decides how it will apportion the water using one of two methods. The first method is the mass allocation method where the Court or special master allocates the total gallons a state is permitted to withdraw on an annual basis.[74] One advantage to this method is that it sets a clear

---

[63] *See, e.g.*, *id.*; Florida v. Georgia, 138 S. Ct. 2502, 2502 (2018); Nebraska v. Wyoming, 325 U.S. 589, 618 (1945).
[64] *See* Florida v. Georgia, 138 S. Ct. at 2519; Nebraska v. Wyoming, 325 U.S. at 620.
[65] *See* Report of the Special Master at 63 n.40, Florida v. Georgia, 138 S. Ct. 2502 (2018) (No. 142, Orig.).
[66] *See id.*
[67] Water Sci. Sch., *Streamflow and the Water Cycle*, USGS (June 12, 2019), https://www.usgs.gov/special-topics/water-science-school/science/streamflow-and-water-cycle [https://perma.cc/X5GL-TMJB].
[68] *See* Nebraska v. Wyoming, 325 U.S. at 597.
[69] *See id.* at 652.
[70] *See generally* Florida v. Georgia, 138 S. Ct. 2502, 2502 (2018).
[71] *See* New Jersey v. New York, 283 U.S. 336, 345 (1931); Florida v. Georgia, 138 S. Ct. at 2516.
[72] *See* New Jersey v. New York, 283 U.S. at 345; Florida v. Georgia, 138 S. Ct. at 2516.
[73] *See* New Jersey v. New York, 283 U.S. at 345; Florida v. Georgia, 138 S. Ct. at 2520; Nebraska v. Wyoming, 325 U.S. at 620.
[74] Nebraska v. Wyoming, 325 U.S. at 620.

amount a state is able to withdraw from the river. Sometimes the Court holds that the natural dependable flow is difficult to quantify.[75] In these cases, the Court rejects the mass allocation method and instead uses the flat percentage method.[76] Using this method, the Court and special master grant each state a specific percentage of the river water, whatever nature may bring.[77]

III. HOW EQUITABLE APPORTIONMENT IS APPLIED TO AQUIFERS

The Supreme Court has held that rivers and aquifers are "sufficiently similar" and "warrant the same treatment."[78] It is, therefore, likely that apportionment methods used for rivers will be applied to aquifers. Unfortunately, while rivers can be apportioned based on their natural dependable flow, which is routinely measured by the U.S. Geological Survey ("USGS"), aquifers do not have an annual flow that is routinely measured.[79] The Court has not even clarified what would constitute the annual flow of an aquifer.[80] The dependable flow equivalent for aquifers could reasonably be assumed to be either the recharge rate or the "water that flows naturally between the [s]tates."[81] Each of these potential measures creates unique issues and problems.[82]

A. Equitable Apportionment of Aquifers Based on Recharge Rates

Between the two potential measures, aquifer recharge rates and the "water that flows naturally between the [s]tates," it seems aquifer recharge rates would be the most environmentally sound, most logical, and scientifically valid measure of how much water is available to be allocated. It is more similar to the dependable flow rates of rivers because it represents the amount of water entering the aquifer on an annual basis.[83] Because the Supreme Court held in *Nebraska v. Wyoming* that water storage (e.g., reservoir or lake storage) does not factor into dependable flow, it is reasonable to assume water currently stored inside an

[75] *See id.*
[76] *See id.*
[77] *See id.* at 647.
[78] Mississippi v. Tennessee, 595 U.S. 15, 24 (2021).
[79] *See* Water Sci. Sch., *supra* note 67.
[80] *See id.*
[81] Mississippi v. Tennessee, 595 U.S. at 25.
[82] *See id.*
[83] *See* Water Sci. Sch., *supra* note 1; Mississippi v. Tennessee, 595 U.S. at 25.

aquifer would not be calculated in the amount of water to be allocated.[84] The equivalent for the dependable flow for rivers thus would seem to be the recharge rate for aquifers.

1. Application Issues

If the Supreme Court holds that the recharge rate represents the dependable flow equivalent, then the questions become how much water will be apportioned and what method will be used. Apportioning aquifers based on recharge rates creates specific issues. Rivers have a set flow and can be measured at one or multiple locations.[85] On the other hand, water enters aquifers through the ground over vast areas of land and at varying amounts depending on many factors, a difficult matter at best.[86] While the USGS has measured the annual flow of rivers for over a century and built infrastructure to easily monitor rivers, they do not annually measure the recharge rate of aquifers.[87] The task is not impossible, and the average recharge rate has been calculated for some principal aquifers such that the mass allocation method can be applied.[88]

Where studies have not been conducted or when it is difficult to calculate the dependable flow, the Court could apportion aquifers using the flat percentage method as it did in *Nebraska v. Wyoming*—measured against the best approximation possible under the circumstances.[89] For example, in *Nebraska*, the changing water flows and release of storage water in the river made it difficult to calculate a dependable flow.[90] The

---

[84] Nebraska v. Wyoming, 325 U.S. 589, 638–39 (1945).

[85] *See* Water Sci. Sch., *How Streamflow Is Measured*, USGS (June 13, 2018), https://www.usgs.gov/special-topics/water-science-school/science/how-streamflow-measured [https://perma.cc/G2KW-JU27].

[86] *See* Saleh Taghvaeian, R. Scott Frazier, Dustin Livingston & Garey Fox, *The Ogallala Aquifer*, OKLA. STATE UNIV. (Mar. 2017), https://extension.okstate.edu/fact-sheets/the-ogallala-aquifer.html [https://perma.cc/DA4Y-NZRT].

[87] *See USGS Current Water Data for the Nation*, USGS, https://waterdata.usgs.gov/nwis/rt [https://perma.cc/D873-ZA39] (last visited Feb. 8, 2024); Water Sci. Sch., *Monthly and Yearly Streamflow Patterns*, USGS (June 9, 2018), https://www.usgs.gov/special-topics/water-science-school/science/monthly-and-yearly-streamflow-patterns [https://perma.cc/Z8Q2-KU8T].

[88] *See, e.g.*, *Recharge Rates and Aquifer Hydraulic Characteristics for Selected Drainage Basins in Middle and East Tennessee*, USGS (Jan. 1, 1990) [hereinafter *Recharge Rates*], https://www.usgs.gov/publications/recharge-rates-and-aquifer-hydraulic-characteristics-selected-drainage-basins-middle [https://perma.cc/Y7BX-F6D8].

[89] *See* Nebraska v. Wyoming, 325 U.S. at 646.

[90] *Id.* at 651–53.

Court believed only an approximation of the natural flow was possible and decided the flat percentage method would be the preferred allocation method when natural flow and storage cannot be segregated.[91] Applying the flat percentage method to aquifers would allow an allocation method to be used until infrastructure is built to properly monitor recharge rates.

2. Benefits to Apportioning Aquifer Water Based on Recharge Rates

Basing apportionment on recharge rates would benefit long-term conservation of aquifers for future generations. It would give states a reliable source of water for emergencies such as droughts.[92] It would also prevent subsidence.

The recharge rate of an aquifer is clearly distinguishable from the water stored in an aquifer.[93] In *Nebraska v. Wyoming*, the Supreme Court held that dependable flow is separate from storage water.[94] The Court defined storage water "for purposes of this decree as any water which is released from reservoirs for use on lands."[95] While this definition was specifically for the rivers at issue, it is reasonable to assume that storage water would also not be included in the definition for aquifers.[96] By setting the dependable flow as the recharge rate, it would be easy to distinguish stored water from non-stored water.

Some states already want to artificially recharge aquifers to store water for droughts, mitigate overdrafting and floods, and for other reasons.[97] This creates an additional complication when allocating water a state may withdraw from an aquifer. It would make sense that a state would not want to spend the time and money on recharging an aquifer

---

[91] *Id.* at 651.
[92] *See* D.W. Page, D. Gonzalez, T. Clune, Y. Colton & G.D. Bonnett, *Water Banking in Aquifers as a Tool for Drought Resilience in the Murray-Darling Basin*, 27 AUSTRALASIAN J. WATER RES. 331 (2023), https://www.tandfonline.com/doi/epdf/10.1080/13241583.2022.2144115 [https://perma.cc/JPD6-SLLB].
[93] *See Recharge Rates*, *supra* note 88.
[94] Nebraska v. Wyoming, 325 U.S. at 638–39.
[95] *Id.* at 631.
[96] *See id.*
[97] *See Going with the Flow: How Aquifer Recharge Reduces Flood Risk*, CAL. DEP'T OF WATER RES. (Aug. 3, 2022), https://cwc.ca.gov/Home/News/Blog/2022/Aug-22/How-Aquifer-Recharge-Reduces-Flood-Risk [https://perma.cc/B5F9-R47J]; *Job Aid: Aquifer Storage and Recovery*, FED. EMERGENCY MGMT. AGENCY ("FEMA") (Aug. 2016), https://www.fema.gov/sites/default/files/documents/fema_aquifer_storage_recovery_jobaid.pdf [https://perma.cc/U5GG-LMFV].

just to have it apportioned to another state.[98] For that reason, apportioning aquifer water using only the natural recharge rate would prevent artificially recharged water from being allocated to other states. A method should also be created to allow states to reap the benefits of their artificial recharge without it impacting their allocation.

Under the right rules, a recognition that a state owns its artificial recharge would allow it to store and withdraw water in times of need or replace overdrafted water. Limiting the dependable flow to the natural recharge rate would encourage states to act responsibly and preserve natural resources.

3. Negatives to Apportioning Aquifers Based on Recharge Rates

Aquifers, unlike rivers, have extremely low recharge rates compared to the amount of water often being withdrawn.[99] This creates issues for how apportionment should be applied. Dozens of states currently withdraw more water than is recharged annually.[100] If states are forced to limit withdrawal to meet recharge, there will be disputes on the amount each state may withdraw from the aquifer.

The Supreme Court has never answered how a diminishing water supply will be reapportioned. The Court almost addressed the issue in *Nebraska v. Wyoming* but held there was insufficient evidence to show the flow had changed.[101] Neither the Court, states, nor Congress have addressed how a decreased dependable flow will be reapportioned.[102] No matter who decides apportionment or how the water is reapportioned, all states will be forced to seriously conserve or reconsider their source of water if the dependable flow is set to the recharge rate.

For the Ogallala Aquifer, over eight states would have to figure out how to conserve or resource over half their drinking water, and at least twenty-seven percent of irrigated U.S. farmland would need new water infrastructure built to maintain current production levels.[103] Even

---

[98] *See* Janny Choy, Geoff McGhee & Melissa Rohde, *Recharge: Groundwater's Second Act*, STAN., WATER IN THE W., https://waterinthewest.stanford.edu/groundwater/recharge [https://perma.cc/R5WJ-VHEF] (Dec. 19, 2014).

[99] *See* Cal. Water Sci. Ctr., *supra* note 28.

[100] *See* Bowman, *supra* note 4, at 1097.

[101] *See* Nebraska v. Wyoming, 325 U.S. 589, 620 (1945).

[102] *See id. See, e.g.*, Ian James, *States Miss Deadline to Address Colorado River Water Crisis; Pressure Builds on California*, L.A. TIMES (Jan. 31, 2023), https://www.latimes.com/environment/story/2023-01-31/states-miss-deadline-for-agreement-on-colorado-river-water [https://perma.cc/V6VA-LNAC].

[103] *See* Bowman, *supra* note 4, at 1086, 1097–98.

if states are allowed to artificially recharge water after overdrafting, they will have to build infrastructure to artificially recharge aquifers and find a source of water for recharging.[104] This simply places new pressure on states that currently rely on aquifers.[105]

States would likely need years to build the necessary infrastructure to treat water and the network of pipes required to transport the water. Many states that heavily rely on aquifers already struggle to supply water to meet the current demands of the state.[106] Whether the problem is solved by conservation or recharge, the economic impact on irrigation, rural communities, and state budgets could cost states billions of dollars.[107] Setting the dependable flow to recharge rates may be impractical for states in the short term.

B. Equitable Apportionment of Aquifers Based on "Water That Flows Naturally Between the States"[108]

Because the Supreme Court has not specified how aquifer water will be apportioned, one can only speculate from past cases. In *Mississippi v. Tennessee*, the only aquifer case, the Court used the phrase "water that flows naturally between the [s]tates" and noted that "the Court's equitable apportionment cases have all concerned such water."[109] The Court stated that even though the "flow here may be a mere 'one or two inches per day,'" that constitutes enough water.[110] The Court further highlighted that this "mere 'one or two inches per day' . . . amounts to over 35 million gallons of water per day, and over ten billion gallons per year."[111]

---

[104] *See* Alejandra Borunda, *The Deceptively Simple Plan to Replenish California's Groundwater*, NAT'L GEOGRAPHIC (Mar. 23, 2022), https://www.nationalgeographic.com/environment/article/the-deceptively-simple-plan-to-replenish-californias-groundwater [https://perma.cc/C84D-GHG8].
[105] *See* Bowman, *supra* note 4, at 1087; Elizabeth Weise & Trevor Hughes, *'Dead Pool' Approaches: Western Water Crisis Looms as California Complicates Critical Water Deal*, USA TODAY (Feb. 12, 2023), https://www.usatoday.com/story/news/2023/02/02/colorado-river-compact-water-crisis-california-plan-explained/11170739002/ [https://perma.cc/3CN9-XUYC].
[106] Weise & Hughes, *supra* note 105.
[107] *See* Condos, *supra* note 29.
[108] Mississippi v. Tennessee, 595 U.S. 15, 25 (2021).
[109] *Id.* (citing Kansas v. Colorado, 206 U.S. 46, 98 (1907)).
[110] *Id.*
[111] *Id.* (referring to the amount of water that shifts in the Middle Claiborne Aquifer between Mississippi and Tennessee).

From this language, one may conclude the "water that flows naturally between the [s]tates" is the flow of an aquifer and therefore the aquifer equivalent of the dependable flow.[112]

The "water that flows naturally between the [s]tates" is not water entering and recharging the aquifer.[113] It is instead simply water shifting in the aquifer.[114] When one speaks of water moving in an aquifer, it is like water moving in a lake.[115] Water in aquifers can move due to such things as pressure changes, geological changes, or human extraction of water.[116] For example, the Middle Claiborne Aquifer has increased its flow from Mississippi into Tennessee due to Memphis simply withdrawing water from the aquifer.[117] It is like water flowing in a lake because it is being drained from one side.

The Supreme Court has held that dependable flow does not include storage water.[118] Since the dependable flow is considered the annual flow minus evaporation loss, it is reasonable to assume the annual flow is only new water that flows into the river and not all water flowing in the river.[119] Using the "water that moves between the [s]tates" as part of any formula to apportion aquifer water between states will create major issues.[120]

1. Application Issues

Apportionment based on "water that flows naturally between the [s]tates" will create short-term issues that will have to be addressed.[121] The flow of aquifers is difficult to measure due to variations in depth, materials that make up the ground, and geological conditions.[122] These variations make it difficult to measure the flow of an aquifer. For example, the Middle Claiborne Aquifer has a possible flow rate between one

---

[112] *Id.*
[113] *Id.*
[114] *See* Mississippi v. Tennessee, 595 U.S. at 25.
[115] *See id.*
[116] Water Sci. Sch., *Groundwater Flow and the Water Cycle*, USGS (June 28, 2018), https://www.usgs.gov/special-topics/water-science-school/science/groundwater-flow-and-water-cycle [https://perma.cc/RJK3-VZPY].
[117] Mississippi v. Tennessee, 595 U.S. at 18, 19, 20.
[118] *See* Nebraska v. Wyoming, 325 U.S. 589, 638–39 (1945).
[119] *See id.*
[120] Mississippi v. Tennessee, 595 U.S. at 25.
[121] *Id.* at 25, 26.
[122] *See* Report of the Special Master at 20, Mississippi v. Tennessee, 595 U.S. 15 (2021) (No. 143, Orig.) [hereinafter Special Master Report].

to two inches per day, which can equate to 35 million gallons of water.[123] The flow changes when one area has lower potentiometric levels than another location.[124] Withdrawing water causes lower potentiometric levels thereby artificially increasing the flow of the aquifer.[125] The Supreme Court would likely have to decide whether increased flow due to pumping is part of the dependable flow or separate, similar to storage water being distinct from the dependable flow of rivers.[126] If it is not included, scientists will have to figure out how to separate the dependable flow from the increased flow due to pumping. This could cause issues similar to those in *Nebraska v. Wyoming*, where accurate measurements were not possible.[127] However, unlike *Nebraska,* where the river flow was estimated, increased flow in the aquifers may not even be subject to a fair estimate.[128]

2. Benefits to Apportioning Aquifers Based on the "Water That Flows Naturally Between the States"[129]

Apportionment of water based on the "water that flows naturally between the [s]tates" can avoid the short-term issues that arise when apportioning based on the recharge rate.[130] By ignoring the recharge rate, states would not be burdened with having to conserve water, find alternative sources, or spend millions of dollars building infrastructure. This could also potentially save billion-dollar economies that are highly dependent on aquifer water.[131]

3. Negatives to Apportioning Aquifers Based on the "Water That Flows Naturally Between the States"[132]

Even though apportionment based on the "water that flows naturally between the [s]tates" may prevent immediate issues for the states,

---

[123] Mississippi v. Tennessee, 595 U.S. at 25.
[124] Special Master Report, *supra* note 122, at 12.
[125] *See id.* at 21.
[126] *See* Nebraska v. Wyoming, 325 U.S. 589, 638–39 (1945).
[127] *See id.* at 646.
[128] *See id.* at 651–53.
[129] Mississippi v. Tennessee, 595 U.S. 15, 25 (2021).
[130] *Id.*
[131] *See* Bowman, *supra* note 4, at 1086, 1097–98.
[132] Mississippi v. Tennessee, 595 U.S. at 25.

it will likely create long-term issues that will need to be addressed later.[133] Apportioning water based on the "water that flows naturally between the [s]tates" would result in more water being apportioned than what is recharging.[134] Simply stated, when more water is withdrawn than comes into an aquifer, one can expect problems in the future. For example, the Middle Claiborne Aquifer, the aquifer in *Mississippi v. Tennessee*, recharges at a rate of only 0.05 centimeters per day while "the water that flows naturally between the [s]tates" was calculated to be about two inches per day.[135]

Also, because each state is apportioned a percentage of the annual flow, a state must either withdraw its annual amount or sacrifice the surplus to the total to be allocated for the next year.[136] This becomes a use-it-or-lose-it resource, and states would be economically encouraged to use aquifer water instead of surface water to save money and maximize their total use of the water.[137] This is the classic tragedy of the commons, where each individual's interest to maximize their own benefit destroys the resource for everyone.[138]

With climate change and the increasing frequency of droughts, the loss of aquifers as an emergency source of water is a major concern.[139] Any equitable apportionment that prioritizes current use over conservation is a problem.[140] Since the "water that flows naturally between the [s]tates" is greater than the recharge rate, aquifers will tend to be overdrafted, and states wishing to conserve water for future use will not be able to stake a claim to conserve water since the Supreme Court has rejected hypothetical arguments about future use and need.[141]

---

[133] *Id.*
[134] *Id.*
[135] *Id.*; David D. Bosch & David W. Hicks, *Observed and Simulated Recharge to the Claiborne Aquifer at the Plains, Georgia Research Site*, 1993 PROC. GA. WATER RES. CONF. 189, 191, https://www.researchgate.net/publication/41782917_Observed_and_Simulated_Recharge_to_the_Claiborne_Aquifer_at_the_Plains_Georgia_Research_Site [https://perma.cc/K75V-J4MD].
[136] *See, e.g.*, Washington v. Oregon, 297 U.S. 517, 527 (1936).
[137] *See id.*
[138] *See* Mark Somma, *Institutions, Ideology, and the Tragedy of the Commons: West Texas Groundwater Policy*, PUBLIUS, Winter 1997, at 1, 1.
[139] Dennis Dimick, *If You Think the Water Crisis Can't Get Worse, Wait Until the Aquifers Are Drained*, NAT'L GEOGRAPHIC (Aug. 21, 2014), https://www.nationalgeographic.com/history/article/140819-groundwater-california-drought-aquifers-hidden-crisis [https://perma.cc/8EFB-VPBS].
[140] *See Colorado II*, 467 U.S. 310, 321–22 (1984).
[141] Mississippi v. Tennessee, 595 U.S. 15, 25 (2021).

Equitable apportionment has historically given deference to the rule of priority and beneficial use while discouraging conservation when apportioning rivers.[142] This encourages current and continued access, while apportioning for future use only if there is a clear and planned beneficial use.[143]

The cases on equitable apportionment have never addressed artificial recharge, as there is no equivalent in surface water. Scientists have proposed that aquifers can be artificially recharged to mitigate droughts and used to store large amounts of water without concern of evaporation.[144] The Federal Emergency Management Agency ("FEMA") is also encouraging aquifer recharge by awarding grants through its Building Resilient Infrastructure and Communities ("BRIC") program that supports aquifer improvements. In 2021, FEMA awarded Provo, Utah, a BRIC grant of $50 million "for an aquifer storage recharging system."[145] FEMA also awarded a BRIC grant to Kern County, California, to "add storage for 30,000 acre-feet of potable water in a naturally occurring aquifer . . . ."[146] So long as the Supreme Court does not distinguish between artificial recharge and the "water that flows naturally between the [s]tates," states have no incentive to artificially recharge aquifers.[147] States that want to artificially recharge aquifers to mitigate droughts and store water will be disincentivized to do so.

While apportioning aquifers based on the "water that flows naturally between the [s]tates" may avoid many short-term problems, it does not ensure the longevity of the aquifers.[148]

---

[142] *See Colorado I*, 459 U.S. 176, 184–88 (1982).

[143] *See* Washington v. Oregon, 297 U.S. 517, 527 (1936) (citing Seaweard v. Pacific Livestock Co., 88 P. 963 (Or. 1907); *In re* Water Rights in Silvies River, 237 P. 322 (Or. 1925); *In re* Hood River, 227 P. 1065 (Or. 1924); State *ex rel.* Ham v. Super. Ct. of Grant Cnty., 126 P. 945 (Wash. 1912)).

[144] D.E. Wendt, A.F. Van Loon, B.R. Scanlon & D.M. Hannah, *Managed Aquifer Recharge as a Drought Mitigation Strategy in Heavily-Stressed Aquifers*, ENV'T RSCH. LETTERS, Jan. 2021, at 1, 10–11 (2021), https://iopscience.iop.org/article/10.1088/1748-9326/abcfe1 [https://perma.cc/CYT3-EFKJ].

[145] *See* Genelle Pugmire, *FEMA Awards Provo $50 Million for Aquifer Recharging Project*, DAILY HERALD (Aug. 30, 2022), https://www.heraldextra.com/news/local/2022/aug/30/fema-awards-provo-50-million-for-aquifer-recharging-project [https://perma.cc/4HV7-7YZY].

[146] *California: Enhancing Drought Management with Groundwater*, FEMA (Mar. 28, 2023), https://www.fema.gov/case-study/kern-county-california [https://perma.cc/6YMT-R4B3].

[147] Mississippi v. Tennessee, 595 U.S. 15, 25 (2021); *see* Joanne Vanderzalm, Declan Page, Peter Dillon, Dennis Gonzalez & Cuan Petheram, *Assessing the Costs of Managed Aquifer Recharge Options to Support Agricultural Development*, AGRIC. WATER MGMT., Apr. 2022, at 1, 5 (discussing the costs of operating aquifer recharge).

[148] Mississippi v. Tennessee, 595 U.S. at 25, 26.

C. *Negatives of Not Apportioning Aquifers*

The Supreme Court has not yet stated how it will apportion aquifers.[149] Until they do, states will continue to overdraft aquifers, and some states may even be encouraged to withdraw water to stake a claim to future apportionment. The open question of how to deal with artificial recharge will naturally discourage states from investing the infrastructure necessary for recharge and until the law is clarified, a state that foots the bill for recharge may simply be subsidizing another state.[150] Until that time, states will likely be hesitant to artificially recharge principal aquifers.[151] If the Court would simply decide the issue of how aquifers will be apportioned and whether states have a claim to water they artificially recharge, states will not be left wondering whether their investment is worthwhile.

IV. POTENTIAL SOLUTIONS TO AQUIFER APPORTIONMENT

Equitable apportionment may create issues, but there are potential solutions that Congress and the Supreme Court will likely have to consider when apportioning aquifers in the future.

A. *Special Apportionment Rules Should Be Created for Aquifers*

The simplest solution would be for the Court to recognize that aquifers and rivers are simply not the same thing and create a rule that allows aquifers to be used for drought mitigation, long-term conservation, short-term usage, and artificial recharge.[152]

Aquifers should be exempt from the ruling in *Colorado v. New Mexico* that discourages conservation for future use.[153] In that case, the Court held that while future use may be considered, the use must substantially outweigh the resulting harm and the future use must adequately remove uncertainties.[154] While the short-term consequences of preserving an aquifer are costly, and the permanent loss of an aquifer is

---

[149] *See id.* at 28.
[150] *See* Choy et al., *supra* note 98 (discussing the cost of artificially recharging an aquifer and voters approving the cost).
[151] *See id.*
[152] *See Colorado II*, 467 U.S. 310, 314 (1984).
[153] *See id.* at 314, 322.
[154] *See id.*

steeped in uncertainty, the consequences of entirely draining an aquifer should be avoided.[155] Scientists have reached a consensus that it is just a matter of time before many aquifers run dry.[156] For these reasons, aquifers should be exempt from the *Colorado v. New Mexico* holding regarding future use.

For aquifers, the Court should especially distinguish water injected through artificial recharge as distinctive from the dependable flow. This is similar to how the Court held in *Nebraska v. Wyoming* that storage water was not included under the dependable flow.[157] While this would not resolve all of the issues, it would certainly allow states to artificially recharge aquifers without concern that the water would become part of the commons.

B. State Compacts

Another potential method of resolving most aquifer issues is through well-thought-out state compacts that are ratified by Congress. States have previously decided to form contracts between themselves regarding how to apportion water.[158] After forming contracts, the states request that Congress ratify them as federal law.[159] This legally prevents the Supreme Court from allocating the water using the equitable apportionment doctrine.[160] For example, the Colorado River, a major source of water for many states, is governed by the Colorado River Compact.[161] The Compact was passed in 1922, less than two decades after *Kansas v. Colorado*.[162] The act has specific guidelines to apportion the water in the Colorado River and to exempt the river from equitable apportionment.[163] These compacts and acts are currently facing scrutiny as a result of decreasing levels of the Colorado River and whether the compact has historically over-apportioned the water in the river.[164]

---

[155] *See id.* at 321–22; Condos, *supra* note 29.
[156] *See* Lucas Bessire, *The Next Disaster Coming to the Great Plains*, ATLANTIC (Dec. 26, 2021), https://www.theatlantic.com/ideas/archive/2021/12/kansas-aquifer-ogallala-water-crisis-drought/621007 [https://perma.cc/QG9V-LUA5].
[157] Nebraska v. Wyoming, 325 U.S. 589, 638–39 (1945).
[158] *See, e.g.*, COLO. REV. STAT. § 37-61-101 (2022).
[159] *See, e.g.*, 43 U.S.C. § 617l.
[160] Arizona v. California, 373 U.S. 546, 565 (1963).
[161] *See* 43 U.S.C. § 617l.
[162] *See id.* § 617l(a).
[163] *See* COLO. REV. STAT. § 37-61-101 (2022).
[164] *See* Drew Kann, Renée Rigdon & Daniel Wolfe, *The Southwest's Most Important River*

One criticism regarding state compacts is that it is unclear whether any federal agencies have the regulatory power to resolve disputes regarding a compact or unilaterally impose changes to the apportionment.[165] While the Bureau of Reclamation has set deadlines for states to reach an agreement to ration the Colorado River, the states have failed to even meet the deadlines.[166] There are concerns that if an agreement to ration the water is not made, the river could reach a condition called "dead pool," when water levels are so low that it no longer is capable of moving downstream from the dam.[167]

CONCLUSION

It is unclear how the Supreme Court will equitably apportion aquifers or define the dependable flow. Each potential definition and method have clear benefits and downsides. While alternatives are possible, they do not guarantee the issues facing aquifers will be addressed. Until the Court defines dependable flow and addresses recharge rates, artificial recharging, and storage, states will continue to benefit from overdrafting aquifers. While any potential measurement for dependable flow has its flaws, setting the dependable flow to the recharge rate has the fewest long-term faults and will prevent aquifers from being depleted over time. If the recharge rate is considered the dependable flow, artificial recharge could easily be distinguished from the dependable flow just like storage water was treated in *Nebraska v. Wyoming*.[168] States could be encouraged to conserve and artificially recharge aquifers for future generations.

Is Drying Up, CNN (Aug. 21, 2021), https://www.cnn.com/interactive/2021/08/us/colorado-river-water-shortage [https://perma.cc/AXU5-NZS4].

[165] *See* Luke Runyon, *On the Colorado River the Feds Carry a Big Stick. Will the States Get Hit?*, KUNC (July 19, 2022), https://www.kunc.org/environment/2022-07-19/on-the-colorado-river-the-feds-carry-a-big-stick-will-the-states-get-hit [https://perma.cc/TLG6-KPCX].

[166] S*ee* Emma Newburger, *Colorado River Deadline Passes with No Deal on Voluntary Water Cuts*, CNBC (Jan. 31, 2023), https://www.cnbc.com/2023/01/31/colorado-river-shortage-states-miss-deadline-for-deal-on-water-cuts.html [https://perma.cc/JRB2-SQLC].

[167] Weise & Hughes, *supra* note 105.

[168] *See* Nebraska v. Wyoming, 325 U.S. 589, 638–39 (1945).