REBALANCING *WINTERS*: INDIGENOUS WATER RIGHTS AND CLIMATE CHANGE IN THE WESTERN UNITED STATES

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The Author acknowledges that he lives and makes his living in the aboriginal homeland of the Nimi'ipuu (Nez Perce) and Schitsu'umsh (Coeur d'Alene) peoples and that the University of Idaho is situated within the boundaries of the Nez Perce Tribe's unceded 1855 Reservation. These Tribal Nations are distinct, sovereign, legal, and political entities with their own powers of self-governance and self-determination. Honor the treaties; "[g]reat nations, like great men, should keep their word." F.P.C. v. Tuscarora Indian Nation, 362 U.S. 99, 142 (1960) (Black, J., dissenting).

Introduction

My daughter is named Minta Ardell, a name she shares with her great-great grandmother. Her namesake was born in 1906 within Indian Territory's Cherokee Reservation. She died nearly one hundred years later in what had become known as the state of Oklahoma. The place where Minta the elder lived and died—the Cherokee Reservation—was set aside in 1835 and was to be the permanent homeland of the Cherokee Nation and its people. Minta the elder saw much change over the course of her life, but perhaps the most consequential was the subtle shift she probably never noticed in the climate of her homeland.

It is Minta the younger that will bear the brunt of this shift. Indeed, although we have already begun to experience the dramatically negative consequences of climate change, it is Minta's generation that is at risk of experiencing changes *beyond* their ability to adapt.[1] One of the most rapidly growing components of that generation are Indigenous children,[2] which have already experienced some of the worst effects of climate change and that remain particularly vulnerable as climate change becomes more intense and catastrophic.[3] Most of these young people live on Indian reservations that were set aside with the promise that they—like the Cherokee Reservation—would remain permanent homelands for the indigenous people that have been there from time immemorial. Climate change threatens to irreparably break that promise.

This article focuses on how climate change jeopardizes tribal water rights—one of the myriad ways that climate change threatens tribal homelands. It is axiomatic that homelands need water and, indeed, the Supreme Court has long recognized that Indian tribes are entitled to water rights sufficient to meet "the ultimate needs of each Reservation . . . ."[4] However, since the middle of the

1. Intergovernmental Panel on Climate Change, Synthesis Report of the IPCC Sixth Assessment Report (AR6): Summary for Policy Makers 7 Fig. SPM.1, 15, 20 (2021) [hereinafter IPCC, Sixth Assessment Synthesis Report].
2. Recent Census Bureau statistics indicate that "The American Indian and Alaska Native alone population grew by 27.1%, and the American Indian and Alaska Native in combination population grew by 160% since 2010." *Improved Race and Ethnicity Measures Reveal U.S. is Much More Multiracial*, U.S. Census Bureau (Aug. 12, 2021), https://perma.cc/WX55-NQWB.
3. IPCC, Sixth Synthesis Report, *supra* note 1, at 5, 16; Kathtryn Norton-Smith et al., Climate Change and Indigenous Peoples: A Synthesis of Current Impacts and Experiences 30 (2016); U.N. Permanent Forum on Indigenous Issues, Climate Change and Indigenous Peoples Backgrounder (2008), https://perma.cc/2EP3-PDJG; *see generally* Rebecca Tsosie, *Indigenous People and Environmental Justice: The Impact of Climate Change,* 78 Colo. L. Rev. 1625 (2008); Jay Williams, *The Impact of Climate Change on Indigenous People–The Implications for the Cultural, Spiritual, Economic, and Legal Rights of Indigenous People*, 16 Int'l J. Human Rights 1 (2011); Linda Etchart, *The Role of Indigenous Peoples in Combating Climate Change,* Palgrave Cmmc'ns, Aug. 22, 2017.
4. Simon H. Rifkind, Special Master Report at 264, Arizona v. California, 373 U.S. 546 (No. 8, Original) [hereinafter 1960 Special Master Report]; Arizona v. California, 547 U.S. 150, 156–57 (1963).

twentieth century, non-Indian communities have been successful in both limiting the scope of tribal reserved water rights and demanding they be decreed for *fixed* quantities. Those quantities are estimated using climatic and hydrological data from the past, building on the assumption that *future* climate and hydrology conditions will remain within the natural variability we have recently experienced. As this article explores in detail, that assumption has become irrational in an era of climate change and threatens to undermine the fundamental promise the United States made to innumerable Indian tribes that it would protect them and ensure their homelands would remain viable permanently.

If the United States intends to fulfill the sovereign government-to-government promise it made with these tribes, then it will need to shift its approach for securing water rights in an era of climate change. The purpose of this article is to begin that conversation. It begins by exploring the historical development of tribal reserved water rights in an effort to discern the Supreme Court's intent when it announced its landmark decision in *Winters v. United States*.[5] It then explores the delicate balance the Court and its special master later struck between these water rights and the water rights within non-Indian communities in the West. That balance was intended to "preserve the full extent of the water rights created by the United States," but also "establish water rights of fixed magnitude and priority so as to provide certainty for both the United States and non-Indian users."[6] While that bargain *might* have been an appropriate balance of uncertainty in 1960, things have shifted significantly against tribes in the modern era as they grapple with fixed quantities of water that may become insufficient to maintain their homelands in an era of climate change. Thus, this article concludes with a series of suggestions that could be interwoven to recalibrate that delicate balance and place tribes on a better footing to protect themselves and their homelands moving into an uncertain future.

I. The Historical Development of Western Water Law

At the time that Europeans first approached what is today the continental United States, Indigenous peoples owned and controlled over 1.73 billion acres of land.[7] Today, American Indian tribes retain an ownership interest in just 105 million acres of land, a reduction of 93.9%.[8] The contemporary approach to quantifying water rights for American Indian tribes is inextricably intertwined with that history of colonialism, appropriation, and inequitable redistribution of land, wealth, and resources.

5. 207 U.S. 564 (1908).
6. 1960 Special Master Report, *supra* note 4, at 265.
7. Justin Farrell et al., *Effects of Land Dispossession and Forced Migration on Indigenous Peoples in North America*, 374 Sci. 1, 3 (2021).
8. *Id*.

Prior to the coming of Europeans, "America . . . was inhabited by a distinct people, divided into separate nations, independent of each other and of the rest of the world, having institutions of their own, and governing themselves by their own laws."[9] These people had "command of the lands and the waters [within their homelands], command of all their beneficial use,"[10] and the concomitant rights they had in those lands and waters were "not much less necessary to the existence of the Indians than the atmosphere they breathed."[11] It was these rights that the United States sought to extinguish as non-Indian settlers flooded into the West. The United States was incredibly efficient in this campaign, having purchased from Indigenous nations some 13.4 *billion* acres of land by 1887.[12] In so doing, the United States became the absolute owner of the lands and, more importantly for our purposes, the waters of the American West.

Pursuant to the Property Clause of the Constitution, the United States had absolute authority over the disposal of those lands and waters.[13] No one could acquire the right to use water on these lands without the permission of Congress, and it was Congress that could define the terms upon which those waters would be disposed.[14] It did this through passage of a series of land granting statutes, culminating in the 1877 Desert Lands Act, which provided that

> all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public . . . subject to existing rights.[15]

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9. Worcester v. Georgia, 35 U.S. 515, 543 (1832).
10. Winters v. United States, 207 U.S. 564, 576 (1908).
11. United States v. Winans, 198 U.S. 371, 381 (1905).
12. According to Farrell et al., Indigenous people historically held title to approximately 7,011,450 square kilometers, which converts to 1,732,567,027 acres. Farrell et al., *supra* note 7, at 3. In 1934, John Collier reported to the Senate and House Committees on Indian Affairs that those land holdings had reduced to 138 million acres in 1887 to 48 million acres in 1934. *To Grant Indians Living Under Federal Tutelage the Freedom to Organize for Purposes of Local Self Government and Economic Enterprise*, *Hearing on S.2755 before the S. Comm. on Indian Affairs*, 73d. Cong. 17 (1934) (statement of John Collier, Commissioner of Indian Affairs). However, as a result of land purchases by the United States and Tribes, tribal land holdings have increased to approximately 426,598 square kilometers or a little over 105 million acres. Farrell et al., *supra* note 7, at 6.
13. U.S. Const. art. IV, § 3, cl. 2; Dale D. Goble, *Prior Appropriation and the Property Clause: A Dialogue of Accommodation*, 71 Or. L. Rev. 381, 386–88 (1992).
14. Cal. Ore. Power Co. v. Beaver Portland Cement Co., 295 U.S. 142, 162 (1935) (noting that "as the owner of the public domain, the government possessed the power to dispose of the land and water thereon together, or to dispose of them separately."). For a comprehensive examination of the interrelationship between public land and federalism, *see* Dale D. Goble, *Prior Appropriation and the Property Clause: A Dialogue of Accommodation*, 71 Or. L. Rev. 381, 386–88 (1992).
15. 43 U.S.C. § 321 (1877).

The Supreme Court interpreted Congress' course of dealings to do two things. First, it authorized non-Indians to use unappropriated water on the public domain "subject to existing rights."[16] Second, with the important exception that "a state cannot . . . destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters," the Court viewed Congress to have acquiesced to state control over the distribution and control of water within their political boundaries.[17]

Pursuant to this power, each state in the West has applied some version of the prior appropriation water rights doctrine.[18] Although complex in practice, the doctrine is simple to articulate:

> One acquires a right to water by diverting it from its natural source and applying it to some beneficial use. Continued beneficial use of the water is required in order to maintain the right. In periods of shortage, priority among confirmed rights is determined according to the date of initial diversion.[19]

Under the doctrine, a person's water right is limited to the amount they divert and put to a beneficial use.[20] Conversely, these rights are subject to loss for nonuse if the water user ceases putting the water to beneficial use.[21] Finally, in times of water scarcity, the most senior user gets their entire quantity of water before the next most senior receives any water.[22]

In contrast, the source and scope of reserved water rights held by American Indian tribes are defined by federal law and depend on the purposes of the creation of each reservation.[23] Like all reserved rights, the basis for reserved water rights for Indian tribes are the treaties, executive orders, and congressionally-ratified agreements that set aside each Indian reservation.[24] While unique in their particulars, the foundations of these operative documents were invariably the same. Consideration on the tribal side was the cession of land and a promise for peace.[25] In exchange, the United States usually paid a nominal amount of

16. *Beaver Portland Cement Co.*, 295 U.S. at 156.
17. United States v. Rio Grande Dam & Irrigation Co., 174 U.S. 690, 703 (1899).
18. Anthony Dan Tarlock & Jason Anthony Robison, Law of Water Rights and Resources § 5.01 (2019).
19. Colo. River Water Conservation Dist. v. United States, 424 U.S. 800, 805 (1976).
20. Felix Cohen, Cohen's Handbook of Federal Indian Law § 19.01(1) (2012); Tarlock & Robison, *supra* note 18, § 5.68.
21. Cohen, *supra* note 20, § 19.01(1); Tarlock & Robison, *supra* note 18, § 5.92.
22. Cohen, *supra* note 20, § 19.01(1).
23. *Id*. § 19.01(3).
24. Tarlock & Robison, *supra* note 18, § 9-76.1.
25. Francis Paul Prucha, The Great Father: The United States Government and the American Indians 46 (1984). ("The new nation faced innumerable difficulties, and it was imperative that the Indians remain at peace. This happy end could be attained only by a policy of justice towards the Indians and protection of their rights and property against unscrupulous traders, avaricious settlers, and ubiquitous speculators.").

money[26] and, more to the point, undertook a number of ongoing obligations. Foremost, the United States recognized and undertook to protect the tribe and its members by establishing permanent homelands. The purpose of those homelands was to ensure the tribes could continue to exercise their traditional lifeways while simultaneously adopting Euro-American agrarian and commercial economies.[27]

Notwithstanding the centrality that water played in the maintenance of these homelands, most agreements failed to mention water rights. Nonetheless, the Supreme Court has long recognized that the United States and tribal nations impliedly reserved enough water to fulfill the purposes for the creation of each reservation.[28] Named for the case that first recognized them, the *Winters* doctrine holds that Indian tribes are entitled to "sufficient water . . . to fulfill the purposes for which a reservation was established,"[29] which necessarily includes water for current and future needs.[30] Though courts have recognized tribes are entitled to water rights for a variety of purposes, water for irrigation remains central to the tribal homeland. Indeed, irrigation water rights have the distinction of being the *first* reserved water right recognized by the Supreme Court and have taken center stage in most of the major water rights adjudications of the past century.[31] They also have the distinction of often being the largest consumptive water rights claimed by the United States and tribes.[32]

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26. For example, the Nez Perce Tribe entered into a treaty with the United States in 1855 wherein it agreed to cede approximately 9.5 million acres of land to the United States. Treaty with the Nez Perce Tribe, Nez Perce Tribe-U.S., art. 1, June 11, 1855, 12 Stat. 957; *Nez Perce Tribe*, Columbia River Inter-Tribal Fish Comm'n, https://perma.cc/7876-2AF8. In exchange, the United States agreed to pay the Tribe $200,000, which averages to approximately two cents per acre of land sold. Treaty with the Nez Perce Tribe, Nez Perce Tribe-U.S., art. 1, June 11, 1855, 12 Stat. 957.

27. *See*, *e.g.*, Treaty with the Chippewa, Feb. 22, 1855, 10 Stat. 1165, art. 2 (setting aside "a sufficient quantity of land for the permanent homes of the said Indians"); Treaty With the Eastern Band Shoshoni and Bannock, July 3, 1868, 15 Stat. 673, art. 4 (promising that the tribes "will make said reservations their permanent home"); Treaty with the Navaho, June 1, 1868, 15 Stat. 667, art. 13 ("[T]he tribe herein named . . . agree to make the reservation herein described their permanent home . . . ."); Act of Mar. 3, 1891, 26 Stat. 989, 1028 (guaranteeing to the Coeur d'Alene Tribe that "the Coeur d'Alene Reservation shall be held forever as Indian land and as homes for the Coeur d'Alene Indians").

28. United States v. Winters, 207 U.S. 564, 564 (1908); Arizona v. California, 373 U.S. 546, 600–02 (1963) [hereinafter *Arizona I*]; Colville Confederated Tribes v. Walton, 647 F. 2d 42, 47 (9th Cir. 1981); United States v Adair, 723 F.2d 1394, 1410 (9th Cir. 1984); *see also* Cohen, *supra* note 20, § 19.02.

29. Cohen, *supra* note 20, § 19.02.

30. *Arizona I,* 373 U.S. at 601.

31. *Winters*, 207 U.S. at 564; Cohen, *supra* note 20, § 19.02 ("Most tribal rights to water arise under the implied reservation doctrine first announced in *Winters v. United States*.").

32. *See e.g.*, Arizona v. California, 373 U.S. 546, 596 (1963) (noting that the tribal irrigation water right was approximately 1 million acre-feet); *See* Report Concerning Reserved Water Right Claims By and On Behalf of the Tribes of the Wind River Indian Reservation, Wyoming at 72–76, In re the General Adjudication of All Rights to Use Water in the Big Horn River

Although the legal basis for reserved water rights and state law water rights are different, they are administered together in times of shortage based on their priority with the senior water rights holders receiving their full allocation of water before relatively junior water rights receive any water. The priority of state law water rights is determined by the date of first use. In contrast, the priority date for reserved water rights is usually "no later than the date on which a reservation was established, which in the case of most Indian reservations in the west, is earlier than the priority of most non-Indian water rights."[33] The upshot? Indian reserved irrigation rights are invariably prior to state law rights, their quantity is typically quite large, and because tribal rights "are often put to actual use long after appropriation rights are established, the exercise of tribal water rights has the potential to disrupt non-Indian water uses."[34] Not surprisingly then, states and their water users have dedicated substantial effort toward ensuring reserved water rights are narrowly construed in order to serve the economic interests of predominantly non-Indian communities.[35]

Although their strategies for limiting tribal reserved water rights have been multifaceted, two approaches are particularly relevant to our discussion here. First, significant effort has been brought to bear toward eroding the overall quantity of tribal irrigation water rights. Second, and more to the point here, non-Indian litigants have demanded that tribal water rights be fixed for a particular quantity of water and have objected to any modification to adjust tribal water rights necessary to address changing conditions. In this regard, these

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System (5th Dist. Wyo. Dec. 15, 1982) (No. 85-203) (noting the tribal irrigation water right was 585,106 acre-feet, which dwarfed the remaining consumptive claims made by the United States).

33. *But see* United States v. Anderson, 736 F.2d 1358, 1361 (9th Cir. 1984) (holding that in some situations reserved water rights appurtenant to lands that had gone out of trust and were subsequently reacquired by the Tribe may carry a priority date matching the date of reacquisition rather than the date the reservation was created).

34. Cohen, *supra* note 20, at 1175.

35. *See* Robert T. Anderson, *Indian Water Rights, Practical Reasoning, and Negotiated Settlements*, 98 Calif. L. Rev. 1133, 1149–53 (2010) (describing water rights litigation in lower state and federal courts); Dylan R. Hedden Nicely, *The Historical Evolution of the Methodology for Quantifying Federal Reserved Instream Water Rights for Indian Tribes,* 50 Env't L. Rev. 207, 268 (2020) (discussing the legal arguments leveled against tribal instream water rights over the past several decades); Stephen M. Feldman, *The Supreme Court's New Sovereign Immunity Doctrine and the McCarran Amendment: Toward Ending State Adjudication of Indian Water Rights*, 18 Harv. Envtl. L. Rev. 433, 449 (1994) (discussing the political pressure applied to state courts by non-Indian communities to limit the scope of reserved water rights); John A. Folk-Williams, *State and Indian Governments: Are New Relationships Regarding Water Possible?, in* Indian Water 1985: Collected Essays 67, 70 (Christine L. Miklas & Steven L. Shupe eds., 1986) (discussing the adversarial relationship between tribes and states in water rights adjudications); Karen Crass, *Eroding the Winters Right: Non-Indian Water Users' Attempt to Limit the Scope of the Indian Superior Entitlement to Western Water to Prevent Tribes from Water Brokering*, 1 U. Denv. Water L. Rev. 109, 114–19 (1997) (discussing some examples of non-Indian work to "erode" the *Winters* doctrine).

litigants have been quite successful; with few exceptions, modern courts have typically agreed to fix tribal water rights for specific quantities of water.[36] And, once fixed, the Supreme Court has ruled that tribes and the United States are often precluded from seeking additional water supply, even where valid water rights were omitted by mistake, and even where it was alleged that the United States breached its trust responsibility by purposely failing to claim sufficient water rights on behalf of a tribe.[37] As we will see next, this was not the approach originally envisioned by the Supreme Court when it announced the *Winters* doctrine.

II. The Devolution of the Quantification Method for Reserved Irrigation Water Rights for Tribes

A. The Original Understanding of the Winters *Doctrine*

Notwithstanding our contemporary obsession with quantifying water rights with precision and fixing them in a decree, it is not clear that the Supreme Court originally intended the reserved water rights doctrine to be so constrained. Just the opposite, the position of the United States in *Winters* was that "it is essential and necessary that *all* of the waters of said Milk River should be permitted to flow down the channel of said river, uninterruptedly and undiminished in quantity . . . ."[38] The legal basis for this position seemed to have been rooted in the Supreme Court's decision *United States v. Winans*,[39] which the Court had decided just a few months prior.[40] That case originated when

36. Arizona v. California, 373 U.S. 546, 596 (1963) (decreeing around 1,000,000 acre-feet of water to irrigate approximately 135,000 acres of land); Colville Confederated Tribes v. Walton, 647 F.2d 42, 45 (1981) (noting the lower court had awarded the Colville Tribes and its allottees 666.4 acre-feet of water from No Name Creek for irrigation); In re Rights to Use Water in Big Horn River, 753 P.2d 76, 103 (1988) [hereinafter *Big Horn I*] (affirming the decree for 188,937 acre-feet per year from the Big Horn Basin for irrigation). *But see* United States v. Anderson, No. 3643, slip op. at 9, 15 (E.D. Wash. July 23, 1979) (awarding 25,650 acre-feet of water from Chamokane Creek for irrigation purposes but retaining jurisdiction to "permit[] the Tribe to apply for a modification of the judgment on showing of a substantial change in circumstances, unanticipated in the Court's quantification herein, resulting in a need for water greater than the amount reserved for future needs.")

37. *Arizona I*, 373 U.S. at 617–28; Nevada v. United States, 463 U.S. 110, 128 (1983).

38. Bill of Complaint at 8, United States v. Anderson, No. 747 (D. Mont. June 26, 1905), *aff'd sub nom*, Winters v. United States, 207 U.S. 564 (1908) (emphasis added) (available in John H. Shurts, Indian Reserved Water Rights: The Winters Doctrine in its Social and Legal Context, 1880s–1930s (2000); *See also* Supplemental Brief for the United States at 18, *Winters*, 207 U.S. 546 (1908) (No. 158) ("[T]he question is directly presented as to whether the Government can be prevented from using all the water that is necessary for the complete development of the agricultural resources of the reservation."); Brief for the United States at 7, *Winters*, 207 U.S. 546 (1908) (No. 150).

39. 198 U.S. 371 (1905).

40. *Id.* at 381.

the Winans brothers sought to exclude members of the Yakama Nation from property situated on the Columbia River they had acquired pursuant to federal homestead laws.[41] Those lands had been part of the Yakama Nation's aboriginal territory, which spanned approximately 12 million acres. In 1855 the Nation ceded approximately 10 million acres of that territory to the United States.[42] In exchange, the Nation reserved approximately 1.4 million acres of its aboriginal lands as a permanent homeland.[43] However, many of the Nation's historical fishing locations were not located on its new reservation. Thus, federal negotiators also promised the Nation "the right of taking fish at all usual and accustomed places, in common with the citizens of the Territory . . . ."[44]

Clinging to the "in common with" language of the treaty, the Winans brothers argued that the Nation had "no rights but what any inhabitant of the territory or state would have. Indeed, [the Nation] acquired no rights but such as they would have without the treaty."[45] The Supreme Court rejected this argument as "an impotent outcome to negotiations and a convention which seemed to promise more, and give the word of the nation for more."[46] Instead, the Court announced what has become known as the reserved rights doctrine: "the treaty was not a grant of rights to the Indians, but a grant of right from them—a reservation of those not granted."[47] Thus, the Court started from the baseline that fishing rights were "part of larger rights possessed by the Indians, upon the exercise of which there was not a shadow of impediment . . . ."[48] From that vantage, the question became whether there was evidence in either the text or circumstances surrounding the treaty that indicated that the Nation intended to cede its fishing rights. To the Court those circumstances were clear; it was inconceivable that the Yakamas would have knowingly given up a right that was "not much less necessary to the existence of the Indians than the atmosphere they breathed."[49]

But what of the scope of that right? Without question, the coming of non-Indians caused "[n]ew conditions [to] c[o]me into existence," and the Nation's fishing rights—which, up to that point, had been absolute and exclusive—had to be "accommodated" to those new conditions.[50] Thus, federal negotiators acquired from the Yakama Nation an agreement that non-Indians could fish "in

41. *Id.* at 380.
42. Wash. Dept. of Licensing v. Cougar Den, Inc., 139 S. Ct. 1000, 1007 (2018).
43. Treaty with the Yakama, Yakama-U.S., art. 2, June 9, 1855, 12 Stat. 951.
44. *Id*. at art 3.
45. *Winans*, 198 U.S. at 380.
46. *Id*.
47. *Id*. at 381.
48. *Id*.
49. *Id*.
50. *Id*.

common" with the Nation throughout its historical fishing grounds.[51] However, that limitation did nothing to affect the Nation's own rights to continue fishing. Just the opposite, according to the Court, the better construction of the agreement was that the treaty "imposed a servitude upon every piece of land" so that "the Indians were given a right in the land—the right of crossing it to the river—the right to occupy it to the extent and for the purpose mentioned."[52]

It was this framework that federal litigators applied to the water rights questions posed in *Winters*.[53] They argued that the Fort Belknap Reservation had been part of a larger reservation that had been set aside in 1856 and again in 1874 that "included the entire waters of Milk River and its tributaries . . . ."[54] Citing back to prior caselaw related to military reservations, the United States argued that

> [w]hen the Government established the reservation, it owned both the land included therein and all the water running in the various near-by streams to which it had not yielded title. It was therefore unnecessary for the Government to "appropriate" the water. It owned it already. All it had to do was to take it and use it.[55]

According to federal litigators, the fact that the land had always been in the possession of the Tribes was relevant for at least two reasons. First, because the waters of Milk River "*never were,* and *never became* public waters [they never were] subject to appropriation by any person based on state or federal laws."[56] Second, according to the federal lawyers, the historical ownership of the land and water colored the intent of the United States and the Tribes. As in *United States v. Winans*, the question became whether there was evidence in either the text or circumstances surrounding the agreement that indicated that the Tribes intended to cede their water rights. Given that the Tribes,

> from time immemorial, had seen the waters of the stream flow down past and through their reservation in abundance, and at no time had

51. Treaty with the Yakama, Yakama-U.S., art. 3, June 9, 1855. The right of non-Indians to fish in common with the Nation did not extend to within the Yakama Reservation, wherein the Nation reserved exclusive fishing rights. *See id.* at art. 3.

52. *Winans*, 198 U.S. at 381.

53. *See* SHURTS, *supra* note 38. As Shurts explains, lead litigator Carl Rasch made arguments based on (1) riparian water rights theories; (2) prior appropriation theories; and (3) theories based on reserved rights pursuant to *Winans*. However, his arguments related to reserved water rights ultimately became the basis for the rule of decision at the lower court, Circuit Court, as well as the Supreme Court. *See id.* at 71, 89, 98–99, 144.

54. Supplemental Brief for the United States at 17, Winters v. United States, 207 U.S. 564 (1908) (No. 158); *see also id.* ("It can not be successfully questioned that [prior to the 1888 agreement] the Indians had the right to the use of the waters in the said river and its tributaries for any purpose.").

55. Supplemental Brief for the United States at 30, *Winters*, 207 U.S. 564 (No. 158).

56. Brief of the United States at 4, *Winters*, 207 U.S. 564 (No. 158).

> they known or seen the channel of Milk River other than as a flowing, living stream . . . it would be preposterous to assume that they understood their bargain with the Government in any other way than that there was secured and reserved to them the flowing, living stream as they had always known and seen it.[57]

Given the Tribes' incredibly strong tie to the waterways of the territory, made stronger through innumerable generations, the United States argued there must be "clear and explicit language" before the Court should presume "that the Indians would . . . surrender or agree to abandon the only means they had to raise crops on any of the lands they retained, and thus to defeat their desire and purpose to acquire permanent homes and gain a livelihood . . . ."[58] Thus, the government argued that silence in the 1888 Agreement could only mean one thing: an intent by the United States and the tribes to "retain[] this right . . . to the full extent in which it had been vested in them under former treaties."[59]

But the federal litigators did not rest on *Winan*'s reserved rights doctrine alone. Instead, they buttressed that argument by outlining the *purposes* of the 1888 Agreement, reasoning that although the agreement itself may have been silent as to water rights, "the purposes to be accomplished by the agreement . . . clearly evinces an intention . . . to make a reservation of so much of said waters . . . to supply the reasonable needs of the Indians . . . ."[60] Overall, that purpose was to set aside the Fort Belknap Reservation "as and for the permanent home and abiding place of the Gros Ventre and Assinniboine bands or tribes of Indians in . . . Montana."[61] Within that homeland, the "main object . . . was to render the Indians 'self-supporting, as a pastoral and agricultural people . . . ."[62] However, everyone understood that "no part of the lands set apart . . . [are] susceptible of cultivation, except [through irrigation]."[63] Thus, the argument went, "unless the right to the use of the waters of Milk River for domestic, stock, and irrigation

57. *Id.* at 45–46.
58. Brief for the United States at 18, *Winters* 207 U.S. 564 (No. 158).
59. Supplemental Brief for the United States at 32, *Winters*, 207 U.S. 564 (No. 158); *see also*, Brief for the United States at 12, *Winters*, 207 U.S 564 (No.158). ("[B]y act of Congress of May 1, 1888 . . . they retained . . . the right to divert and use for domestic, irrigation, and other beneficial purposes so much of the waters of Milk River as was sufficient to meet their needs and to carry out the objects and purposes sought to be effected by said agreement."); Brief for the United States at 35–36, Winters v. United States, 143 F. 740 (9th Cir. 1906) ("The property and property rights that were actually and expressly reserved for the use and benefit of the Indians, by the terms and provisions of the treaty, properly construed and interpreted, included the lands and the corpus of the water within the limits of the reserve . . . and the right to the use of the waters of the entire stream bordering on the reserve.").
60. Brief for the United States at 15, Winters v. United States, 207 U.S. 564 (1908) (No. 158).
61. *Id.* at 4.
62. *Id.* at 15 (quoting Act of May 1, 1888, 25 Stat. 113, 113 (1888)).
63. *Id.*

purposes was reserved to the Indians, they could not . . . obtain a 'livelihood' . . . they could not secure 'permanent homes.'"[64]

But how much water? On this point, the United States was unequivocal; the Tribes "depend[ed] *entirely* upon the waters of said river 'for domestic, culinary, and irrigating purposes.'"[65] Those uses, particularly irrigation, currently required large quantities of water from Milk River and eventually would require *all* of the water from the river as agriculture on the Reservation expanded.[66] Accordingly, to fully achieve the purposes set out in the 1888 Agreement—to establish a viable homeland now and into the future for the Gros Ventre and Assiniboine Tribes, the United States argued that "all the waters of said river . . . are essential and necessary for the use of [the Tribes,]" and that "'it is necessary and essential that the waters of said Milk River should be permitted to flow down the channel . . . .'"[67] Consistent with this position, the United States requested an injunction prohibiting the defendant non-Indian water users "from in any manner impeding, obstructing or preventing the waters of said Milk River or its tributaries from flowing down the channel of said river" and into the Reservation.[68]

Initially, the trial court issued a temporary restraining order consistent with the United States' prayer for relief. That order was eventually modified to only prohibit the non-Indian water users from interfering with the Tribes' current needs, which the United States estimated to be approximately 11,000 miner's inches.[69] Hence, as the Court did in *Winans*, the lower court recognized that the coming of non-Indian homesteaders caused "[n]ew conditions to c[o]me into existence."[70] This time, it was the Tribes' *water* rights—which, up to that point, had been absolute and exclusive—that had to be "accommodated" to those new conditions.[71] But, once again, the court affirmed that the tribal accommodation did not extend so far as to work a limitation upon *their* water rights. Instead, the court found that the "patents issued by the Land Department for lands held by defendants *are subject to the treaty, and defendants can acquire no rights to the exclusion of the reasonable needs of the Indians*."[72]

To get there, the court looked to the history of the Tribes, as well as the circumstances surrounding the creation of the Fort Belknap Reservation to

64. *Id.* at 16.
65. *Id.* at 4 (emphasis added).
66. Complaint at 8, United States v. Anderson, No. 747 (D. Mont. June 26, 1905), *aff'd sub nom*, Winters v. United States, 207 U.S. 564 (1908).
67. Brief for United States at 5, Winters v. United States, 207 U.S. 564 (No. 158).
68. Shurts, *supra* note 38, at 71.
69. *Id.* at 71. 11,000 miners inches amounts to approximately 275 cubic feet per second (cfs). That amount was later reduced to 5,000 miners inches or 125 cfs. *Winters*, 207 U.S. at 565.
70. United States v. Winans, 198 U.S. 371, 381 (1905).
71. *Id.*
72. United States v. Anderson, No. 747 (D. Mont. Aug. 8th, 1905) (order granting preliminary injunction); *see also* Shurts, *supra* note 38, at 74.

color the text of the 1888 Agreement. It agreed with the United States that "[p]rior to 1888 nearly the whole of Northern Montana . . . was recognized as Indian country."[73] In consideration of the Tribes' massive cession in 1888, the United States agreed to help the Tribes to transition to an agricultural economy rooted in farming and stock raising.[74] However, "notice of conditions of climate and soil of Montana tells us that water for irrigation is indispensable in successful farming . . . ."[75] Thus, the court concluded, that "the intention was to reserve sufficient [amounts] of the waters to insure to the Indians the means wherewith to irrigate their farms."[76] This, according to the court, was the only construction of the Agreement that could "be in accord with the rules which the Supreme Court has repeatedly laid down in arriving at the true sense of treaties with Indians. United States v. Winans, decided May 15, 1905."[77]

The Ninth Circuit affirmed the trial court's decision, once again applying both the reserved rights doctrine as well as an analysis of the purposes for the creation of the Fort Belknap Reservation. It began by recognizing that originally, "all of the country within the state of Montana was Indian country."[78] Therefore, according to the court, "[w]hen the government established the reservation . . . it owned both the land . . . and all the water running in the various streams . . . ."[79] Nonetheless, the Ninth Circuit concluded that pursuant to the Desert Lands Act, Congress had caused nonnavigable water upon the public domain to be appropriable pursuant to state law.[80] Thus, when the lands outside Fort Belknap became public domain after Congress ratified the 1888 Agreement and the lands were disposed of pursuant to the Desert Lands Act, the water appurtenant to that land became subject to appropriation.[81] However, those acts did *nothing* to effect a change in the nature of the water rights reserved by the Tribes; they simply paved the way for non-Indian access to the waters of Milk River "'subject to existing rights,'" including the rights of the Tribes.[82] Thus, the Tribes continued to have "as much right to the water as to the land included in the boundaries for their permanent homes for the uses and purposes of the agreement made with the government" and that right remained paramount in times of shortage.[83]

The Ninth Circuit then turned to the purposes of the creation of the Fort Belknap Reservation to determine the scope of the Tribes' reserved water rights.

73. United States v. Anderson, No. 747 (D. Mont. Aug. 8th, 1905).
74. *Id*. at 1.
75. *Id.* at 2.
76. *Id.*
77. *Id.*
78. Winters v. United States, 143 F. 740, 742 (9th Cir. 1906).
79. *Id*. at 747.
80. *Id*. at 747–48 (citing 19 Stat. 377 (1877)).
81. *Id.*
82. *Id*. at 747 (citing 19 Stat. 377 (1877)).
83. *Winters*, 143 F. 740 at 746.

That analysis once again began by exploring the history of the Tribes as well as the circumstances leading up to the 1888 Agreement.[84] The court acknowledged that "[t]he territory over which they previously had occupancy and dominion was very large," and, coupled with their rights to hunt and fish, provided them with their means of a living.[85] The court refused to believe that these lands were "voluntarily abandoned, were . . . surrendered to the government without consideration, or without an object or purpose on their part."[86] That purpose, according to the court, was a desire on the part of the Tribes to "become self-supporting, as a pastoral people and agricultural people . . . ."[87] However, "they knew that 'the soil could not be cultivated' without the use of water to 'irrigate the same.'"[88] Thus, "it was so understood by the respective parties to the treaty at the time it was signed"[89] that the Reservation came with sufficient right "to the use of the waters of Milk [R]iver, at least to an extent reasonably necessary to irrigate their lands."[90]

Written by Justice Joseph McKenna, the same Justice that wrote *Winans*, the Supreme Court's opinion in *Winters* is incredibly succinct given the impact it has had on the history of the Western United States. Perhaps it was because the Court felt there was not much to add to the reasoning of the lower courts, which it adopted and applied in its entirety. The Justice began by observing that "[t]he reservation was a part of a very much larger tract which the Indians had the right to occupy and use . . . ."[91] And like his opinion in *Winans* just a few years prior, this baseline provided Justice McKenna the foundation necessary to apply the reserved rights doctrine:

> [T]he Indians had command of the lands and the waters—command of all their beneficial uses, whether kept for hunting, "and grazing roving herds of stock," or turned to agriculture and the arts of civilization.[92]

McKenna asked rhetorically, "[d]id they give up all this?" He concluded that "[i]f it were possible to believe affirmative answers, we might also believe that the Indians were awed by the power of the government or deceived by its negotiators. Neither view is possible."[93]

The Court then turned to the purposes of the Reservation, observing that "[i]t was the policy of the government, it was the desire of the Indians, to change

84. *Id.* at 743.
85. *Id*. at 743–44
86. *Id.* at 744.
87. *Id*. (quoting 25 Stat. 113 (1888)).
88. *Winters*, 143 F.740 at 745.
89. *Id*. at 746.
90. *Id*. at 749.
91. Winters v. United States, 207 U.S. 564, 576 (1908).
92. *Id*.
93. *Id*.

[from their subsistence economy] and to become a pastoral . . . people."[94] The Court recognized that "[l]arge portions of the lands embraced within the reservation are well fitted and adapted for pasturage and the feeding and grazing of stock . . . ."[95] However, "[t]he lands were arid, and, without irrigation, were practically valueless."[96] Thus, "in order to make [the lands] productive, [they] require large quantities of water for the purposes of irrigating them."[97] This led to Justice Mckenna's second rhetorical question: "[d]id [the Tribes] reduce the area of their occupation and give up the waters which made it valuable or adequate?"[98] Applying the maxim that "ambiguities occurring will be resolved from the standpoint of the Indians," the Court determined that such a conclusion was simply not possible.[99] Thus, having resolved that the construction of the Agreement to be applied is the "one [that] would support the purpose of the [A]greement," the Court affirmed the trial court's decree.[100]

Although cases based on *Winters* are few in the early twentieth century, the main course of those cases demonstrate that *Winters* was not originally understood to require reserved water rights be quantified and fixed but remain flexible to achieve the purposes of the reservation through time. *United States v. Conrad Investment Company*,[101] filed nearly concurrently with *Winters* and by the same federal lawyer, provides perhaps the most probative evidence.[102] That case arose out of a controversy over the use of the waters of Birch Creek, which forms the southern border of the Blackfeet Reservation in Montana. Once again, the United States claimed that "all the waters of Birch [C]reek will be needed [to achieve the homeland purpose of the Blackfeet Reservation]."[103] As in *Winters*, the trial court rejected that argument, but not because the United States was not entitled to that amount. Instead, the court found that the United States had not demonstrated that such a large quantity of water was *currently* necessary to supply the needs of the Tribe and awarded them a water right sufficient to irrigate their lands currently under cultivation.[104] At the same time, the court found that pursuant to a number of federal homestead laws, including the Desert Lands Act, non-Indians such as Conrad "could rightfully divert water from streams coursing the public domain . . . ."[105] The question thus centered on whether the United States and Tribe had reserved any additional water rights beyond their current

94. *Id*.
95. *Id*. at 566.
96. *Winters*, 207 U.S. at 576.
97. *Id*. at 566.
98. *Id*. at 576.
99. *Id*. at 576–77.
100. *Id*. at 577.
101. 156 F. 123 (C.C.D. Mont. 1907).
102. *Id*. at 129.
103. *Id*. at 130.
104. *Id*. at 130–32.
105. *Id*. at 128.

needs and, if so, on the interrelationship between those yet-to-be-developed reserved water rights and the water rights appropriated by non-Indians.

The district court reasoned:

> [m]anifestly . . . [the Indians] are not far enough advanced in the art of agriculture to reduce the water to a continuous use, and the water . . . that they shall finally need depends largely upon their progress in this art. The government, however, being their guardian, has a most important trust to perform in this relation; that is, so to conserve the waters of such streams as traverse or border the reserve as to supply the Indians *fully* in their probable, or, I may say, even possible future needs.[106]

Therefore, the court concluded "[w]hat needs may in the course of time . . . is a matter that cannot be determined from the present record and, I am of the opinion that it should be left to the Interior Department to determine what as the exigencies may arise."[107]

But would these newly developed reserved water rights be senior or junior to non-Indian water rights that had been appropriated in the interim? The court concluded that although the *use* would be new, the *water right* for that use had been reserved at the same time as the reservation of land, reasoning:

> [t]he government has not to make a prior appropriation to enable it to obtain the use of the water. It has only to take that *which has been reserved* . . . and all persons seeking appropriations from public streams must take subject to this paramount right.[108]

Thus, the court ultimately concluded that although it was only awarding the United States 1,666 2/3 inches of water at the time of the court's decision, "the government will have leave to apply for a modification of this decree at any time that it may determine that its needs will be in excess of the amount of water so designated."[109]

The Ninth Circuit affirmed, concluding "[t]he law of [*Winters*] is applicable to the present case, and determines the paramount right of the Indians . . . to the use of the waters of Birch [C]reek to the extent reasonably necessary for the purposes of irrigation and stock raising, and domestic and other useful purposes."[110] In so doing, the court highlighted that the quantity reserved was "not only for present uses, but for future requirements, [which was] clearly within the terms of the treaties as construed by the Supreme Court in the *[Winters]* Case."[111] The

106. *Id.* at 129.
107. *Id.* at 131.
108. *Id.* at 129–30 (emphasis added).
109. *Id.* at 132.
110. Conrad Inv. Co. v. United States, 161 F. 829, 831 (9th Cir. 1908).
111. *Id.* at 832.

court could not determine that amount, however, "with absolute accuracy at this time . . . ."[112] Rather than try to develop a method that could potentially reserve too much or too little water for the Tribe, the court approved the lower court's decree recognizing the Tribe's current needs.[113] Indeed, that approach would allow "a considerable flow of water to be retained by defendant's dam and used in its system of irrigation . . . ."[114] However, those water rights remained subject to the United States' and Tribe's "paramount right to the waters of Birch [C]reek . . . ."[115] Thus, although the reserved water right was decreed based on the Tribe's current needs, "the [United State or Tribe] may apply to the court for a modification of the decree," and "the permission given to [Conrad] to . . . the excess . . . water [remained] subject to [such] modification."[116]

A few decades later, the United States took the same approach in *United States v. Walker River Irrigation District*.[117] There, the United States brought suit against 253 non-Indian irrigators in Nevada's Walker River Basin, seeking to quiet title to the federal reserved water rights appurtenant to the Walker River Indian Reservation.[118] Unlike *Winters* and *Conrad*, the United States did not argue that it was entitled to *all* the flow of Walker River. Instead, the United States took a new approach, asking for a decree awarding it 150 cubic feet per second (cfs), which was the amount it estimated to be necessary to irrigate all of the irrigable lands within the Reservation.[119] The district court rejected this claim and, consistent with *Conrad*, ultimately awarded the United States just 26.25 cfs, which was the amount necessary for the Tribe and United States to continue its current irrigation.[120] However, also like *Conrad*, the final decree

112. *Id.*
113. *Id*. at 835.
114. *Id*. at 834.
115. *Id*. at 835.
116. *Id.*
117. *See* United States v. Walker River Irrigation Dist., 11 F.Supp. 158, 159 (D. Nevada 1939).
118. *Id.*
119. *Id.* at 160. For their part, the defendants made similar arguments to the non-Indian defendants in *Winters*:

> The defendants further allege that their lands were acquired from the United States under the homestead and desert land laws; . . . that the government permitted . . . to expend millions of dollars in the construction of irrigation works for the irrigation of their lands, in reclaiming their lands, and in constructing houses and other improvements, all with the knowledge, assistance, and acquiescence of the government . . . .

Id. at 160. Although they perhaps got some traction with the district court, the Ninth Circuit ultimately rejected this argument, concluding that "[t]he settlers who took up lands in the valleys of the stream were not justified in closing their eyes to the obvious necessities of the Indians already occupying the reservation below." United States v. Walker River Irrigation Dist., 104 F.2d 334, 339 (9th Cir. 1939).

120. Initially, the district court actually rejected that the United States was entitled to *any* water pursuant to the *Winters* doctrine. *Walker River Irrigation Dist*., 11 F.Supp. at 167. Instead, it

entered by the court provided that "[t]he Court retains jurisdiction of this cause for the purpose of changing the duty of water or for correcting or modifying this decree . . . . The Court shall hereafter make such regulations . . . for change or modification of this decree . . . ."[121]

The Ninth Circuit went further in *United States v. McIntire*,[122] a case addressing the scope of the Confederated Salish and Kootenai Tribe's water rights in Mud Creek, a small non-navigable stream located within the Flathead Reservation.[123] The court refrained from determining a quantity necessary to fulfill the purposes for the creation of the Flathead [R]eservation, holding instead that *all* the waters of Mud Creek had been reserved by the United States for the benefit of the Tribe.[124] As a result, "no title to the waters could be acquired by anyone [else] except as specified by Congress."[125] Going further still, the court found that "the Montana statutes regarding water rights are not applicable because Congress at no time has made such statutes controlling in the reservation."[126] Indeed, unlike Milk River in *Winters* or Birch Creek in *Conrad*—both of which formed the border of the reservation—the portion of Mud Creek at issue was located entirely within the Flathead Reservation. As a result, the court rejected that the Desert Lands Act—which applied only to water use appurtenant to public lands—provided any congressional authorization for state law to apply.[127] Thus, the court held that not only did the United States reserve all of the water in Mud Creek but also that the State of Montana was precluded from issuing water rights or otherwise regulating water resources in that stream.

The Ninth Circuit continued this tack in its 1956 decision *United States v. Ahtanum Irrigation District*.[128] That case addressed the reserved water rights held by the Yakama Nation in Ahtanum Creek, a small stream running through the Yakama Reservation. The court followed the *Winters* blueprint, beginning with the observation that "[i]n the *[Winters]* case, as here, . . . the reserved lands were a part of a much larger tract which the Indians had the right to

concluded that "[t]he rights of the government . . . like the rights of all other diverters in the Walker River Basin, are to be adjudged, measured, and administered in accordance with the laws of appropriation as established by the state of Nevada." *Id.* at 167. The Ninth Circuit rejected this argument, agreeing with the special master in the case that the United States was entitled to a federal reserved water right but only for the amount necessary to maintain the current need of 26.25 cfs. *Walker River Irrigation Dist.*, F.2d at 336, 340.

121. Order for Entry of Amended Final Decree to Conform to Writ of Mandate Etc. at 75, United States v. Walker River Irrigation Dist., In Equity No. C-125 (April 14, 1936); *see also* United States v. Walker River Irrigation Dist., 890 F.3d 1161, 1169 (9th Cir. 2018).
122. 101 F.2d 650 (9th Cir. 1939).
123. *See id.* at 653.
124. *Id.*
125. *Id.*
126. *Id.* at 654.
127. *Id.*
128. 236 F.2d 321 (9th Cir. 1956).

occupy . . . ."[129] From that, the court reasoned that, like the Fort Belknap Tribes and Milk River, "[b]efore the treaty the Indians had the right to the use of not only Ahtanum Creek but of all other streams in a vast area."[130] The court then harkened back to *Winans*, reminding the parties that "it must be born in mind, as the Supreme Court said of this very treaty, that 'the treaty was not a grant of rights to the Indians, but a grant of right from them—a reservation of those not granted.'"[131] Thus, the court concluded that "[t]he Indians did not surrender *any* part of their right to the use of Ahtanum Creek regardless of whether the Creek became the boundary or whether it flowed entirely within the reservation."[132] Those rights remained "paramount . . . regardless of the quantity remaining for the use of white settlers . . . . [T]he non-Indian appropriators may have . . . only the excess over and above the amounts reserved for the Indians . . . ."[133]

Next, the court reaffirmed that "that the quantum is not measured by the use being made at the time the treaty reservation was made. The reservation was not merely for present but for future use."[134] The court observed that—like the Yakama in 1855—"[a]t the time of the making of the treaty construed in the [*Winters*] case, it is plain there was little or no irrigation then being carried on by the Indians."[135] Nonetheless, "[n]o one . . . thought in the [*Winters*] case that the rights of the Indians to the use of the water reserved should be limited to the quantities used at the date of the treaty. The implied reservation looked to the needs of the Indians in the future "when they would change their nomadic habits and become accustomed to tilling the soil."[136] Thus, the court concluded that "the paramount right of the Indians to the waters of Ahtanum Creek was not limited to the use of the Indians at any given date but this right extended to the ultimate needs of the Indians as those needs and requirements should grow and keep pace with the development of Indian agriculture upon the reservation."[137] Although that quantity was developed by estimating the amount of irrigable acres within the Basin, the methodology ended up simply justifying the United States' claim that the tribal reserved right was for "substantially all of the waters of Ahtanum Creek."[138]

129. *Id.* at 325.
130. *Id.* at 326.
131. *Id.* (quoting United States v. Winans, 198 U.S. 371, 381 (1905)).
132. United States v. Ahtanum Irrigation Dist., 236 F.2d 321, 326 (9th Cir. 1956) (emphasis added).
133. *Id*. at 327.
134. *Id.* at 326
135. *Id*. at 327.
136. *Id*.
137. *See id*.
138. *Ahtanum Irrigation Dist.*, 236 F.2d at 327.

Taken together, *Winters* and these early cases seem to converge on a rule that recognizes that tribes reserved *all* the water within their new homelands.[139] Indeed, the Supreme Court acknowledged the United States' argument that "*all* of the waters of the river are necessary for . . . the purposes for which the reservation was created," and, therefore, "it is essential and necessary that all of the waters of the river flow down the channel uninterruptedly and undiminished in quantity . . . ."[140] However, equally apparent throughout these cases is that those water rights did *not* remain absolute and exclusive,[141] at least not for streams that traversed reservation boundaries.[142] Instead, by allowing for non-Indians to settle on lands hydrologically connected to the reservations, Congress effected a change in conditions in the West—those settlers needed water and the tribes' absolute and exclusive water rights needed to "accommodate" that need.[143] Nonetheless, in allowing non-Indian access to western water supplies, Congress did nothing to diminish or limit the paramount rights of the tribes.[144] Just the opposite, Congress expressly made the settlers newly formed water rights "subject to existing rights."[145] Those "existing rights" included water rights held by the United States in trust for the tribes that were reasonably required to fulfill the purposes for the creation of each reservation, which necessarily included water rights for both current and future needs.[146] And, although the current needs of the tribes should be quantified to determine the excess water supply available for non-Indians, those non-Indian water rights remained subject to the expanding needs of the tribes.[147]

B. The Balance Struck in Arizona v. California

Despite the Court's ground-shifting decision in *Winters*, aside from the few cases decided by the Ninth Circuit, the reserved water rights doctrine was largely ignored for the next half century.[148] Instead, during that time, the United States engaged in a massive effort to develop the water resources of the

139. *See* Winters v. United States, 143 F. 740, 747 (1908); United States v. McIntire, 101 F.2d 650, 653 (9th Cir. 1939); *Ahtanum Irrigation Dist.*, 236 F.2d at 326 (emphasis added).
140. Winters v. United States, 207 U.S. 564, 567 (1908) (emphasis added).
141. *See* United States v. Anderson, No. 747 (D. Mont. Aug. 8, 1905); *Winters*, 143 F. at 747; United States v. Conrad Inv. Co., 156 F. 123, 128 (C.C.D. Mont. 1907).
142. *McIntire*, 101 F.2d at 653 (holding that Congress made no water available pursuant to the Desert Land Act from a stream located entirely within the Flathead Reservation).
143. Winans v. United States, 198 U.S. 371, 381 (1905).
144. *See Anderson*, No. 747, at 3 (D. Mont. Aug. 8 1905); *Winters*, 143 F. at 747; *Conrad Inv. Co.*, 156 F. 123, 129-30; United States v. Ahtanum Irrigation Dist., 236 F.2d 321, 327 (9th Cir. 1956).
145. *Winters*, 143 F. at 747 (citing 19 Stat. 377 (1877)).
146. Winters v. United States, 207 U.S. 565, 577 (1908) ("That the government did reserve them we have decided, and for a use which would be necessarily continued through years."); *Conrad Inv. Co.*, 161 F. at 129; *Ahtanum Irrigation Dist.*, 236 F.2d at 327.
147. *Conrad Inv. Co.*, 161 F. at 129; *Ahtanum Irrigation Dist.*, 236 F.2d at 327.
148. *See* National Water Comm'n, Water Policies for the Future 474 (1973).

West for the benefit of non-Indians, all the while systematically working to limit tribal development of water resources, particularly those that competed with non-Indian needs.[149] The few water rights the Bureau of Indian Affairs did secure were largely appropriated pursuant to state law, and Congress consistently rejected proposals for irrigation projects to benefit reservations.[150] Instead, as the National Water Commission observed in 1973:

> With the encouragement, or at least the cooperation, of the Secretary of the Interior—the very office entrusted with protection of all Indian rights—many large irrigation projects were constructed on streams that flowed through or bordered Indian Reservations, sometimes above and more often below the Reservations. With few exceptions the projects were planned and built by the Federal Government without any attempt to define, let alone protect, prior rights that Indian tribes might have had in the waters used for the projects. Before *Arizona v. California* . . . actions involving Indian water rights generally concerned then existing uses by Indians and did not involve the full extent of rights under the [*Winters*] doctrine. In the history of the United States Government's treatment of Indian tribes, its failure to protect Indian water rights for use on the Reservations it set aside for them is one of the sorrier chapters.[151]

Things began to change in the 1950s when the *Winters* doctrine seemed to suddenly spring back to life in the minds of federal officials.[152] However, the doctrine caught the imagination of those officials not out of a sense of duty to the tribes but instead for what it might do for federal projects benefiting non-Indians. The government's first strike was *F.P.C. v. Oregon*,[153] a case addressing whether the United States must apply for and receive a state water right before installing a dam on the Deschutes River, a non-navigable river running through reserved federal lands.[154] The United States argued that it did not need permission from the State because, pursuant to the *Winters* doctrine, "[t]itle to the rights to the use of unappropriated water in a non-navigable stream on federal lands resides in the United States."[155] The Court agreed, concluding that state water law did not apply within federal reservations.[156] Suddenly, the *Winters* doctrine

149. *Id.* at 474–75.
150. Daniel McCool, Command of the Waters: Iron Triangles, Federal Water Development, and Indian Water 122 (1994).
151. National Water Comm'n, *supra* note 148, at 474–75.
152. *See* McCool, *supra* note 150, at 127–32.
153. 349 U.S. 435 (1955).
154. *Id.* at 435–36.
155. Brief for the Federal Power Commission at 44, Federal Power Comm'n v. Oregon, 349 U.S. 435 (1955) (No. 367).
156. *Federal Power Comm'n*, 349 U.S. at 446–48.

had the potential to go well beyond Indian country—it suddenly became an avenue for expanding *federal* power over western water resource management.

The ongoing saga of *Arizona v. California* proved to be the United States' vehicle for pushing the *Winters* doctrine back to the fore of Western water law. Originating as an interstate dispute between Arizona and California regarding the division of water in the Lower Colorado between themselves, the case ballooned to involve every state within the Colorado River Basin and addressed itself to the division of water for the entire mainstream of that River.[157] Important for our story, however, is that the United States moved to intervene, filing claims pursuant to the *Winters* doctrine on behalf of not only the tribes, but many other federal properties primarily serving non-Indians in the Basin.[158]

The United States began by maintaining the same theory for the source of the tribal reserved water rights it had advanced since *Winters*. It reiterated that upon acquisition of the land within the lower Colorado River Basin, the United States was "the owner of such running waters on the public lands . . . and of their beds."[159] Resultantly, "no one could acquire ownership of a right to the use of any of such waters except by grant or authorization from the United States."[160] Congress had provided that authorization through the Desert Lands Act, "[b]ut . . . The Desert Land Act did not divest the United States of its ownership of the right to use the unappropriated waters . . . ."[161] Instead, it merely "made possible the acquisition by appropriation in accordance with local laws and customs of privately-owned rights . . . ."[162] However, those later-acquired appropriative rights remained subject to the paramount rights reserved by the tribes "not merely for present but for future use. Any other construction of the rule in the [*Winters*] case would be wholly unreasonable."[163]

157. Motion for Leave for Bill of Complaint § 373, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original); Arizona v. California, 373 U.S. 546, 550–51 (1963) ("In 1952, the State of Arizona invoked the original jurisdiction of this Court by filing a complaint against the State of California and seven of its public agencies. Later, Nevada, New Mexico, Utah, and the United States were added as parties, either voluntarily or on motion. The basic controversy in the case is over how much water each State has a legal right to use out of the waters of the Colorado River and its tributaries.").

158. Petition of Intervention on Behalf of the United States, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original); Motion on Behalf of the United States for Leave to Intervene and Brief in Support of Motion, *Arizona v. California*, 373 U.S. 546 (1963) (No. 9 Original).

159. Reply Brief for the United States at 30, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original).

160. Rebuttal Brief of the United States at 2, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original).

161. *Id*. at 3.

162. *Id*.

163. Brief in Support of Findings of Fact and Conclusions of Law by the United States at 29, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original) (quoting United States v. Ahtanum Irrigation Dist., 236 F.2d 321, 326 (9th Cir. 1956)).

At this point, however, the federal lawyers made a decision that would have ripple effects through the history of water resources litigation. Instead of quantifying the Tribes' current needs and then demanding an adaptive decree that provided the opportunity to adjust those needs over time, the United States claimed a fixed amount of water that it estimated would be sufficient to meet the Tribes' current and future needs. Seizing on the fact that agriculture was an expressed purpose for the creation of the reservation, as well as the convenient truth that irrigation required by far the most water of any of the tribal uses, the United States argued that "[t]he water right thereby reserved is large enough to irrigate the entire irrigable acreage of the reservation. This rule has been translated into definite quantity by the proof of the United States . . . ."[164]

It is not clear why the United States decided to try to determine the ultimate needs of the Tribes rather than seek an adaptive decree. For one, there seemed to be a certain amount of hubris among federal lawyers that "the limit of such future needs is ascertainable and indeed has been defined by the computation of water requirements for the irrigable areas of those Reservations."[165] More apparent, however, the United States simply seemed dead-set against the "necessity for an open-end decree," which would place the junior water rights of other water users under a cloud of uncertainty.[166]

On the other hand, the United States remained steadfast that it claim enough water to ensure the Tribes would not be left wanting. Because of the large quantities of water required, therefore, irrigable acreage represented the

164. Brief of the United States before the Special Master at 29, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original); *see also id*. at 28 ("The quantity of water thus protected was [the amount] needed for the development . . . of all the lands on the Reservation susceptible of irrigation . . . ."). In addition to its monumental shift in position regarding quantity, the United States also shifted its position regarding the *priority* of tribal water rights. Indeed, scholarship advanced by Professor Christian W. McMillen demonstrates that the United States Department of Justice initially claimed that the water rights it claimed on behalf of Indian tribes were "prior and superior to each and every right to the use of water asserted by the parties to this litigation." Christian McMillen, *Prior and Superior: American Indian Water Rights and the Pre-History of* Arizona v. California, at 31 (manuscript on file with author) (quoting Samuel J. Flickinger to Reuel Armstrong, Office of the Solicitor, 2 October 1953, 90-1-2-523, Section 2, Box 71, RG 60, NARA-College Park). However, just a few weeks later, the Justice Department amended its petition to remove that language. Instead, it claimed priority dates consistent with the dates each reservation was created. *Id*. at 32. That position has ripened into the law, with the Court later holding that "when the Federal Government withdraws . . . land . . . and reserves it . . . the United States acquires a reserved right in *unappropriated* water which vests on the date of the reservation and is *superior to the rights of future appropriators*." Cappaert v. United States, 426 U.S. 128, 138 (1976). Although beyond the scope of this article, Professor McMillen has thoroughly examined the history of this development along with its negative ramifications for tribal water rights.

165. Brief of the United States before the Special Master at 30, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original)

166. Rebuttal Brief of the United States before the Special Master at 5, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original).

surest way to ensure the Tribes would never need additional water supply.[167] Ultimately, the United States concluded that "the application of such a measure would be in the best interests of all parties to this case."[168]

For their part, both California and Arizona argued against the existence of the "So-Called 'Winters Doctrine'" at all.[169] Both argued that the doctrine only applied to reservations set aside by treaty and not to reservations—like those in the lower Colorado River Basin—that had been set aside by executive order.[170] Arizona argued that *Winters* and its progeny simply held that tribes were entitled to a water right sufficient to address their needs at the time the suit commenced.[171] It argued that the Supreme Court's decision in *Winters* was actually "a rejection of the government's claim to the quantity of water necessary for the irrigation of all irrigable lands and was a clear recognition of the present needs requirement . . . as the governing criteria."[172] It dismissed *Winters* progeny as one-offs that had "varying results depending upon the particular fact situation before the court."[173] Similarly, California categorically denied the *Winters* doctrine applied, concluding that any water rights acquired by the Tribes must have been appropriated consistent with "the principle that use creates the right . . . ."[174] Thus, California "conceded . . . for each and every Indian reservation . . . a quantity of water which is at least equal to the maximum annual quantity of water which the Indians have historically used . . . ."[175] Its lawyers argued that "we have erred, if at all, on the side of liberality."[176]

In adopting the United States' Solomonic approach, Special Master Simon Rifkind set into motion the approach that is invariably followed to this day. Rather than explore the legal history of *why* the United States and tribes retained paramount rights, the Master simply observed that

> [t]he *Winters* case has been cited many times as establishing that the United States may . . . reserve water for the future needs . . . and that

167. *Id*.
168. *Id*.
169. *See* Response of the California Defendants to Brief in Support of Proposed Findings of Fact and Conclusions of Law of the United States of America at 114–21, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original); Arizona's Answering Brief before the Special Master at 92, Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original).
170. California's Answering Brief before the Special Master at 114–21, Arizona v. California, 546 U.S. 373 (1963) (No. 9 Original); Arizona's Answering Brief before the Special Master at 92, Arizona v. California, 546 U.S. 373 (1963) (No. 9 Original).
171. Arizona's Answering Brief before the Special Master, Arizona v. California, 92 373 U.S. 546 (1963) (No. 9 Original).
172. *Id*. at 93.
173. *Id*. at 94.
174. California's Answering Brief before the Special Master at 114. Arizona v. California, 373 U.S. 546 (1963) (No. 9 Original).
175. *Id*. at 114.
176. *Id*.

> appropriative rights of others established subsequent to the reservation must give way when it becomes necessary for the Indian Reservation to utilize additional water for its expanding needs.[177]

The reason for reserved *future* water rights was simple: "[i]nvariably the United States intended that the Indian tribes settled on a Reservation would remain there for generations . . . ."[178] And, because one of the main purposes for the creation of these reservations was agricultural, "expanding populations, expanding agricultural development, and hence expanding water needs must have been apparent at the time each Reservation was created."[179] However, because "Indians were not an agricultural people[, . . .] it was necessary for them to develop their agricultural skills after settling on the Reservations."[180] Thus, had they *not* reserved water for future use but instead had water rights whose relative priorities were based on the time of actual use, "they would have lost the match before it was begun."[181] Therefore, the Master concluded, "the United States intended to reserve mainstream water for the reasonable future needs of the [five] Indian Reservations."[182]

However, an undefined and open-ended future water right for the Tribes created a serious problem for *non-Indian* water users:

> [S]uch a limitless claim would place all junior water rights in jeopardy of the uncertain and the unknowable. Financing of irrigation projects would be severely hampered if investors were faced with the possibility that expanding needs on an Indian Reservation might result in a reduction of the project's water supply. Moreover, it would not give the United States any certainty as to the extent of its reserved rights, which would undoubtedly hamper the United States in developing them.[183]

Thus, the Master was left looking for a compromise that created certainty for the non-Indian water users of the Colorado River while also ensuring that the Tribes had sufficient water to supply their expanding populations, economy, and agricultural output.[184] The Master resolved to meet this compromise by

177. 1960 Special Master Report, *supra* note 4.

178. *Id.* at 260.

179. *Id; see also id.* at 262 ("What the United States did, in withdrawing public lands for these Indian Reservations, was to establish areas that could be used in the indefinite future to satisfy the needs of Indian tribes in the United States as those needs might develop.").

180. *Id.* at 261.

181. *Id.*

182. *Id.* at 260; *see also id.* at 263 ("It is clear that the water rights of the five Reservations in question cannot be fixed at present uses for this would defeat the basic purpose of reserving water to meet future requirements.").

183. *Id.* at 264.

184. 1960 Special Master Report, *supra* note 4 ("The other possibility, which would avoid the serious disadvantage of creating uncertainty as to the extent of the reserved rights, would be to

"predict[ing] the ultimate needs of each Reservation and to decree that much water for its future uses."[185] But the Master struggled to find a technically feasible way to determine that quantity with certainty.[186] A quantification method based solely on population was unworkable because "it was impossible to predict the future needs of the Indians who might inhabit [the reservations]."[187] That approach, therefore, ran the risk of *under-quantifying* the tribal water right, which "would result in a forfeiture of the Indians' water rights and would stultify development of the Reservations."[188]

Instead, the Special Master identified irrigable acreage as the most objective way to ensure the veracity of the tribal water rights.[189] This approach had several advantages. First, it was consistent with the Master's finding that "it is apparent that [the United States] intended that the Indians would settle on the Reservation land and develop an agricultural economy," and thus would satisfy one of the major purposes for creating the reservations.[190] Likewise, because the water necessary for irrigation far outstripped any other uses on the Reservations, the Master seemed confident that so long as the Tribes received sufficient water to irrigate all of their irrigable lands, that quantity would be sufficient to subsume any other water needs the Tribes might have.[191] Finally, unlike the reservation population, the amount of reservation land remained relatively static. Furthermore, the physical properties of the soils that made up the lands largely did not change over time.[192] And, in 1960, the parties and Master were confident that water supply and crop water demand would both continue to be relatively constant into the future. Thus, in the minds of the United States and the Special Master, quantifying a water right based on irrigable acreage provided the "most feasible" way, given the circumstances, to ensure they would accurately estimate the ultimate needs of the Tribes.[193] Ultimately then, the Master concluded that:

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predict the ultimate needs of each Reservation and to decree that much water for its future uses.").

185. *Id.* at 265.

186. *Id.* ("The shortcoming of this solution, however, lies in the difficulty of predicting the future needs of Indian reservations."); *id.* at 264–65 ("Whatever might be possible in a case involving solely the issue of the reserved rights of a single Indian Reservation, it would not be possible to predict future Reservation needs in this litigation.").

187. *Id.* at 262.

188. *Id.* at 265.

189. *Id.*

190. *Id.* at 260.

191. *Id.* at 265 ("[T]he United States asks only for enough water to satisfy future agricultural uses. This does not necessarily mean, however, that water reserved for Indian Reservations may not be used for purposes other than agricultural and related uses."); *id.* at 266 ("[T]he decree establishes a property right which the United States may utilize or dispose of for the benefit of the Indians as the relevant law may allow.").

192. Brief of the United States before the Special Master at 29–30, Arizona v. California, 373 U.S. 546 (1963).

193. 1960 Special Master Report, *supra* note 4, at 265.

> [i]t follows from this that the United States intended to reserve enough water to make the lands productive, in other words, enough to irrigate all of the practicably irrigable acreage. Only by reserving water in this manner could the United States ensure that the Reservation lands would be usable when needed to support an Indian economy.[194]

This was the bargain struck by the Special Master: on the one hand, provide *certainty to non-Indians* by moving away from the adaptive decrees that had largely been applied for the first half of the twentieth century. However, in consideration for that certainty, the United States and Tribes were entitled to certainty that their water rights would be fixed at an amount that would meet "the ultimate needs of each Reservation . . . ."[195] Only in this way could the Master meet his dual objectives of:

> preserv[ing] the full extent of the water rights created by the United States and . . . establish[ing] water rights of fixed magnitude and priority so as to provide certainty for both the United States and non-Indian users.[196]

Importantly, despite his expressed preference against an adaptive decree, Master Rifkind did ultimately recommend a final decree that included a modification clause, which provided that:

> Any of the parties may apply at the foot of this decree for its amendment or for further relief. The Court retains jurisdiction of this suit for the purpose of any order, direction or modification of the decree, or any supplementary decree, that may at any time be deemed proper in relation to the subject matter in controversy.[197]

The scope of that clause came before the Supreme Court in 1983, nineteen years after it had approved a final decree in *Arizona II*.[198] After the decree had been entered, the United States and tribes discovered that some lands that would qualify for water rights had been omitted from the original case.[199] The parties pointed to the modification clause in an effort to reopen the decree to add these additional water rights.[200] For their part, the states objected to the United States' attempt to reopen the decree, arguing that it was precluded by *res judicata*.[201] The Court agreed with the United States that "the technical rules of preclusion are not strictly applicable . . . if a party moves the rendering

194. *Id.* at 262.
195. *Id.* at 264.
196. *Id.* at 265.
197. *Id.* at 618.
198. *Arizona II*, 460 U.S. 605, 610 (1983).
199. *Id.* at 614.
200. *Id.*
201. *Id.* at 615–16.

court in the same proceeding to correct or modify its judgment."[202] Nonetheless, the Court found that "a fundamental precept of common-law adjudication is that an issue once determined by a competent court is conclusive."[203] The Court found that concept was particularly prescient in cases dealing with real property, especially water rights.[204] In so holding, the Court was particularly concerned with the "gallon-for-gallon reduction in the amount of water available for water-needy state and private appropriators" that would occur if the Court reopened the decree.[205] Emphasizing the certainty for non-Indians side of Master Rifkind's original bargain, the Court observed that "[a] major purpose of this litigation . . . has been to provide the necessary assurance of the Southwest and to various private interests, of the amount of water they can anticipate to receive from the Colorado River system."[206] On the other hand, the Court was less concerned that the tribal water rights be sufficient to meet the "ultimate needs of each Reservation."[207] The Court seemed satisfied that the original decree was sufficient, concluding that "the Indians . . . won what can be described only as a complete victory. A victory, it should be stressed, that was in part attributable to the Court's interest in a fixed calculation of future water needs."[208]

Although the Court construed narrowly the provision allowing the 1964 decree to be reopened. Nonetheless, the Court did give meaning to the provision, concluding that "the Article was mainly a safety net added to . . . adjust[] the Decree in light of unforeseeable changes in circumstances."[209] The Court acknowledged "the need for flexibility in light of changed conditions and questions which could not be disposed of at the time of an initial decree."[210] Importantly, the very type of "changed conditions" the Court had in mind came from *Wisconsin v. Illinois*,[211] where low-flow conditions in the Mississippi River had caused the Court to modify a previous decree prohibiting the Sanitary District of Chicago and State of Illinois from diverting water out of Lake Michigan.[212] Thus, the Court seems to have already recognized hydrologic conditions

202. *Id.* at 619.
203. *Id.*
204. *See id.* at 620.
205. *Id*. at 621.
206. *Id*. at 620.
207. 1960 Special Master Report, *supra* note 4, at 218.
208. *Arizona II*, 460 U.S. at 617.
209. *Id.* at 622.
210. *Id*. at 624.
211. 352 U.S. 945 (1956).
212. *Arizona II*, 460 U.S. at 624 (citing Wisconsin v. Illinois, 352 U.S. 945 (1956)). At issue in *Wisconsin* was whether the State of Illinois could authorize the Sanitary District of Chicago to divert "8,500 or more" cfs from Lake Michigan, which was "reducing the level of the Great Lakes." Wisconsin v. Illinois, 281 U.S. 179, 196 (1930). The purpose of the diversion was to dilute sewage that was being discharged into a canal that eventually flowed into the Illinois River, a tributary to the Mississippi River. *Id*. at 199. The Supreme Court enjoined the Sanitation District from diverting more than 5,000 cfs from the Lake. *Id*. at

brought on by an aberration of the climate as the very thing that it thought would justify a "'court of equity to modify an injunction in adaptation to changed conditions.'"[213]

Just a few months after the Supreme Court decided *Arizona II*, it decided in *Nevada v. United States* that once a court had entered a final water rights decree, *res judicata* precludes tribes or the United States from seeking additional water rights in a *second* proceeding.[214] In 1913, the United States had initiated a water rights adjudication and made a claim for 500 cfs to support irrigation on the Pyramid Lake Paiute Reservation, as well as a claim for 10,000 cfs to support the Newlands Recreation Project.[215] Those water rights were finally decreed in 1944, which was meant to be "a final decree quieting title to the rights of all parties."[216] However, the Tribe leveled significant questions about whether the United States breached its trust responsibility by purposefully privileging the reclamation project to the detriment of the Reservation by refusing to claim sufficient water rights on behalf of the Tribe.[217] Partially in response, the United States initiated a *new* adjudication in 1973, this time seeking to claim water rights to support the reservation fishery.[218] The Court rejected that claim, finding that the federal claims in 1913 were "claim[s] for the full 'implied-reservation-of-water' rights that were due [to] the Pyramid Lake Indian Reservation."[219] Thus, because the second lawsuit sought to re-adjudicate claims that the court deemed to have been identical to the claims in the 1913 adjudication, it was precluded by *res judicata*.[220]

Importantly, neither *Arizona II* nor *Nevada v. United States* preclude the use of adaptive decrees. Just the opposite, *Arizona II* seems to expressly recognize the utility of adaptive decrees as a "safety net" to hedge against "unforeseeable changes in circumstances" such as climate-driven changes in hydrology. Meanwhile, *Nevada v. United States* did not include analysis of an adaptive decree at all.[221] Nonetheless, these cases loom large over modern water rights adjudications, creating a prevailing mythos that reserved water rights may not be reconsidered once quantified and decreed. Compounding matters, much of the

201. However, around 1955 the flows in the Mississippi decreased to such a degree that it was causing an "emergency with respect to navigation . . . on the Illinois Waterway . . ." *Wisconsin v. Illinois*, 352 U.S. at 946. In response to this change in hydrologic and climatic conditions, the Court allowed the diversion of up to 8,500 cfs from Lake Michigan to supplement Mississippi River flows. *Id*.

213. *Id*. at 624–25 (quoting Sys. Federation v. Wright, 364 U.S. 642, 647 (1961)).

214. Nevada v. United States, 463 U.S. 110, 113 (1983).

215. *Id*. at 116.

216. *Id*.

217. *See id*. at 119, 127–28.

218. *See id*. at 113.

219. *Id*. at 133.

220. *Id*. at 113.

221. *Id*. at 622.

modern jurisprudence surrounding water rights quantification has been developed by the state judiciary, which has progressively ratcheted up the requirements associated with making a reserved irrigation water right claim. In 1952, Congress passed what has become known as the McCarran Amendment, which waived the sovereign immunity of the United States and allowed for their joinder in state court general stream adjudications "where it appears that the United States is the owner of or is in the process of acquiring water rights by appropriation under State law, by purchase, by exchange, or otherwise . . . ."[222] Despite strong evidence to the contrary,[223] the Supreme Court held that the McCarran Amendment extended to state court adjudication of reserved water rights held by the United States in trust for American Indian tribes.[224] As a result, since at least 1976, the primary venue for the determination of tribal water rights has been state instead of federal courts. These state courts remain sensitive to the political power wielded by their majority non-Indian electorate.[225] That's not to say that some state courts have not remained faithful to the *Winters* doctrine.[226] Nonetheless, many state courts have proven to be "hostile forums" that have acquiesced to non-Indian demands for reserved water rights with fixed quantities while simultaneously being highly responsive to arguments limiting the nature, quantity, and priority of tribal reserved water rights.[227]

222. McCarran Amendment, 43 U.S.C. § 666 (1952).

223. Dylan R. Hedden-Nicely, *The Legislative History of the McCarran Amendment: An Effort to Determine Whether Congress Intended for State Court Jurisdiction to Extend to Indian Reserved Water Rights*, 46 Envtl L. Rev. 845 (2017).

224. *See* Colo. River Water Cons. Dist. v. U.S., 424 U.S. 800, 809 (1976); Arizona v. San Carlos Apache Tribe, 463 U.S. 545, 564 (1983).

225. Stephen M. Feldman, *The Supreme Court's New Sovereign Immunity Doctrine and the McCarran Amendment: Toward Ending State Adjudication of Indian Water Rights*, 18 HARV. ENVTL. L. REV. 433, 449 (1994).

226. *See*, *e.g.*, In Re: CSRBA Case No. 49576, Subcase No. 91-7755, 448 P.3d 322, 322 (Idaho 2019); In re Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source, 35 P.3d 68, 72 (Ariz. 2001); State of Montana, ex. rel., Mike Greely v. Confederated Salish and Kootenai Tribes, et. al., 712 P.2d 754, 92–95 (Mont. 1985).

227. *See, e.g.*, *Big Horn I*, P.2d at 99–100. (declining to find the purpose of the Wind River Reservation was to create a permanent homeland that included water rights for a variety of needs and instead finding that the sole purpose of the reservation was agricultural); *Big Horn II*, 835 P.2d 273, 275 (Wyo. 1992) (finding the Wind River tribes may not convert agricultural water rights to instream flow rights, despite federal court precedent authorizing tribal changes in use); State Ex. Rel. Martinez v. Lewis, 861 P.2d 235, 204–10 (N.M. 1993) (applying unprecedented market limits from the federal principles and guidelines on certain crops used by the Mescalero Tribe in making its claim under the practicably irrigable acreage quantification standard to award a water right for irrigated agriculture for just 13% of the water claimed by the Tribe); Wash. Dep't of Ecology v. Aquavella, 935 P.2d 595, 1310 (1997) (finding that although the Confederated Bands and Tribes of the Yakama Nation reserved a water right for fish that right had been substantially diminished, entitling the Tribes to a quantity for the "minimum instream flow necessary to maintain anadromous fish life in the river . . . ."); Scott B. McElroy & Jeff J. Davis, *Revisiting* Colorado River Reservation District v. United States––*There Must be a Better Way*, ARIZ. ST. L. J., 597 ,615 (1995).

All of this adds up to a bargain unfulfilled. Since Special Master Rifkind's report in *Arizona v. California*, courts have primarily decreed reserved irrigation water rights for fixed quantities with no provision for adaptation.[228] As a result, junior non-Indian water users are often no longer placed in "jeopardy of the uncertain and unknowable" that results from senior reserved water rights of adaptive magnitude.[229] At the same time, the courts—spurred on by these same non-Indian litigants—have been less inclined to honor the *quid pro quo* that was supposed to come with that certainty by zealously ensuring tribal water rights are fixed for sufficient quantities to meet the "ultimate needs of each Reservation."[230] Instead, the contemporary method for quantifying reserved irrigation water rights has become an exacting standard that has significantly curtailed the quantity of water that tribes are entitled to for the protection of their homelands.

C. The Contemporary Method for Estimating Reserved Irrigation Water Rights

In 1963, the United States Supreme Court adopted Special Master Rifkind's recommendation and applied irrigable acreage as "the only feasible and fair" way to quantify reserved water rights necessary to fulfill a reservation's agricultural purpose.[231] As the only quantification method that has been explicitly considered and approved by the United States Supreme Court, this method has the advantage of being broadly applicable across reservations, replicable, and—at

228. *See*, *e.g.*, In re the General Application of All Rights to Use Water in the Big Horn River System, 835 P.2d 273, 277 (Wyo. 1992) [hereinafter Big Horn II]; Coville Confederated Tribes v. Walton, 647 F.2d 42, 51 (9th Cir. 1981); Coville Confederated Tribes v. Walton, 752 F.2d 397, 405 (9th Cir. 1985).

229. 1960 Special Master Report, *supra* note 4 at 264; Robert T. Anderson, *Indian Reserved Water Rights, Practical Reasoning, and Negotiated Settlements,* 98 Calif. L. Rev. 1133, 1149–53 (2010) (describing water rights litigation in lower state and federal courts); Dylan R. Hedden-Nicely, *The Historical Evolution of the Methodology for Quantifying Federal Reserved Instream Water Rights for Indian Tribes,* 50 Env't. L. Rev. 207, 268 (2020) (discussing the legal arguments leveled against tribal instream water rights over the past several decades); Stephen M. Feldman, *The Supreme Court's New Sovereign Immunity Doctrine and the McCarran Amendment: Toward Ending State Adjudication of Indian Water Rights*, 18 Harv. Envtl. L. Rev. 433, 449 (1994) (discussing the political pressure applied to state courts by non-Indian communities to limit the scope of reserved water rights); John A. Folk-Williams, *State and Indian Governments: Are New Relationships Regarding Water Possible?, in* Indian Water 1985: Collected Essays 67, 70 Christine L. Miklas & Steven L. Shupe eds., 1986) (discussing the adversarial relationship between tribes and states in water rights adjudications); Karen Crass, *Eroding the Winters Right: Non-Indian Water Users' Attempt to Limit the Scope of the Indian Superior Entitlement to Western Water to Prevent Tribes from Water Brokering*, 1 U. Denv. Water L. Rev. 109, 114–19 (1997) (discussing some examples of non-Indian work to "erode" the *Winters* doctrine).

230. 1960 Special Master Report, *supra* note 4, at 264.

231. Arizona v. California, 373 U.S. 546, 601 (1963).

least originally—relatively straightforward to apply.[232] However, application of the method has become more complex in the wake of state court decisions adding myriad requirements that were likely not originally envisioned by the Court. As a result, the method is extremely time-consuming, costly and, as will become apparent, quite sensitive to climate change.

Although first announced and analyzed in *Arizona v. California,* the path-making case that provides the modern methodology for making a reserved irrigation claim comes from the Special Master's Report in *In re Big Horn River*, a state court general stream adjudication that included the reserved water rights of the Wind River Reservation.[233] At the outset, notice that the methodology seeks to quantify irrigable *acres*, making it, in the first instance, a quantification of *land*. That land inventory includes both lands that have been historically irrigated[234] as well as lands within the reservation that have never been irrigated but are "susceptible to sustained irrigation at reasonable cost."[235]

The method for determining the water right appurtenant to the tribes' future lands is known as the practicably irrigable acreage ("PIA") method and is the focus of the remainder of this section. It is helpful to think of this analysis like a sieve. Starting with all tribal land on a reservation, the first question is to determine which lands are arable.[236] Next, of those lands deemed to be arable, the second question is to determine which of those lands can access water supply and how much it will cost to access that water supply and build out irrigation systems.[237] Finally, of those lands that are arable and irrigable, an economic analysis must take place to determine whether the irrigation can take place "at reasonable cost."[238] A water duty is then applied to each acre of land that has either been historically irrigated or has passed the PIA test in order to arrive at a final water right for the tribal irrigation claim.[239]

The first step in the PIA analysis is to determine land arability. Soil quality is classified by factors such as crop type, soil texture, depth, moisture retention, alkalinity, salinity, slope, level of the surface, drainage, and the hydraulic conductivity and soil depth to barrier.[240] Based on these factors, soil scientists

232. *Id.* at 600–01.

233. *See* Report Concerning Reserved Water Right Claims By and On Behalf of the Tribes of the Wind River Indian Reservation, Wyoming, In re The General Adjudication of All Rights to Use Water in the Big Horn River System (5th Dist. Wyo. Dec. 15, 1982) (No. 85-203) [hereinafter Special Master Report, *In re Big Horn*].

234. *Id*. at 137.

235. *Id*. at 155.

236. *Id*. at 156–57.

237. *Id*. at 166.

238. *Id*. at 183.

239. *Id*. at 286.

240. *Id.* at 157; *see also* Brief of the United States before the Special Master at 29–30, California v. Arizona, 373 U.S. 546 (1963) (No. 9 Original) (noting that the reservation lands "have been carefully classified for suitability for irrigation according to depth, texture and permeability of soil and subsoil slope, erosion, drainage, salinity and alkalinity."). To assess these factors,

classify each parcel of land within the reservation into one of six different soil classifications.[241] Of those classifications, soils classified 1-3 are generally considered to be of sufficient quality to be considered "arable" for the purposes of the PIA methodology. Any lands grouped into classes 4-6, on the other hand, are removed from the PIA analysis.

The soils analysis is then handed to a civil or agricultural engineer, who is responsible for determining how many of the arable lands can be irrigated.[242] That engineer is also responsible for estimating the cost to irrigate those lands.[243] The most efficient way to do this is to design hypothetical irrigation projects for lands classified as arable throughout the reservation to demonstrate that: (1) water is sufficiently available to serve the project; (2) there is a coherent method for conveying the water to the lands; and (3) the costs associated with the development, operation, and maintenance of each project are reasonable.[244] To do this analysis in *Big Horn*, the federal expert Dr. Woldezion Mesghinna, set out an "11 Point Analysis:"

1. Climate
2. Crops
3. Evapotranspiration
4. On-farm system design
5. Pipe network design
6. Pumps and pumping plants
7. Canals and related structures
8. Subsurface and maintenance
9. Operation and maintenance

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soil scientists ground truth available soil maps by setting up study areas throughout the reservation. In the case of *Big Horn*, federal soils experts installed 197 borings between five and ten feet and 357 borings to a depth of five feet or less. Additionally, the U.S. had dug 9 backhoe pits and had drilled 117 deep holes. Special Master Report, *In re Big Horn*, *supra* note 233, at 161.

241. The classifications are as follows:

> Class 1: Of high quality for irrigation, and will yield high returns with minimum production and management costs.
> Class 2: Good quality lands with only minor deficiencies.
> Class 3: Consists of fair quality lands having more serious deficiencies than class 2 lands.
> Class 4: Of marginal quality for irrigation and are used mainly for shallow-rooted crops or pasture.
> Class 5: Those lands which have been placed into deferred status pending further investigation.
> Class 6: Lands that do not meet the minimum requirements for arability under the land classification standards used. Special Master Report, *In re Big Horn*, *supra* note 233, at 159.

242. *Id.* at 166.
243. *Id.* at 173.
244. *Id.* at 168–78.

10. Water duty
11. Total costs[245]

Notice the strong interrelationship between the first three of these factors and the eventual water duty claimed. Indeed, different crops have different water requirements, and the same crop can require different amounts of irrigation water depending on the climate. Hence, the proper crop rotation for the particular reservation is paramount to the claim. More importantly for our purposes, as I explore in section III.B, *infra*, crop water requirements will change as the climate changes in a particular location.

That information is then passed on to the economics expert, who is tasked with ensuring the economic benefits of each project outweigh the costs over the 100-year life of the project.[246] Notice this analysis requires examination of the "economic" rather than merely the "financial" costs and benefits of the projects. As it sounds, a method that considers financial costs and benefits considers "all the monetary outlays made in connection with a program . . . ."[247] In contrast, an "economic" analysis includes not only the financial costs and benefits of a project but all other costs and benefits as well, "whether in goods, services, or intangibles, whether direct or induced, and whether measurable in monetary or nonmonetary terms."[248] Although the former analysis is appropriate for *individuals* trying to determine the feasibility of a single project, *governments*, which are responsible for making infrastructure investment for the benefit of their entire communities, use this broader suite of economic considerations beyond simple project profit when balancing project benefits and costs.[249] Thus, courts have long recognized that the feasibility of tribal irrigation projects, which are set aside for tribal *governments*, must be assessed using this broader economic analysis.[250]

First, to determine the overall benefit each project would yield, the economist estimates the income each project might generate.[251] To do this, the economist works with the agricultural engineer to determine the most economically efficient cropping pattern for each project.[252] Those cropping patterns are then multiplied by the estimated crop yield and price to arrive at a total income

245. *Id*. at 167.
246. *Id*. at 199.
247. Bureau of the Budget, Bureau Circular NO. A-47 3 (1952).
248. *Id.*
249. Elbert P. Tuttle Special Master Report at 94–95, Arizona v. California, 460 U.S. 605 (1983) (No. 93–906) [hereinafter 1983 Special Master Report].
250. *Id.* at 94–95 (noting that "Master [Rifkind] and the witnesses [in the original *Arizona v. California* trial] called their analysis a study of 'economics' or 'economic feasibility.' The testimony further reveals that the standards used by the experts generally conformed to Bureau of the Budget Circular A-47 which was the general standard used to measure the feasibility of all federal water resource projects.").
251. Special Master Report, *In re Big Horn*, *supra* note 233, at 183–87.
252. *Id.* at 183.

generated across the Reservation.[253] Not surprisingly, the type of crop used can have a dramatic effect on the outcome of the analysis. Experts in *Big Horn* exclusively used field crops such as barley, alfalfa, and corn.[254] Modern PIA analyses also include higher value crops such as berries, Christmas trees, and other tree fruits.[255]

The benefits realized by these hypothetical irrigation projects are then compared to the economic costs of building and maintaining the projects.[256] Those costs include basic financial costs such as machinery and equipment costs, which includes analysis of the overall quantity of equipment needed and its lifespan in order to determine the costs over the entire life of the project.[257] The analysis also includes labor costs; however, because it is an economic analysis that examines the costs to the community's economy as a whole, labor costs are estimated based on the labor market's opportunity cost rather than the absolute cost to employ each laborer.[258] That analysis assigns the cost of laborers to be equal to the income foregone by not employing those laborers in the next-best employment opportunity.[259] Often that cost can be set to zero for Indian irrigation projects because of the high rate of unemployment on reservations.[260] In contrast, management costs are assumed to be equal to some percentage—10% in *Big Horn*—of the production cost subtotals.[261] However, the figure is progressively reduced over the life of the project as formerly unemployed or underemployed tribal members are trained into management positions.[262] Thus, like the labor market more broadly, the opportunity costs for these individuals can be set to zero in the economic analysis.

The overall feasibility of each project is finally assessed by comparing the ratio of total benefits against the total costs over the course of the entire 100-year lifespan of each project.[263] However, those benefits and costs must be brought back to present value so they "can be analyzed fairly and consistently

253. *Id*. at 185–87.
254. *Id*. at 185.
255. *See, e.g.*, State Ex. Rel. Martinez v. Lewis, 861 P.2d 235, 247 (N.M. Ct. App. 1993). Although there is no legal justification for doing so, state courts have sometimes limited the tribes' ability to use these types of crops beyond the amount that could be added without displacing the existing market for that crop. *Id.* at 249.
256. Special Master Report, *In re Big Horn*, *supra* note 233, at 183–88.
257. When making this estimate, economists can assume greater levels of cooperation for tribal agricultural projects, which negates the necessity that each individual farm have its own equipment. *Id*. at 189–90. Thus, rather than estimate equipment costs on a per-farm basis, economists can determine the total machinery costs by estimating the "most efficient level of use of any given piece of equipment." *Id*. at 189.
258. *Id*. at 192.
259. *Id*.
260. *See* Special Master Report, *In re Big Horn, supra* note 233, at 192.
261. *Id*. at 194.
262. *See id*. at 194.
263. *See id*. at 199.

with all other values involved [in the PIA analysis]."[264] As the Master observed: "[t]he discount rate performs that task—determining the present value of the 100-year stream of costs and returns associated with the projects."[265] The result of this analysis is the estimation of a single economic cost and single economic benefit value associated with each project. The benefit is divided by the cost to arrive at a "benefit-cost ratio."[266] If that ratio is greater than one, then the project is considered feasible, and its acreage is counted toward the PIA water right. On the other hand, if the ratio is less than one then the project is not considered feasible. However, these projects are not abandoned. Instead, projects that are not initially found to be feasible can be shrunk, infused with higher-value crops, or otherwise reconfigured in an effort to make them feasible. At the same time, projects that have benefit-cost ratios that are much greater than one will be reconfigured with more acreage, or different cropping patterns, for example, so as to maximize their economic utility and conserve higher-value crops for more marginal projects. Thus, the engineering design and economic analyses are iterative, with the goal being to arrive at projects that maximize the acreage irrigated while still maintaining a reasonable level of economic feasibility across all the projects proposed.

Once the final cropping patterns are determined for every irrigation project, the total acreage of each crop included is readily calculated.[267] Those acreages are then combined with the historically irrigated lands on the reservation and multiplied by a water duty for each crop to arrive at a total irrigation demand for each crop type across the various projects.[268] Finally, an efficiency factor is added to account for conveyance losses and other reasonable inefficiencies in the irrigation system.[269] That final diversion requirement is summed to arrive at a final PIA water right.

Climate change is poised to influence the PIA analysis in all phases of the methodology.[270] This paper, however, focuses on the final step of the PIA

264. *Id.*

265. Special Master Report, *In re Big Horn*, *supra* note 233, at 199.

266. *Id*. at 183.

267. *Id*. at 179, 184, 205.

268. *Id*. at 205. The water duties were estimated in *Big Horn* on a per-project basis rather than a per-crop basis. However, this was because the United States used the same percentages of each crop for each project. *Id*. at 166, 169. Therefore, the analysis is the same as that described above but done in a slightly different order.

269. *Id*. at 179–80.

270. Although beyond the scope of this article, changes in temperature and precipitation are expected to alter the physical and chemical properties of soils around the globe. U.S. Global Change Research Program, Fourth National Climate Assessment, Vol. II 404–06 (2018) [hereinafter Fourth National Climate Assessment, Vol. II]; *see generally* G. Gelybó et al., *Potential Impacts of Climate Change on Soil Properties*, 67(1) Agrochemistry and Soil Sci. 121 (2018); Eric C. Brevik, *The Potential Impact of Climate Change on Soil Properties and Processes and Corresponding Influence on Food Security*, 3(3) Agriculture 398 (2013). Likewise, climate change is widely expected to continue to alter agricultural economics in a

methodology—the estimation of water demand necessary to irrigate the final cropping patterns developed through the iterative process outlined above. As the Master observed in *Big Horn*, "[t]he importance of climate cannot be underestimated in determining engineering feasibility because of its significant impact on cropping patterns and, therefore, all other aspects of a feasibility analysis."[271] Critical for our discussion here, that method uses *current* conditions[272] to quantify an irrigation water right that is supposed to reserve sufficient water to meet the "ultimate needs of each Reservation."[273] That approach was rational in the 1960s when the Supreme Court decided *Arizona v. California* or even in the early 1980s when *Big Horn* was decided because climate change was not well understood.[274] However, the continued viability of the approach is highly questionable in an era of climate change.

III. Climate Change and its Effects on Western United States Irrigation

Climate is defined as the "long-term averages and variations in weather measured over a period of several decades."[275] Earth's climate is moderated by its atmosphere, which contains, among other things, greenhouse gases such as carbon dioxide, methane, chlorofluorocarbons, water vapor, and nitrous oxide.[276] At the molecular level, these gasses allow shortwave radiation from the sun through the atmosphere, which is then absorbed by the Earth, causing it to warm.[277]

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variety of ways. *See generally* Richard M. Adams, *Global Climate Change and Agriculture: An Economic Perspective*, 71 Am. J. Agricultural Econ. 1272 (1989); David B. Lobell et al., *Prioritizing Climate Change Adaptation Needs for Food Security in 2030*, 319 Sci. 607 (2008); David B. Lobell & Sharon M. Gourdji, *The Influence of Climate Change on Global Crop Productivity*, 160(4) Plant Physiology 1686 (2012); Ariel Ortiz-Bobea, et al., *Anthropogenic Climate Change Has Slowed Global Agricultural Productivity Growth*, 11 Nature Climate Change 306 (2021).

271. Special Master Report, *In re Big Horn*, *supra* note 233, at 168.

272. *Id*. at 156. ("My reading of *Arizona v. California* supports the view that evidence of 'practicable irrigability' was determined by then current standards."); 1983 Special Master Report, *supra* note 249, at 98. ("[M]y determination of practicable irrigability should be based on present standards. Reference to past standards would introduce an additional complication in an already complex case.").

273. 1960 Special Master Report, *supra* note 4, at 264.

274. *See* Andrew Revkin, *Climate Change First Became News 30 Years Ago. Why haven't We Fixed It?*, Nat'l Geographic (2018) (reporting that although climate change was noticed as early as the 1950s its import was not widely understood until around 1988 when the Intergovernmental Panel on Climate Change was first established).

275. U.S. Global Change Research Program, Climate Change Impacts in the United States 22 (2014) [hereinafter Climate Change Impacts in the United States].

276. Nat'l Rsch. Council, Climate Change: Evidence and Causes: Update 2020 B1 (2020) [hereinafter Climate Change: Evidence and Causes].

277. *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 74; Climate Change: Evidence and Causes, *supra* note 276.

That warming causes the emission of longwave radiation from the Earth, which we feel as heat.[278] Unlike shortwave radiation, greenhouse gasses readily absorb and reradiate longwave radiation, causing some of that heat to be readmitted back toward Earth.[279] Thus, the Earth's temperature is strongly correlated to the concentration of greenhouse gasses in the atmosphere. That concentration did not exceed 300 parts per million (ppm) for over 800,000 years until the onset of the Industrial Revolution in the late 1800s.[280] Since that time, our energy infrastructure has relied almost exclusively on fossil fuels, which, when combusted, emit large amounts of greenhouse gasses.[281] As a result, greenhouse gas concentrations topped 410 ppm in 2019, which is the highest experienced in the last two million years.[282] Evidence is overwhelming and unequivocal that most of the warming that has occurred over the past few decades is attributable to this phenomenon.[283]

Climate change has had significant and detrimental acute effects, including increased instances of high intensity storms, flooding, heatwaves, fire, and drought.[284] Although those events are often most obvious, climate change also poses more chronic challenges to the way we manage our water resources. Importantly, the intensity of climate change and, by extension, the intensity of the acute and chronic harms that climate change brings, depends on human climate policy moving forward.

To demonstrate the significant difference in climate futures, researchers have developed a few scenarios to standardize comparison of climate effects across the scientific community.[285] The primary two scenarios are the RCP4.5

278. *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 74; Climate Change: Evidence and Causes, *supra* note 276.

279. *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 74; Climate Change: Evidence and Causes, *supra* note 276.

280. *See also* Intergovernmental Panel on Climate Change, Climate Change 2021: The Physical Science Basis 300 (2021) [hereinafter The Physical Science Basis] (noting that for most of the last 12,000 years, greenhouse gas concentrations have remained relatively stable, having fluctuated of up to 9.6 parts per million (ppm), an order of magnitude *less* than that observed over the past century.).

281. Fourth National Climate Assessment, Vol. II, *supra* note 270, at 6, 39; *see also* Climate Change: Evidence and Causes, *supra* note 276; The Physical Science Basis, *supra* note 280, at 299.

282. *See* IPCC, *Summary for Policymakers in* The Physical Science Basis, *supra* note 280, at 4.

283. *See* U.S. Global Change Program, Climate Change Impacts in the United States 22 (2014); *see generally* V. K. Arora et al., *Improved Constraints on 21st-Century Warming Derived Using 160 Years of Temperature Observations*, 39 Geophysical Rsch. Letters 5 (2012); J. F. Painter et al., *Identifying Human Influences on Atmospheric Temperature*, 110 Proceedings of the Nat'l Acad. of Sci. 26 (2013); *See* Peter A. Stott et al., *Detection and Attribution of Climate change: a Regional Perspective*, 1 Wiley Interdisciplinary Reviews: Climate Change 192 (2010).

284. *See* IPCC, *Summary for Policymakers in* The Physical Science Basis, *supra* note 280, at 5.

285. *See generally* Richard H. Moss, et al., *The Next Generation of Scenarios for Climate Change Research and Assessment,* 463 Nature 747 (2010); Kaywan Riahi et al., *RCP 8.5—A Scenario*

and RCP8.5 scenarios, which correspond to radiative forcing levels of 4.5 Wm^{-2} (~650 ppm CO_2 equivalent) and 8.5 Wm^{-2} (~1370 ppm CO_2 equivalent) in the atmosphere by 2100.[286] Qualitatively, the RCP4.5 is the scenario that examines relatively aggressive reductions in greenhouse gas emissions coupled with relatively significant rates of renewable energy, carbon capture, and other technological improvements.[287] In contrast, the RCP8.5 scenario assumes business as usual: a steady rate of high greenhouse gas emissions driven by consistent trends in population and energy demand coupled with modest rates of technology change and intensity improvements.[288] Although strides have been made in the past few years, no systematic policy improvements have been made on the scale necessary to shift us from the RCP8.5 to the RCP4.5 scenario. Therefore, the bulk of the discussion below focuses on the effects of climate change on water supply and demand under the RCP8.5 scenario.

A. Climate Change and Water Supply

The most obvious and measurable effect of climate change is rising temperatures around the globe. On average, the global temperature over both land and water has increased by approximately 1°C (1.8°F) since the onset of the Industrial Revolution.[289] With an average temperature increase of 0.7°C (1.2°F), North America has fared better than the world more broadly.[290] However, the largest changes were in the West, where average temperature increased by more than 0.8°C (1.5°F).[291]

Water storage in the form of snow is crucial to western water resource management. Each winter, precipitation falls as snow in the mountains of the West, building a reservoir of water that slowly releases throughout the spring and summer. It is that reservoir of water that makes life as we know it possible in the West.[292] Climate change is disrupting that cycle by changing seasonal precipitation patterns, particularly in the winter and spring. Interestingly, winter

of Comparatively High Greenhouse Gas Emissions, 109 Climate Change 33 (2011); Detlef P. van Vuuren et al., *The Representative Concentration Pathways: An Overview*, 109 Climatic Change 5 (2011).

286. *Id.*

287. *See generally* Alison M. Thomson et al., *RCP4.5: A Pathway for Stabilization of Radiative Forcing by 2100*, 09 Climatic Change 77 (2011).

288. Riahi et al., *supra* note 285, at 33–34.

289. Fourth National Climate Assessment, Vol. II, *supra* note 270, at 76; *see also*, IPCC, Sixth Synthesis Report, *supra* note 1, at 4 ("Global surface temperature was 1.09°C [0.95°C–1.20°C] higher in 2011–2020 than 1850–1906 with larger increases over land (1.59°C [1.34°C–1.83°C]) . . . .").

290. Fourth National Climate Assessment, Vol. II, *supra* note 270, at 86.

291. *Id.*

292. *See* Katherine E. Hale et al., *Recent Decreases in Snow Water Storage in Western North America*, 4 Commc'n Earth & Env't. 1, 2 (2023).

and spring precipitation is expected to *increase* in the Northwest.[293] However, that increase in precipitation will be coupled with rising temperatures, resulting in fewer snow events and increased rain and, more problematic, rain on snow events.[294] As a result, the Northwest has experienced declines in snowpack, which is likely to become increasingly pronounced over the coming decades.[295] That, coupled with large *decreases* in summer precipitation is likely to have dramatically negative consequences for water availability during the summer growing season. In contrast, Southwest precipitation is expected to largely decrease across the board, with springtime precipitation expected to decrease by up to 20% or more.[296] As a result, southwestern snowpacks have decreased dramatically over the past few decades, a trend that is expected to intensify and continue to negatively affect overall water availability during the irrigation season.[297]

Water availability is also closely linked to increased instances of wildfire caused by climate change. The acreage burned by wildfires between 1984 and 2015 is estimated to be double what it would have been but for climate change,[298] a phenomenon that is expected to continue to worsen as climate change progresses.[299] Fire affects water availability in myriad ways but primarily through the removal of hillside vegetation and the creation of water-repellent soils.[300] As a result, water is less able to infiltrate into landscapes that have been recently burned, causing increases in runoff that would otherwise be more readily stored within the soil profile.[301] The removal of vegetation also causes snow to melt

293. *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 89 Fig. 2.5.

294. *Id.* at 1041; Philip W. Mote et al., *Declining Mountain Snowpack in Western North America*, 86 Bull. Am. Meteorological Soc'y 39, 48 (2005); Philip W. Mote et al., *Dramatic Declines in Snowpack in the Western U.S.*, 1 Climate & Atmospheric Sci. 2, 4 (2018) [hereinafter Philip W. Mote, *Dramatic Declines in Snowpack*]; EPA, Climate Change Indicators in the United States 49 (2018); *see also* Erica R. Siirila-Woodburn et al., *A Low-to-No Snow Future and its Impacts on Resources in the Western United States*, Nature Revs. Earth & Env't 1, 2 (2021).

295. *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 88, 89 Fig. 2.5.

296. *Id.* at 89 Fig. 2.5.

297. *Id.* at 1107; *see generally* Sirila Woodburn et al., *A Low-to-No Snow Winter,* 2 Earth & Env't 800 (2021); John C. Fyfe et al., *Large Near-Term Projected Snowpack Loss over The Western United States*, 8 Nature Commc'ns 1 (2017); Philip W. Mote et al., *Perspectives on the Causes of Exceptionally Low 2015 Snowpack in the Western United States*, 43 Geophysical Rsch. Letters 10980 (2016); Philip W. Mote, *Dramatic Declines in Snowpack*, *supra* note 294; David W. Piece et al., *Attribution of Declining Western U.S. Snowpack to Human Effects,* 21 J. Climate 6425 (2008); Theodore B. Barnhart et al., *Snowmelt Rate Dictates Streamflow,* 43 Geophysical Rsch. Letters 8006 (2016).

298. *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 1104.

299. IPCC, Sixth Assessment Synthesis Report, *supra* note 1, at 13.

300. J. R. Goode et al., *Enhanced Sediment Delivery in a Changing Climate in Semi-Arid Mountain Basins: Implications for Water Resource Management and Aquatic Habitat in the Northern Rocky Mountains*, Geomorphology 1, 2 (2011).

301. Brian A. Ebel et al., *Hydrologic Conditions Controlling Runoff Generation Immediately after Wildfire,* 48 Water Res. Rsch. W03529, W03529 (2012); John A. Moody et al., *Current*

more readily, which exacerbates declining mountain snowpacks.[302] In this way, there is a vicious feedback loop between water availability and wildfire whereby increased drought leads to increased fire risk, which then increases the probability of worsening drought.

All of this will have a dramatic effect on water availability throughout much of the West. Although annual streamflows are expected to remain relatively stable,[303] the variability of streamflow timing and magnitude is expected to increase dramatically. Furthermore, the combination of smaller snowpacks and decreased summer precipitation is expected to cause dramatic decreases in summertime streamflow for much of the West.[304] The bright spot appears to be the inland northwest and north-central United States, where summer streamflows are expected to increase slightly over the coming century.[305] However, summer streamflows in rivers on the West Coast, Colorado River Basin, Southern Rockies, and the Southwest more broadly are all expected to decrease as climate change progresses.[306] Those decreases in flow have been—and will continue to be—exacerbated by anthropogenic changes to stream geomorphology such as channel simplifying, diking, and straightening, each of which promotes the efficient flow of water out of a watershed, thereby decreasing natural water storage.[307]

Decreasing surface water availability causes increased reliance on groundwater to make up shortfalls, making it a crucial buffer for western water resources management as climate change worsens.[308] As a result, since the middle of the twentieth century, reliance on groundwater has increased substantially and now accounts for more than 40% of all water used for agricultural and domestic purposes.[309] The long-term sustainability of this approach is spatially variable.[310] In

Research Issues Related to Post-Wildfire Runoff and Erosion, Earth-Sci. Revs. 10, 21 (2013).

302. Stephanie K. Kampf et al., *Increasing Wildlfire Impacts on Snowpack in the Western US,* 119 Proceedings of the Nat'l Acad. Scis. 1, 1 (2022); Arielle L. Koshkin et al., *Wildfire Impacts on Western United States Snowpacks*, 4 Frontiers in Water 1,1 (2022); Jeremy Giovando & Jeffrey D. Niemann, *Wildfire Impacts on Snowpack Phenology in a Changing Climate within the Western U.S.,* 8 Water Res. Rsch. 1, 1 (2022).
303. *Climate Change Indicators: Streamflow,* EPA (Apr. 2020), https://perma.cc/YX6F-DNVE; Climate Change Impacts in the United States, *supra* note 275, at 74.
304. Climate Change Impacts in the United States, *supra* note 275, at 74 Fig. 3.4.
305. *Id*. at 74.
306. *Id*. at 74 Fig. 3.4.
307. Seth J. Wenger et al., *Twenty-Six Questions in Assessment of the State of Science,* 26 J. N. Am. Benthological Soc'y 1080, 1090–91 (2009).
308. U.S. Global Change Research Program, Global Climate Change in the United States 46–47 (2009).
309. Tess A. Russo & Upmanu Lall, *Depletion and Response of Deep Groundwater to Climate-Induced Pumping Variability*, 10 Nature Geoscience 105 (2017); Cheryl A. Dieter et al., Estimated Use of Water in the United States in 2015 27 (2018); Fourth National Climate Assessment, Vol. II, *supra* note 270, at 152.
310. Climate Change Impacts in the United States, *supra* note 275, at 76; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 159.

many locations, groundwater withdrawals have already outstripped recharge, in some cases by a factor of ten times, causing rapidly declining aquifer levels.[311] Climate change will exacerbate groundwater decline as recharge from precipitation decreases and reliance on groundwater pumping increases to make up for surface water shortfalls.[312] Relatedly, there is often a conjunctive relationship between surface and groundwater sources,[313] which can result in depleting groundwater levels having a negative effect on surface water flows. The degree to which water managers are able to conjunctively manage ground and surface water sources varies widely, however, depending on the jurisdiction.[314] Thus, many communities, including Native communities, that rely principally on groundwater will become increasingly at risk as climate change develops.

B. Climate Change and Water Demand

As the proceeding section demonstrates, much of the research and scholarship surrounding the interrelationship between climate change and water resource management focuses on the supply side, dedicating significant effort to better understanding how water supply will change in the coming decades because of climate change. Equally important, however, is the demand side of the ledger, which will drive how adaptive our water resources infrastructure will be as supply continues to dwindle. More importantly for our purposes here, examination of water demand exposes some significant issues with current water resources practices related to quantifying Indian reserved water rights.

Per capita water demand in most sectors has decreased in recent years, particularly in urban areas, due to a mix of regulatory and economic demand management strategies.[315] However, because of the West's booming population, overall water demand has nonetheless continued to increase.[316] Demographic models estimate that this overall increase in water demand will continue even in the absence of climate change as more people move into the Western United

311. Climate Change Impacts in the United States, *supra* note 275, at 76; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 152.

312. Fourth National Climate Assessment, Vol. II, *supra* note 270, at 153 Figure 3.2 (2018).

313. *See* Xiaodong Zhang, *Conjunctive Surface Water and Groundwater Management under Climate Change*, Environ. Sci. 1, 1–2 (2015).

314. *See generally* Dylan R. Hedden-Nicely, *New Developments for Conjunctive Management in Idaho: Why our Expanding Understanding of Science Should Expand How We Address the Doctrine against Waste in Idaho Water Right Transfers Comment,* 47 Idaho L. Rev. 147 (2010); John Ruple, *Clear Law and Murky Facts: Utah's Approach to Conjunctive Surface and Groundwater Management*, 47 Idaho L. Rev. 217 (2010); Judith Royster, *Conjunctive Management of Reservation Water Resources: Legal Issues Facing Indian Tribes*, 47 Idaho L. Rev. 255 (2010); Jr. Barton H. Thompson, *Beyond Connections: Pursuing Multidimensional Conjunctive Management*, 47 Idaho L. Rev. 273 (2010).

315. Climate Change Impacts in the United States, *supra* note 275, at 84.

316. *Id.*

States.[317] Without significant mitigation, climate change could intensify the stress placed on western water resources by increasing water demand across the country by anywhere between 42% and 82% by the end of this century.[318] Water demand in the West, which is driven extensively by water for irrigation purposes, is particularly susceptible to climate change.[319] This is primarily attributable to two reasons. First, irrigation accounts for by far the most water consumption in the Western United States, making small shifts in demand result in large shifts in overall water consumption.[320] Second, the primary drivers of irrigation demand—precipitation and evapotranspiration—are uniquely sensitive to climate change.[321]

A companion study to this article demonstrates the sensitivity of irrigation demand to climate change.[322] As that article explains, irrigation demand can be conceptualized by the following equation:

$$I_n = \frac{ds}{dt} - P_e - \Delta SW + ET_c \quad (1)$$

Where I_n is the net irrigation requirement, P_e is the effective precipitation, ΔSW is the change in soil water content from the previous day. ET_c is the crop evapotranspiration, which is defined as "loss of water from the [E]arth's surface through the combined processes of evaporation (from soil and plant surfaces) and plant transpiration (i.e., internal evaporation)."[323] The term $\frac{ds}{dt}$ is the difference between the field capacity and the current modeled soil water content. Field capacity is defined to be the point where the soil is holding the maximum amount of water that may be used by the plant.[324]

317. Thomas C. Brown et al., *Projected Freshwater Withdrawals in the United States under a Changing Climate,* 49 Water Res. Rsch. 1259, 1271 (2012).

318. *Id.* at 1273 ("Averaging across the three climate models for each scenario, the U.S. withdrawals are projected to increase from 2005 to 2060 by 26%, 34%, and 5% for the A1B, A2, and B2 scenarios, respectively; corresponding increases from 2005 to 2090 are 42%, 82%, and 12%, respectively.").

319. *See generally* Robert I. McDonald & Evan H. Girvetz, *Two Challenges for U.S. Irrigation Due to Climate Change: Increasing Irrigated Area in Wet States and Increasing Irrigation Rates in Dry States,* PLOS One (2013); Elodie Blanc et al., *Is Current Irrigation Sustainable in the United States? An Integrated Assessment of Climate Change Impact on Water Resources and Irrigated Crop Yields,* 5(8) Earth's Future 877 (2017); Dylan Hedden-Nicely & K.E. Kaiser, *Water Governance in an Era of Climate Change: A Model to Assess the Shifting Irrigation Demand and Its Effect on Water Management in the Western United States,* Water 2024, 16 [hereinafter Hedden-Nicely & Kaiser, *Water Governance*].

320. Dieter, *supra* note 309, at 28–30.

321. Climate Change Impacts in the United States, *supra* note 275, at 84; Hedden-Nicely & Kaiser, *Water Governance*, *supra* note 319.

322. Hedden-Nicely & Kaiser, *Water Governance*, *supra* note 319.

323. Am Soc'y of Civil Eng'rs, The ASCE Standardized Reference Evapotranspiration Equation 2 (2005).

324. Nyle C. Brady & Ray R. Weil, The Elements of the Nature and Properties of Soil 2d ed. 155 (2002).

Conceptually, this equation says that the irrigation requirement for a crop is the amount of water necessary to bring the soil to field capacity. That amount can be reduced if there continues to be moisture in the soil profile (i.e., ΔSW) and/or if precipitation has occurred. However, the irrigation requirement must increase to account for water loss from the soil resulting from evapotranspiration. Thus, the equation essentially reduces to the amount of water in the soil, minus precipitation, plus evapotranspiration, making precipitation and evapotranspiration key components to irrigation demand. Both of these parameters are particularly sensitive to climate change.

Precipitation during the irrigation season is highly variable both spatially and temporally.[325] Making matters more complex, the irrigation season varies by crop and occurs during different times around the United States. Irrigation in the Northwest and north-central part of the United States typically begins in the early summer and lasts through harvest at the end of the summer. Summer precipitation in these regions is expected to decrease, particularly in Washington state and northwest Oregon.[326] The growing season is similar in most of the Great Plains region of the United States, where summer precipitation is likewise expected to decline, albeit not as dramatically.[327] In contrast, the extreme Southwest has a much longer growing season, lasting through most of the winter and into the summer. As we have already discussed, precipitation in this region during these times is expected to decline dramatically.[328] That reduction is compounded by significant reductions in precipitation during the summer months as well.[329]

Evapotranspiration is the combined process of evaporation at the soil surface and transpiration, which is defined as "the vaporization of liquid water contained in plant tissues and the vapour removal to the atmosphere."[330] Although these processes occur separately from each other, their quantification is more readily estimated as a unit: thus, evapotranspiration.[331] Primary drivers of evapotranspiration are incoming solar radiation, wind speed, and temperature.[332]

325. U.S. Global Change rsch. Program, Fourth National Climate Assessment, Vol. I 217 (2018) [hereinafter Fourth National Climate Assessment, Vol. I]; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 89 Fig. 2.5.

326. Fourth National Climate Assessment, Vol. I, *supra* note 325; *See* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 89 Fig. 2.5.

327. Fourth National Climate Assessment, Vol. I, *supra* note 325; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 89 Fig. 2.5.

328. Fourth National Climate Assessment, Vol. I, *supra* note 325; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 89 Fig. 2.5.

329. Fourth National Climate Assessment, Vol. I, *supra* note 325; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 89 Fig. 2.5.

330. Richard G. Allen et al., FAO Irrigation and Drainage Paper No. 56: Crop Evapotranspiration 2–3 (1998), [hereinafter Allen et al.]

331. *Id.* at 3.

332. *Id.*; Richard G. Allen & Clarence W. Robison, Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho 3 (2007) [hereinafter Allen &

Although the process is complex, and there remain significant uncertainties in how climate change will affect solar radiation and wind speed—an increase in any of these parameters will cause evapotranspiration to likewise increase.[333] For its part, estimation of wind speed is likely the most spatially and temporally complex of these parameters, making climate change's effect on wind speed highly uncertain.[334] However, recent studies seem to agree that windspeed is likely to generally increase somewhat in the Great Plains and decrease throughout the Intermountain West and Great Basin region.[335] These studies project that wind speed will—on the average—remain relatively stable or decrease slightly throughout much of the rest of the West.[336]

Likewise, changes to incoming solar radiation as a result of climate change is highly uncertain. Some models suggest that the continental United States can expect to experience overall solar dimming.[337] In contrast, others indicate a more complex pattern.[338] Those models estimate that annual incoming solar radiation will likely mildly increase throughout much of the West Coast, Southwest, and Central Plains, while increasing substantially in the southern plains.[339] In contrast, annual incoming solar radiation is expected to decrease in much of the

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Robison]; Am. Soc'y of Civil Eng'rs, *supra* note 323, at 4.

333. Allen et al., *supra* note 330, at 3; Allen & Robinson, *supra* note 332, at 3; Am. Soc'y of Civil Eng'rs, *supra* note 323, at 4.

334. *See generally* Dana L. Johnson & Robert J. Erhardt, *Projected Impacts of Climate Change on Wind Energy Density in the United States*, 85 Renewable Energy 66 (2016) [hereinafter Johnson & Erhardt, Renewable Energy];

> Zhenzhong Zeng et al., *A Reversal in Global Terrestrial Stilling and its Implications for Wind Energy Production*, 9 Nature Climate Change 979 (2019); Sara C. Pryor et al., *Climate Change Impacts on Wind Power Generation*, 1 Nature Revs. Earth & Env't 627 (2020) [hereinafter Pryor et al., Nature Revs. Earth & Env't]; John T. Abatzoglou & Timothy J. Brown, *A Comparison of Statistical Downscaling Methods Suited for Wildfire Applications*, 32 Int. J. Climatology 777 (2012); Kepa Solaun & Emilio Cerdá, *Climate Change Impacts on Renewable Energy Generation. A Review of Quantitative Projections*, 116 Renewable & Sustainable Energy Revs. 1, 6 (2019).

335. Johnson & Erhardt, Renewable Energy, *supra* note 334, at 69; Pryor, et al., Nature Revs. Earth & Env't, *supra* note 334.

336. Johnson & Erhardt, Renewable Energy, *supra* note 334, at 69.

337. Liang Chen *Uncertainties in Solar Radiation Assessment in the United States Using Climate Models*, 56 Climate Dynamics 665, 671 Fig. 2(d)-(f) (2021).

338. *Id*. at Fig. 2(a)-(c). Dr. Chen suggests that this disparity can be primarily attributed to these contrasting models' incorporation of aerosols into model estimates. *Id*. at 676. Those models that estimate steady or increasing emission of aerosols into the atmosphere generally indicate solar dimming while those that assume aerosol emissions will decrease over time estimate the conditions described in the main text above. *Id*. Currently, researchers are reporting that legislation around the globe is resulting in decreasing emission of aerosols into the atmosphere, a trend that is expected to continue. *See generally* Øivind Hodnebrog, et al., *Recent Reductions in Aerosol Emissions Have Increased Earth's Energy Imbalance*, 5 Commcn's Earth & Environment 1 (2024).

339. *Id*. at Fig. 2(a)-(c) (2021).

northern portion of the West, particularly the Intermountain West and northern Rockies.[340] However, solar radiation is expected to increase across the West during the growing season.[341] The American Southwest is expected to see an increase in solar radiation during winter and spring, the seasons when much of the growing takes place in that region.[342] Likewise, the rest of the West—which predominantly grows crops in the summer—is expected to experience increases in summertime incoming solar radiation.[343]

Although still uncertain, researchers have a better handle on the interrelationship between climate change and growing season temperatures.[344] Temperatures in the Southwest are expected to increase significantly in all seasons, particularly during its growing seasons in the winter, spring, and summer.[345] Although somewhat more variable, the trend is similar during the summer growing season for the rest of the West.[346] In fact, the U.S. Global Change Research Program predicts that most locations throughout the United States will experience approximately twenty to thirty *additional* days above 90°F by the middle of the twenty-first century.[347] These average seasonal increases will be coupled with increased instances and intensity of temperature extremes.[348] The summer's warmest day is expected to increase by approximately 6.25°F, 5.85°F, 6.5°F, and 5.7°F for the Northwest, Southwest, Northern Plains, and Southern Plains, respectively, by the middle of this century.[349] Finally, the intensity of extreme heatwaves, which are defined as 1-in-10 year events (i.e., the hottest temperature observed in a decade) lasting for at least five days, are projected to increase by *at least* 11°F throughout the West.[350]

The upshot? Summer precipitation throughout the West is expected to decline. Likewise, evapotranspiration is likely to increase throughout most of the region. Undoubtedly, the increase in temperatures in some regions will be moderated by decreases in solar radiation and/or stilling wind. However, it seems unlikely that these phenomena will be sufficient to overcome temperature increases in most locations. Thus, referring to equation (1), decreases in precipitation coupled with increases in evapotranspiration will result in increasing crop water deficits, which require additional irrigation to make up the difference.

340. *Id.*
341. *Id.* at 672 Fig. 4.
342. *Id.* at 672 Fig. 4(a)-(b).
343. *Id.* at 672 Fig. 4(c).
344. *See* Fourth National Climate Assessment, Vol. I, *supra* note 325, at 188.
345. *Id.* at 188.
346. *Id.*
347. *See id.* at 199.
348. *See id.* at 199.
349. *See id.* at 198; *see also* IPCC, Sixth Assessment Synthesis Report, *supra* note 1, at 14 Fig. SPM.2(a).
350. Fourth National Climate Assessment, Vol. I, *supra* note 325, at 197.

This is the trend that we see throughout Indian country in the Western United States.[351] In a recently published study, I explained the methodology and results for a model that estimated how irrigation demand is expected to change at thirty-seven Indian reservations across the West and Great Plains regions of the United States.[352] Assuming little change in our climate policy, those results indicate that most reservations will experience an increase in irrigation demand over the course of the next century.[353] Furthermore, the study estimates that the seasonal variability in irrigation demand will likely increase as climate change progresses, which comes with its own host of problems.[354] Similarly, it appears that early-season irrigation demand will increase in many locales, increasing the risk of early season crop stress as well as putting consumptive uses such as irrigation in conflict with instream water needs for fish migration and aquatic habitat.[355]

However, the core problem for the purposes of this paper is that climate change will cause an overall increase in the amount of water necessary to irrigate the same number of acres of a particular crop. Although their alternative method was no better, Arizona recognized this as early as the original 1963 proceeding before the Supreme Court when it argued that:

> [w]hat constitutes irrigable land is itself a matter of uncertainty and is subject to frequent change, depending upon . . . the chemical [and physical] composition of soils . . . *as well as climatic conditions* . . . . The lesson . . . is plain: The number of acres within an Indian reservation regarded as irrigable depends on the date the question is decided.[356]

Take an example from *Big Horn*, wherein the United States developed the North Crowheart irrigation project as part of its PIA analysis.[357] That project yielded 34,993 PIA acres, 67% of which (23,445 acres) was to grow alfalfa.[358] With an estimated diversion requirement of 3.81 acre-feet per acre, the total water duty for this part of the project yielded a PIA water right of 89,327 acre-feet. However, the amount of water necessary to grow alfalfa on the Wind River Reservation is expected to increase by over 7.5% by 2039, by up to 15% by 2069, and by more than 24% by the end of the century.[359] **Table 1** shows how those increases in water demand as a result of climate change would change the overall water

351. *See* Hedden-Nicely & Kaiser, *Water Governance*, *supra* note 319.
352. *Id.*
353. *Id.*
354. *Id.*
355. *Id.*
356. Brief for Arizona at 155–56, Arizona v. California, 373 U.S. 546 (1963).
357. Special Master Report, *In re Big Horn*, *supra* note 233, at 205.
358. *Id.* at 170, 205.
359. Hedden-Nicely & Kaiser, *Water Governance*, *supra* note 319.

duty, as well as the reduction in acres that could be irrigated with the fixed water right of 89,327 acre-feet that was decreed in *Big Horn*.[360]

Table 1: Potential Reductions in the Number of Acres that Can Be Irrigated

	Water Duty (AF/A)	**Acres Irrigated**	**Reduced Acreage**
Current	3.81	23,445	
2039	4.10	21,787	(1,658)
2069	4.38	20,394	(3,051)
2099	4.72	18,925	(4,520)

As **Table 1** demonstrates, if these estimates hold, the Wind River Tribes will not be able to irrigate the irrigable acreage found within this portion of the Wind River Reservation with the fixed water right awarded by the *Big Horn* court. Instead, the Tribe would have to either change the crop to something more water thrifty (which would change the economics of the project), invest in costly water efficiency infrastructure, or reduce the overall acreage it is irrigating in order to remain in line with the fixed decree set by the court. Notably, the modelling estimates that the changes in irrigation demand at the Wind River Reservation will be relatively mild compared to other reservations in the West, some of which can expect increases in irrigation demand anywhere from 5 to 180%.[361] In other words, by fixing the tribal water right in this way, tribes across the West will ultimately end up with a quantity that is *less than* what is necessary to satisfy the "ultimate needs of each Reservation," precisely the type of "forfeiture of the Indians' water rights" that Special Master Rifkind worked to avoid when he developed his original bargain in *Arizona v. California*.[362]

360. Some of the shortfall demonstrated in Table 1 could potentially be mitigated through the development of irrigation efficiency improvements. However, although part of the suite that will be necessary for climate adaptation, irrigation efficiency alone is unlikely to make up the shortfall and sometimes comes with its own complexities and unintended consequences. For an introduction to the debate surrounding irrigation efficiency, *see generally* Quentin Grafton et al., *The Paradox of Irrigation Efficiency*, 361 Sci. 748 (2018); Louis Sears et al., *Jevons' Paradox and Irrigation Efficiency*, 10 Sustainability 1590 (2018); Les Levidow et al., *Improving Water-Efficient Irrigation: Prospects and Difficulties of Innovative Practices*, 146 Agricultural Water Mgmt. 84 (2014); Haoying Wang, *Irrigation Efficiency and Water Withdrawal in US Agriculture*, 21 Water Pol'y 768 (2019); C.A Scott et al., *Irrigation Efficiency and Water-Policy Implications for River Basin Resilience*, 18 Hydrology And Earth Syst. Sci. 1339 (2014); Shyam Nair, *Efficiency of Irrigation Water Use: A Review from the Perspectives of Multiple Disciplines*, 105 Agronomy J. 351 (2013).

361. Hedden-Nicely & Kaiser, *Water Governance*, *supra* note 319.

362. 1960 Special Master Report, *supra* note 4, at 264.

IV. Adapting Reserved Water Rights to Build Water Resiliency in Tribal Communities

Climate change promises to continue to exacerbate the unintended inequities that have resulted from the balance of certainty developed by Master Rifkind in 1960. Primarily, those inequities stem from the mythos non-Indian have built up around *their* need for certainty by insisting that tribal reserved water rights be both limited and fixed in quantity.[363] In so doing, they have seized upon broader property principles, which have long emphasized clarity of title as paramount for the security of property rights.[364] However, as Professor Joseph Singer has effectively demonstrated, property law—like all private law—is subject to equitable exceptions with many rules based on the balancing of competing interests.[365] There is no normative reason to treat water law differently and, in fact, the equities point in the opposite direction for reserved water rights, which were recognized at least partially to blunt the hard edge of colonialism by ensuring sufficient water remains in tribal homelands. That is precisely the approach taken by Special Master Rifkind in *Arizona v. California* when he attempted to balance the certainty demanded by junior non-Indian water users against the need for sufficient water to meet the "ultimate needs" of the tribal communities.[366] However, with time, it has become apparent that the balance originally envisioned by Master Rifkind has failed to live up to its lofty expectations.

At the outset, it is far from clear that the approach has actually led to meaningful certainty for junior non-Indian water users. Indeed, water adjudications have proven to be the *start* of protracted litigation that extends well beyond the issuance of the final decree. Oregon's Klamath Adjudication demonstrates

363. *See generally supra* section II(A).

364. *See, e.g.*, Abraham Bell & Gideon Parchomovsky, *Reconfiguring Property in Three Dimensions*, 75 U. Chi. L. Rev. 1015, 1022 (2008) ("There cannot be ownership in land without some clear idea of who owns the land, what land is owned, and what rights accrue to the owner as a result of her status."); Steven J. Eagle, *Private Property, Development and Freedom: On Taking Our Own Advice*, 59 S.M.U L. Rev. 345, 352 (2006) ("Individuals working to grow their assets must be supported by clear laws defining their property rights."); Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. Rev. 1719, 1797 (2004) ("Property rules have informational advantages."); Donald J. Kochan, *Certainty of Title: Perspectives after the Mortgage Foreclosure Crisis on the Essential Role of Effective Recording Systems*, 66 Ark. L. Rev. 267, 303 (2013) ("[C]onfidence and certainty in ownership are essential for the efficient use of property."); Hernando de Soto, Opening Ceremony at the Int'l Bar Ass'n Annual Conference (Oct. 12, 2008), *in* Law Connects, Int'l B. News, Dec. 2008, at n.10, 16 ("[T]he problem is that nobody's going to invest unless they know who owns it, or that they own it. Nobody's going to remove the rocks; nobody's going to put in the irrigation systems or the roads, until they feel they own it.").

365. Joseph William Singer, *The Rule of Reason in Property Law,* 46 U.C. D Davis L. Rev. 1369 (2013).

366. 1960 Special Master Report, *supra* note 4, at 264.

the point. There, the Oregon Department of Water Resources issued its Findings of Fact and Final Order of Determination in 2013, which was affirmed by the Oregon circuit court in 2021 and included a variety of fixed-quantity water rights for the Klamath Tribe.[367] However, rather than resolve the controversy, the decree simply begat more questions, resulting in a flurry of litigation and a number of petitions to the United States Supreme Court.[368]

In other cases, the fact that water rights were decreed for fixed quantities actually serves as *the source* of ongoing uncertainty. Ironically, *Arizona v. California* itself serves as the quintessential example of this problem. There, the Supreme Court affirmed an allocation of 15 million acre-feet to be divided between the upper and lower basin states, with each state receiving a fixed amount of water from the Colorado River.[369] That allocation was based on the parties' best estimate of the available water in the Basin using the period of record available to them. That period, it turned out, was one of the wettest in the Colorado River Basin in the last 500 years.[370] The confluence of this rigid quantification method, along with significantly changing climatic conditions, has led to significant uncertainty for the millions of people that rely on the Colorado River system.[371]

That relatively small modicum of certainty for non-Indians has come at the expense of the tribes, who now have *one* opportunity to *attempt* to secure water rights that serve the ultimate needs of their people and homelands into perpetuity. The imbalance has become more pronounced as courts have consistently imposed new requirements over the past seventy-five years that have morphed the quantification of reserved water rights into an extremely complex process that has effectively chipped away at the amount of water tribes may expect to protect their homelands. Climate change adds a new element that—when combined with the current practice of fixing reserved water rights for certain quantities—will result in "forfeiture of the Indians' water rights."[372] Put simply, the delicate balance originally envisioned by Master Rifkind that, in his

367. OR. Water res. Dept., Order Entering the Amendments and Corrections to the Findings of Fact and Order of Determination Dated March 7, 2013 (2014); Court's Opinion and Conclusions of Law on Phases 3, Part 1, Group C Motions, In the Matter of the Determination of the Relative Rights of the Waters of the Klamath River, A Tributary of the Pacific Ocean, Case No. WA1300001 (Or. Cir. Feb. 24, 2021).

368. *See e.g.*, Baley v. United States, 942 F.3d 1312 (Fed. Cir. 2019), *cert. denied*, 141 S. Ct. 133 (2020); Hawkins v. Haaland, 991 F.3d 215 (D.C. Cir. 2021), *cert. Denied*, 142 S. Ct. 1359 (2021); Klamath Irrigation Dist. V. United States Bureau of Reclamation, 48 F.4th 934 (9th Cir. 2022), *cert. denied*, 144 S. Ct. 342 (2023); *Petition for Certiorari*, Klamath Irrigation Dist. V. United States Bureau of Reclamation, Case No. 22-1116 (May 11, 2023).

369. Bureau of Reclamation, Colorado River Compact Art. III (1922).

370. Connie A. Woodhouse et al., *Updated Streamflow Reconstructions for the Upper Colorado River Basin*, 42 Water Res. Rsch. W05415 (2006).

371. *See generally* Homa Salehabadi, et al., The Future Hydrology of the Colorado River Basin (2020).

372. 1960 Special Master Report, *supra* note 4, at 264.

view, maximized certainty for all parties, no longer holds. Instead, the balance has shifted such that non-Indians enjoy at least the perception of certainty while tribes shoulder an incredible amount of risk and uncertainty.

The inequity of this approach comes into clearer focus when you consider that Indigenous people "contribute little to greenhouse gas emissions."[373] Nonetheless, they already form part of the global population that experience mortality rates from climate-driven floods, storms, and droughts that are fifteen times higher compared to people living in less sensitive regions.[374] Native people are often strongly tied to place, having evolved to rely upon the ecosystems within which they have lived since time immemorial for physical, mental, and spiritual sustenance. Thus, place is not fungible for Indigenous people, making them particularly vulnerable to ecosystem failure associated with climate change.[375] Compounding matters, the socioeconomic history within tribal communities causes climate change to "threaten[] Indigenous peoples' livelihoods and economies, including agriculture, hunting and gathering, fishing, forestry, energy, recreation, and tourism enterprises."[376] These vulnerabilities are deeply rooted in the United States' history of colonialism, which "created both the economic conditions for anthropogenic climate change and the social conditions that limit indigenous resistance and resilience capacity."[377] Thus, we should strive to avoid perpetuating that colonial legacy by engaging in "[m]aladaptive responses" such as purposefully excluding them from access to water rights that rightfully belong to them, which "can worsen existing inequities . . . for Indigenous Peoples . . . ."[378]

These moral positions have crystalized into norms on the international level.[379] Those norms have been memorialized in the United Nation's Declaration on the Rights of Indigenous Peoples (UNDRIP), which includes robust protection for tribal property rights.[380] More particularly, they include the right of Indigenous people to "maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used . . . waters . . . and other resources and to uphold their responsibilities for future

373. *Climate Change and Indigenous Peoples,* U.N. Permanent Forum on Indigenous Issues (2008), https://perma.cc/2EP3-PDJG; *see* Fourth National Climate Assessment, Vol. II, *supra* note 270, at 573–603; IPCC, Sixth Assessment Synthesis Report, *supra* note 1, at 5.

374. IPCC, Sixth Assessment Synthesis Report, *supra* note 1, at 5.

375. *Id.* at 16; Fourth National Climate Assessment, Vol. II, *supra* note 270, at 578.

376. Fourth National Climate Assessment, Vol. II, *supra* note 270.

377. Kathryn Norton-Smith et al., Climate Change and Indigenous Peoples: A Synthesis of Current Impacts and Experiences 3 (2016).

378. IPCC, Sixth Assessment Synthesis Report, *supra* note 1, at 5.

379. *See generally* S. James Anaya, Indigenous People in International Law (2004).

380. G.A. Res. 61/295, United Nations Declaration on the Rights of Indigenous Peoples ("UNDRIP").

generations in this regard."[381] Conversely, UNDRIP obligates states to "consult and cooperate in good faith with indigenous peoples . . . in order to obtain their free and informed consent . . . of any project affecting their . . . water or other resources."[382] Finally, relevant here, UNDRIP provides that Indigenous people ought to have "access to . . . just and fair procedures for the resolution of conflicts and disputes with States or other parties, as well as to effective remedies for all infringements of their individual and collective rights."[383]

At the most basic level, however, current quantification standards threaten to undermine the fundamental promise made by the United States that Indian reservations would be permanent homelands for the people that have lived there since time immemorial. The consideration provided by the Tribes in exchange for this promise was enormous; indeed, the lands ceded serve as the foundation upon which the incredible wealth of the United States is built.[384] As beneficiaries of these agreements, it is incumbent upon the United States—and its people—to ensure they continue to be honored. Water is crucial to that effort—as the Supreme Court has recognized since *Winters* itself, many of the homelands set aside would be "practically valueless" without sufficient quantities of water.[385] That understanding formed the underpinning of the Court's articulation of the *Winters* doctrine, which entitles the tribes to sufficient quantities—whatever they may be—to fulfill the ongoing homeland purpose for the creation of the reservations.[386] Unquestionably, the Court in *Arizona v. California* acquiesced to the balance suggested by Master Rifkind, but only because it concluded that balance was the most "feasible and fair way by which reserved water for the reservations can be measured" in that case.[387] That underlying assumption no longer holds true. Thus, if the United States, its people, and the Court intend to continue to honor the United States' commitments to the Indigenous people of this country, as well as remain faithful to precedent, then they must revisit Master Rifkind's approach and find ways to rebalance how we allocate water between tribal and non-Indian communities.

A. Integrating Climate Change into the PIA Analysis

A fundamental assumption underlying the PIA analysis is that current and past conditions related to soil, agricultural engineering, and economic conditions will remain static moving into the future.[388] Thus, the method relies

381. *Id.* at Art. 25.
382. *Id.* at Art. 32.
383. *Id.* at Art. 40.
384. *See* Farrell et al., *supra* note 7, at 1–2.
385. Winters v. United States, 207 U.S 564, 576 (1908).
386. *See supra* section II(A).
387. Arizona v. California, 373 U.S. 546, 601 (1963).
388. Special Master Report, *In re Big Horn*, *supra* note 233, at 156. ("My reading of Arizona v. California supports the view that evidence of 'practicable irrigability' was determined by

heavily on past and current data in order to synthesize the quantity of irrigation water that will be necessary to meet the "ultimate needs of the Indians as those needs and requirements should grow and keep pace with the development of Indian agriculture on the reservation."[389] For all of the reasons already discussed, the assumption that the PIA parameters will remain static, particularly the climatic and hydrologic parameters, no longer holds. Therefore, relying *solely* on past observations to estimate the amount of practicably irrigable acreage on the reservation is no longer a rational approach.

Perhaps the most basic way to make the PIA methodology more robust would be to integrate climate change into the analysis. While climate change is expected to affect many aspects of the PIA method, estimation of irrigation demand and the economic analysis seems the most sensitive. Although beyond the scope of this article, it is noteworthy that a large body of economic literature exists on the interrelationship between agricultural economics and climate change.[390] From this, economic experts could develop climate change scenarios in an effort to assess how the economics of specific PIA projects might change as climate change progresses.

More to the point here is that estimates of irrigation demand could be improved significantly by integrating climate change into the analysis. Climate models have improved significantly in recent years, particularly those that estimate how climate change is expected to affect some of the primary drivers to irrigation demand, including precipitation, as well as the component parts of evapotranspiration—for example, temperature, wind speed, and solar radiation.[391] That work has been disaggregated to address seasonal effects.[392]

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then current standards."); 1960 Special Master Report, *supra* note 4, at 98. ("the determination of practicable irrigability should be based on present standards. Reference to past standards would introduce an additional complication in an already complex case.").

389. United States v. Ahtanum Irrigation Dist., 236 F.2d 321, 327 (1956).

390. *See, e.g.*, *generally* Richard M. Adams, *Global Climate Change and Agriculture,* 71 Am. J. Agricultural Econ. 1272 (1989); Lobell et al., *Prioritizing Climate Change Adaptation Needs for Food Security in 2030*, 319 Sci. 607 (2008); Lobell & Gourdji, *The Influence of Climate Change on Global Crop Productivity*, 160 Plant Physiology 1686 (2012); Ortiz-Bobea et al., *Anthropogenic Climate Change has Slowed Global Agricultural Productivity Growth*, 11 Nat. Climate Change 306 (2021).

391. *See, e.g.*, Mohammad Kazemi Garajeh et al., *An Integrated Approach of Remote Sensing and Geospatial Analysis for Modeling and Predicting the Impacts of Climate Change on Food Security*, 13 Sci. Reports 1 (2023); Shah Fahad et al., *Implementing a Novel Deep Learning Technique for Rainfall Forecasting via Climate Variables: An Approach via Hierarchical Clustering Analysis*, 854 Sci. of the Total Environment 1 (2023); Ahmed Attia et al., *Coupling Process-Based Models and Machine Learning Algorithms for Predicting Yield and Evapotranspiration of Maize in Arid Environments*, 14 Water 1 (2022); Mojtaba Kadkhodazadeh et al., *A New Methodology for Reference Evapotranspiration Prediction and Uncertainty Analysis under Climate Change Conditions Based on Machine Learning, Multi Criteria Decision Making and Monte Carlo Methods*, 14 Sustainability 1 (2022).

392. *See generally* J.T. Abatzoglou, *Development of gridded surface meteorological data for ecological applications and modelling*, Int'l J. Climatology (Nov. 5, 2011); *see also* Tishya Manna and

Furthermore, researchers have been successful at downscaling global models to the regional or even local scale.[393]

Armed with this body of knowledge, an expert climate change researcher could work with the agricultural engineer to develop a method for integrating climate change into the estimates of irrigation demand. That could include synthesizing timeseries data related to precipitation, temperature, and other parameters expected to be influenced by climate change. Alternatively, experts could continue to use observed past data for these parameters and then use Monte Carlo or other statistical and/or predictive techniques to estimate how those results might change with the integration of climate change scenarios.[394] With the modern downscaling methods available, these experts may feel comfortable using site-specific data to arrive at their estimates of shifting irrigation demand.

Unquestionably, since climate change affects nearly all facets of irrigation demand, the complexity of the problem could swallow the project. Additionally, as we explored above, it is less clear how climate change might affect some of the parameters such as solar radiation and wind speed.[395] Thus, at some point researchers will likely hit a point of diminishing returns where the complexity of integrating in more variables to the climate change analysis is not justified by the incremental increase in methodological robustness. However, at the least, researchers should focus on integrating climate change into their estimates of precipitation and temperature, both of which are primary drivers of irrigation demand and have the benefit of extensive climate change research. Moreover, unlike some of the other aspects of the PIA analysis, this portion of the method will have to be updated and adapted to the current body of best available science as our understanding of climate change and its drivers continues to evolve. Ultimately, the purpose here is not to prescribe any particular method but instead to merely point out that reasonable and well-accepted methods exist and, therefore, the method should be updated to address this critical shortcoming in the contemporary PIA methodology.

Although integrating climate change scenarios into the PIA analysis would unquestionably make the method more robust, the approach is not a panacea. Indeed, despite our progress in the field, the progression of climate change and its effects remains highly uncertain. Hence, we should develop this portion of the methodology carefully so that it remains flexible to changing conditions and the best available science.[396] Importantly, many studies seem to indicate that climate

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A. Anitha, *Precipitation Prediction by Integrating Rough Set on Fuzzy Approximation Space with Deep Learning Techniques*, 139 Applied Soft Computing 1 (2023).

393. *See, e.g.*, Abatzoglou & Brown, *A Comparison of Statistical Downscaling Methods Suited for Wildfire Applications*, 32 Int. J. Climatology 772 (2012).

394. *See, e.g.*, Hedden-Nicely & Kaiser, *Water Governance, supra* note 319.

395. *See supra* section II(A).

396. *Cf.* Rebuttal Brief of the United States before the Special Master, Arizona v. United States, 373 U.S. 546 (1963) (No. 9 Original) ("[T]he limit of such future needs is ascertainable and

change is progressing much faster, and its effects are more severe, than anticipated.[397] In other words, even with the integration of climate change into the PIA methodology, there remains a real risk that reserved irrigation water rights will continue to be under-quantified. Thus, unlike the federal lawyers advancing the PIA method in *Arizona v. California*, we should be under no illusions that this approach will finally allow us to determine "the limit of such future needs [as] has been defined by the computation of water requirements . . . ."[398] Instead, the better solution would be to integrate these technical solutions with meaningful legal and policy improvements such as those outlined below.

B. Winters*-Style Injunctions*

Perhaps the most basic way to rebalance the risks climate change poses to water resources management would be to return to the approach adopted by the United States in *Winters* itself. Recall, *Winters* was not a water rights adjudication to determine the nature, extent, and priority of all water rights associated with the Fork Belknap Reservation. Instead, the United States had identified the water users that were primarily responsible for interfering with the tribal water rights, and it sought injunctive relief against those users from interfering with tribal water use from the Milk River.[399] Tracking this approach, the United States and/or the tribe could identify the primary non-Indian water users responsible for interfering with existing tribal water needs. It would then seek an injunction against those individuals in federal court and, if successful, would receive a declaration of the scope of the rights the United States and tribe hold under the *Winters* doctrine. As in *Winters*, the injunction would likely track the current needs of the tribe, allowing non-Indian use to any available water supply.[400] However, the rights of the non-Indians would remain subject to the paramount rights of the tribes and, therefore, would have to yield to any expanding needs they might have.[401]

This approach enjoys the benefit of tracking the method first envisioned by the Supreme Court when it announced the *Winters* doctrine. More practically, by allowing the tribes to seek additional water supply whenever it so needs, it would provide tribal communities with the greatest certainty possible that their homelands would remain viable as climate change worsens. It would also significantly recalibrate the balance of power over water resources management

indeed has been defined by the computation of water requirements for the irrigable areas of those Reservations.").

397. Jeff Tollefson, *Climate Change is Hitting the Planet Faster than Scientists Originally Thought*, Nature (Feb. 28, 2022), https://perma.cc/ERD6-7ZY9.

398. Brief of the United States before the Special Master at 30, California v. Arizona, 373 U.S. 546 (1963) (No. 9 Original).

399. United States v. Winters, 207 U.S. 564, 565 (1908).

400. Shurts, *supra* note 38, at 71.

401. *See* United States v. Winters, 143 F. 740, 746 (9th Cir. 1906).

between states, tribes, and the United States by reaffirming that tribes and the United States continue to have significant (if not complete) sovereign interests in the water resources of the West.[402] Through that lens, the justification for the draconian and byzantine adjudication process that states have developed to limit reserved water rights starts to fall apart. Instead, should the tribes or United States need water supply it would simply have to "take it and use it.[403]

Nonetheless, the approach has significant drawbacks. Much has changed since 1908, not least of which is that states have come to closely associate water management with state sovereignty.[404] Compounding matters, Western water resources management has evolved into a vast and interconnected web of water use, rendering available water supply essentially non-existent in most places.[405] Thus, unchecked expanding of reserved water rights will have a cascading effect on other water users that will undoubtedly be politically impossible to maintain in most locales. Further, the piecemeal nature of these injunctions would expose the United States and tribes to the risk of inconsistent decisions between cases. Similarly, injunctions only operate to preclude those named as parties in the case. Thus, it is difficult to predict how these injunctions would interrelate with the general stream adjudication process that the United States continues to be obligated to participate in and, by now, is deeply entrenched in Western water resource management.[406] Those cases are, by definition, *inter sese*, which would include non-parties to previous suits brought by the United States who would not be bound by those prior decisions.[407] Thus, as Master Rifkind observed in *Arizona v. California*, this approach has the real drawback of "not giv[ing] the United States any certainty as to the extent of its reserved rights . . . ."[408]

The upshot is that despite its advantages, the broadscale application of *Winters*-style reserved water rights injunctions is highly doubtful. Nonetheless, they may be advantageous in certain situations and should not be ruled out as part of a broader federal strategy to provide tribal communities more certainty regarding their water resources.

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402. *See supra* section II(A).

403. Supplemental Brief for United States at 30, Winters v. United States, 207 U.S. 564 (1908) (No. 158).

404. *See* Goble, *Prior Appropriation and the Property Clause: A Dialogue of Accommodation*, 71 Or. L. Rev. 381, 382, 392 (1992).

405. Vincent C. Tidwell et al., *Mapping Water Availability, Projected Use and Cost in the United States*, Env't Rsch. Letters 1, 7 (2014); Fourth National Climate Assessment, Vol. II, *supra* note 270, at 52.

406. *See generally* Hedden-Nicely, *supra* note 319.

407. Perhaps the best example of this is Fort Belknap itself, which—despite being the birthplace of the *Winters* doctrine—is one of the only reservations in Montana that has yet to have its water rights finally recognized and decreed as part of Montana's state-wide general stream adjudication process. *See* Gros Ventre and Assiniboine Tribes of the Fort Belknap Indian Community Water Rights Settlement Act of 2021, S. 1911, 117th Cong. (2022).

408. 1960 Special Master Report, *supra* note 4, at 264.

C. Adaptive Decrees

A more balanced approach would be to return to the adaptive decrees used by the courts of the early twentieth century.[409] Importantly, nothing in *Arizona v. California* precludes the use of adaptive decrees. Just the opposite: the Master there openly admitted that his recommendation for the Reservations in that case might not apply in other contexts.[410] More importantly, the decree ultimately settled on by the Supreme Court in that case provided for modifications in certain circumstances.[411] Moreover, despite their rarity, some modern courts have eschewed Master Rifkind's approach and entered decrees that were subject to modification.[412] The clearest example comes from *United States v. Anderson*, wherein the Eastern District of Washington held that:

> [t]he judgment entered is a final adjudication of the water rights in the Chamokane Creek basin. The quantification of the Tribe's reserved rights is based upon the amount necessary to irrigate "all the practicably irrigable acreage on the reservation," and as such is designed to meet the future as well as the present needs of the Tribe. . . . However, the Court will retain jurisdiction as was done in *Arizona v. California* . . . . Such retention of jurisdiction permits the [Spokane] Tribe to apply for a modification of the judgment on showing of a substantial change in circumstances, unanticipated in the Court's quantification herein, resulting in a need.[413]

Significantly, the parties in *Anderson* have successfully used this provision to adjust the quantity of water decreed to the United States and Tribe, albeit in the context of the fishing rather than the irrigation portion of the Tribe's reserved water rights.[414] Originally, the tribal instream water right to support the fishing purpose for the creation of the Spokane Reservation was quantified to be "sufficient water to maintain the water temperature below the falls at 68°F or less,

409. *See, e.g.*, Conrad Inv. Co. v. United States, 161 F. 829, 835 (1908).

410. 1960 Special Master Report, *supra* note 4, at 264–65. ("[W]hether it is ever possible accurately to predict the future needs of an Indian Reservation, it is clearly not possible in this case . . . . Whatever might be possible in a case involving solely the issue of the reserved rights of a single Indian Reservation, it would not be possible to predict future Reservation needs in this litigation."); *see also id*. at 265 n.5 ("Even in such cases, courts have not attempted to bind the Indians on the basis of a prediction as to future needs.").

411. Arizona v. California, 460 U.S 605, 618 (1983).

412. *See e.g.*, United States v. Anderson, No. 3643, slip op. at 15 (E.D. Wash. July 23, 1979).

413. *Id*. (judgment entered stating that "the Tribe may apply for modification of this judgment upon a showing of a substantial change in circumstances, unanticipated in the Court's quantification made in said Memorandum Opinion and order of July 23, 1979, and in this Judgment, resulting in a need for water greater than the amount which has been reserved to the plaintiffs for the Tribe's future needs.").

414. United States v. Anderson, No. 3643, § 2–3 (E.D. Wash. Dec. 9, 1988).

provided that at no time shall the flow . . . be less than 20 cfs."[415] Approximately ten years later, the United States and Tribe successfully moved for a modification of that decree to eliminate the temperature requirement but increase the minimum flow to "24 cfs as applied against any state law water rights that existed before the Court's adjustment order in 1988 and 27 cfs "[i]n relation to all other water rights established subsequent to the entry of this order . . . ."[416]

Notably, the *Anderson* court did quantify the full extent of the tribal water right using the PIA methodology, as well as the method used to quantify the tribal fishing right.[417] As a result, the junior non-Indian water users in the basin were insulated from the "jeopardy" caused by "uncertain and unknowable" senior reserved water rights.[418] Undoubtedly, the open-ended nature of the decree shifted some uncertainty from the Tribe onto the non-Indian community. However, because everyone was starting from the baseline that was the quantities already decreed to the Tribe, any modification—like the change from 20 cfs to 24 cfs—would be marginal rather than catastrophic for those junior water users.

Similarly, the United States successfully reopened the decree from *United States v. Walker River* in 2018.[419] The award in that decree was limited to the tribal water use as it existed in 1939 but included a modification clause that allowed the court to "retain[] jurisdiction of this cause for the purpose of changing the duty of water or for correcting or modifying this decree . . . ."[420] Citing to that clause, the United States and Walker River Tribes brought additional water rights claims necessary to fulfill new water needs on the Reservation that had developed since 1939.[421] The Ninth Circuit affirmed that approach, concluding that the 1939 decree's language allowing for "modifying [the] decree" "may properly be read as also retaining jurisdiction . . . to litigate additional rights in the Walker River Basin."[422]

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415. *Anderson,* No. 3643, slip op. at 15 (E.D. Wash. July 23, 1979).

416. *Anderson,* No. 3643, § 2–3 (Order Modifying the Minimum Flow Provisions of this Court's Memorandum Decision of July 23, 1979); *see also* Hedden-Nicely, *The Historical Evolution of the Methodology for Quantifying Federal Reserved Instream Water Rights for American Indian Tribes,* 50 Env't L. Rev. 205, 243 (2020).

417. *Anderson*, ILR F at 131; *see also* United States v. Anderson, No. 3643, slip op. at 6 (E.D. Wash. Sept. 12, 1979) (judgment entered stating: "the Tribe may apply for modification of this judgment upon a showing of a substantial change in circumstances, unanticipated in the Court's quantification made in said Memorandum Opinion and order of July 23, 1979, and in this Judgment, resulting in a need for water greater than the amount which has been reserved to the plaintiffs for the Tribe's future needs.").

418. 1960 Special Master Report, *supra* note 4, at 264.

419. 890 F.3d 1161 (9th Cir. 2018).

420. Order for Entry of Amended Final Decree to Conform to Writ of Mandate Etc. at 74-75, United States v. Walker River Irrigation Dist, In Equity No. C-125 (D. Nev. April 14, 1936); *see also id*. at 1166.

421. *Id*. at 1167.

422. *Id*. at 1171.

The success of these modifications demonstrate the proof of concept that adaptive decrees are workable in the modern era of water resources management. Tribal irrigation water rights would continue to be quantified consistent with the PIA methodology. However, those quantities would be subject to modification "on showing of a substantial change in circumstances," namely climate change.[423] Those modifications would start with the previously decreed quantities as a baseline, adjusting incrementally to account for the change in irrigation demand resulting from climate change in the region.

Importantly, this approach does not provide the tribes and United States with a blank check for additional water supply. Instead, they would shoulder the initial burden of establishing that (1) there has been a substantial change; that (2) was not originally accounted for in the PIA methodology; and (3) has resulted in the tribe not having sufficient water supply to meet their irrigation needs. This is precisely the prescription made by the Supreme Court in its 1983 decision in *Arizona v. California* when it found that a "'court of equity [may] modify an injunction in adaptation to changed conditions.'"[424] Recall that changes in hydrology brought on by poor climate conditions served precisely as the type of "changed condition" the Court supposed would trigger the decree's provisions for modification.[425]

Undoubtedly, any method that allows for fluctuations in the quantity of reserved irrigation rights is subject to criticism for preventing finality as well as for exposing junior non-Indian water users to the very type of uncertainty and risk Master Rifkind sought to avoid in 1960. Whether Master Rifkind's balance was ever truly equitable is open for debate. What is clear, however, is that climate change has completely altered the balancing calculus. Thus, going back to adaptive decrees actually *rebalances* the risk in a way that is well understood, feasible, and fair. Adaptive decrees are broadly applied, and the procedure for modification is well understood. More critically, it mitigates the significant risk that tribes currently shoulder that their homelands will not remain viable through the dramatic shifts in climate regimes that are expected to come.

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423. United States v. Anderson, 6 ILR F 129, 131 (E.D. Wash. 1979); *see also* United States v. Anderson, No. 3643, slip op. at 6 (E.D. Wash. Sept. 12, 1979) ("[T]he Tribe may apply for modification of this judgment upon a showing of a substantial change in circumstances, unanticipated in the Court's quantification made in said Memorandum Opinion and order of July 23, 1979, and in this Judgment, resulting in a need for water greater than the amount which has been reserved to the plaintiffs for the Tribe's future needs.").

424. Arizona v. California, 460 U.S. 605, 624–25 (1983) (quoting Sys. Federation v. Wright, 364 U.S. 642, 647 (1961)).

425. *Id.*; *see also* Arizona v. California, 530 U.S. 392, 414 (2000) (finding it appropriate to reopen the decree and that issue preclusion did not apply to claims for additional water rights appurtenant to lands that had ownership disputes during the original proceeding because the issue of water rights appurtenant to those lands had not been actually litigated in the prior proceeding).

D. Annual Water Resource Allocation

A variation on the adaptive decrees discussed above would be to decree a mechanism whereby tribal irrigation needs are assessed on an annual or rolling basis. The approach has been applied with some success to the instream flow water rights of the Yakama Nation in the so-called *Acquavella* adjudication.[426] The Court there expressly recognized that it was impossible to reliably estimate a single and permanent quantity for these water rights because of the extreme variability in "water quality, *climatic and temperature changes* . . . , etc."[427] Given these "ever-changing circumstances," the court concluded that "it would be inappropriate . . . to set specific, discrete quantifications . . . for all times and conditions."[428] Instead, the court decreed that these water rights would be set on an annual basis, given "current yearly considerations and constraints" in climate and hydrology within the Basin.[429]

A similar approach could be applied to reserved irrigation water rights. Once again, the Court could require the United States and/or tribe to establish a baseline irrigation water right using the PIA method. That amount of water would be subject to modification early each year as agronomic and irrigation requirements come into clearer view based on cropping patterns, as well as snowpack, water availability, and near-term climatological estimates for that irrigation season.[430] Alternatively, these adjustments could be made on a rolling basis every three, five, ten or more years if the parties determine that conditions do not warrant reassessing irrigation needs every year.

This approach has the advantage of providing near real-time estimates of actual irrigation needs each irrigation season. It is notable that the uncertainty imposed on the non-Indian community here would be marginal because the incremental change each year would simply be the difference between the baseline set previously by the PIA analysis and the additional (or negative) need for that particular year. That uncertainty will be further reduced as climate forecasting continues to improve, providing junior water users with the data needed to make cropping and other financial decisions well in advance of the planting season. Moreover, the incremental difference in irrigation demand in any given year could be *either* positive or negative, which could prove to be advantageous for non-Indian water users in some years when tribal cropping patterns requires less water or mild climate conditions are expected. In those years, tribal water allocations could be reduced, thereby freeing up water for junior users early

426. *See generally* Amendment to Memorandum Opinion Re: Motions for Partial Summary Judgment Dated May 22, 1990, Washington Dept. of Ecology v. Acquavella, No. 77-2-01484-5 (Wash. Super. Ct. Oct. 22, 1990).

427. *Id*. at 59.

428. *Id.*

429. U.S. Bureau of Reclamation, Interim Comprehensive Basin Operating Plan for the Yakima Project Washington 5-1 (2002).

430. *See, e.g.*, *id.*

enough for them to alter their cropping patterns to take advantage. In this way, annual water allocations seem to encourage the efficient use of water and—in some years—may broaden the water available within the community.

Nonetheless, this approach is technically, politically, and legally complex, making its success highly fact-dependent. Indeed, the Yakima River Basin's success stems largely from the presence of the Bureau of Reclamation, which plays an oversized role in water allocation among tribal, federal, and non-Indian water users in the Basin.[431] Without an organization that is similarly trusted and resourced, and has the technical expertise as well as allocation authority to implement the annual plan, it seems quite unlikely that this approach would be successful. Compounding the complexity, the approach requires significant cooperation among the parties, something that "is neither legally required nor realistically always to be expected."[432] As a result, revisiting annually the highly controversial question of how water should be allocated between tribal and non-Indian water users threatens to break down rather than build up delicate relationships, posing a real risk that the communities inadvertently enter into a never-ending cycle of litigation. But the potential upside is noteworthy, making it a worthwhile alternative to explore within communities that are willing to develop the relationships necessary for its success.

E. Tribal Water Resources Management

A separate but related means toward building tribal water resource resilience to climate change would be to expand the tribal role in water management. I use the term "management" here broadly to encompass water allocation, water user regulation, infrastructure development, and administration in times of shortage. The prototype for this approach comes from the Flathead Reservation in Northwestern Montana. There, the Confederated Salish and Kootenai Tribes ("CSKT"), the State of Montana, and the United States agreed to a compact that included, among other things, a tribal consumptive water right to divert up to 229,383 acre-feet per year and consume 128,158 acre-feet per year.[433] Thus, the CSKT did agree to a *fixed* quantity of water for their consumptive water right, including irrigation. However, the CSKT was able to significantly mitigate the risks associated with that approach through the development of a Unitary Administration and Management Ordinance.[434] Pursuant to that ordinance water management authority has been removed from any of the three sovereigns

431. *Id.* at 3-1–3-3.

432. Arizona v. California, 460 U.S. 605, 568–69 (1983).

433. Water Rights Compact Entered into by the Confederated Salish and Kootenai Tribes of the Flathead Reservation, Montana, the State of Montana, and the United States Ratified, Art. III(C)(1)(c), M.C.A. 85-20-1901 (2019) (hereinafter CSKT Water Compact), *ratified* Montana Water Rights Protection Act, S. 3019, 116th Cong. §4(a)(1) (2019).

434. M.C.A. 85-20-1902 (2019), *ratified* Montana Water Rights Protection Act, S. 3019, 116th Cong. § 3(11) (2019)

and vested in the Water Management Board of the Flathead Indian Reservation ("Board").[435] That board is comprised of two members selected by the Confederated Salish and Kootenai Tribe, two members selected by the State, and one member selected by the four board members.[436] The authority of the Board is broad, including the "issuance of Appropriation Rights and authorizations for Changes in Use of Appropriation Rights and Existing Uses, and for the administration and enforcement of all Appropriation Rights and Existing Uses."[437]

A similar approach has been implemented for management of groundwater within a portion of the Lummi Reservation in northwestern Washington.[438] There, the parties agreed to partition the groundwater by determining the amount of water necessary to satisfy non-Indian uses and recognizing the rest belong to the United States and Lummi Nation.[439] That non-Indian portion was allocated to the State Department of Ecology, which had the ongoing authority to regulate that amount of water among the non-Indian water users.[440] All of the remaining water was controlled by the Lummi Nation, which was empowered to "authorize withdrawal of all groundwater . . . not subject to allocation by Ecology . . . provided that such withdrawal is subject to the Lummi Nation's commitment to serve non-Lummi water users . . . and that such withdrawal shall not violate [the terms of this compact]."[441]

Most fundamentally, this approach is the only one that allows tribes to move beyond being mere holders of water rights and towards the full suite of sovereign rights that come with water resource *management* within a territory. On the more practical side, water management provides significant certainty to tribes, even where their irrigation water rights have been fixed, because it provides them the opportunity to develop a comprehensive management strategy for the effective and efficient use of all water resources in the area. The approach provides the space necessary to develop long-term and comprehensive water management strategies that could take stock of climate change. In this way, tribes could manage the allocation of new rights to deliberately avoid—to the extent physically possible within their regions—the conflict that over-appropriation brings. And, in those regions already over-appropriated, tribes could implement stringent water conservation and technology-forcing efficiency standards in an effort to reduce the stress on the water system. In sum, tribes

435. CSKT Water Compact, *supra* note 433, at Art. IV(I)(1).

436. *Id*. at Art. IV(I)(2).

437. *Id.* at Art. IV(I)(1).

438. *See generally* Settlement Agreement Regarding Uses of Groundwater on Lummi Peninsula, United States and Lummi Nation v. State of Washington Dept. of Ecology, et al., No. C01-0047Z (W.D. Wash. 2007).

439. *Id*. § III(A), III(B).

440. *Id*. § V(C)–(E). The parties also agreed that the allocation of water to Ecology would shrink should any land being served by Ecology's allocation be transferred to tribal ownership. *Id*. § III(C).

441. *Id*. § III(B).

would have the ability to both react and act prospectively to protect their water use infrastructure and the natural ecosystems that make up their homelands.

Water management goes beyond regulatory authority; it extends to the development of incentives for efficient water use as well as for the development of modern water resources infrastructure.[442] Given its checkered history in this arena, which is largely responsible for many of the water conflicts between tribal and non-Indian communities in the West, the United States has a unique role to play in this particular effort.[443] This is particularly true for the many tribes whose water rights have already been adjudicated for fixed quantities in decrees that have no mechanism to be reopened. As a result, any inroads into water management will be particularly important for these tribes as they grapple with the risks to their water resources being brought to bear by climate change. Although the scope of the United States' legal liability for this history remains an open question,[444] there can be little doubt that it shoulders a heavy moral obligation to take corrective action. Furthermore, it makes for good policy, bringing communities together to build resilience to climate change.

The United States should take action on its own and in collaboration with tribal nations to encourage good governance of water resources. On its own, the United States could develop tax incentives for water efficiency infrastructure similar to those recently developed in the energy arena in an effort to reduce the stress on our water systems.[445] It could also work with tribes to develop robust tribal codes that address the unique needs of the community, removing barriers that discourage water use efficiency, as well as facilitating water transfers, leasing, and other techniques that allow tribes to holistically manage the entire water system. Finally, the United States is the *only* government that is equipped to fund and develop the next generation of water resources infrastructure in the West. Thus, the United States has a unique opportunity to reverse its history of excluding tribes from water access while simultaneously bringing communities together around the development of inclusive water resources infrastructure that accounts for the unique needs of each region.

However, expanding tribal management of water resources is fraught with political risk, making its success highly circumstantial. Notice that both the

442. Dylan R. Hedden-Nicely, *Climate Change and the Future of Western US Water Governance*, 12 Nat. Climate Change 108, 109 (2022).

443. *See supra* section II(A), text accompanying notes 148–152.

444. *See* Arizona v. Navajo Nation, 599 U.S. 555, 557 (2023) (finding that the 1868 Treaty with the Navajos did not obligate the United States to "address[] the Tribe's water needs [by] developing a plan to secure the needed water, and potentially building pipelines, pumps, wells, or other water infrastructure"). Importantly, the Court expressly disclaimed any opinion on whether federal interference with water access would rise to a breach of trust. *Id.; see also* Nevada v. United States, 463 U.S. 110, 135 n.14 (1983) (recognizing that tribes may be entitled to compensation for breach of trust when the United States purposefully excludes them from water necessary to maintain reservation purposes).

445. *See* Inflation Reduction Act of 2022, H.R. 5376, 117th Cong. (Jan. 3, 2022)

CSKT and Lummi examples were developed in the context of water *settlements*. Tribes have had mixed results when trying to litigate the scope of water resources management authority.[446] Moreover, notwithstanding the progressive approach taken by Washington and Montana in those settlements, states—many of whom view sovereignty as a zero-sum game—jealously guard their water management authority. As a result, states and their citizens invariably rebuff attempts by tribes or the United States to engage in water management of non-Indian water rights, which they view as a critical aspect of state sovereignty. Thus, the success of this approach seems highly dependent on the unique legal history in each locality, as well as the relationships that exist within the community. Notably, the federal government—through the incentives and infrastructure development above—can play a critical and positive role in shifting communities to this type of cooperative paradigm. As the International Panel on Climate Change has observed, "[c]ooperation, and inclusive decision making, with Indigenous Peoples and local communities, as well as recognition of inherent rights of Indigenous Peoples, is integral to successful adaptation and mitigation" to climate change.[447]

V. Conclusion

Climate change places the United States and its people at a crossroads—our actions now will dictate the options we have in the future.[448] Of course, the most meaningful adaptations we can apply would be those that slow climate change itself. It is already clear that the perpetuation of current climate policies will cause "[e]very increment of global warming [to] intensify multiple and concurrent hazards."[449] Thus, if we want to avoid the worst of these hazards, we must develop policies that involve "rapid and deep and, in most cases, immediate greenhouse gas emissions reductions in all sectors this decade."[450]

However, it is too late to completely reverse climate change, and "some future changes are unavoidable and/or irreversible . . . ."[451] Soon, we will no longer have the luxury of resting on our institutions, infrastructure, or even our ways of knowing, making adaptation to a new climate regime the necessary

446. United States v. Anderson, 736 F.2d 1358, 1363 (E.D. Wash. 1982); Ute Indian Tribe of the Uintah and Ouray Reservation v McKee, 32 F.4th 1003, 1005 (10th Cir, 2022). *But see* Colville Confederated Tribes v. Walton, 647 F. 2d 42, 51 (1981); United States v. McIntire, 101 F.2d 650, 654 (9th Cir. 1939).

447. *See generally* IPCC, Sixth Assessment Synthesis Report, *supra* note 1, at 105.

448. *Id.* at 19 ("Adaptation options that are feasible and effective today will become constrained and less effective with increasing global warming. With increasing global warming, losses and damages will increase and additional human and natural systems will reach adaptation limits.").

449. *Id*. at 12.

450. *Id*. at 20.

451. *Id*. at 18.

path forward. But change, particularly change surrounding something as complex as our water resources management regime, comes slow. Nonetheless, the moral imperative to future generations is steep; if we do nothing, it will be our children that will truly suffer our decisions.[452] Therefore, the work of adaptation must begin now if we expect to keep pace with the new world climate change will bring.

But *how* we go about adapting to climate change is just as important as whether we do that work in the first place. The United States and its people have a long history of *taking* resources and excluding non-Euro Americans.[453] That history began with the colonization of the United States itself and was perpetuated by the federal policies surrounding water resource allocation of the early twentieth century. Some modern courts have further exacerbated the exclusion by their practice of simultaneously limiting the extent of tribal reserved water rights and insisting that reserved water rights be quantified with precision and decreed for a fixed amount. In light of this history, the path forward will be riddled with thousands of choices, all of which drive toward the ultimate question of whether we will perpetuate the United States' colonial roots by continuing to systematically exclude tribal nations from their water rights or whether we will adopt a new paradigm based on inclusion and cooperation.

The single most meaningful way to reverse that colonial legacy and embark on a new path would be to recenter our focus on the maintenance of the tribal homeland, which should once again become the lodestar of our Indian law and policy. In recognizing that basic principle and applying it to water, the *Winters* doctrine remains a bulwark against the continued colonialization of this country. Indeed, the *Winters* court recognized that homelands need water and therefore, to remain faithful to our promise to the tribes, the agreements must be read to include enough water to fulfill the purposes for the creation of those reservations. The Court placed no limits on that amount and recognized that it would grow with time. The Court accepted that as a necessary corollary to the bargains struck by the United States.

Undoubtedly, "[n]ew conditions [have] to c[o]me into existence" in the West.[454] The population of non-Indian and tribal communities continues to grow, which, combined with climate change, is causing unprecedented pressure on dwindling water supply. But the answer to that problem cannot be to continue to erode the law of the *Winters* doctrine, which is necessary to give effect to the myriad congressional promises to protect and maintain tribal homelands across the country.[455] This article provides several ways to recalibrate that

452. *Id*. at 7 Fig.SPM.1.

453. *See supra* section II(A).

454. United States v. Winans, U.S. 198 U.S. 375, 381 (1905).

455. *Cf.* Mark Olalde & Anna v. Smith, *Western States Opposed Tribes' Access to the Colorado River 70 Years Ago. History Is Repeating Itself*, Propublica (Oct. 17, 2023), https://perma.cc/3UNA-9CAQ; *see also* IPPC, Sixth Assessment Synthesis Report, *supra* note 1 at

balance. Of the approaches analyzed, adaptive decrees seem to hold the most promise and would likely be the most broadly applicable across the plethora of complex geographic and legal landscapes. However, each has benefits and drawbacks that will affect their applicability in different locales. Likewise, they do not stand alone but instead could be interwoven with one another so as to maximize their efficacy. Also important, other approaches certainly exist that may be more appropriate in a particular location. The important thing is not to follow any one path but to develop a comprehensive and flexible strategy that is capable of addressing the unique risks that climate change will bring to different communities. Ultimately, the path forward should be the one that brings communities together to mitigate the worst of climate change's risk and best *balances* between tribal and non-Indian communities the remaining uncertainties that climate change will bring to our water resources management regime.

19 ("Maladaptation can be avoided by flexible, multi-sectoral, inclusive, long-term planning and implementation of adaptation actions, with co-benefits to many sectors and systems.").