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Hearing before the U.S. Senate Committee on Indian Affairs

Concerning
S. 4633—Northeastern Arizona Indian Water Rights Settlement Act of 2024

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Chairman Schatz, Vice Chairman Murkowski, and members of the Senate Committee on Indian Affairs, my name is Timothy Nuvangyaoma and I serve as Chairman of the Hopi Tribe. Thank you for the opportunity to testify on behalf of the Hopi Tribe and its members in support of S. 4633, the "Northeastern Arizona Indian Water Rights Settlement Act of 2024." I also want to thank our Arizona Senators Kelly and Sinema, who jointly introduced this bill in the Senate, as well as Representative Ciscomani for introducing this historic bipartisan bill in the House, and Representatives Stanton, Crane, Schweikert, Grijalva, and Gallego for joining as cosponsors.

Hopi are northeastern Arizona's most ancient inhabitants. Archaeological records show that our ancestors in the region date back to prehistoric times. Our oral histories go even further back. According to Hopi oral history, upon emergence into this world, our people encountered the deity who I will refer to in English as the Original Caretaker, who gave them his blessing to live on the land. The Original Caretaker required that the Hopi follow in his path as humble farmers and respect the land through religion and guidelines that he passed on to them. A covenant was thus established between Hopi and the Original Caretaker in which land was set aside for the Hopi to live as stewards.

The Hopi Reservation was created to be a permanent homeland for the Hopi people. However, when it divided up tribal lands in northeastern Arizona, the United States government landlocked the Hopi Reservation within the Navajo Reservation. As a result, we were cut off from direct access to many of the water resources that sustained our ancestors for thousands of years. The water resources we are left with on the Hopi Reservation are severely limited and inhibit our ability to experience the true tribal sovereignty and economic self-sufficiency which is our right under the law of the United States of America.

Despite the dry, arid conditions of our Reservation, Hopi have pushed the bounds of human ingenuity, finding ways to sustainably use every available water resource to the maximum extent possible to uphold our covenant with the Original Caretaker and ensure these lands remain our home. But even as experts in desert survival since time immemorial, Hopi cannot alone keep pace with the severe water scarcity and uncertainty of today and tomorrow.

The Northeastern Arizona Indian Water Rights Settlement Agreement has shown the Hopi People that we are not alone. Through the collaborative efforts of a historic coalition of tribal and non-tribal parties—representing approximately one-third of Arizona's geographical extent—Hopi

can finally envision a future with a reliable supply of safe, clean drinking water and essential water infrastructure. Among other things, the agreement makes available to the Hopi Tribe diverse water sources to meet future water needs on the Hopi Reservation, including reliable mainstem Colorado River water. It also includes inter-tribal agreements between the Hopi Tribe and the Navajo Nation to manage and protect groundwater resources shared by the tribes, highlighting principles of sustainability and cooperation.

For the Hopi Tribe, passage of the Northeastern Arizona Indian Water Rights Settlement Act of 2024 is not just a legal milestone, it is a path forward. This Act will provide the Hopi Tribe with access to reliable water and water infrastructure necessary to ensure the health, well-being, and economic prosperity of the Hopi People for generations to come. Of paramount importance to Hopi, this settlement and the infrastructure made possible by this Act provide a way for Hopi to fulfill its covenant with the Original Caretaker: to continue to live as stewards of *Hopitutskwa*.

I. A Brief History of the Hopi People and Hopi Lands.

The Hopi Tribe is a tribe of Hopi Indians organized under Section 16 of the Indian Reorganization Act of June 18, 1934 (25 U.S.C. § 476), and duly recognized by the Secretary of the United States Department of the Interior (89 Fed. Reg. 944, 945 (Jan. 8, 2024)).

We are an ancient, agrarian people with one of the oldest cultures in North America. Archaeological evidence indicates that present day Hopi are a Puebloan people descended from the ancient Basketmaker culture that existed in the Four Corners area from prehistoric times. The archaeological record confirms centuries of continuous, uninterrupted occupation of the Hopi ancestral territory culminating in the lifeway of our contemporary Hopi people. Indeed, after extensive fact-finding, the court in *Healing v. Jones* concluded that "[n]o Indians in this country have a longer authenticated history than the Hopis." *Healing v. Jones* ("*Healing II*"), 210 F. Supp. 125, 134 (D. Ariz. 1962), *aff'd*, 373 U.S. 758 (1963) (per curiam).

For thousands of years my people have lived and farmed the valley floors, terraces, and tops of three mesas on the Colorado Plateau, using a variety of specialized farming techniques adapted to the arid region. Hopi field types included flood-water fields, *akchin* fields at the mouths of arroyos, sand dune seepage fields, irrigated terraces fed by springs, and irrigated fields fed by canals and reservoirs. Each of these field types took advantage of the scarce water available in the region. Hopi also hunted game, had poultry flocks, and gathered native seeds and plants to supplement their agrarian lifestyle. Following the introduction of livestock by the Spanish, we also mastered the art of animal husbandry, making cattle herding and livestock a mainstay of Hopi culture and development.

We continue to maintain many of the practices of our ancestors—speaking our ancient Hopi language, practicing our ancient religions, upholding ancient forms of village governance, and farming the fields around our villages. In particular, agriculture is still inextricably tied to our identity and culture as Hopi people. Our religious cycles are structured around agriculture, with ceremonies marking the cycles of the harvest season. Seeds are blessed with water and prayer for them to grow strong. To live as a farmer is part of the Hopi covenant. The Original Caretaker presented the ancient Hopi with three gifts that symbolized their life principles: corn seeds, a gourd

filled with water, and a planting stick. Corn was to be the soul of the Hopi people. The planting stick provided a simple and dependable farming tool. The water gourd represented the Original Caretaker's blessings and the relationship with the natural environment.

Water has particular religious significance to my people, beyond agriculture. We pray for rain and snow and hold religious ceremonies at springs. During the trial to quantity the Hopi Tribe's water rights, a Hopi witness, Mr. Leonard Selestewa, eloquently testified: "Water to the Hopi people is very sacred. Water is alive. It is a spirit with life."

Hopi Ancestral Lands. The Hopi Tribe's ancestral territory (*Hopitutskwa*) far exceeds the lands recognized as the Hopi Reservation today. *Hopitutskwa* encompasses the entire Little Colorado River watershed from its confluence with the Rio Puerco River west to its confluence with the Colorado River. My people and our ancestors have used or occupied the Little Colorado River Basin in Arizona for many centuries. Hopi have inhabited the area between Navajo Mountain in the north to the Little Colorado River in the south and between the San Francisco Mountains and the Luckchukas since before A.D. 1300. *See Hopi Tribe v. United States*, 23 Ind. Cl. Comm'n. 277, 292–93 (1973).

The Hopi Reservation. The Hopi Reservation covers approximately 3,000 square miles (roughly 1.66 million acres) in northeastern Arizona and is bordered on all sides by the Navajo Reservation. It is comprised of two non-contiguous geographic areas known as the 1882 Executive Order Reservation[1] ("1882 Reservation") and Moenkopi.[2] Unlike many Indian reservations, the Hopi Reservation is comprised entirely of trust lands held by the United States on behalf of the Hopi Tribe. There are no inholdings of fee land owned by non-members because the 1882

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[1] The Executive Order of December 16, 1882, set aside a reservation of some 2.5 million acres for use by the Hopi Indians "and such other Indians as the Secretary [of the Interior] may see fit to settle thereon." *See also Sekaquaptewa v. MacDonald*, Case No. CIV-579-PCT-JAW (D. Ariz.), *aff'd*, 626 F.2d 113 (9th Cir. 1980). Litigation followed to resolve conflicting land claims by the Hopi Tribe and Navajo Nation to portions of the 1882 Reservation. *See Healing II*, 210 F. Supp. at 134. The Hopi Tribe was granted exclusive title to "Land Management District 6," (District 6) and the balance of the 1882 Reservation was found to be a "Joint Use Area" in which the Hopi Tribe and the Navajo Nation shared the surface and subsurface rights. *Id*. The Joint Use Area was later formally partitioned into the "Hopi Partitioned Lands" and "Navajo Partitioned Lands" in accordance with the Act of December 22, 1974 (Public Law 93-531; 88 Stat. 1712; codified as amended at 25 U.S.C. §§ 640d - 640d-24).

[2] By the Act of June 14, 1934 (48 Stat. 960; codified at 25 U.S.C. § 640d-7), Congress set aside for the Navajo "and such other Indians as were already 'located' thereon" an additional area of land outside the boundaries of the 1882 Reservation. Pursuant to that Act, the Hopi Tribe brought an action in the federal district court to establish the Hopi Tribe's right to the 1934 Reservation. The court declared that portions of the 1934 Reservation belong to the Hopi Tribe, including the Villages of Upper Moenkopi and Lower Moencopi and surrounding areas (collectively, "Moenkopi"). *See Masayesva v. Zah*, 65 F.3d 1445 (9th Cir. 1995); *see also Honyoama v. Shirley, Jr.*, Case No. CIV 74-842- PHX-EHC (D. Ariz. 2006).

Reservation was never allotted. Within the exterior boundaries of the Hopi Reservation, in the lands around the Village of Moenkopi, are eleven (11) allotments, which have never left trust ownership. The Hopi Tribe has acquired a beneficial interest in most of the allotments as individual Hopi allottees' interests have fractionalized over time. *See* 25 U.S.C. § 2206, 25 U.S.C. § 373a.

There are no perennial streams located on the Hopi Reservation. Before creating the 1882 Reservation, the United States was aware there was no perennial water source on the Reservation and government officials expressed concerns that the lack of perennial water sources represented a major challenge to the Tribe's economic advancement. Nevertheless, the Hopi Reservation lines were drawn, landlocked and waterlocked, with Navajo lands on all sides.

The United States established the Hopi Reservation to protect Hopi lands from incursions by our tribal neighbors and non-tribal settlors so that Hopi could continue our agrarian lifestyle and support ourselves rather than depend on the government for support. Because the Hopi Reservation today is landlocked and isolated from water sources, however, we are deprived of the fundamental prerequisites for modern self-sufficiency: access to adequate and reliable sources of water. This Settlement Act will remedy that.

Hopi Off-Reservation Lands. Under the Navajo-Hopi Land Dispute Settlement Act of 1996 (Public Law 104-301; 110 Stat. 3649) ("1996 Settlement Act"), the Hopi Tribe acquired off-Reservation property to settle claims stemming from the loss of Hopi Reservation lands due to Navajo families settling on them. Lands acquired under the 1996 Settlement Act have express federal statutory water rights to both surface water and groundwater. *See id.* § 12.

The Hopi off-Reservation ranches include the 26 Bar Ranch, the DoBell Ranch, the Aja Ranch, the Hart Ranch, the Clear Creek Ranch, and the Drye Ranch. They are generally comprised of a mix of fee land, land held in trust by the United States for the benefit of the Hopi Tribe, and Arizona State trust land leased by the Hopi Tribe. The Hopi Tribe also has separate fee lands (at and around the site of the ancestral Hopi village of Homolovi) and trust lands (Twin Arrows and Hopi Industrial Park).

II. Elements of the Settlement for the Hopi Tribe.

Let me now summarize the principal elements of the comprehensive water rights settlement ratified by S. 4633 specific to the Hopi Tribe:

- The Act ratifies the comprehensive settlement of all the Hopi Tribe's federally reserved and other water right claims, including the Tribe's right to water from the Colorado River, for the Tribe's Reservation and off-Reservation trust lands, and for the Tribe's fee lands.
- The Act recognizes the Hopi Tribe's exclusive rights to all groundwater on the Hopi Reservation, subject to an agreement between the Hopi Tribe and the Navajo Nation that limits:
    - the Hopi Tribe's pumping from the confined portion of the N Aquifer to 5,600 acre-feet of water per year ("AFY") (2,000 AFY of which may be used for industrial purposes); and

- the Navajo Nation's pumping from the confined portion of the N Aquifer and the Shonto recharge area of the Little Colorado River Basin to 8,400 AFY (2,000 AFY of which may be used for industrial purposes).

- The Act protects the Hopi Tribe's on-Reservation groundwater by ratifying agreements between the Hopi Tribe and the Navajo Nation concerning the N-Aquifer (including the pumping limits described immediately above). The N Aquifer is the primary source of groundwater for the Hopi Reservation.

- The Act recognizes the Hopi Tribe's exclusive rights to all surface water on the Hopi Reservation, subject to an agreement between the Hopi Tribe and the Navajo Nation as to the five major washes (the "Northern Washes") shared by the Tribes to: (1) grandfather existing water uses; (2) limit new uses upstream of the southern boundary of the Hopi Reservation; (3) provide for the rehabilitation of historic irrigation uses; and (4) permit traditional agriculture and wash restoration.

- The Hopi Tribe receives an allocation of 2,300 AFY of Arizona's Upper Basin Colorado River water entitlement, some of the most reliable Colorado River water in the system, which will provide a vital and reliable supplement to the insufficient water resources on the Hopi Reservation.
- The Act affords the Hopi Tribe the option to use all or a portion of 4,178 AFY of the Tribe's existing fourth priority Lower Basin Colorado River water (along with the Tribe's existing contract rights to 750 AFY of fifth priority Lower Basin Colorado River water, and 1,000 AFY of sixth priority Lower Basin Colorado River water) on the Hopi Reservation.
- With respect to the Hopi Tribe's Colorado River water rights (in both the Upper and Lower Basins), the Act authorizes leasing, exchanges, long-term storage credits accrued as a result of storage, storage on the Hopi Reservation for aquifer recovery, and inter-basin transfer of Colorado River water rights in Arizona.
- The Act ratifies agreements among the Hopi Tribe, the Navajo Nation, and the San Juan Southern Paiute Tribe to grant each other and the United States rights-of-way for water projects without objection or cost to ensure the efficient and cost-effective execution of the infrastructure projects contemplated in the Act.
- The Act authorizes and approves an agreement among the United States, the Hopi Tribe, the Navajo Nation, the Arizona State Land Department, and the Bar T Bar Ranch to facilitate cooperative and sustainable use of shared water resources, by (among other things):

    - setting certain limitations on the Hopi Tribe's pumping on its off-Reservation trust lands within six miles south and west of the Navajo Reservation;
    - limiting aggregate Hopi Tribe pumping to 6,570 AFY within certain areas of the Hart Ranch proximate to the Navajo Reservation; and
    - establishing a protective buffer zone around the Hopi Tribe's Bluebird Well near the Twin Arrows and Interstate Highway 40 interchange.

- The Act authorizes and funds the *iiná bá - paa tuwaqat'si* pipeline,[3] to transport Colorado River water from Lake Powell to the reservations for municipal, domestic, commercial, and industrial water uses:
    - to serve Hopi communities with up to 3,076 AFY;
    - to serve Navajo communities with up to 7,100 AFY; and
    - to serve the San Juan Southern Paiute Southern Area with up to 350 AFY.
- The Act authorizes and funds multiple trust funds for the Hopi Tribe for essential water infrastructure on the Hopi Reservation and other purposes:
    - $390 million to plan, design, construct, operate, and maintain water supply infrastructure, including wells, water treatment facilities, pipelines, storage tanks, pumping stations, electrical transmission equipment, wastewater treatment facilities, and renewable energy facilities to serve Hopi Reservation communities. The groundwater projects currently contemplated include:
        - The Side Rock-Moenkopi Groundwater Project, which is intended to provide potable water to communities at Moenkopi and unserved locations on the 1882 Reservation; and
        - The Expanded Hopi Arsenic Mitigation Project (HAMP), which is intended to provide potable water to communities at First Mesa, Second Mesa, Third Mesa and Keams Canyon.
    - $87 million to support the operation, maintenance, and replacement of the *iiná bá - paa tuwaqat'si* pipeline and Hopi groundwater projects.
    - $30 million to reduce water shortages on irrigated and grazing land within the Hopi Reservation by funding the implementation or repair of sprinklers, drip or other types of irrigation systems, land leveling, stream bank stabilization and restoration, pasture seeding, pasture management, fencing, wind breaks, stockponds, windmills and wells, spring restoration, repair, replacement, and relocation of low technology structures to support *akchin* farming, flood-water farming and other traditional farming practices, among other actions; and
    - $1.5 million for the purchase of land and associated Lower Basin Colorado River water rights within Arizona.
- The Act's authorized and appropriated amounts for the *iiná bá - paa tuwaqat'si* pipeline and the Expanded HAMP are based on updated estimates from the Bureau of Reclamation's "Navajo-Hopi Value Planning Study – Arizona" (October 2020, updated February 2024).
- The groundwater projects will address immediate needs on the Hopi Reservation, and later be operated in conjunction with the *iiná bá - paa tuwaqat'si* pipeline to satisfy the water needs of the Hopi Reservation.

[3] *iiná bá* are Navajo words that we understand to mean "for life." *paa tuwaqat'si* are Hopi words that translate as "water is life."

III. The Dire Need for Water and Water Infrastructure on the Hopi Reservation.

A. Inadequate Surface and Groundwater Resources.

Surface Water. Surface water on the Hopi Reservation is insufficient for a permanent homeland. The five Northern Washes are the Reservation's only significant potential sources of surface water. Perennial flow occurs in limited portions of three of the five washes, but these flows are too small to provide a meaningful source of water to meet future Hopi needs. The majority of the flow that occurs in the washes, estimated to be between 29,941 AFY and 31,480 AFY, is from high intensity, short duration monsoon storm flow events that are highly variable and produce flows that have excessive amounts of sediment. This excessive sedimentation inhibits storage and has historically been a problem for reservoirs and canals in the region.

Further, the Northern Washes are listed as impaired under the Hopi Tribe's *Clean Water Action Plan Unified Watershed Assessment*, due to the high sediment load, chemical contamination, and presence of coliform bacteria. As a result, surface water on the Hopi Reservation would require considerable, likely cost-prohibitive, treatment to serve as a source of drinking water.

As a result, alternative water resources, such as groundwater and off-Reservation Colorado River water, are vital to ensuring the Hopi Reservation is a permanent and sustainable homeland for the Hopi.

Groundwater. There are several groundwater aquifers beneath the Hopi Reservation, including the alluvial aquifers, the Bidahochi (B) Aquifer, the Toreva (T) Aquifer, the Dakota (D) Aquifer, the Navajo (N) Aquifer, and the Coconino (C) Aquifer. Most of these aquifers cannot provide adequate, reliable water. There is very limited potential for the development of additional water supplies from the alluvium, and the B, T, and D Aquifers. The alluvial, B and T Aquifers are limited in extent and only produce small quantities of water to wells. The D Aquifer also is known for wells with limited yield and the water would need to be treated prior to use. The C Aquifer is present throughout the Hopi Reservation, but occurs at great depth, making it difficult and expensive to access. Moreover, water in the C Aquifer beneath the Hopi Reservation has a high salt content, and C Aquifer water would need to undergo expensive treatment in order to be used as a drinking water source. The Hopi Tribe already attempted to use the C Aquifer at one of its villages where the N Aquifer is depleted, and shut down the project after several years because the water treatment costs were prohibitive.

The N Aquifer has historically been the source of water for industrial and municipal uses in the area. In Arizona, the N Aquifer occurs only beneath portions of the Hopi and Navajo Reservations. The N Aquifer is named for the Navajo Sandstone, and known to Hopi as *Pukya*. The N Aquifer units beneath Black Mesa dip into a structural basin to more than 1,500 feet below ground surface, and in these areas, where the aquifer units are deeply buried beneath Black Mesa, the aquifer is confined (the water occurs under pressure). The N Aquifer is confined under the majority of the 1882 Reservation, including the Hopi Mesas. It is unconfined under the southern and western portions of the 1882 Reservation and Moenkopi.

The N Aquifer is primarily recharged by rainfall or snowmelt. Most of the groundwater stored in the N Aquifer was recharged during the late Pleistocene period when the temperature was cooler and precipitation was higher. N Aquifer groundwater is more than 30,000 years old in the vicinity of the Hopi villages on the 1882 Reservation. The confined portion of the aquifer is recharged near the Shonto area on the Navajo Reservation, and from there the groundwater moves to the southeast, south and southwest beneath Black Mesa. A natural groundwater divide existed under predevelopment conditions at about the northeastern tip of the Hopi 1882 Reservation. North and east of the divide, the groundwater flowed to the northeast on the Navajo Reservation. South and west of the divide, groundwater flowed to the southwest beneath the Hopi 1882 Reservation. In 1983, the U.S. Geological Survey (USGS) estimated annual recharge near Shonto to be 4,830 acre-feet. More recently, the confined N Aquifer annual recharge rate has been estimated between 2,500 and 3,500 acre-feet.

N Aquifer well yield on the 1882 Reservation in the vicinity of the Hopi Mesas is about 100 gallons per minute (gpm). The N Aquifer is thicker in the northern portion of the 1882 Reservation, where N Aquifer well yield is about 350 gpm. In the far northeastern corner of the 1882 Reservation, the well yield can reach about 500 gpm. N Aquifer well yield in the unconfined portion of the aquifer under Moenkopi is about 25-30 gpm. Significant quantities of groundwater (i.e., more than about 40 gpm) cannot be obtained from N Aquifer wells anywhere on Moenkopi. Although N Aquifer water quality is generally very good, it exceeds the U.S. Environmental Protection Agency's Maximum Contaminant Level for arsenic at First and Second Mesas.

For decades, the N Aquifer's ancient, pristine and irreplaceable water was mined to slurry coal via a pipeline to the Mohave Generating Station near Laughlin, Nevada. My people have always viewed, and continue to view, the mining of this water as a desecration. Indeed, serious questions about the circumstances and validity of Hopi "consent" to this arrangement have never been answered.

Due to concerns of the Hopi Tribe and Navajo Nation regarding the long-term effects of withdrawals from the N Aquifer, the USGS established a monitoring program for water resources in the Black Mesa area in 1971. The program monitors N Aquifer water levels and water quality, compiles information on water used by Peabody Western Coal Company (PWCC) and tribal communities, maintains several stream-gaging stations, measures discharge at selected springs, conducts studies, and reports findings. The USGS has prepared progress reports on the monitoring program since 1978.

According to published USGS monitoring reports, N Aquifer groundwater withdrawals for mining and municipal uses began around 1965. Groundwater withdrawals from the N Aquifer reached a peak of 8,000 acre-feet in 2002. The average annual withdrawal between 1965 and 2016 was 5,063 acre-feet. This includes all withdrawals from the N Aquifer by PWCC, the Hopi Tribe, and the Navajo Nation. No other entity uses the N Aquifer.

PWCC has been the largest user of groundwater on Black Mesa since the late 1960s. PWCC began pumping in 1968 and averaged about 4,000 AFY from 1972 through 2005. From 2006 through 2021, PWCC pumping averaged 1,105 AFY. As a result of PWCC's reduced pumping

beginning in 2006 due to cessation of water mining for the coal slurry, some water levels in the confined portion of the N Aquifer have started to recover. Annual N Aquifer withdrawals by the Hopi Tribe between 2000 and 2016 averaged 498.2 acre-feet. Hopi Tribe N aquifer withdrawals were just under 440 acre-feet for 2020 and 2021. The maximum amount of water withdrawn in the past from the N Aquifer by the Hopi Tribe was 562.1 acre-feet in 2007.

Groundwater pumping has caused N Aquifer water-level declines. From the prestress period (before 1965) to 2021, the USGS reports that groundwater levels declined in 18 of 25 wells with measured water levels. Water levels in the unconfined area had a median change of -0.4 feet, with 7 of the 13 wells monitored indicating a water-level decline. Water levels in the confined area of the N Aquifer had a median change of -25.9 feet, and the changes ranged from -133.7 feet to +17.3 feet. Of the 12 wells monitored in 2021, 11 showed a water level decline.

Water level declines in the N Aquifer have led to reduced flow at springs and streams. The USGS reports downward trends in flow at Moenkopi School Spring, Pasture Canyon springs, and Moenkopi Wash. Many of these springs are vital to Hopi religious ceremonies and cultural practices.

B. The Impacts of Aging and Inadequate Water Infrastructure.

Current infrastructure on the Hopi Reservation is a patchwork of aging and inadequate systems, which has long jeopardized the well-being of our people and forced many to leave their ancestral lands. Without adequate infrastructure, the Hopi Tribe lacks the foundation upon which to build a well-functioning economy in the modern era.

Current Water Infrastructure. There are sixteen public water systems on the Hopi Reservation, all of which are supplied by groundwater, mostly through wells. Most of the systems were constructed between the 1950s and the 1990s with federal funds and assistance from the Indian Health Service. The systems have expanded incrementally over time as the village populations increased; as a result, much of the piping and storage volumes are undersized and are incapable of providing typical water demands and adequate fire protection. Our pipes are smaller than what is ordinarily used in typical cities and towns and the distances between fire hydrants within villages exceed that typically required by national standards. Other deficiencies include water towers and storage tanks in need of maintenance and pump houses and controls in need of refurbishment and replacement. Some supply wells are over fifty years old and approaching the end of their useful life, and some exceed EPA drinking water standards for arsenic.

In 2005-2006, Dr. W. Michael Hanemann and Dr. Dale Whittington, both economists with expertise in water resource management in developing countries, conducted a household survey of 737 households in the twelve main Hopi villages on the Hopi Reservation to determine detailed household water use behavior. According to the survey, 18% of the people who lived in homes in villages were not connected to a public water supply. Of those people, 84% accessed water through public taps or neighbors with connections to the public system with the remaining 16% obtaining water from windmills and springs.

Today, the enrolled membership of the Hopi Tribe stands at 14,768, approximately 9,000 of whom are residents of the Hopi Reservation. The Hopi Tribe estimates that at least 2,700 enrolled members on the Reservation live without running water. I live in one of the oldest continuously inhabited communities in the United States, the Village of Mishongnovi. Many homes in Mishongnovi do not have running water. These circumstances are inexcusable in the United States of America.

Socio-Economic Conditions. Lack of reliable water resources and water infrastructure on the Hopi Reservation has been detrimental to the health, safety, and prosperity of all residents of the Hopi Reservation. It has artificially restrained economic development and population growth. The Hopi Tribe has consequently suffered poor socio-economic conditions, resulting in extremely low household incomes and increased reliance on public assistance. These challenges are compounded by the lack of housing and basic modern amenities like running water.

The socio-economic conditions on the Hopi Reservation reflect the need for economic development to improve the lives of the Hopi people. The Hopi Tribal Council, as a sovereign government, is keenly aware of these socio-economic indicators as it leads efforts to develop economic strategies on the Reservation and drive initiatives to promote federal policies of tribal self-determination and economic self-sufficiency. The Tribe has worked tirelessly to generate economic development while continuing to protect its lands and cultural resources. The Hopi Tribe continues to explore and secure funding for economic development projects to capitalize on its natural resources, including exploration of coal gasification, solar/wind generation, and other alternative energy strategies. In addition to these energy development projects, future potential business ventures on Hopi lands include RV parks, hotel/motels, restaurants, campgrounds, convenience stores with gasoline stations, small tourism galleries or museums, billboards, and small travel centers and shopping centers. The Tribe and its affiliates also continue to be leaders in the cattle industry. Ranching is an integral part of Hopi life, and it is the most extensive land use activity on the Hopi Reservation today.

However, without reliable water and the infrastructure to deliver the water to where it is needed, the Hopi Tribe's strategies and efforts to improve economic conditions on the Reservation are doomed to failure. The Settlement Act is the first and most important step towards solving these problems.

Population. Hopi is one of the few tribes whose reservation is located on a portion of its ancestral homeland. A pillar of Hopi community is the call to return home that is inherent in all of us. However, the socio-economic conditions described above, in addition to historic federal assimilation policies, have forced many Hopi people to leave the Reservation. This, among other factors such as scattered housing and language barriers, makes it difficult to get a true count of the Hopi population.

Experts estimate the Hopi population in its ancestral territory exceeded 29,000 in the early 16th century but dropped dramatically to between 8,000 and 10,000 due to smallpox and other disease epidemics brought by the Spanish after their arrival in 1540.

During the Hopi Tribe's water adjudication, the Hopi Tribe retained expert witness, Dr. David Swanson, a renowned a demographer who holds a doctorate in sociology/population studies.[4] Using a complex autoregressive integrated moving average (ARIMA) method, Dr. Swanson forecasted that by 2100 the total population on the Hopi Reservation would be 20,142 (19,084 tribal members and 1,058 non-Hopi) and the total off-Reservation Hopi member population would be 23,338.

However, Dr. Swanson explained the limitations of the ARIMA method—namely that it relies on historical data to forecast the future and therefore assumes the same policies, economic conditions, and other factors that were in effect during the period of the beginning population data will continue unchanged into the future. Past federal laws and policies, such as the Indian Relocation Act of 1956 (Public Law 959; 70 Stat. 986), encouraged—if not outright forced—Native Americans to leave their reservations and traditional homelands and assimilate into the general population. *See* Cohen's Handbook of Federal Indian Law § 1.04; *see also, e.g.*, Lorie M. Graham, *"The Past Never Vanishes": A Contextual Critique of the Existing Indian Family Doctrine*, 23 Am. Indian L. Rev. 1, 15 (1998); Ryan Seelau, *Regaining Control over the Children: Reversing the Legacy of Assimilative Policies in Education, Child Welfare, and Juvenile Justice That Targeted Native American Youth*, 37 Am. Indian L. Rev. 63, 84 (2013). Less overt federal policies also affected migration. The child welfare system had a rippling effect on the separation of Native families. Graham, at 23-25, 53-54. Criminal legislation swept Native offenders into the federal criminal justice system, incarcerating and relocating Native people to off-reservation prisons and treatment facilities. Seelau, at 92-95. Many Native American men enrolled in the military during WWI and WWII and were often relocated off-reservation when they returned home from war through the federal government's relocation policies.

These historic federal policies have had lasting effects on reservation populations, even though federal policy has shifted away from assimilation, relocation, and termination and towards tribal self-sufficiency and sovereignty. *E.g.,* the Indian Civil Rights Act of 1968, (Public Law 90-284; 25 U.S.C. §§ 1301 *et seq*.); the Indian Education Act of 1972 (Public Law 92-318); the Indian Self-Determination and Education Assistance Act of 1975 (Public Law 93-638); the Tribally Controlled Schools Act of 1988 (Public Law 100-297); the Indian Education Act of 1988 (Public Law 100-427).

The Hopi population has been deeply affected by these policies. Although Hopi resisted efforts to send our children to off-Reservation boarding schools at the turn of the 20th century, many Hopi children attended boarding schools and other off-Reservation schools through 1985 when the first high school opened on the Hopi Reservation. Many Hopis enroll in the military. Many have left in search of economic opportunities. Dr. Swanson's ARIMA method could not account for how policy changes will impact future demographic patterns.

The United States' population expert during the Hopi Tribe's water adjudication was Dr. Gretchen Greene, a PhD economist with an expertise in economic development on Indian reservations. Using a Cohort Component Method (CCM), Dr. Greene forecasted that by 2110 the total population on the Hopi Reservation would be 49,301 and would reach a stable population at

[4] Curriculum Vitae available at https://profiles.ucr.edu/api/CvAttachment/7034812.

52,016 sometime thereafter. Unlike Dr. Swanson's ARIMA projection, Dr. Greene's CCM allowed her to model the "components of change" in a population (i.e., births, deaths, and migration) rather than rely only on historical population or enrollment data.

Based on all of the best available data and projection methods provided by the United States and Hopi Tribe experts, the Hopi Tribe predicts a future on-Reservation population of 52,016. The Hopi Reservation cannot serve as a permanent homeland for the Hopi people without sufficient reliable water to meet the needs of the entire population, and infrastructure to get that water to where it is needed.

IV. Conclusion

In the closing lines of the Arizona Supreme Court's seminal opinion on the water adjudications in Arizona, the Court expressed its sincere "hope that interested parties will work together in a spirit of cooperation, not antagonism" in resolving Native American tribes' claims to federal reserved water rights for their reservations. *In re Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source* ("*Gila V*"), 35 P.3d 68, 81 (Ariz. 2001). The Court aptly observed that "the welfare and progress of our indigenous population is inextricably tied to and inseparable from the welfare and progress of the entire state." *Id.* Twenty years later, the Hopi Tribe seeks nothing more than a fair allocation of water and adequate infrastructure to make the Hopi Reservation an abiding and livable homeland for present and future generations of Hopi. Despite the practical difficulties of surviving in such an arid, and often hostile, environment, the Hopi Tribe has a well-documented history of thriving in northeastern Arizona for a thousand years.

In a spirit of cooperation, the Northeastern Arizona Indian Water Settlement identifies the water quantities, water resources, and critical infrastructure needed to deliver safe, reliable water that will allow the Hopi Tribe to prosper and continue to preserve its history, culture, and religious traditions on its aboriginal homeland for another thousand years.