water

MDPI

Review

Spatio-Temporality and Tribal Water Quality Governance in the United States

Teresa Cavazos Cohn [1,*], Kate Berry [2], Kyle Powys Whyte [3] and Emma Norman [4]

[1] Department of Natural Resources and Society, University of Idaho, McCall Field Campus, McCall, ID 83638, USA
[2] Department of Geography, mailstop 154, University of Nevada—Reno, Reno, NV 89557, USA; kberry@unr.edu
[3] Department of Philosophy and Department of Community Sustainability, Michigan State University, East Lansing, MI 48824, USA; kwhyte@msu.edu
[4] Native Environmental Science Department, Northwest Indian College, 2522 Kwina Road, Lummi Nation, Bellingham, WA 98226, USA; enorman@nwic.edu
* Correspondence: tcohn@uidaho.edu; Tel.: +1-208-885-1080

Received: 10 November 2018; Accepted: 2 January 2019; Published: 9 January 2019

Abstract: Hydrosocial spatio-temporalities—aspects of water belonging to space, time, or space-time—are central to water governance, providing a framework upon which overall hydrosocial relations are constructed, and are fundamental to the establishment of values and central to socio-cultural-political relationships. Moreover, spatio-temporal conceptions may differ among diverse governing entities and across scales, creating "variability" through ontological pluralism, as well as power asymmetries embedded in cultural bias. This paper explores spatio-temporal conceptions related to water quality governance, an aspect of water governance often biased toward technical and scientific space-time conceptions. We offer examples of different aspects of spatio-temporality in water quality issues among Tribes in the United States, highlighting several themes, including spatiotemporal cycles, technological mediation, and interrelationship and fluidity. Finally, we suggest that because water is part of a dynamic network of space-times, water quality may be best governed through more holistic practices that recognize tribal sovereignty and hydrosocial variability.

Keywords: water quality; Indigenous water; spatio-temporal; hydrosocial; water governance

1. Introduction

This paper explores spatio-temporal conceptions related to tribal water quality governance. Our discussion opens with two water contamination incidents involving the Navajo Nation and the Mohawk community of Akwesasne in order to draw attention to the "watery networks" in which tribal water quality governance is embedded [1,2], as well as ontological differences and the inherently political, colonial, and decolonizing processes associated with these networks [3–8]. We then examine spatio-temporality in tribal water quality governance by focusing on three themes: spatio-temporal cycles, technological mediation, and interrelationship and fluidity paired with related water quality examples involving the Nez Perce Tribe, Miccosukee Tribe, and Isleta Pueblo. We conclude by revisiting the original Navajo Nation example, suggesting that tribal water governance discussions, and even broader water governance literature, may benefit from applying a spatio-temporal lens. Boelens [9], notes that "water is the symbolic and material power linking time, space and place." Linton and Budds [1] write that water and society "make and remake each other over space and time." While space and time are central to hydrosocial discussions, spatio-temporalities themselves have received little explicit attention.

1.1. Tribal Water Quality Governance

On 5 August 2015, an Environmental Protection Agency (EPA) contractor accidentally released pressurized water above an old mine adit, spilling 300 million gallons of contaminated mine materials into Cement Creek, which flowed downstream into the Animas River [10,11]. La Plata County, Colorado, declared a state of emergency as the Animas River turned yellow and acidic with heightened levels of copper, manganese, zinc, lead, mercury, and arsenic [11,12]. Flowing at one to two miles per hour, contaminated water from the Animas emptied into the San Juan River in the state of New Mexico and reached the Navajo Nation, which declared a state of emergency on 12 August, stating that the incident was, "causing unknown health risks to our people, and water used by the Navajo people for irrigation, livestock and free roaming animals, disturbing the Navajo way of life" [13]. Navajo Nation President Russell Begaye issued a public service announcement warning affected chapters (local government units) to refrain from drinking or diverting water from the river, irrigating, and feeding it to livestock and pets [14]. Begaye threatened to sue Gold King Mine and the EPA on August 8th [15]. On 19 August, the EPA declared that water quality in the San Juan River had returned to pre-event conditions and was again usable for irrigation [16]. However, citing concerns over heavy metals settling in river sediments, President Begaye refused to lift irrigation restrictions. The Navajo Nation's Shiprock Chapter announced it would close canals for a year, despite the costs and efforts of hauling water, and the likelihood of losing crops [17,18]. On 21 August, President Begaye allegedly ordered police to confiscate 16,000 tanks of water delivered to communities to alleviate water shortages because of water contamination in the tanks [19,20]. He additionally advised Navajo people not to sign Standard Form No. 95, allegedly distributed by the EPA, regarding the waiving of claims for damages and injuries [21]. "I am furious," Begaye stated, and a local farmer noted, "We can't be compensated for all the prayers that was given to that water of life" [18].

This incident underscores how water, through its inherent dynamism, is connective within networks of governing entities, including tribal governments, the federal government (particularly the EPA), state governments, local governments, and the judiciary [22]. In this particular case, the U.S. EPA, the Navajo Nation executive branch, Navajo chapters, and the judiciary are connected in water quality governance networks. Such interconnectivities between governing entities—what Dennison terms "colonial entanglements" [23]—characterize water governance. Networks of water governance vary across cultural and physical geographies [24], between distinct water rights doctrines [25], and as a result of different treaties [26,27] and water settlements [22]; yet the common implication is that tribal water governance is not isolated, but rather connected to other governments through complex "watery" networks. Such networks are within, and produce, what Kevin Bruyneel calls a "third space of sovereignty," in which tribal governance "resides neither simply inside nor outside the American political system but rather on these very boundaries, exposing both the practices and contingencies of American colonial rule" [28]. Diver argues that water quality governance represents a productive "third space of sovereignty" for Tribes because networks connect the gains made by Tribes to other entities. As such, tribal water quality governance is both a territorial governance strategy and an extra-territorial strategy [29].

In the U.S., one significant network associated with tribal water quality governance relates to the Clean Water Act's (CWA) Treatment in a manner similar to a State (TAS) provision [29–36]. TAS was first applied to the CWA through 1987 amendments, in which Congress acknowledged the capacity of tribal governments in water quality planning, monitoring, and implementation, such that federally-recognized Tribes may now apply for and receive TAS. The EPA, a federal regulatory agency, determines TAS status and approves standards and other water quality control measures, just as they do for state governments. Currently, only 60 federally-recognized Tribes have been approved to administer their own water-quality standards program, and 44 Tribes have had their water quality standards accepted, or fewer than ten percent of eligible Tribes [37–39]. The Navajo Nation has TAS status and received approval to administer a water quality standards program in 2006, the same year that EPA approved its water quality standards [37].

Significantly, definitions of water quality, methods of determining water quality, and responses to water degradation are not always shared [6,24,40]. As the incident above described, President Begaye refused to lift water restrictions for the Navajo Nation when the EPA announced that water quality had returned to pre-event levels, and even local Navajo chapters did not respond homogeneously to contamination concerns. Such acute water contamination, often resulting from industrial, mining, urban, or agricultural pollution, raises complicated proprietary and regulatory issues for tribal governments and Indigenous groups vis-à-vis federal, state, and local governments [33]. Tribal governments are forced to maneuver ways to resolve the impacts of such pollution, while simultaneously exercising jurisdictional influence, both on and off the reservation [22,30,35,41].

We offer a second case to illustrate the significance of political organization and ontological differences within the complex networks that imbricate tribal governments and Indigenous organizations. In 1958, New York Power Authority and Ontario Power Generation jointly constructed the Robert Moses-Robert H. Saunders Power Dam [42]. Low-cost hydropower generated by this dam supported industry development, including General Motors (1958), Reynolds Metals (1959), and Dominion Tar and Chemical (1961), located upstream and upwind of the Mohawk community of Akwesasne [40,43]. These industrial facilities produced significant amounts of contamination, including polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), phenols, and volatile organic compounds (VOCs) [43,44]. In 1986, the Health Service for the St. Regis Mohawk Tribe issued fish consumption advisories [40], and in later studies between the Akwesasne community and the State University of New York (SUNY), Albany identified contaminants passing from water to fish to humans [40,45–47]. A number of tribal governments and Indigenous organizations strategized ways to combat pollution, including the Mohawk Council of Akwesasne and the St. Regis Mohawk Tribe, the Akwesasne Task Force on the Environment, the Mother's Milk Project, the Traditional Mohawk Nation Council of Chiefs, and the leadership of Mohawk scientists in the Saint Lawrence River Institute [43]. Moreover, some members of this network emphasize not just water quality as determined by measurement and assessment of water in a particular place at a particular time, but by the level of disruption in the moral relationships that create the fabric of Mohawk societies [48,49]. For example, Arquette et al., emphasize, "When considering true risk, social and cultural impacts must be included with toxicologic and ecologic factors" [50]. Arquette, Cole and the Akwesasne Task Force on the Environment write, "The scientific view is that specific forms of damage have resulted from the accumulated harm caused by the damming of the river and its resulting industrialization. Our view is that as a consequence of these actions, the reciprocal relationships between human beings and non-human nations have been negatively affected" [51]. Elizabeth Hoover describes both physical and cultural health consequences of breaking the relationship between fish, "whose duty it is to cleanse the water and offer themselves as food", and humans, "whose role it is to respectfully harvest these fish" [40]. Moreover, contamination spreads beyond just water and fish as pollutants are absorbed in medicinal plants, which in turn leads to traditional health care providers not recommending these as natural remedies [52]. Inextricable linkages between human health and environmental health—viewing the quality of water and quality of life as related—call attention to fundamentally different ontologies associated with water quality governance networks. For example, while the EPA has been active in site remediation and fish consumption advisories, both Hoover [40] and Arquette et al. [50] call for more nuanced approaches to risk assessment with greater emphasis on cultural context and less emphasis on streamlined techno-scientific analysis. In addition, from a political standpoint, this example shows how tribal governance of water quality is embedded in colonial processes (such as industrial development), along with efforts to decolonize [3–8].

1.2. Space and Time in Indigenous Ontologies

Space and time, and their connection as space-time, create a fundamental fabric of reality, as well as a practical concern of daily life. Conceptions of time and space are diverse among Indigenous groups and perhaps impossible to thoroughly represent or interpret through a different language and culture. Regardless, we offer a few rough sketches from scholarly literature. Northern Arapaho space-time is a "four-stage-four-direction order that synthesizes linear and circular motion within the same space-time" [53]. Aymara people use the word nayra (eye/front/sight) as an expression for the past, and qhipa (back/behind) for the future, and thus gesture forward when referring to the past and backward when referring to the future [54]. Residents of the eastern Australian Aboriginal community Pormpuraaw use directional terms (North/South/East/West) instead of what English-speakers refer to as right or left and time progressions are represented from east to west, as an English timeline would move from left to right [55]. The Yupno of mountainous Papua New Guinea conceive of the past as downhill, the present as located with a speaker, and the future as uphill in a non-linear temporality, reflecting the local topography [56]. Like the Yupno spatio-temporal constructs, some chronologies do not track time as a linear flow of the past, present, or future [57]. The Anishinaabemowin (Neshnabémwen) expression aanikoobijigan (yankobjegen) means both ancestor and descendant, so the speaker is linked simultaneously to future and past generations through spiraling time [58]. Finally, in Maori, the words space and time are the same [59].

Several Indigenous scholars emphasize that altering such fundamental conceptions of space-time is a critical component of Euro-American colonization processes. With regard to time, Vine Deloria [60] wrote, "It is debatable which factor was most important in the destruction of tribal ceremonial life: The prohibition of . . . traditional rituals . . . or the introduction of white man's system of keeping time." Regarding space, Linda Tuhiwai Smith [59] emphasizes, " . . . indigenous world view, the land and the people, have been radically transformed in the spatial image of the West. In other words, indigenous space has been colonized." The collision/combination of Euro-American and Indigenous space-times has resulted in hybrids, desynchronizations, divergence, resistance, evolution, and adaptation [61] or spatio-temporal colonial entanglement [23,62]. These dynamic space-times are central—and often invisible—to governance dynamics, associated with networks that connect tribal governance processes to "a more comprehensive universe that entails critical values and potencies in which governance is grounded" [63].

2. Spatio-Temporal Themes in Water Governance Literature

2.1. Spatio-Temporality in Tribal Water Quality Governance

Focusing on spatio-temporality, we have identified three central themes through which to examine tribal water quality governance: Spatio-temporal cycles, technological mediation, and interrelationship and fluidity. In the following discussion, we describe each theme and then connect the theme to a tribal water quality governance example. We continue to draw on these examples to illustrate governance networks, ontological pluralism, political colonial processes, and decolonization using a spatio-temporal lens.

2.2. Spatio-Temporal Cycles

Cycle is defined most generally as a series of regularly repeated events, though the term carries disciplinary nuances [64]. In Earth sciences, "cycle" refers to processes of movement and transformation; for example, the Oxford Dictionary of Geology and Earth Sciences defines the hydrologic cycle as "the flow of water in various states through the terrestrial and atmospheric environments" [65]. Linton, and others [66–69] examine the historical roots of this term, note its limitations, and use the term "hydrosocial cycle" to acknowledge and emphasize the importance of social processes in dimensions of water. Linton and Budds define the "hydrosocial cycle" as "a socio-natural process by which water and society make and remake each other over space and

time" [66]. The following discussion embeds itself in this broader context, in which combined social and physical processes shape, and are shaped by, the flow of water [69] in cyclic or repeated ways over space and/or time.

Cycling may take place on large or small spatio-temporal scales [70,71] and involve synchronous or asynchronous patterns in social relationships with water [72,73]. This cycling may involve annual processes such as, for example, toxic contaminants in streams that cycle seasonally [71] or increased water temperatures related to anthropogenic climate change, which affect fisheries [74]. Governance processes, rather than bio-physical processes, may also drive cycling, such as those involving environmental impact statement procedures as dictated by the U.S. National Environmental Policy Act (NEPA) [75] or judicial appeals processes [76]. More pointedly, cycles may circulate within networks of socio-natural systems with ontological and political dimensions. We offer the following tribal water quality example involving mining impact on water quality and the Nez Perce Tribe.

Water Quality Governance Example: Stibnite Gold Project and the Nez Perce Tribe

In September 2016, Midas Gold submitted a plan proposing new mining and milling activities in a historical mining district of West Central Idaho. "The Stibnite Gold Project" involves National Forest System lands, and specifically, the Payette National Forest, within an area open to mineral extraction under the General Mining Act of 1872. The project aims to extract four to five million ounces of gold and 100–200 million pounds of antimony over an approximate 20-year construction and operations period [77].

On 9 October 2018, the Nez Perce Tribal Executive Committee passed a resolution formally opposing the Stibnite Project [78]. The Tribe expressed concern about the environmental and cultural impacts of mining operations, including the effects of a proposed open pit mine, 100 million tons of toxic mine tailings, and 350 million tons of waste rock to be stored at the site in perpetuity. The site, which has been intermittently mined since 1902, is located in the Nez Perce aboriginal territory, where the Tribe maintains treaty rights ensuring tribal use of usual and accustomed places [79–81]. The South Fork of the Salmon River, downstream of the mine, supports a culturally significant salmon fishery; the Tribe spends over 2.5 million dollars each year on hatchery supplementation, fishery research, and watershed restoration in that area to support salmon populations impacted by prior mining practices [78,81].

A comparison of the Nez Perce Tribal Executive Committee resolution to oppose the Stibnite Gold Mine [78] and Midas Gold's Stibnite Gold Project Plan of Restoration and Operations [77] illustrates several examples of spatio-temporal cycles associated with mining and water quality. First, the Tribe links proposed Stibnite activities to disruption in cyclic patterns associated with networks that sustain water quality-salmon-Nez Perce relationships. Salmon and water quality are both critical to Nez Perce culture. As a medicine, water flushes toxicity from stream systems, animals, and people; and cold, clean, high altitude water (which characterizes water at the Stibnite site) is valued over lower elevation warmer waters, in part because it supports salmon, which are central to Nez Perce ideological and material foundations [79,82]. Nez Perce people have maintained traditional fishing cycles—and governance that ensures the continuance of these cycles—for generations, with regard to fish harvests of tribal members [79], for example, and the development of multi-million dollar fisheries programs [81]. In a whitepaper developed to increase knowledge about the Tribe's interests and activities in and around the Stibnite Gold Project area, the Tribe emphasizes mining threats to water quality and salmon [81]:

> [The Tribe has] installed nine fish passage projects . . . and decommissioned 180 miles of road to reduce sediment levels . . . detrimental to listed fish species. Renewed mining activities such as the Stibnite Gold Project, however, could undermine the gains in fisheries and habitat improvements vital to the Tribe by negatively affecting . . . watersheds through increased sedimentation to streams (mining activities, increased traffic adjacent to streams), potential fuel and chemical spills, and decreased water quality resulting from mineral exploration.

Moreover, the Nez Perce Tribe suggests that proposed mining activity is directly connected to historic cycles of negative cultural and water quality impacts; the corporate project could be the next in a series of broken promises. For example, the tribal resolution references mining boom-bust cycles affecting local economies and water quality, including repeated incidents in which gold mining resulted in disastrous consequences for the Tribe:

> Gold mining has left a legacy of destruction and contamination and boom and bust economies, the scars of which are still visible throughout the Tribe's aboriginal territory, the American west, and world; and . . . gold mining within the Tribe's aboriginal territory has specifically led to the diminishment of the Tribe's Reservation in the Treaty of 1863; the armed clash between the Nez Perce and the U.S. Army; and the diminishment of the Tribe's Treaty-reserved natural resources, including the extirpation of Spring/Summer Chinook salmon in the upper East Fork South Fork Salmon River in the 1940s.

Finally, temporal cycles differ between Midas Gold's plan and the Nez Perce resolution. Midas Gold outlines three time-cycles: Three years of construction and development, 12 to 15 years of operation, and two to three years of reclamation and closure. In contrast, the Nez Perce Tribe views the mining operation as one in a series of resource extractive events since Euro-American settlement, negatively impacting water quality and fisheries. In short, because of their connection to place, Nez Perce governance cycles are much longer than the mining company's, based on many generations' prior experiences, as well as critical socioecological cycles that will sustain the Tribe and water quality for many generations to come.

In sum, *spatio-temporal cycles*, or repeated processes over space and/or time in tribal water quality governance, are illustrated in this example through the disturbance of cyclic patterns that sustain water quality-salmon-Nez Perce relationships, boom-bust cycles affecting local economies and water quality, and different conceptions of spatio-temporal cycles related to project planning and water quality risk.

2.3. Technological Mediation

Hydrosocial spatio-temporalities are influenced—intentionally and unintentionally—by the application of scientific knowledge and practices to water. We refer to this as *technological mediation*. As Leslie Head suggests, human communities are dependent on distant water flows, but also "pipes, pumps, weirs, and web-based financial transfer instruments", along with other technologies that mediate "human-water relations in various ways and across both space and time" [72]. Such technological mediation may involve water quality through monitoring regimes that assess certain parameters in particular places over time [83]; water infrastructure including dams, diversions, treatment facilities, and irrigation equipment [69,84–87]; and a range of technologies that are not specifically water-oriented, but influence water governance [72,88]. As such, technologies that Tribes contend with (each in their own fashion) serve to mediate power relations, inform cultural histories [87], and reconfigure space and time, as they restructure "watery" networks.

Water Quality Governance Example: The Miccosukee

The Miccosukee Tribe of Indians (or simply, the Miccosukee) became a federally recognized Tribe in 1962. In 1994, the Miccosukee received TAS status under the CWA and in 1999, the EPA approved their water quality standards. Given that Miccosukee homelands are in close proximity to the City of Miami, Florida, the Tribe has been active in initiatives designed to protect water quality, wildlife, and tree islands of the Everglades. In addition to reservation lands in and around the Everglades, the Miccosukee Tribe has a perpetual lease to lands within Water Conservation Area 3A, deep within the Everglades. Tribal members hunt, fish, and gather materials in these areas, engage in religious planting and harvesting on tree islands, and operate a recreational business for visitors to the Everglades [89]. As Carden observes, tribal members rely "upon the integrity of Everglades ecosystem to support its religion, culture, and economic survival" [89].

The Miccosukee Environmental Protection Agency supports a dedicated Water Resources Department (Miccosukee WRD) that addresses water flows and water quality as a key aspect of Everglades restoration. This tribal initiative is especially challenging due to the multiple layers of water control technologies deployed and operated at various times by different government entities, each designed to manage waters of the Everglades. For example, the Central and South Florida (C&SF) Project is a particularly intricate and aggressive system of water control operated by the U.S. Army Corps of Engineers composed of dams, gates, canals, levees, and pumping stations, designed to control water flows over 16,000 square miles so as to serve the various needs of a residential area to the east, an agricultural area to the south, and the Everglades National Park, but not the needs of the Miccosukee [90]. As a result of this and other water control systems, it is clear that the "watery" networks the Miccosukee are involved in are strongly mediated by a variety of technologies.

In an effort to improve the impact of these highly modified aspects of the Everglades' flow regime, the Miccosukee WRD has deployed its own technological mediation by addressing the hydroperiod, water depth, flow volume, and velocity in ways that couple with their water quality management initiatives [91] and which differ from other governments' efforts. With this end in mind, the Tribe recently asserted its opposition to a proposed Florida transportation and recreation project [92]. The Tribe looks to both the past and the future in developing approaches to address flow regime modifications that change the spatialities of water and land within the Everglades. In so doing, the Miccosukee both counter and deploy technologies to spatially and temporally re-orient "watery" networks.

Because water quality is important to the Tribe, the Miccosukee have actively resisted technologies that may contaminate the waters of the Everglades and litigation has become a significant dimension of their tribal water quality governance. The Miccosukee Tribe has instigated or been an intervenor in many different cases related to water quality and environmental issues in the Everglades, including cases that started in 1988, 1994, 1998, 2002, and 2004, many of which continued for years [93]. For example, a 1998 case, which resulted in a 2004 U.S. Supreme Court decision in favor of the Miccosukee, concerned a pumping system operated by the South Florida Water Management District (the District). The Miccosukee sought to require the District to be regulated under a CWA National Pollution Discharge Elimination System (NPDES) permit for conveying waters laden with high levels of phosphorus and other contaminants into the Everglades, [89]. The District argued that the Everglades are one—a singular water—denying any change to spatial boundaries and thus arguing that regulation was rendered irrelevant. Conversely, the Miccosukee successfully argued that water quality differences resulted in a different set of spatialities in which boundaries were created by differences in water quality [93]. This litigation, along with other court battles, underscore another strategy for tribal water quality governance, one that effectively changes the spatial orientation of a "watery" network through technological mediation. In so doing, the Miccosukee open up a "third space of sovereignty."

2.4. Interrelationship and Fluidity

Interrelationship and fluidity are two related and significant spatio-temporal themes. *Interrelationship* refers to the interdependence of all beings, or interconnectivity created by, and inherent in, water—socially and materially [94]; or as McGregor [95] writes, "when one considers water, one must consider all that water supports and all that supports water". As a value commonly referenced in Indigenous water governance literature, this interrelationship is often contrasted with the more fragmented Euro-American categorization of water (e.g., surface water, groundwater) or hierarchical positioning (e.g., tiered uses such as municipal, industrial, recreational) [41,94,96]. Similar terms, such as "complex connectivity" [97] and "holism" [95], convey related concepts, recognizing reciprocity between people and water. Time and space are fundamental to this web of "co-becoming" [98] as water circulates across space and over time as an interconnected whole [95].

If *interrelationship* is the web of connectivity, *fluidity* is the movement within the interconnected relationships, which contributes to the constitution of the web itself. *Fluidity* is the capacity to flow,

is not settled or stable, and is likely to change [64]. By means of this motion, water transports materials through both space and time and across scales in movements " . . . as fleeting as the tiny capillary shifts through which water crosses a plant membrane, or as literally glacial as the accumulation of meltwater in underground aquifers" [99]. Metaphorically, this fluidity reflects constant motion in adaptive relationships between Tribes and water over space and through time [100].

Water Quality Governance Example: Isleta Pueblo

The nineteen Pueblos in New Mexico have a unique relationship with the U.S. because of their history with Spain and then Mexico; the fact that they own their land—their lands are not held in trust by the U.S.; and the fact that no Pueblo has signed a treaty with the U.S. These factors, plus traditions and governance structures that differ politically and culturally between each Pueblo, lead to unique governance networks [25]. Amidst these networks, Pueblos are entitled to the same benefits as other Tribes under the CWA. As such, the Isleta Pueblo was the first Pueblo or Tribe to receive TAS status on 13 October 1992 and the EPA approved the Pueblo's water quality standards on 24 December of that same year [37]. Since the Isleta Pueblo (population 3725) is located on the Rio Grande River, five miles downstream from the City of Albuquerque (population 545,852) [101] and from one of the city's wastewater treatment plants discharges into the Rio Grande, the EPA revised a permit to the City so that its effluent met both the State standards and new Pueblo's standards, which were more stringent than those of the State [102,103].

Notably, and as part of their water quality standards, the Isleta Pueblo designated ceremonial uses as a primary contact use, and specified related standards for a number of pollutants, including *Escherichia coli (E. coli),* bacteria, algae, organic contaminants, heavy metals, and total inorganic nitrogen [104]. Of particular concern were high arsenic and ammonia concentrations, resulting from wells tapping aquifers with a high arsenic content [102].

The City of Albuquerque filed a motion for summary judgment on 11 June 1993 in the District Court of New Mexico, charging that EPA misinterpreted two provisions of the CWA, failed to provide a mechanism to resolve unreasonable consequences arising when a Tribe and State oppose different standards on a water body, and that the standards lacked rational scientific basis [103]. Notable in its questions was that ceremonial use violated the Constitution by imposing a mandate aiding tribal religion at the expense of the City [102]. The District Court upheld the EPA's approval of Isleta Pueblo standards and the Tenth Circuit affirmed the District Court; the U.S. Supreme Court declined to hear the case and Isleta water quality standards held.

Several aspects of interconnection and fluidity are evident in this case. First, not only does water connect Tribes to distant upstream and downstream relationships through waterways themselves [72]; Tribes are also connected to governance networks that include, for example, regional and national EPA offices; district, state, regional, and federal courts; and tribal offices across the region, with hubs in Washington, DC, Denver, Santa Fe, along the Rio Grande, and beyond. These networks are constituted through fluid relationships in at least three ways. First, very literally, sewage from the City of Albuquerque is treated in a wastewater treatment plant that discharges effluent flowing downstream. Through its fluidity, the activities involved in water treatment are connected to the activities of Isleta Pueblo residents, including their ceremonial uses of water. Yet the motions and activities upstream are also affected by downstream users; the City of Albuquerque's discharge activities changed as the result of Isleta's governance imposing restrictions upstream. Upstream and downstream communities thus affect one another through fluid motions that connect the entire hydrosocial system. Second, fluidity includes the courts passing decisions up and down a judicial hierarchy, and through networks of federal, state, tribal, and local governing entities. Finally, fluidity moves between scales. The movements of water across plant membranes are connected to the 10th Circuit Court of Appeals in Denver; plumbing pipes in Albuquerque homes are connected to Rio Grande cottonwoods. Interrelationships are hydrosocial in the sense that their fluid movements contribute to the constitution of the governance itself.

3. Conclusions

Water both creates, and is created by, dynamic networks of space-time. Likewise, tribal water quality governance is constituted through and reconstitutes spatio-temporalites. In this paper, we have explored how spatio-temporal cycles, technological mediation, interrelationship, and fluidity illustrate the dynamism of spatio-temporality in tribal water quality governance, but also demonstrate how spatio-temporality may provide a lens through which to examine nuances of water governance itself.

Spatio-temporal cycles illustrate the role played by regularly repeated processes over space and/or time in tribal water quality governance. *Technological mediation* underscores how technologies both facilitate and impede tribal water quality governance through modifying flow regimes, influencing the spatial and/or temporal orientation of values associated with water quality, and recreating or reinforcing temporal and/or spatial boundaries that constrain water quality governance options. *Interrelationship* illustrates the interconnected networks of water governance, with *fluid* movement through waterways themselves, but also through federal, tribal, state, and local governance assemblages; up and down judicial hierarchies; and across scales, from osmotic membranes to transportation pipes to ceremonial practices and courts.

Moreover, these categories are cast within networks and are not exclusionary; spatio-temporal cycles are embedded in technological mediation, just as an interrelationship facilitates fluid movements. Tribal water quality governance is thus composed of spatio-temporal hybrids, desynchronizations, divergence, resistance, evolution, and adaptation among governing groups [61]. Gibbs [105,106] uses the term "variability" to describe the dynamism of the physical, social, cultural, and ontological qualities of water, which incorporate diversity, change, and complexity. "Spatio-temporal variability" is thus an apt term to illustrate the complexities of space and time in tribal water quality governance. Tribes simultaneously use technical and scientific space-times to, for example, establish water quality standards, operate dams, and manage fisheries operations, while simultaneously governing in what Hatfield et al., [57] define as "Indian time" or an orientation to other environmental phenomena in relationship to appropriate behavior and action. The Nez Perce Tribe, for example, manages streams to maintain reciprocal relationships with salmon through highly technical fisheries and water quality sampling operations. The Miccosukee Tribe, whose members continue to hunt, fish, gather, plant, and harvest on tree islands, works on water quality governance and to improve water inflows in the Everglades, both through countering water infrastructure development and strategically deploying infrastructure and technology in their own right. The Isleta Pueblo sets water quality standards that meet their Tribe's designated uses according to TAS protocol under the CWA.

In conclusion, we return to the Gold King Mine Spill. Diné scholar Teresa Montoya reflects on the incident a year later through a photo essay composed of text coupled with images along the spill path between Silverton, Colorado, and Shiprock, New Mexico [20]. She illustrates *interrelationship* and *fluidity* over space and through time by connecting Diné people with both the literal path of contaminants, and policies that divorced Indigenous peoples of the region from their homelands and waters to allow mining to take place. She depicts this interconnectivity through images of community members gathering along the San Juan River to begin a nine-mile second annual Gold King Mine Spill Resilience Walk, an old water tank along the San Juan decorated with Diné figures and the words "water is life," and an image of water flowing through mineral stained rock from acid mine drainage near Silverton. "There have been spills before," she writes, citing Navajo community concerns over repeated *cycles* of upstream contamination, including uranium and vanadium from the 1960s that disrupted Diné-water relationships, including those involving cycles of daily sustenance over many generations. An image depicts a uranium mill site warning sign advising humans and animals not to drink water. She remembers tracking the Gold King mine contamination moving downstream, first on social media, and then into the San Juan River, where "one by one, irrigation gates were shuttered for Diné communities." Simultaneously, "environmental organizations, universities, and tribal agencies assembled teams to sample the soil and water" as various *technologies* were employed to *mediate* potential contamination, as well as assess contamination. Connecting *cycles*, *technological*

mediation, and *interrelationship* and *fluidity* in one sentence, she writes, "the spill revealed as much about the present fissures in bureaucracy and jurisdiction as it did about the fragmentation of Indigenous territories that first occurred when the mines were built."

Amidst networks that extend across multi-jurisdictional decisions, a spatio-temporal lens may help illustrate such fissures. For example, a spatio-temporal lens may reveal cycles of space and time that circulate in parallel to the ontologies upon which water quality governance is premised. Recognizing how particular technologies that mediate water quality governance associate with space and time configurations may enable the restructuring of power relations to facilitate a "third space of sovereignty." Finally, a spatio-temporal lens may make the interconnections and fluidity that characterize water quality governance networks apparent. In sum, a spatio-temporal lens may facilitate more holistic practices that recognize hydrosocial variability and tribal self-determination.

Author Contributions: Conceptualization, T.C.C., K.B., E.N.; Methodology, K.B., T.C.C.; Writing-Original Draft Preparation, T.C.C., K.B., K.P.W., E.N.; Writing-Review & Editing, T.C.C., K.B.; Project Administration, T.C.C.; Funding Acquisition, T.C.C., K.B., K.P.W.

Funding: This material is based upon work supported by the National Science Foundation under Grant No. 1636533 and the APC was provided by the University of Idaho Open Access Publishing Fund.

Acknowledgments: The authors would like to thank reviewers of this article for their helpful comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Linton, J.; Budds, J. The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water. *Geoforum* **2014**, *57*, 170–180. [CrossRef]
2. Berry, K.A. Actor-network theory and traditional cultural properties: Exploring irrigation as a hybrid network in 19th century, Hawaii. *Hum. Geogr.* **2014**, *7*, 73–87.
3. Stevenson, S.A. Decolonizing hydrosocial relations: The river as a site of ethical encounter in Alan Michelson's TwoRow II. *Decolonization-Indig. Educ. Soc.* **2018**, *7*, 94–113.
4. Yazzie, M.K.; Baldy, C.R. Introduction: Indigenous peoples and the politics of water. *Decolonization-Indig. Educ. Soc.* **2018**, *7*, 1–18.
5. Griffith, J. Do some work for me: Settler colonialism, professional communication, and representations of Indigenous water. *Decolonization-Indig. Educ. Soc.* **2018**, *7*, 132–157.
6. Daigle, M. Resurging through Kishiichiwan: The spatial politics of Indigenous water relations. *Decolonization-Indig. Educ. Soc.* **2018**, *7*, 159–172.
7. Norman, E.S. Standing up for inherent rights: The role of Indigenous-led activism in protecting sacred waters and ways of life. *Soc. Nat. Resour.* **2017**, *30*, 537–553. [CrossRef]
8. Wilkinson, C.F. *Blood Struggle: The Rise of Modern Indian Nations*; WW Norton & Company: New York, NY, USA, 2005; ISBN 0393051498.
9. Boelens, R. Cultural politics and the hydrosocial cycle: Water, power and identity in the Andean highlands. *Geoforum* **2014**, *57*, 234–247. [CrossRef]
10. US EPA. Emergency Response to August 2015 Release from Gold King Mine. Available online: http://www2.epa.gov/goldkingmine (accessed on 18 October 2018).
11. Chief, K.; Artiola, J.F.; Beamer, P.; Wilkinson, S.T.; Maier, R.M. *Understanding the Gold King Mine Spill*; Superfund Research Program; The University of Arizona: Tucson, AZ, USA, 2016.
12. U.S. Environmental Protection Agency (EPA). Summary of Surface Water Sampling of Select Metals Results to Date, Gold King Mine Blowout. Available online: http://www2.epa.gov/sites/production/files/2015-08/documents/data_update_08082015.pdf (accessed on 18 October 2018).
13. Navajo Nation. Declaration for State of Emergency. Available online: http://www.navajo-nsn.gov/NewsReleases/OPVP/2015/aug/20150810-DeclarationforStateofEmergency.pdf (accessed on 18 October 2018).
14. Navajo Nation. San Juan River Public Service Announcement 8/8/2015. Available online: https://www.youtube.com/watch?v=Hw-Y9v8An5w&feature=youtu.be (accessed on 18 October 2018).

15. Quintero, D. Begaye to Sue Gold King Mine and EPA. *Navajo Times*, 9 August 2015. Available online: https://www.navajotimes.com/reznews/begaye-to-sue-gold-king-mine-and-epa/(accessed on 18 October 2018).
16. US EPA. EPA Data Shows Water Quality in San Juan River in the Navajo Nation Back to Pre-Event Levels. Available online: https://www.epa.gov/goldkingmine/epa-data-shows-water-quality-san-juan-river-navajo-nation-back-pre-event-levels (accessed on 18 October 2018).
17. Navajo Nation. Navajo Nation President Begaye keeps Restrictions in Place for San Juan River 8/24/2015. Available online: http://www.navajo-nsn.gov/News%20Releases/OPVP/2015/aug/Navajo%20Nation%20President%20Begaye%20keeps%20restrictions%20in%20place%20for%20San%20Juan%20River.pdf (accessed on 18 October 2018).
18. Morales, L. Navajo Nation Farmers Feel the Weight of Colorado Mine Spill. *National Public Radio*, 17 August 2015.
19. Landry, A. Navajo Nation Sends Back Oily-Smelling Water Tanks. *Indian Country Today*, 21 August 2015.
20. Montoya, T. Yellow water: Rupture and return one year after the Gold King Mine spill. *Anthropol. Now* **2017**, *9*, 91–115. [CrossRef]
21. Navajo Nation Office of the President and Vice President. U.S. EPA Urges Navajo People to Waive Rights to Future Reimbursement Claims [Press Release] 8/12/2015. Available online: http://www.navajo-nsn.gov/News%20Releases/OPVP/2015/aug/U.S.%20EPA%20Urges%20Navajo%20People%20to%20Waive%20Rights%20to%20Future%20Claims.pdf (accessed on 18 October 2018).
22. McCool, D. *Native Waters: Contemporary Indian Water Settlements and the Second Treaty Era*; University of Arizona Press: Tucson, AZ, USA, 2006; ISBN 081652615X.
23. Dennison, J. Entangled sovereignties: The Osage Nation's interconnections with governmental and corporate authorities. *Am. Ethnol.* **2017**, *44*, 684–696. [CrossRef]
24. Chief, K.; Meadow, A.; Whyte, K. Engaging southwestern tribes in sustainable water resources topics and management. *Water* **2016**, *8*, 350. [CrossRef]
25. Pevar, S.L. *The Rights of Indians and Tribes*, 3rd ed.; Southern Illinois University Press: Carbondale, IL, USA, 2002.
26. Bernholz, C.D.; Weiner Jr, R.J. The Palmer and Stevens "Usual and Accustomed Places" treaties in the opinions of the courts. *Gov. Inf. Q.* **2008**, *25*, 778–795. [CrossRef]
27. Chandler, M.E. A link between water quality and water rights: Native American control over water quality. *Tulsa LJ* **1994**, *30*, 105.
28. Bruyneel, K. *The Third Space of Sovereignty: The Postcolonial Politics of US-Indigenous Relations*; U of Minnesota Press: Minneapolis, MN, USA, 2007; ISBN 0816649871.
29. Diver, S. Native water protection flows through self-determination: Understanding tribal water quality standards and "treatment as a state". *J. Contemp. Water Res. Educ.* **2018**, *163*, 6–30. [CrossRef]
30. Rodgers, W.H., Jr. Treatment as tribe, treatment as state: The Penobscot Indians and the Clean Water Act. *Ala. L. Rev.* **2003**, *55*, 815.
31. Saunders, M. Clean water in Indian Country: The risks (and rewards) of being treated in the same manner as a state. *Wm. Mitchell L. Rev.* **2009**, *36*, 533.
32. Fort, D.D. State and tribal water quality standards under the Clean Water Act: A case study. *Nat. Resour. J.* **1995**, 771–802.
33. Kannler, K.A. The struggle among the states, the federal government, and federally recognized Indian tribes to establish water quality standards for waters located on reservations. *Georget. Int. Environ. Law Rev.* **2002**, *15*, 53–77.
34. Maccabee, P.G. Tribal authority to protect water resources and reserved rights under Clean Water Act Section 401. *William Mitchell Law Rev.* **2015**, *41*, 618.
35. Moser, K.R. Water quality standards and Indian tribes: Are tribes afraid of clean water. *Univ. Denver Water Law Rev.* **2004**, *8*, 27–54.
36. Marx, J.; Walker, J.L.; Williams, S.M. Tribal jurisdiction over reservation water quality and quantity. *SDL Rev.* **1998**, *43*, 316–379.
37. US EPA EPA Actions on Tribal Water Quality Standards. Available online: https://www.epa.gov/wqs-tech/epa-actions-tribal-water-quality-standards-and-contacts (accessed on 18 October 2018).
38. Bureau of Indian Affairs Notice of Tribal entities recognized and eligible for funding and services from the Bureau of Indian Affairs by virtue of their status as Indian Tribes. Available online: https://www.federalregister.gov/documents/2018/01/30/2018-01907/indian-entities-recognized-and-eligible-to-receive-services-from-the-united-states-bureau-of-indian (accessed on 18 October 2018).

39. Berry, K.A. Tribes and water. In *A Twenty-First Century US Water Policy*; Oxford University Press: Northants, UK, 2012; pp. 90–108.
40. Hoover, E. Cultural and health implications of fish advisories in a Native American community. *Ecol. Process.* **2013**, *2*, 4. [CrossRef]
41. Flanagan, C.; Laituri, M. Local cultural knowledge and water resource management: The Wind River Indian Reservation. *Environ. Manag.* **2004**, *33*, 262–270. [CrossRef]
42. New York Power Authority. The St. Lawrence-FDR Power Project Relicensing Project Overview. Available online: http://www.stl.nypa.gov/power.html (accessed on 18 October 2018).
43. Whyte, K. Critical investigations of resilience: A brief introduction to indigenous environmental studies & sciences. *Daedalus* **2018**, *147*, 136–147.
44. U.S. Environmental Protection Agency (EPA). Declaration for the Record of Decision. Available online: https://semspub.epa.gov/work/02/112586.pdf (accessed on 18 October 2018).
45. Fitzgerald, E.F.; Hwang, S.-A.; Gomez, M.; Bush, B.; Yang, B.-Z.; Tarbell, A. Environmental and occupational exposures and serum PCB concentrations and patterns among Mohawk men at Akwesasne. *J. Expo. Sci. Environ. Epidemiol.* **2007**, *17*, 269–278. [CrossRef]
46. Hwang, S.-A.; Yang, B.-Z.; Fitzgerald, E.F.; Bush, B.; Cook, K. Fingerprinting PCB patterns among Mohawk women. *J. Expo. Sci. Environ. Epidemiol.* **2001**, *11*, 184–192. [CrossRef]
47. Fitzgerald, E.F.; Hwang, S.-A.; Brix, K.A.; Bush, B.; Cook, K.; Worswick, P. Fish PCB concentrations and consumption patterns among Mohawk women at Akwesasne. *J. Expo. Anal. Environ. Epidemiol.* **1995**, *5*, 1–19.
48. Akwesasne Task Force on the Environment Akwesasne Task Force on the Environment Research Advisory Committee Protocol for Review of Environmental and Scientific Research Proposals. Available online: https://docs.google.com/viewer?a=v&pid=sites&sr%0Acid=ZGVmYXVsdGRvbWFpbnxhdGZlb25saW5lfGd4OjNkMDdhMmE1OGViZDk1YWQ (accessed on 18 October 2018).
49. Saint Regis Mohawk Tribe Saint Regis Mohawk Tribe Environment Division. Available online: http://www.srmtenv.org/index.php?spec=aboutUs (accessed on 18 October 2018).
50. Arquette, M.; Cole, M.; Cook, K.; LaFrance, B.; Peters, M.; Ransom, J.; Sargent, E.; Smoke, V.; Stairs, A. Holistic risk-based environmental decision making: A Native perspective. *Environ. Health Perspect.* **2002**, *110*, 259. [CrossRef]
51. Arquette, M.; Cole, M.; Akwesasne Task Force on the Environment. Restoring our relationships for the future. In *The Way of Development: Indigenous Peoples, Life Projects and Globalization*; Zed Books: New York, NY, USA, 2004; pp. 332–349.
52. Tarbell, A.; Arquette, M. Akwesasne: A Native American community's resistance to cultural and environmental damage. In *Reclaiming the Environmental Debate: The Politics of Health in a Toxic Culture*; The MIT Press: Cambridge, MA, USA, 2000; pp. 93–122.
53. Anderson, J.D. *The Four Hills of Life: Northern Arapaho Knowledge and Life Movement*; U of Nebraska Press: Lincoln, NE, USA, 2008; ISBN 0803260210.
54. Núñez, R.E.; Sweetser, E. With the future behind them: Convergent evidence from Aymara language and gesture in the crosslinguistic comparison of spatial construals of time. *Cogn. Sci.* **2006**, *30*, 401–450. [CrossRef]
55. Boroditsky, L.; Gaby, A. Remembrances of times East: absolute spatial representations of time in an Australian aboriginal community. *Psychol. Sci.* **2010**, *21*, 1635–1639. [CrossRef]
56. Núñez, R.; Cooperrider, K.; Doan, D.; Wassmann, J. Contours of time: Topographic construals of past, present, and future in the Yupno valley of Papua New Guinea. *Cognition* **2012**, *124*, 25–35. [CrossRef]
57. Chisholm Hatfield, S.; Marino, E.; Whyte, K.P.; Dello, K.D.; Mote, P.W. Indian time: Time, seasonality, and culture in Traditional Ecological Knowledge of climate change. *Ecol. Process.* **2018**, *7*, 25. [CrossRef]
58. Whyte, K.P. Indigenous science (fiction) for the Anthropocene: Ancestral dystopias and fantasies of climate change crises. *Environ. Plan. E Nat. Space* **2018**. [CrossRef]
59. Smith, L.T. *Decolonizing Methodologies: Research and Indigenous Peoples*; Zed Books Ltd.: New York, NY, USA, 2013; ISBN 1848139535.
60. Deloria, V., Jr.; Lytle, C.M. *American Indians, American Justice*; University of Texas Press: Austin, TX, USA, 1983; ISBN 029273834X.
61. Anderson, J.D. The history of time in the Northern Arapaho Tribe. *Ethnohistory* **2011**, *58*, 229–261. [CrossRef]
62. Dennison, J. Stitching Osage governance into the future. *Am. Indian Cult. Res. J.* **2013**, *37*, 115–128.

63. Munn, N.D. The cultural anthropology of time: A critical essay. *Annu. Rev. Anthropol.* **1992**, *21*, 93–123. [CrossRef]
64. Oxford English Dictionary. *Art n. 1*; OED Online; Oxford University Press: Oxford, UK, 2018.
65. Allaby, M. *A Dictionary of Geology and Earth Sciences*; Oxford University Press: Oxford, UK, 2013; ISBN 9780191744334.
66. Budds, J.; Linton, J.; McDonnell, R. The hydrosocial cycle. *Geoforum* **2014**, *57*, 167–169. [CrossRef]
67. Linton, J. *What Is Water?: The History of a Modern Abstraction*; UBC Press: Vancouver, BC, Canada, 2010; ISBN 0774817038.
68. Bakker, K. Water: Political, biopolitical, material. *Soc. Stud. Sci.* **2012**, *42*, 616–623. [CrossRef]
69. Swyngedouw, E. The political economy and political ecology of the hydro-social cycle. *J. Contemp. Water Res. Educ.* **2009**, *142*, 56–60. [CrossRef]
70. Whitehead, P.G.; Wilby, R.L.; Battarbee, R.W.; Kernan, M.; Wade, A.J. A review of the potential impacts of climate change on surface water quality. *Hydrol. Sci. J.* **2009**, *54*, 101–123. [CrossRef]
71. Baldwin, A.K.; Corsi, S.R.; De Cicco, L.A.; Lenaker, P.L.; Lutz, M.A.; Sullivan, D.J.; Richards, K.D. Organic contaminants in Great Lakes tributaries: Prevalence and potential aquatic toxicity. *Sci. Total Environ.* **2016**, *554–555*, 42–52. [CrossRef]
72. Head, L.; Klocker, N.; Dun, O.; Spaven, T. Irrigator relations with water in the Sunraysia region, northwestern Victoria. *Geogr. Res.* **2018**, *56*, 92–106. [CrossRef]
73. Cosens, B.; Gunderson, L.; Chaffin, B. The adaptive water governance project: Assessing law, resilience and governance in regional socio-ecological water systems facing a changing climate. *Ida. Law Rev.* **2014**. Available online: https://ssrn.com/abstract=251923 (accessed on 18 October 2018)
74. Mantua, N.; Tohver, I.; Hamlet, A. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. *Clim. Chang.* **2010**, *102*, 187–223. [CrossRef]
75. U.S. Environmental Protection Agency (EPA). National Environmental Policy Act Review Process. Available online: https://www.epa.gov/nepa/national-environmental-policy-act-review-process (accessed on 18 October 2018).
76. Anne, M. Eyeing the Future on the Wind River. *Wyo. L. REv.* **2015**, *15*, 517.
77. Midas Gold Idaho, Inc. Plan of Restoration and Operations. Available online: https://www.midasgoldcorp.com/project/plan-of-restoration-and-operations/ (accessed on 18 October 2018).
78. Nez Perce Tribal Executive Committee Resolution Opposing Proposed Stibnite Gold Mine. Available online: http://www.nezperce.org/wp-content/uploads/2018/10/2018-10-9-Stibnite-Press-Release_Final.pdf (accessed on 18 October 2018).
79. Nez Perce Tribe. *Treaties Nez Perce Perspectives*; Environmental Restoration and Waste Management Program in association with United States Department of Energy and Confluence Press: Lewiston, ID, USA, 2003; pp. 70, 78.
80. U.S. Congress. Senate. *Treaty between the United States of America and the Nez Perce Indians, June 11, 1855, 12 Stat. 957 (1863)*; University of Washington Libraries: Washington, DC, USA, 1859.
81. Nez Perce Tribe. *Nez Perce Tribe's Interests and Activities in and around the Stibnite Gold Project Area 2018 (Whitepaper)*; Nez Perce Tribe: Lapwai, ID, USA, 2018.
82. Colombi, B.J. Salmon and the adaptive capacity of Nimiipuu (Nez Perce) culture to cope with change. *Am. Indian Q.* **2012**, *36*, 75–97. [CrossRef]
83. Wagner, R.J.; Boulger, R.W., Jr.; Oblinger, C.J.; Smith, B.A. *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting*; U.S. Geologic Survey: Reston, VA, USA, 2006. Available online: https://pubs.usgs.gov/tm/2006/tm1D3/pdf/TM1D3.pdf (accessed on 18 October 2018).
84. Budds, J.; Hinojosa, L. Restructuring and rescaling water governance in mining contexts: The co-production of waterscapes in Peru. *Water Altern.* **2012**, *5*, 119–137.
85. Loftus, A. Reification and the dictatorship of the water meter. *Antipode* **2006**, *38*, 1023–1045. [CrossRef]
86. White, R. *The Organic Machine: The Remaking of the Columbia River*; Hill & Wang (Verlag): New York, NY, USA, 1996; ISBN 978-0-8090-1583-2.
87. Jackson, S.; Barber, M. Historical and contemporary waterscapes of North Australia: Indigenous attitudes to dams and water diversions. *Water Hist.* **2016**, *8*, 385–404. [CrossRef]

88. Boelens, R.; Vos, J. The danger of naturalizing water policy concepts: Water productivity and efficiency discourses from field irrigation to virtual water trade. *Agric. Water Manag.* **2012**, *108*, 16–26. [CrossRef]
89. Carden, K. South florida water management district V. Miccosukee tribe of indians. *Harv. Envtl. L. Rev.* **2004**, *28*, 549.
90. Carpenter, H. "Miccosukee v. United States": The continuing unwieldiness of equal protection in environmental justice. *Ecol. Law Q.* **2014**, *41*, 597–603.
91. Erskine, J.; Weinand, T.S. Miccosukee Standards Development Grant: Developing Hydrologic Standards to Protect Designated Uses of the Miccosukee Federal Reservation. Available online: https://www.epa.gov/sites/production/files/2015-10/documents/thurs2_03miccosukee.pdf (accessed on 18 October 2018).
92. Miccosukee Tribe Miccosukee Tribe Website. Available online: https://www.miccosukee.com/tribe-c/environmental-issues/ (accessed on 30 October 2018).
93. Allen, G. U.S. Sugar Tastes Sour to Everglades Tribe. *National Public Radio*, 9 October 2008. Available online: https://www.npr.org/templates/story/story.php?storyId=95557360(accessed on 18 October 2018).
94. Yates, J.S.; Harris, L.M.; Wilson, N.J. Multiple ontologies of water: Politics, conflict and implications for governance. *Environ. Plan. D Soc. Space* **2017**, *35*, 797–815. [CrossRef]
95. McGregor, D. Traditional knowledge: Considerations for protecting water in Ontario. *Int. Indig. Policy J.* **2012**, *3*, 11. [CrossRef]
96. Berry, K.A.; Jackson, S.; Saito, L.; Forline, L. Reconceptualising water quality governance to incorporate knowledge and values: Case studies from Australian and Brazilian Indigenous communities. *Water Altern.* **2018**, *11*, 40.
97. Wilson, N.J. Indigenous water governance: Insights from the hydrosocial relations of the Koyukon Athabascan village of Ruby, Alaska. *Geoforum* **2014**, *57*, 1–11. [CrossRef]
98. Country, B.; Wright, S.; Suchet-Pearson, S.; Lloyd, K.; Burarrwanga, L.; Ganambarr, R.; Ganambarr-Stubbs, M.; Ganambarr, B.; Maymuru, D.; Sweeney, J. Co-becoming Bawaka: Towards a relational understanding of place/space. *Prog. Hum. Geogr.* **2016**, *40*, 455–475. [CrossRef]
99. Strang, V. Fluid consistencies. Material relationality in human engagements with water. *Archaeol. Dialogues* **2014**, *21*, 133–150. [CrossRef]
100. Whyte, K. On concepts of collective continuance in Indigenous studiesBrief reflections concerning responsibility, fluidity and justice. *LittCrit* **2017**, *43*, 86–98.
101. U.S. Census Bureau American FactFinder. Available online: https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml (accessed on 18 October 2018).
102. Baker, J.K. Tribal water quality standards: Are there any limits. *Duke Environ. Law Policy Forum* **1996**, *7*, 367–391.
103. *City of Albuquerque v. Browner*; United States District Court: Albuquerque, NM, USA, 1993.
104. Pueblo of Isleta. Pueblo of Isleta Surface Water Quality Standards. 1992. Available online: https://www.epa.gov/sites/production/files/2014-12/documents/isleta-tribe.pdf (accessed on 18 October 2018).
105. Gibbs, L.M. "A beautiful soaking rain": Environmental value and water beyond Eurocentrism. *Environ. Plan. D Soc. Space.* **2010**, *28*, 363–378. [CrossRef]
106. Gibbs, L.M. Valuing water: Variability and the Lake Eyre Basin, central Australia. *Aust. Geogr.* **2006**, *37*, 73–85. [CrossRef]