Chapter 5

Water Management on the Wind River Indian Reservation, Wyoming: A Rapid Assessment and Recommendations

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ABSTRACT

Water management policy on the Wind River Indian Reservation (WRIR), Wyoming, home to Shoshone and Northern Arapaho Tribes, is awaiting resolution in the common interest (i.e., in environmental sustainability and human dignity terms). Irrigation water is taken from the Wind River largely for non-Indian agricultural activities. In the past thirty years, there has been growing controversy on who can use water, how much should be used, for what purposes, and who gets to decide. We took on the WRIR water case at the invitation of Native Americans on the WRIR because it is a complex large scale case study that deals directly with challenges to human dignity. We assessed the case during a five-day rapid assessment field trip and through follow up research. The existing water management policy is not supported by a broad-based consensus among all interests, is inefficient, and does not work well in practice for all the people involved. Alternatives to current management exist that might improve matters. We explore nine alternatives, but for brevity, our analysis here evaluates only four in detail. It is recommended, however, that future efforts to improve water management policy consider all nine and any other options that present themselves.

Key words: *Wind River Indian Reservation, water management policy, Native Americans, policy research, Wyoming, common interest, human dignity, sustainability*

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INTRODUCTION

The 2.2 million acre Wind River Indian Reservation (WRIR) in central Wyoming is home to the Shoshone and Northern Arapaho Tribes. Non-native ranchers and other Euro-American immigrants reside on inholdings and adjacent lands. Irrigation water is taken from the Wind River, the only significant river on the reservation, largely for non-Indian agricultural activities. Water use has been adjudicated in the Wyoming court system and before the U.S. Supreme Court, but the appropriate allocation and uses of water remain highly conflicted. Water is managed using the single and multiple use paradigm (Chapter 3, this volume). Over the past thirty years, there has been growing controversy among stakeholders focusing on who can use water, how much should be used, for what purposes, and who gets to decide. The western frontier worldview dominates the regional and local culture and this has major implications for how Indians are treated (Slotkin 1992, Western 2002).

We took on this large scale water management case at the invitation of Native Americans on the WRIR, because it is complex technically and politically, and most importantly, because we see it as a human dignity case. Given the diverse interests of Native Americans, Wyoming agriculturalists and politicians, and other stakeholders, this is an exceeding complex case with no simple short- or long-term resolution easily at hand. O'Gara's book *What You See in Clear Water: Life on the Wind River Reservation* provides a background of this case. In many ways, the issue is less about water and more about a lack of human dignity for Indians. Human dignity is about respect for individuals and equal treatment under law. Achieving the goal of dignity cannot happen unless people live in healthy, sustainable environments (Clark 2002). Nevertheless, most people involved, including observers and the courts, continue to treat the case as only about water and its proper management. We conclude that the WRIR situation is ripe for resolution in the common interest. This paper describes the WRIR water management case, emphasizing the dynamics of social and decision processes at play, analyzes trends and conditions that have brought the issue to its present conflicted state, and offers recommendations for ameliorating some underlying issues in the common interest.

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Policy problem

Beyond the contextual problems as introduced above, the policy problem is that Wyoming water law operates under the prior appropriation doctrine known as "first in time-first in right." This is often referred to as "use it or lose it," wherein, if a water allocation is not used for a defined beneficial purpose within a certain amount of time, the right to use it in the future is forfeited. Water rights are issued by state

officials to those who plan to make "beneficial use of water," a concept that is narrowly defined in terms of agricultural productivity and mining. Water rights obtained under the doctrine of "first in time" conflict with water rights obtained by Native Americans through a formal treaty with the U.S. government, which does not require that water be used in order for those rights to be recognized. The current regulatory structure and water management policy provide little incentive for conservation of water. The "first in time" doctrine and the "use it or lose it" principle conflict directly with the desires of some participants (e.g., Native Americans, conservationists, sportspeople) to leave water in the Wind River for cultural, ecological, and recreational purposes. Accordingly, competing definitions over what constitutes "the most beneficial use of water" lies at the heart of the policy problem.

Euro-American settlers immigrated to the region in large numbers in 1870, and in 1890 Wyoming achieved statehood. The U.S. Bureau of Reclamation developed the first federal irrigation district to distribute water in the area (Fremont County) in 1904. This program today extends along both sides of the reservation's major river, the Big Wind River. The river and associated irrigation systems provide water for farms and ranches in a 335,000-acre zone of the reservation (Massey 2004). This arrangement is highly problematic for some interests. It raises questions about allocation of resources and also larger questions about human dignity. For example, how are constitutive issues of "first in time" to be reconciled with Indian treaty rights? And importantly, how can matters be adjudicated to enhance human dignity for all, especially Indians? These questions have neither been answered nor the policy problem resolved in an enduring way that fully supports human dignity for all.

Theory, methods, and standpoint

This case was researched beginning with a five-day rapid assessment field trip in early November 2005. Rapid assessments are short duration (typically a few days) during which researchers seek "inventory" information around a resource issue (Del Campo and Clark 2009). Often, rapid assessment focuses on ecological issues, but assessments are most complete when they also include social and contextual elements. Our assessment included both human and ecological concerns. We used methods that were a mix of tools from ecology (e.g., direct observation, site visits, GIS, data on water flow), anthropology (e.g., observation, cataloguing of practices), sociology (e.g., interviews, social metrics), economics (e.g., income measures, cost-benefit analysis), and public health (e.g., health statistics). Our approach kept the human dignity concern in mind at all times.

We drew on a comprehensive problem-oriented framework to guide our research (McDougal et al. 1980, Lasswell and McDougal 1992, Chapters 2 and 9, this volume). This approach, in addition to offering an analytic perspective and method, is also a theory about human dignity and sustainability. This approach is systematic, empirical, and problem focused (Clark et al. 2000). The approach required us to focus our research on the social and decision processes at play in the case and to use triangulative methods. Triangulation involves obtaining data from three or more sources and cross-checking it to see if it all focuses on a single conclusion. We used

indices of people's lives (e.g., poverty, unemployment, income, health care) and the status of the environment (e.g., crop yield, soil, in-stream flows). In addition, we drew on indices and standards associated with the overall social and decision processes (e.g., was the decision process comprehensive, timely, open, and so on – see Lasswell 1971). These helped us assess the quality of the decision making process and to apply procedural, substantive, and practical tests of the common interest, as described by Brunner et al. (2002), Brunner and Steelman (2005), and Steelman and DuMond (2009).

This approach, in addition to offering an analytic perspective and method, is also a theory about human dignity and sustainability.

Our methods included mapping of the social process: identifying key stakeholders, their perspectives, situations, values at stake, strategies being used, and outcomes sought. We contacted professionals in the region to gain insight into the case and spoke with people who had experience with water management in the Wind River region. Interviews were pre-arranged by contacting key participants identified during the social process mapping stage. While in Wyoming, we toured much of the WRIR by car and spoke to over thirty people from all sides of the conflict over how water should be used. This included representatives of the federal government, members of both Indian tribes, County Commissioners from two counties, a newspaper editor, elected state officials, individual Indians, ranchers, environmentalists, and citizens. We visited dam sites, irrigation systems, crop and livestock lands, wildlife habitat, rivers, streams, and lakes. After our field trip assessment, we followed up with interviewees to discuss our observations, and continued library research.

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According to Lasswell and McDougal (1992), people tend to behave in ways that they perceive will leave them better off. Because people's goals are motivated by their values, we assessed both goals and values at stake. We were particularly interested in the value dynamics and outcomes of WRIR water management for Native Americans. We recognized that what we observed was more than a result of water management. It reflects a long history of the relationship between native peoples and the dominant culture (Euro-Americans). All natural resource management policy is a normative activity, so our focus on values is essential (see Bell 1970). This contrasts with the conventional approaches that have been applied to this case, and which typically focus on technical, biophysical facts and underattend to the value dynamics involved.

Values encompass "orientations towards what is considered desirable or preferable by social actors" (Zavalloni 1980: 64). Values are socially organized, and are invested

with deep feelings of identification and emotional commitment for individuals. They are basic to developing a collective understanding of the "good" or common interest (McDougal et al. 1980). They are the bedrock on which all claims to water in the WRIR rest. We used Lasswell's (1971) system of values as it recognizes our common shared humanity and our individual and social heritage. Lasswell offers eight broad values that flow from his conception of human dignity and "each one," according to Bell (1997: 180), "is a good candidate for being universal." The functional values are about the shaping (producing) and sharing (enjoying) of power, enlightenment, wealth, well-being, skill, affection, respect, and rectitude (in no order). The WRIR water case clearly involved conflict among participants across all eight values.

The WRIR management policy problem is brought into focus through our descriptions of the decision making functions that make up the WRIR case. We used a decision process model comprised of interrelated functions or activities. Taken together, the person involved acquires relevant information, debates the meaning of the information, decides on a course of action, implements management actions, evaluates consequences, and adapts accordingly.

The observational and analytic standpoint of the authors and five other field trip participants is reflected in the text, impressions, and recommendations that follow. Because our work was based on a rapid appraisal and some follow-up work, we realize that our report could benefit from a longer study, one with more empirical data, and thorough analysis. Although our travel and meetings did not present us with a complete picture of the issue and its context, we feel that useful insights were gained, that our recommendations are practical, and that they serve common interest and human dignity ends.

WIND RIVER WATER MANAGEMENT

Wind River water management policy has a long history. The WRIR was established as a result of three treaties negotiated with Shoshones, the last in 1868, all pre-dating Wyoming statehood, which occurred in 1890. Thus the rights of the Shoshone were established on the property before the federal government created the Territory and then the State of Wyoming. Shoshones claim sovereignty over the WRIR. The reservation, however, is shared with the Northern Arapaho tribe. The Northern Arapaho peoples were moved onto the Shoshone Reservation some years after it was established, against the objections of the Shoshone people. They too, however, side with the Shoshones on how they want the water to be used and who should decide.

Geographic context

The WRIR, once 44 million acres, is now 2.2 million acres and supports about 8,000 individuals, 6,500 of whom are Native Americans (Massey 2004). Agriculturalists, miners, ranchers, recreationalists, retirees, and other people inhabit the region. Reservation lands are bounded on the west and south by the Wind River Range and are characterized by foothills, sagebrush basins, and a few riparian areas (Knight

1994). It is bounded on the north by the Owl Creek Range and opens into the basins and prairies to the east. Once considered to be barren land, the area is now valued for its resources, especially minerals. Given the low levels of rainfall (less than 10 inches annually in some areas) and varying winter snow pack levels, water is typically in short supply, especially given recent demands for agriculture and ranching. The eighth consecutive year of drought was in 2008.

Social context

Many different groups are involved in the WRIR case with diverse interests (values) at stake. Understanding participants, their values, and the way in which they are employed (strategies) allows us to offer recommendations to remedy this policy problem in the common interest. The social context of western Wyoming was described by Taylor and Clark (2005). These authors discuss settlement patterns, statehood and state's rights, federalism, and community dynamics in the region. These features figure prominently in the WRIR water case. A brief description of the major participants follows.

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Federal government

Through the Department of Interior (DOI), the federal government manages affairs for this area via the Bureau of Indian Affairs (BIA), the Bureau of Reclamation (BOR), and the Fish and Wildlife Service (FWS). Additional intervention and oversight occurs through the federal judicial system. The government and its programs predominantly seek value outcomes of power, wealth, and respect. In most cases the federal government uses all four strategies at its disposal (i.e., diplomatic, ideological, force, and economic means). The outcome of the decision process thus far has been to maintain federal and state authority and control above all else (e.g., an overriding constitutive outcome in this case).

State of Wyoming

The State of Wyoming exercises its interests through the State Water Engineer's Office and indirectly through elected officials, such as County Commissioners. The state shares similar values to those of the federal government regarding the management of water resources and also uses all four strategies. Overall the state's strategies has been to promote wealth, power, and well-being on a state level, especially for non-Indian participants.

Indian tribes

The Eastern Shoshone and Northern Arapaho tribes both live on the WRIR and are sensitive to human dignity concerns as a consequence of a long history of respect, power, and other value deprivations. These deprivations have been well documented (O'Gara 2002). The tribes have traditionally shown a strong "sense of place" about the surrounding natural resources, though these values are diminishing in younger generations. The Indians, like the government, seek value indulgences. The tribes are exploring diplomatic strategies through their tribal liaison officer with the Wyoming state government. Overall, the tribes have lost power, well-being, and other value outcomes since the early 1800s.

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Agricultural sector

In addition to individual farmers and ranchers, the agricultural sector includes the irrigation districts that administer the irrigation system. The Bureau of Reclamation still owns these districts and will not turn them over to local owners until the debt for the system is paid off. Participants in this sector who have gained ownership of these irrigation districts are of European ancestry and are characterized by utilitarian beliefs and a pursuit and maintenance of wealth, well-being, and power. These participants use diplomatic strategies through negotiations and political connections with the state to achieve their outcomes.

Non-governmental organizations (NGOs)

NGOs include the Wind River Alliance (WRA), Wyoming Outdoor Council (WOC), and the Greater Yellowstone Coalition (GYC). These organizations value rectitude, power, and respect for themselves and others. Other than the WRA, few directly address the WRIR water case. However, all are interested in natural resource management and policy in the region. Strategies utilized by these groups include the full range of strategies – public outreach and education, negotiations, and lobbying.

Sportsmen/recreationalists

Sportsmen and recreationalists include individual hunters, fishermen, hikers, campers, and boaters, as well as the groups representing them. These participants value skill, well-being, and rectitude. They have mostly employed diplomatic and economic strategies in support of their values, including recreation.

The arena within which all these participants interact is centralized and under the authority and control of the federal and state governments. Indian relationships with

the federal government and state of Wyoming remain complex, ambiguous, or problematic, thus allowing conservative local interests that favor the status quo to dominate the current arena, as they have throughout the past. If the overriding goal is a fair, effective and practical water management policy in the common interest, our interviews, observations, and analysis of the social process show much value conflict and discontent. The present management policy process strongly favors local agricultural and state interests at the expense of environmental interests and those of Native Americans and their allies.

Analysis

We used empirical indices of the situation to gain insight into the history and conditions, and as a basis for predicting likely future events and processes in this case. We focused on selected indices about people and their lives, the environment, and the management decision process used to decide how resources are used and who decides. We sought indices that could be easily obtained and were in keeping with our rapid assessment.

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People's quality of life indices

People interact through a social process that has consequences that can be measured in terms of social values and indices thereof. We could not find direct indicators of people's lives and water management during our brief visit. With more time, we could have found and detailed these. In the absence of this time and work, we took general social indicators from the literature, such as unemployment, poverty, and health care, as measures of values that people seek. Although not directly tied to water management, the indices that we used do give some insight into the quality of life for people involved. Measuring and understanding these is a way to identify past performance and future opportunities in the decision making process (Clark 2002). We found that there are vast differences in values outcomes for participants on and off the Reservation because of past decision processes. Obtaining data on these value dynamics (and indices thereof) was not easy. For example, according to senior economist David Bullard from the Wyoming Department of Employment and Research Planning, information of the status of people's lives is collected at the county level and is not broken down on an on-reservation versus off-reservation basis (personal communication, 11 November 2005). Thus data for Indian and non-Indian populations in value terms is either nonexistent or difficult to acquire. However, we did find indices of value outcomes—human dignity measures—as described below.

We used a series of indices about people's lives that are a measure of human dignity and the distribution of value outcomes in the region. Poverty statistics provide an index of human dignity. Poverty is clearly a problem on the Reservation. Of Wind

River Indian residents, 67.6 percent fell below the official poverty line in 1987, and 56.7 percent did so in 1998 (Antell et al. 1999). Significant variation in poverty exists between the two tribes. On the WRIR, 62.4 percent of Northern Arapaho families and 49.5 percent of Eastern Shoshone families live below the poverty threshold (Antell et al. 1999). By comparison, the 1990 U.S. census showed that the poverty level for the rural town of Riverton, mostly non-Indians, was 16.5 percent below the poverty line (Bureau of the Census 1990). Current conditions have little changed, and are not good for residents, Indian or not.

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Second, we used employment as an index of human dignity. The 1990 U.S. Census indicates that unemployment of WRIR Indians was 32.4 percent, or four times the national average. In 1998, 38.1 percent of WRIR Indians between 18 and 64 were unemployed (Antell et al. 1999). Job shortages and a poor fit between available human capital and job requirements in economic sectors (e.g., oil/gas drilling, guiding tourists, and service industry) influence these high levels (Massey 2004). In contrast, the Wyoming Department of Employment Research and Planning reports that the unemployment rate in Fremont County, as of March 2008, was only 5.0 percent, down from 6.2 in 2002, and 5.7 in 1992 (Wyoming Labor Force Trends 2008, 2005, Wyoming Department of Employment, Research and Planning 2005). The statewide seasonally adjusted unemployment rate has steadily increased since the 2000 rate of 3.8 percent, to 4.2 percent in 2002, and to the 2008 rate of 5.1 percent (Wyoming Labor Force Trends 2008, Wyoming Department of Employment 2005).

Third, we used income as an index of human dignity. As for income, reports suggest that total household income on the reservation is low, with a median annual income for Indian households of $11,920 (Massey 2004). Twenty-five percent of households have an annual income of less than $4,700, and only the top quartile has an annual income above $21,940. According to the 1990 U.S. Census, median household income for Riverton, Wyoming is $22,641, and according to the 2000 U.S. Census, the same measure showed $32,503 for Fremont County. Relatively speaking, non-Indian households are doing well (Wyoming Department of Employment 2005). Overall, income is low.

Fourth, we used health statistics as an index of human dignity. Health care in general in the region is a widely acknowledged problem. Preliminary efforts to obtain data on health care access for Fremont County revealed numerous problems. A nursing supervisor at the Fremont County Public Health office indicated that access to healthcare for uninsured individuals (an unknown number of people) between the ages of 19 to 64 living off the reservation is "horrible." She stated there are disparities between the levels of service available to Indians versus non-Indians, with Indians getting poorer quality health care. It was noted that overall access to healthcare in the

region is below national standards. Furthermore, the Director of the Indian Health Service (HIS) Wind River Unit indicated that the Unit suffers from financial shortfalls and is experiencing health professional shortages, particularly for nurses and pharmacists. Demand exceeds available services at the two ambulatory health care facilities in Fort Washakie and Arapaho, and about 30 percent of the Wind River Unit IHS user population has no other form of healthcare coverage (Cathy Keene, personal communication, 21 April 2005).

This analysis suggests that values such as skill, wealth, and well-being – indices of human dignity – are not fairly distributed compared to Fremont County as a whole. There are striking differences in levels of poverty, unemployment, and healthcare access on the reservation as compared to off the reservation. This is true for the other values as well (i.e., power, knowledge, respect, affection, and rectitude), again based on our observations and interviews. There are many institutional practices in place that determine these value flows and who experiences the most dignity/indignity. The way water is managed is just one of these institutional practices. It reflects how the water "resource" is allocated and used. Uses are determined through past and existing decision and social processes that allocate sought-after values (e.g., well-being). These processes also show who benefits and who is deprived as a consequence.

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Environmental indices

People interact through a social and decision process that has environmental consequences that can be measured. We used crop yields, irrigation data, and in-stream flows as an index of environmental sustainability. Crop yields were used as a measure of agricultural prosperity, salinization as a measure of environmental degradation, and in-stream flow as an indicator of ecosystem health. These indices integrate many environmental factors and human land management practices.

First, crop yield data is one index of environmental sustainability. Data is hard to interpret due to regional rainfall variation in this semi-arid environment and variation in individual agricultural practices. The environmental situation in Fremont County is not amenable for agriculture unassisted by irrigation. This is especially true for alfalfa, which requires huge volumes of water inputs. The largest alfalfa crop yield in recent history took place in 1991 during a drought year caused by a low snow pack in the mountains, which was only 70% of its mean annual level. During that year, water rights allotments were enforced strictly and farmers used less water more effectively than in years prior (David Skates, personal communication, 4 November 2005). Aside from the bumper crop in 1991, crop yield data shows great variation annually. However, the implication of this example is that good water management can probably improve crop yields while at the same time freeing up water to remain in the river.

Second, land is consistently over-irrigated, causing water-soluble salts to accumulate on the soils, a phenomenon visible throughout the region. This was widely reported to us and visible on the land. Hard indices of the rate and other aspects of salinization and consequences for crop yield were not available. Nevertheless, considerable acreages were white from salt build-up. Most people we spoke with expected this trend to continue.

Third is in-stream flow. In past years, water levels have been consistently low, and miles-long portions of the Wind River have dried up completely. These portions include the area between a Federal diversion dam, where water is removed for irrigation districts, and downstream, where heavily salinized water is returned to the riverbed. There is consensus that the drying is due to water diversion. This has serious ecological and aesthetic implications. Low flow and changes in flow patterns affect riverine organisms adapted to the already narrow range of environmental conditions. The Yellowstone cutthroat (*Oneorhynchus clarki*), a once thriving species in the region, is nearly gone from the Wind River system. David Skates, a United States Fish and Wildlife biologist, indicates that the fish commonly known as the sauger (*Sander sp.*) had declined to approximately 4,000-5,000 individuals in the early 2000's from much higher but unspecified numbers a decade or two ago (personal communication, 11 November 2005). Reduced natural flow in the river impairs water quality because irrigation runoff is typically polluted with nutrient-rich fertilizers and pesticides, causing adverse impacts on agriculture and on the aquatic ecosystem. Instream flow statistics suggest that current practices are not sustainable.

When it comes to projections, this analysis suggests that if current trends and conditions persist, then crop yield, increasing soil salinization, and continuing low in-stream flows will bring about a deteriorating environmental situation. According to David Skates (personal communication, 11 November 2005) and observations of wildlife and agricultural activities, crop yields, despite the variation, will continue to decline for the next 30 years, at which time the ground will be so saline that it will be virtually impossible to farm. As well, low levels of in-stream flow will continue to contribute to the decline of ecological conditions in the river, eliminating valuable habitat for riverine organisms and reducing biodiversity. This projection assumes that the situation remains unchanged from the past. If this turns out to be the case, then an even more conflicted decision and social process can be expected as people's value demands become unmet. In other words, the value demands for human dignity and environmental sustainability will grow. What can be done to aid this situation?

Decision-making process indices

In the Wind River case, the data cited above, our observations, and interviews suggest that all decision functions are problematic in the way they are carried out. Below we briefly offer our observations and conclusions about the management decision process.

First, our research showed that the *intelligence* function is incomplete (Clark 2009). This function ideally seeks information to understand the problem at hand and its context, but not all the information needed for understanding the WRIR water case

is available or it is under-used at present. Our research and the field visit showed little available data on the full problem and its context. Weak intelligence occurs because of limited resources, including lack of official commitments to collect the needed social, environmental, and physical data relevant to the case. An example supporting this conclusion is the removal of several U.S. Geological Survey water gauges used to measure the volume of water diverted for agriculture and the amount remaining for in-stream flow. Thus data formerly available is no longer available. Now no one knows how much water is being diverted for agriculture. Efforts to restore these gauges, even if the expense is borne by a non-governmental organization, have been met with resistance from both irrigators and regulators. Officials claim it is too costly to maintain them. Other examples include the lack of disaggregated data with respect to economic and health indicators between native and non-native peoples.

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Second, the *promotion* of alternatives is inadequate. Individuals and groups typically promote different interpretations of information and courses of action. For example, our research confirmed that Indian participants are left out of key discussions. This occurs because adequate forums, arenas, and situations do not exist in which the different interests can gather to identify and work out differences of facts, perspectives, and values.

Third, the deciding activity, called the *prescription* function, lacks specificity and resources. Our research indicates that the selected or prescribed rules do not serve all participants fairly. The contentious legal history of the issue before the U.S. Supreme Court and in other legal venues reflects the "special interest," not the common interest, focus of this activity (see O'Gara 2002).

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Fourth, *implementation* must work in practice by being contextual, unbiased, and constructive. Our research shows that the past and existing water management programs have limited success in meeting these standards. A number of people that we spoke with claimed that the majority of irrigators use many times the amount of water allocated; however, this is not enforced or even measured precisely by officials.

Fifth, *appraisal* or *evaluation* shows that much of the WRIR management process has been conducted in the courts, and that the litigation process has not effectively addressed all of the issues inherent in the WRIR water management policy decision making process. The appraisal that the courts have put forth does not blend,

Table 1 Alternatives to the Wind River Indian Reservation water management problems

DEGREE OF FEASIBILITY IN REACHING A SOLUTION IN THE COMMON INTEREST	ALTERNATIVE	DESCRIPTION	EVALUATION
HIGH	Improved regional communication	Innovative avenues of communication such as professionally facilitated workshop may bring together influential parties to develop improved water policy.	Unclear if local and state leadership is capable of moving beyond established worldviews.
HIGH	Increased water metering	An effort to pay for appropriate water metering facilities once removed by the USGS may be inexpensive effort providing valuable information to water policy management decision makers.	This effort could be undertaken by the establishment of an area foundation. Collaboration between the local communities, state and federal government would be necessary.
MEDIUM	Irrigations district restructuring	Returning ownership of irrigation districts to local farmers will provide an opportunity to review past district management efforts and result in better management. Identifying and publicizing the financial shortcomings of the current structure may lead to improved regional management.	Unclear how this process would proceed. Relinquishing ownership would require leadership and organization at the local level and buy-in from the federal government.
MEDIUM	Upgrade irrigation infrastructure / assumption of ownership of irrigation infrastructure by Native Americans	Current irrigation infrastructure on the WRIR is inefficient. Upgrades and transfer of infrastructure may result in efficient uses and increased water conservation	Institutional barriers may prevent this alternative. Tribes are unlikely to want to assume responsibility of an ineffective system.
MEDIUM	Substitution of crops and the purchase of unproductive agricultural lands	Replacing current crops will place less stress on the regional ecosystem.	Cultural traditions heavily influence agricultural practices and some are resistant to change. Residents fear that such actions will prevent recreational users from accessing natural resources on lands.
MEDIUM	Innovative agricultural use	Interpretation of a U.S. Supreme Court Decision gives the WRIR a large allotment of water if put to an agricultural use. Uses such as hydroponics farming, landscaping nurseries, and aquaculture may satisfy this definition and be a positive tribal economic effort.	Location and outflow of such a project and return flow to the river will be key factors in factoring non-Indian users. This may heighten conflict, or could potentially induce non-Indian irrigators into more equitable solutions.
LOW	Create new water storage facilities	New water storage would ensure greater water availability	Location, cost, payment, environmental concerns among others make this a less likely option.
LOW	Statutory Change	Changing water laws to reflect a broader definition of beneficial use to include in-stream flow will enhance abilities for the parties involved to develop an improved water management policy.	Past efforts to implement such change have been ineffective. Regional differences and political barriers act as roadblocks.
LOW	Litigation	The sluicing of the Diversion Dam may be a point source emission under the Clean Water Act, potentially opening up further avenues of litigation.	Litigation as a strategy to improve water management policy has proven to be ineffective in the common interest, is cost prohibitive and fails to address competing worldviews.

harmonize, or integrate different interests of the larger Wind River community into an overall common interest program outcome. For example, beginning in the 1970s, Indian participants appealed to the court system to resolve a host of problems, beginning with state courts, and eventually reaching the U.S. Supreme Court. An outcome in the U.S. Supreme Court case that was more or less satisfactory to the Native Americans was remanded back to the Wyoming Superior Court to refine. In this local arena, the local decision favored non-Indian water users in a manner harmful to the tribes, as they saw it. Following this controversial decision, the tribes chose not to go back to the U.S. Supreme Court. They feel that justice has not been served and that costs and time are not worth revisiting the issue in that venue. The claims and counterclaims have not been fully adjudicated as yet.

Finally, *termination* or ending of the existing policy or program has not occurred. As a result, a status quo management policy remains in place. It is unlikely that it will be terminated and/or replaced with more effective means and outcomes given the current context.

In sum, the functioning of the current decision process is problematic. There is little likelihood for change in the foreseeable future. The decision process as presently configured favors dominant, non-Indian water users over Native Americans.

Problem revisited

The policy problem is that water management is contentious and management policy is not in the common interest given the human dignity and environmental sustainability goals. Various human, environmental, and decision making indices support this conclusion. Social interactions have not included all key participants fairly or comprehensively in a timely fashion. As a result, the existing water management policy lacks consensus, is inefficient, and does not work well in practice for all the people involved. Different views of the adequacy of water management are reflected in competing claims (value demands) and prescriptions for policy today. What is to be done? To achieve water management that supports human dignity for all and environmental sustainability, it is essential to use irrigation water in contextually sensitive ways. This is especially true given the diverse participants who want to be included in decision making and their myriad value demands.

As a result, the existing water management policy lacks consensus, is inefficient, and does not work well in practice for all the people involved.

RECOMMENDATIONS

Alternatives do exist that might improve matters. Table 1 presents options to move the entire management policy process towards a common interest outcome. Nine alternatives are presented in total, but for brevity, our analysis evaluates only four in

detail. It is recommended, however, that future efforts to improve water management policy consider all nine and any other options that present themselves.

The four alternatives discussed below are: (1) upgrade irrigation infrastructure and assumption of ownership by Native Americans, (2) make statutory changes in Wyoming water law, (3) substitute crops and purchase agricultural lands from non-Indian irrigators on the reservation and nearby, and (4) improve regional communication among diverse perspectives.

Subsequent to the identification of the nine alternatives and more detailed review of the four alternatives listed above, our analysis indicates that the greatest opportunity for near term improvement would be to improve communication and coordination among federal, state, and tribal agencies while working to increase efficiency of current water use infrastructure (e.g., irrigation ditches). Long-term improvements can come from addressing water laws.

Upgrade infrastructure and assumption of rights

Irrigation infrastructure (e.g., irrigation ditches, headgates, and related facilities) in Fremont County, especially on the WRIR, is highly inefficient (e.g., irrigation ditches) compared to that on non-Indian lands on the reservation or nearby. Infrastructure upgrades may be costly; however, the state of Wyoming has enjoyed a budget surplus for years due to its energy development. A small part of these surpluses, estimated at $1.8 billion in 2005 alone, according to State Senator Robert Peck (personal communication, 12 November 2005), could be channeled into renovation efforts to replace flood irrigation with gated pipes and center pivots. The state could subsidize infrastructure improvements since water conservation is in the public good.

A joint management scheme could, however, address concerns.

Another possibility would be for a tribal governmental agency, such as the Wind River Water Resources Control Board, to assume shared responsibility for Indian irrigation infrastructure, which is now owned and controlled by the Bureau of Indian Affairs (BIA). The federal government, and hence the BIA, currently fails to allocate appropriate funding to the maintenance of the irrigation system despite the fact that water users on the reservation pay for such services. Likewise, the tribes do not want to assume sole responsibility for a dilapidated system and incur the costs of improving infrastructure. A joint management scheme could, however, address concerns.

Statutory change

Changing Wyoming's state water laws to reflect a broader definition of the beneficial use of water to include in-stream flow will enhance the ability for all parties involved to develop an improved water management policy. Other states, such as New Mexico and Oregon, have taken action to recognize in-stream flow as a beneficial use and

have implemented programs to increase the quantities of water allocated for this purpose. New Mexico established a Strategic River Reserve, and through legislation, instructs an intrastate stream commission to manage water and water rights within the strategic water reserve to benefit threatened and endangered species. The state of Wyoming could follow suit and establish a Water Trust Board similar to the commission in New Mexico.

Since residents of Wyoming respond strongly to property rights doctrine and the western frontier myth and regimes, it is possible that they would support a tradable water rights scheme that promotes temporary transfers of water quantities rather than those that must be permanently relinquished. Legal precedent for this alternative exists. In-stream rights have been recognized by Oregon under the 1987 in-stream Water Rights Act that recognized in-stream uses as beneficial and permitted the appropriation and transfer of in-stream water rights.

Crop substitutions and purchase of agricultural lands

Crops that are currently grown in Fremont County such as sugar beets and alfalfa are water intensive. Replacing these crops with others that are less water intensive will place less stress on the regional ecosystem. The economic consequences of such a change are unknown at present.

Purchasing less productive agricultural lands and taking them out of production would prevent ecosystem degradation (e.g., salinization), leave more water in the river, increase water availability per agricultural acre to existing land, and improve water management. This presumes that the beneficial use issue is addressed first. Otherwise someone else would just get access to the water. Organizations, including The Nature Conservancy, have bought farms and ranches, but rather than restoring the land to its natural character, have continued to operate agricultural enterprises using water. While private owners are buying property in the Wind River area, some residents fear that such actions "lock it up" and prevent recreational users from accessing natural resources on lands that previously allowed hunting or fishing.

This alternative ultimately reduces water demand to affect water management but is likely to face resistance from local residents who believe strongly in their property rights and the ability to enjoy their land at its highest and best use. This use may include development that does not promote the common interest.

Improved regional communication

Innovative avenues of communication and professional facilitation may bring together influential parties for improved water policy. Non-centralized facilitation services may be able to restore lines of communication previously broken as a result of long, legal processes. Such an effort, agreed upon by all parties with clearly defined rules and objectives for engaging in talks, may increase understanding in the contentious environment. It is unclear if local and state leadership is capable of moving beyond established state's rights, anti-federalism, and western frontier perspectives. Furthermore, without determination by the parties to reach a common interest goal, this alternative may face setbacks.

CONCLUSION

Given the complex, ongoing nature of this case, there are several options open to improve water management policy, the human dignity of Native American and non-Indian people and cultures, and ecological consequences in the common interest. Any resolution should produce constant pressure towards achieving these policy goals that will offer the greatest net value gains for all people. All decision process activities can be upgraded to approximate higher standards than presently exist (e.g., timeliness, factuality, openness, fairness, and comprehensiveness). This can be partially achieved by improving the social process to increase effective communication among all the present parties as well as through a more comprehensive representation of constituencies in a fully respectful, effective series of forums. As well, improved irrigation systems management (e.g., ditches, headgates, and pivots) could help minimize water use and consequent negative effects on in-stream flows, biodiversity, and recreational losses. In the long-term, Wyoming water laws, and perhaps the entire Western water law of prior appropriation, must be revised. Few, if any, new resources would be required to try these options. A genuine commitment to problem solving will be essential to improving water management policy in the common interest.

Given the complex, ongoing nature of this case, there are several options open to improve water management policy, the human dignity of Native American and non-Indian people and cultures, and ecological consequences in the common interest.

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