Chapter 17

The Challenge of Managing Groundwater in the Gulf Coast Aquifer: Recognizing and Incorporating Divergent Value Systems Regarding Groundwater as a Resource

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Introduction

People *need* water. A simple statement of fact, but also a good starting point for exploring how water management, particularly the management of groundwater in the Gulf Coast aquifer, is subject to the influence of personal preferences about how water should be allocated to meet these *needs*—preferences which are revealed in individual perspectives, or *value systems*, regarding groundwater as a resource. Effective groundwater management depends, in part, on understanding and accommodating the many, often divergent, value systems exhibited by those elected officials, citizens, landowners, and other stakeholders involved in the process, while still adhering to principles of sound science and state law.

This paper explores the factors involved in the development of individual value systems regarding groundwater resources, how these values are sometimes expressed, and the effect they have on the decentralized process of groundwater management in the Gulf Coast aquifer of Texas. It suggests a few elements of what could be a new framework for groundwater resource management that is designed to better enable the State to protect the resource base, promote people's rights and interests in the use of the resource, and achieve statewide goals regarding water policy.

The content of this paper is based on the author's experiences during a decade and a half of professional activity spent developing regional solutions to water resource management challenges in the South Texas area. While the author's early role in this water management arena took place in the public sector, dealing primarily with surface water issues, later experiences have been in the private sector, working with landowners to develop public-private partnerships

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that facilitate a conjunctive management approach to the more effective use of water resources. The observations and opinions contained in this paper are solely those of the author.

The Use Value of Water

The human use of water ranges from the essential to the optional. Water is required to support life-sustaining biological functions, and it is used in a myriad of human endeavors that benefit the health and well being of individuals, economies, and societies. Some uses of water are more, as parents might point out to their children, in the nature of *wants*, rather than basic *needs*—but many of these less essential uses of water contribute to a quality of life that is important to the users.

Individuals inherently assign some relative value to each of these uses. These personal ideas about the role water plays in our lives, the relative value it has in various uses, who "owns" it, and the way it should be allocated among competing uses, may or may not reflect the more objectively derived management principles that have been used in *traditional* resource management. This is particularly evident when the decision-making process regarding groundwater management has been delegated to the local level, where stakeholders and voters, through their elected officials, can more directly express their views and preferences stemming from these personal value systems.

Where there has been little opportunity for those involved in this new, de-centralized groundwater management process to become well-versed with the legal and technical aspects of groundwater management, the value systems that seem to operate most often are those based on an individual's subjective experience (opinions and feelings) regarding their own access to their preferred uses of water, rather than objective scientific, economic and policy analysis.

Based on observation, it appears that in many cases, *fear* is the underlying emotion shaping personal value systems regarding water resources—fear based on past experiences. Many people in Texas still recall the hardships experienced during the "Great Drought" of the 1950s. In the introduction to "The Time It Never Rained," a novel about a family in West Texas during the drought of the 1950's, writer Elmer Kelton keenly observed about Texans that:

> *"Each new generation tends to forget—until it confronts the sobering reality—that dryness has always been the normal condition in the western half of the state. Wet years have been the exceptions"* (Kelton, 1984).

This realization, and the fear that it invokes, burns deep into the psyche of Texans who still depend on water supplies that are subject to the effects of this natural drought cycle. Although droughts affect surface water sources more immediately and directly, some aquifer systems are still vulnerable to long periods of diminished recharge and/or excessive use during droughts.

While this fear may lead to greater stakeholder involvement in the groundwater management process, it can also result in an emotionally charged atmosphere that is not particularly conducive to either building consensus on appropriate groundwater management policies or protecting the rights of stakeholders with legitimate, but minority, viewpoints. The challenge is to find ways to

appropriately address the subjective—even emotional—content of the value systems being expressed and to incorporate those values into an equitable, inclusive, legally defensible, and scientifically sound framework for effective groundwater resource management.

The Characteristics of Groundwater as a *Resource*

The first task may be to demonstrate how groundwater fits in the category of a *resource*. The Merriam-Webster Online Dictionary defines *resource* as "a natural source of wealth or revenue—often used in plural" (that is, *resources*). Another definition of *resource*, found in Webster's II New Riverside University dictionary, is: "an accessible supply that can be withdrawn from when necessary" (Soukhanov and others, 1994). Groundwater, especially groundwater in the Gulf Coast aquifer, appears to fit the definition of a *resource* or, more specifically, a *natural resource*. Implicit in the concept of a *natural resource* is the idea that, while existing in nature, the resource is withdrawn to meet human needs. (Although, as described later, groundwater is a natural resource that is also used to meet environmental needs.)

Setting aside for the moment the question of "to whom, if anyone, does the groundwater belong?" one might imagine an aquifer system as being somewhat analogous to a financial trust established for a diverse group of beneficiaries. In this case, the trust (*the aquifer*) contains an initially funded principal amount (*aquifer storage*) and also receives periodic additions from earnings or "cash flow" generated by processes outside the trust's savings account (*aquifer recharge*). By the terms of the trust (*aquifer characteristics and parameters*), there is a maximum amount of principal that can to be held in the trust (*total aquifer storage*). Amounts in excess of this cap (*discharge)* may be distributed to the beneficiaries under the terms of the trust.

Professional trust officers (*water resource managers*) direct the trust, with input from members of a board representing the beneficiaries (*those using the aquifer*). The trust officers must abide by the terms of the trust (*certain well-known aquifer parameters*), their financial institution's asset management policies (*a local groundwater management plan*), and state and federal laws governing financial institutions (*that is, the Texas Water Code*).

Obviously, there are many differences between managing and allocating *natural resource* "accounts," like groundwater, and managing a financial trust. Exploring some of these differences may provide a few insights into the issues facing those involved in the efforts to manage groundwater resources in the Gulf Coast aquifer of Texas:

- The analogy assumes there is active management of the "trust assets," or the groundwater in the aquifer. This is the case in those areas within the Gulf Coast aquifer in Texas where there are groundwater conservation districts (GCDs) established by the Texas Legislature to provide for "local" management of groundwater resources. The exceptions are those areas where there are no GCDs.
- Unlike financial accounts such as trusts, where performance data is readily available to facilitate decision-making, usable data on aquifer parameters and conditions may not be available except where development has already occurred and monitoring is taking place. Where development is only anticipated—the areas most in need of good information to

support decisions on the allocation of groundwater resources—data is scarce, at best. This often leads to decisions being made on the basis of more subjective criteria, especially criteria that reflect the value systems prevailing within the decision-making body.

- While it may be assumed that the assets of the financial trust are used to generate economic benefit, at least to certain designated groups or individuals, not all groundwater uses are for the purpose of creating pure economic benefit. Some uses are environmental in nature—supporting populations of endangered species in the springs of the Edwards aquifer, for example—and may have little directly measurable economic benefit. In the context of groundwater management and allocation, however, these uses are generally recognized as having important "non-market" values and, in some cases, have been given higher priority than other, more traditionally valued uses of groundwater.[2]
- In managing a financial trust, the professional trust officers often find themselves dealing with beneficiaries who have conflicting views of how the trust should be managed. While the trust officers may understand the different points of view among the beneficiaries, they don't necessarily have the means, or an obligation, to make all the beneficiaries

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[2] In attempting to incorporate more of the subjective values at work among stakeholders, water planners and economists have had to address the non-market value of water resources. In fact, the *non-use*, or *passive use*, value of surface-water resources is now recognized as a legitimate economic parameter in evaluating the benefits of proposed water projects—although, because it is related to personal, aesthetic preferences, it is difficult to quantify objectively and incorporate in most economic analyses (*see* Hanemann, 2005 for a discussion of non-market valuation of water).

Someone once remarked—after trying unsuccessfully to generate income from a tract of rural land—that "the highest and best use of the property is just looking at it." It may be hard to "see," and accept, that groundwater has some inherently greater value being left in the aquifer, rather than being withdrawn for use, simply because an appreciation exists of the fact that "it's there." However, there are certain other values associated with non-use that may be held by some stakeholders and need to be considered: that is, the *bequest value*—the desire to leave it there for future generations—or, the *option value*—a desire to protect the resource, through current non-use, in order to have the option of potential use in the future.

Both of these two types of non-use values have, as an underlying element, some anticipated future economic benefit to be derived by actual use, albeit the use may occur at such an indeterminate time in the future that it is difficult to discount these back to a present value. In any case, the perceived value is real and appreciable to those holding these views.

Unfortunately, the allocation of groundwater under many current regulatory approaches tends to favor immediate withdrawal and actual use. For example, regulatory policies that reward use by basing permits on historic use—especially where there has been no significant prior development within an aquifer system—may penalize those who, in the past, wished to reserve the option to use groundwater in the future. Even policies based on identifying some sustainable quantity of "water available for permitting," and then issuing permits on a "first-come, first-served" basis up to that amount, reward those who apply for and receive the "rights" to use groundwater before the permit limit is reached, and penalize those who would prefer to "bequest" that right to subsequent generations.

happy with their actions. The comfort the trust officers have is that, under the terms of the trust, they are responsible for making investment and distribution decisions within a strictly defined set of legal and institutional policies. In contrast, groundwater resource management in Texas has largely been delegated to local GCDs, where elected board members and the professional staff they employ are operating in an "evolving" area of state law and public policy. These local officials often must make decisions without the benefit of adequate, accurate technical information on the aquifer system they are charged with managing. As a result, they may be heavily influenced by the value systems being expressed by particular stakeholders—especially those stakeholders who can vote in or influence the next local election.

Ownership Rights in Groundwater Resources

If groundwater can be considered a resource that lends itself to being used for some individual or collective benefit, then the question remains: "To whom, if anyone, does the groundwater belong?" Differing views on the ownership of groundwater, stemming from divergent value systems, create disagreement on which uses should be allowed and to whom the benefits should accrue.

It can be argued that some system of private ownership rights in water, including groundwater, is essential to encouraging investment in the infrastructure necessary to develop water supplies and make them available for use. Without such investment, whether from public or private sources, water will not be available to meet even the basic human needs. When the prospect exists of there being some means of realizing a return on investment, via, at minimum, the right to charge fees to recover the expense involved in making the water available for use, there tends to be a greater availability of water for most uses.

It is important to note that while the debate is not necessarily over the issue of ownership rights in water, there are widely diverging philosophical and legal opinions relating to whether "access to a basic water requirement is a fundamental human right implicitly and explicitly supported by international laws, declarations, and State practice" (Gleick, 1999).

Texas water law recognizes certain private ownership rights in groundwater—rights that are usually derived from ownership of the surface estate—including the right to receive whatever economic benefits accrue with the beneficial use of groundwater developed from beneath that surface estate. Historically, Texas law has provided that landowners could install wells on their property and withdraw groundwater, which they owned and could put to a recognized beneficial, non-wasteful use. Under Texas' version of the absolute "Rule of Capture," withdrawal of groundwater is relatively unconstrained—there is no liability involved even if a landowner's withdrawal and use of groundwater impairs another landowner's ability to withdraw and use groundwater from wells on his or her property.

Although there is a history of repeated rulings by the Texas Supreme Court upholding the Rule of Capture, the most recent rulings began to direct the attention of the Texas Legislature to the shortcomings of this legal doctrine as a basis for effective, equitable groundwater management (Potter, 2004). Gradually acknowledging the Texas Supreme Court's message that the Rule of

Capture was no longer an effective, or equitable, method of managing groundwater usage and avoiding conflicts between landowners, the Texas Legislature has more recently authorized and encouraged the creation of groundwater conservation districts (GCDs) as the "state's preferred method of groundwater management" (Texas Water Code, Chapter 36, Section 36.0015).

Chapter 36 of the Texas Water Code provides a detailed statement of legislative policy regarding the purpose of GCDs and establishes the legal framework for the management of groundwater under the authority of a GCD. Section 36.002 of the Texas Water Code states that:

> *The ownership and rights of the owners of the land and their lessees and assigns in groundwater are hereby recognized, and nothing in this code shall be construed as depriving or divesting the owners or their lessees and assigns of the ownership or rights,* ***except as those rights may be limited or altered by rules promulgated by a district****"* (Texas Water Code, Section 36.002—emphasis added).

Thus, while landowners still have certain "ownership or rights" in the groundwater resources associated with the surface estate, the reality is that, where GCDs exist and have adopted rules regulating groundwater withdrawals, there are significant constraints on a landowner's ability to fully exercise his or her "ownership or rights."

Ideally, such constraints are based on a legitimate effort to protect, and quantify, each landowner's respective rights to withdraw and use some amount of groundwater that does not interfere with the similar right of another landowner. If crafted properly and equitably applied, GCD management plans and rules function to provide landowners with a much greater degree of certainty regarding their rights and ownership in groundwater than what is available under the Rule of Capture.

How Groundwater Science, or the Lack Thereof, Shapes Views on Groundwater Resources

People develop different perspectives on the availability and sustainability of certain resources depending on the kind of information they have access to and how that information is presented. Even though the science of hydrogeology might be able to provide ever-increasing amounts of information on the characteristics and behavior of certain aquifer systems, much of that technical information will be useless in the context of de-centralized groundwater management unless it can be communicated to the non-technical audience in simple, understandable terms.

As a scientific discipline, hydrogeology is still grappling with how to create groundwater models and other tools that are equally *technically sophisticated* and *usable* by both the stakeholders and the professionals involved in the process at the local level. Unfortunately, as the tools tend to become more complex—by necessity—the level of understanding, outside of a select group of groundwater science practitioners, diminishes in a corresponding fashion.

The situation remains that most people develop their perspectives on local groundwater resources from information that is not very well founded in science, or from information that is less than

ideal in its accuracy and coverage. Unfortunately, even when a good amount of scientifically valid data is available on local and regional aquifer systems, it is hard to disseminate the information in a format that is quickly and easily understood by the vast majority of the stakeholders involved in the groundwater management process.[3]

Misapplication of "global" information to local problems—Faced with a lack of accurate, locally relevant, and easily accessible information, people often adopt views on groundwater resources that are derived from more general information on the availability and sustainability of groundwater. Lacking locally specific information on critical aquifer characteristics such as recharge rates, quantity of water in storage, transmissivity values, and other factors which dictate an aquifer's response to stresses, there is tendency to adopt and apply information gleaned from articles and information about conditions that may exist in other, perhaps completely different, aquifer systems. Unfortunately, news articles and other information readily available to the general public tend to focus on the problems of water scarcity and conflicts over limited water supplies—problems that may not exist in the local area.

Misinterpretation of limited data on groundwater resources—Even where there is an attempt by stakeholders to acquire and interpret technical data on local groundwater conditions, the limited amounts of data that are available, or mistakes in the way the data is analyzed, may lead to erroneous conclusions. An example might be where only a short period of record is available for measured water levels. Aquifer systems with significant storage tend to operate as temporal buffers of short-term processes that affect water levels. Where a few years of monitoring data may reveal some decreasing trend in water levels, without a long period of record, there may be no way to determine if that trend is a response to recent pumping stresses, or just a part of the normal, longer-term cycle of fluctuations in water levels. If a longer period of record were available, it might reveal that there were prior periods of both increases and decreases in water levels even during "pre-development" conditions.

Another common misinterpretation of limited hydrogeologic data is failing to consider and account for the effects of other stresses besides groundwater pumping on water levels in aquifers. In some areas overlying the Gulf Coast aquifer there has been a succession of changes in land use and vegetative cover. Changes such as an increase in impermeable cover due to urbanization or an increase in the amount of brush coverage affect the *net* recharge rates.[4]

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[3] The one major advance that has created some hope of bridging this communication gap is the use of computer-generated graphical displays of groundwater resources. These amazingly good visual representations of aquifer structure, characteristics, and response can be particularly effective in getting some broad base understanding of the hydrogeologic processes at work in a particular aquifer system. Unfortunately, computer-generated graphics are only as good as the information on which they are based, and data scarcity remains a seriously limiting factor in their development and deployment.

[4] Mesquite, huisache, and some other invasive brush are in a category of plants called "phreatophytes"—a deep-rooted plant that obtains water from the water table. The origin of the word is Greek: phrear or phreat, meaning "well" or "spring." It may help to picture a pasture infested with mesquite as being covered with thousands of "little

In some areas, where there has been little groundwater development, these factors may be more important determinants of water levels than pumping stresses. However, because precipitation and pumping data may be easier to obtain and correlate with whatever data is available on water levels, changes in water levels are sometimes associated only with variations in rainfall and/or pumping.

A Clash of Values

Although Chapter 36 of the Texas Water Code sets out the broader policy goals and the legal framework for groundwater management in Texas, GCDs operate in a climate where certain value systems give rise to strongly held views that may not correspond to either the reality of the hydrogeologic conditions or existing state law on the ownership, management, and allocation of groundwater. GCDs are local governmental bodies controlled by board members chosen in local elections—elections where non-resident landowners and other legitimate stakeholders may have no voice.

This situation sets the stage for a conflict between those concerned with the business of realizing the broader state water policy goals and those concerned simply with "local control" of groundwater resources. Most often this is manifested in the area of permits for projects that are proposed to develop and "export" groundwater out of a GCD's jurisdictional area. Since the majority of such proposed projects would involve a transfer of groundwater from rural areas to urban areas, the resulting conflict over the permits for these projects is often portrayed as a rural vs. urban "clash of values" (Kaiser, 1994).

While this may be true in some broad sense, explaining conflicts over groundwater projects like these as simply a fight between rural and urban interests ignores the fact that the permits for groundwater withdrawals are being sought by, or on behalf of, landowners in the GCD. If there were no landowners interested in exercising their rights and ownership in groundwater for the purpose of providing water for these types of projects, then there would not be a venue within which the broader rural vs. urban argument might arise.

The source of the current conflict over these proposed projects, then, would appear to originate in a clash between the value systems of the various "local" stakeholders—between the resident landowners and non-resident landowners, between large landowners and small landowners, between the "environmental community" and the "development community," or between any of the many other categories of stakeholders having divergent interests and views on how and where groundwater resources should be used.

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pumping wells" extracting stored water out of the ground and discharging it, as water vapor, through their leaves and into the atmosphere (http://www.answers.com/phreatophytes&r=67).

Managing Groundwater Resources—Responding to Need or Responding to Fear

Under the Rule of Capture, groundwater in Texas, or at least a large part of the state, was virtually "unmanageable." But where groundwater use was largely a matter of widely dispersed agricultural, domestic, and livestock wells, there was not a pressing need to establish a new regulatory scheme to replace the Rule of Capture.

The exceptions were aquifer systems with specifically identified problems resulting from excessive withdrawals—areas in need of groundwater management. Some special districts have been established and given authority by the Texas Legislature to address these real problems (for example, the GCDs in the Texas Panhandle over the Ogallala aquifer, the Harris-Galveston Subsidence District; and the Edwards Aquifer Authority). In these instances, the problems were well known to landowners and stakeholders within these districts, and the nature and extent of the regulatory authority provided to address the problems was clearly defined in the enabling legislation and subsequent district rules.

Chapter 35 of the Texas Water Code allows the state to designate Priority Groundwater Management Areas (also known as PGMAs) where certain problems exist and groundwater management is a high priority. The Legislature has provided that the state may create GCDs in these PGMAs, with or without local initiative, to address these problems (*see* Texas Water Code, Chapter 35, Sections 35.007–35.013).

More recently, however, many local GCDs have been established on the initiative of local interests because of a general concern that, lacking local control, some outside entity—usually the "water marketers" or big cities—could over-pump and "export" the groundwater in the area. It is an understandable reaction, based in the fear that a traditional way of life might be threatened by some new, large use of the groundwater resources in an area. However, it can create unrealistically high expectations about the role and the effectiveness of the resulting GCD in addressing these concerns.

Many voters, when considering the confirmation of a proposed GCD, do not realize either how little, or how much, authority is truly being granted by the state to affect "local control." Some of the confusion may be due to a lack of familiarity with the provisions of Chapter 36 of the Texas Water Code, which governs most GCDs. Even among the legal community there is a wide range of opinion regarding the authority state law grants to these districts to carry out their mission of managing groundwater resources.

State law, however, is relatively clear that GCDs must treat all applications for pumping permits on an equitable basis, including applications for wells that would export water. GCDs have no authority to deny permits for these projects simply because they may be unpopular. As a result, GCDs often have difficulty in fulfilling some of the local expectations that gave rise to their creation.

A New Framework is Necessary

Each of the divergent viewpoints evident among stakeholders probably has some basis in legitimate interests or concerns, but the result is that there are many different "horses" pulling the "water wagons" around Texas. It is unlikely that the Texas Legislature, having decided to de-centralize groundwater management and empower GCDs with some degree of local control over groundwater resources, will be able to herd all the horses into one corral. The challenge, and perhaps the key to success, is getting all the horses to realize the benefits of pulling their wagons in the same direction.

The goal is an effective and inclusive groundwater management process that recognizes and respects the diversity of stakeholder value systems regarding groundwater resources but also has a foundation on sound scientific principles and established state laws that govern groundwater management in Texas. Such a policy and management framework should:

- recognize and protect landowners' rights and ownership in groundwater resources and promote the role landowners can play in facilitating the sustainable, conjunctive management of water resources;
- minimize, as far as possible, well interference so that each and every landowner can fully exercise their respective right to develop their available groundwater resources and put those resources to a beneficial use of their choice;
- recognize and help realize both the broader state water management goals and the desires of local landowners in utilizing groundwater on a sustainable basis;
- incorporate and honor uses with "non-market" values, such as environmental flows and "non-use," including protection of the option to reserve the right of use of groundwater resources for some future generations; and
- minimize litigation over decisions made at the "local" management level.

How could this possibly be accomplished? First, it entails recognizing that there are a large number of stakeholders involved in the groundwater management process and that their level of knowledge and understanding of the hydrogeologic basis for groundwater management varies widely. The interests of all stakeholders would be well served if there were much more emphasis put on developing and implementing educational programs aimed at providing stakeholders with at least some amount of accurate, usable information about their respective aquifer systems. While there is a requirement that this be included in the approved management plan for a GCD, it may simply be beyond the ability of many local GCDs to fund and execute this task. It may be a more appropriate role for a state resource agency, like the Texas Water Development Board (TWDB), to develop and disseminate these basic educational resources. In fact, where good data exists in the Groundwater Availability Models (GAMs) developed by TWDB, it may not involve too much effort to take some of the graphical representations of aquifer system properties and use them to prepare regionally specific educational materials.

The state has already established what may be an appropriate venue for these efforts. The 79th Texas Legislature passed HB 1763, which requires local GCDs to engage in a joint planning and

coordination process aimed at establishing, by consensus, the "desired future conditions for the relevant aquifers in the management area." (In this case, the "management area" for each aquifer system is a specifically delineated "Groundwater Management Area," or GMA. GMAs were previously defined by TWDB in a rulemaking process responding to a legislative mandate contained in SB2, enacted by the 77th Texas Legislature (see SB2, Sections 2.21, 2.22, & 2.48).

Local groundwater management efforts do not operate in a vacuum. There needs to be greater effort made to communicate the importance of the broader policy goals that the Legislature has established for local groundwater management efforts and to highlight the benefits for all Texans.

It appears that the over-arching state policy with respect to groundwater management is to continue to recognize private property rights in groundwater, but to subject those rights to some limitations—based on locally specific groundwater conditions—so as to prevent well interference, waste, subsidence, and other manifestations of overuse of locally, or regionally, available groundwater resources (see Section 36.1071 of the Texas Water Code pertaining to those management goals required to be included in a GCD's management plan).

State law also appears to recognize that groundwater resources should be available for development and use as part of the larger need to assure a long-term, dependable, affordable supply of water for regions across the state. These statewide policy goals need to be more clearly and effectively communicated to local stakeholders so they can put their individual interests and value systems in perspective with the goal of providing for the broader interests and good of the state as a whole.

One way to encourage the internalization and adoption of the statewide policy goals is to provide incentives for local GCDs and stakeholders to participate in the process of groundwater management on a more regional basis. While the state, under the provisions of HB1763, appears to be heading in the direction of requiring more regional coordination among GCDs on certain basic issues, like identifying the "desired future condition" of an aquifer or portion of an aquifer, and using this information to determine the amount of "water available for permitting," there still remains the need to steer the de-centralized management process in more of a uniform direction.

Some stakeholders may have less fear about certain uses of groundwater if they can be assured that those uses generate identifiable benefits for the local area, in addition to achieving the goals of the landowner(s) involved and the broader goals of statewide water policy. This is where local incentives come into play. One example of an incentive may be to change state law so as to allow GCDs to use the revenues generated by export fees towards efforts designed to meet local economic development needs, rather than only for purposes of supporting the GCD's operating budget.

A Final Thought

In almost every gathering on the subject of water resources, someone will trot out the line "Whiskey is for drinking and water is for fighting." It is always attributed to Mark Twain,

although one researcher scoured everything Mark Twain wrote and couldn't find it in print. However, it certainly sounds like something Mark Twain *might have* said.

The truth may be that, while whiskey has probably started more fights than water, whiskey tends to fuel barroom brawls and riots, while water tends to ignite feuds, civil wars, and international conflicts. Disputes like these over water are usually rooted in divergent value systems that have not been properly identified or addressed before it is too late.

Perhaps a better paradigm would be that "whiskey is for drinking, and water is for sharing." Getting to this new framework for groundwater management might start with the various groups involved sitting down, over a drink—water, or whiskey, depending on your value system.

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