Concepts and Definitions Related

to Water Use in Georgia

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Executive Summary

Georgia is undergoing a transition from a condition of water abundance to one of water scarcity. Water scarcity occurs when available water resources are not sufficient to meet all of the demands placed upon them. Georgia's water scarcity results, in part, from the reduction in water supplies due to the recent, prolonged drought, as well as from increased demands by the state's burgeoning municipal, industrial, and agricultural sectors. The drought has also resulted in an increasing recognition of the high value of in-stream water flows in supporting aquatic ecosystems and outdoor recreation. No longer are available water quantities sufficient to meet all beneficial uses during times of drought at current rates of use.

The inevitable consequence of water scarcity is that the use of water for one purpose restricts the opportunity for other uses of the water. Water scarcity means that difficult decisions must now be made to develop and implement an improved system of water management in Georgia. There are many options for managing water. Regardless of which system emerges from the state's planning process, a water management system must establish how water is to be allocated among competing uses. Making this task even more complex is the need to develop allocation strategies that protect the aquatic environment and adapt to variable and uncertain climatic conditions while adjusting to the changing needs of a dynamic and fast-growing state.

New technical and institutional tools are needed to manage the state's water resources. It is almost certain that litigation will be the mechanism that allocates water if legislative and administrative mechanisms for mediating between competing uses cannot be crafted. A scheme of water allocation must be devised, along with a mechanism that allows for the reallocation of water between and among water users. The effort to fairly, effectively, and efficiently create a new water management system will be substantially easier if those involved in the debate are 1) clear about the multiple legitimate uses of water; 2) appreciate the fact that these uses will inevitably compete with each other; and 3) understand the complementary roles of public and private institutions in making decisions about water.

The purpose of this document is to discuss and clarify a range of issues that are central to the development of a water policy for Georgia. To accomplish this goal, we provide a set of definitions as a starting point for discussions of water resource management. Our intent is not to resolve the difficult problems that lie ahead, but rather to focus and inform the discussion.

The *Public Trust Doctrine* is a commonly used, but frequently misunderstood, term that may not provide sufficient guidance for the management of Georgia's water resources. We argue that the Public Trust Doctrine only requires that public benefits be considered when water is allocated - and not that public benefits are superior to private benefits.

We propose an alternative framework of water management, that defines water as a *public resource* that is managed in the *public interest* to support both *public* and *private* uses. The *public interest* should be defined in terms of maximizing the twin-goals of *environmental integrity* and *public welfare*. *Environmental integrity* includes *environmental health* and *ecosystem integrity*. *Public welfare* includes economic, health, safety, educational, aesthetic, recreational, and other quality of life metrics.

We then discuss the importance of basing water management on the *consumptive use* of water. Water uses are consumptive when they diminish the quantity or quality of water, either by the loss of the water by evapotranspiration to the atmosphere, by transfer from its point of withdrawal to a discharge location elsewhere, by storage and release so that the timing of discharge is different from its withdrawal, or by diminishing the discharge quality by reducing the assimilative capacity of receiving waters. *Non-*

consumptive uses of water are those that do not substantially alter the magnitude, quality, or timing of flows. Most water uses are consumptive to some degree; the key is to define the extent to which any given use affects the availability of water for other uses.

Next, we explain the differences between *water value*, the *price of water*, the *opportunity cost* of water, and *scarcity value* of water. The total *value of water* is practically infinite, because no life on Earth can survive without this precious resource. The *marginal value* of water provides information on the costs and benefits of changes from any given starting pattern of water use. The *opportunity cost* reflects the value of water when alternative uses are available. The *scarcity value* is the component of the price of a natural resource that reflects that the resource is in fixed supply relative to all of the competing beneficial uses of the resources.

Ideally, the price of water would be equal to its opportunity cost and would include its scarcity value. In Georgia, the price that water users currently pay does not reflect the water's opportunity cost or its scarcity value. If water prices did reflect these costs, users would have increased incentives for efficient use and conservation.

Finally, we propose a two-step process for approaching a water management plan. The first step establishes an initial allocation of water, based on some combination of historical use, legal precedent, fairness, and protection of public uses of water. The second step establishes a process for reallocating water to meet the needs of a changing state. We do not wish to favor nor to preclude any options in this discussion, but rather to establish a process for discussing these difficult issues.

The first water-resource allocation step is to formulate a framework for determining the *initial allocation* of public and private uses of water. An *initial allocation* is a one-time event that allows water uses to be determined for sectors and individual users. Public use allocations must include appropriate in-stream flow and water quality requirements for ecosystem protection and other public interest uses of water.

Fundamental to this process is the need to measure and quantify withdrawals and return flows, as well as to identify consumptive and non-consumptive uses by individual users of surface and groundwater resources. Also needed are the flow rates required for waste assimilation, or for other water quality objectives. The framework should also define the allocations so that uses can be modified based on flow quantity and quality at the time of use.

The second water-resource allocation step is to formulate a framework for allowing *water reallocations among* users. A *water transfer* is an ongoing adjustment to water resource needs of the state, communities, and the environment that moves water use from an initial allocation to a new pattern of use.

Mechanisms for water transfers can be voluntary or involuntary. Users that give up water in a reallocation process may or may not receive compensation. The choice of reallocation mechanisms has important consequences for efficiency, fairness, and the protection of public uses of water.

Water transfers may be facilitated by public or by private groups. The advantages and disadvantages of each mechanism should be evaluated and discussed. Important *third-party effects* should be considered for special classes of water transfers. A *third-party effect* results when individuals or entities not directly associated with the transfer are affected by the resulting change in water use. These include effects on the environment, on other water users, and on regional economies.

Managing Water in the Public Trust

Many in Georgia are discussing the relevance and importance of the *Public Trust Doctrine* with respect to the future allocation and management of Georgia's water resources. This section gives our interpretation of the concept of managing water in the *public trust*. Our intent is to define, and to distinguish between, a number of terms that have different, yet related, meanings. The intent of this exercise is to clarify the role of public and private entities in the allocation and management of water resources.

Water as a Public Trust

There are two different notions of water as a public trust. The *Public Trust Doctrine* is a set of responsibilities placed on government management of waterways, coastal lands, and other natural resources. It can be traced back to Roman Law, and is an important but imperfectly defined concept in current US environmental law[1].

The Public Trust Doctrine requires that the public benefits of water be considered when water is allocated. How central this concept will be in managing Georgia's waters is an open legal and policy question, and we will not comment on it at length here.

What needs to be made clear is that the Public Trust Doctrine does not automatically give priority to water uses that support ecosystems, fisheries, or recreational uses. The Public Trust Doctrine requires that these beneficial uses be balanced against other beneficial uses in public allocation decisions. In this sense, it merely holds that public decision-makers have a duty to manage water in the broadly defined public interest.

A second definition conveys the sense that water is a special resource that must be managed in the public interest. This is the sense in which water is referred to as a public resource held in trust:

> "WHEREAS, the surface and ground waters of the State of Georgia are public resources and are vital areas held by the state as a trustee charged with the duty to manage these waters in the best interests of the public" [2]

We interpret the use of the terms *public trust* and *public resource* in this context to mean that the state has an obligation to manage water resources in the *public interest*.

Water as a Public Resource

Water in Georgia is currently managed as a *public resource* that is allocated for both public and private uses. A *public resource* is ultimately allocated among competing users and managed by a public agency, or by a private agency with governmental review. Examples include the public lands, the broadcast spectrum, and website domain addresses.

Public uses of water are those where individuals benefit without substantially diminishing the benefits that other individuals enjoy from the same use. This includes water for recreational and aesthetic uses, supporting fisheries, and providing healthy ecosystems. Most public uses are available to anyone, although in some cases access is rationed or payment is required (for example, fishing and boating license fees may be required for recreation in public waters).

Private uses of water are those where the use directly benefits individuals or companies in their household or business activities. Most private uses are consumptive, so that water resources are diminished in quality and/or quantity when used. The benefits of private water use are generally limited to the individuals or companies engaged in the activity using the water, or to those that are granted access by that user.

Water will inevitably be put to both public and private uses. The important question here is the balance among all of the multiple demands upon the resource. Establishing that water is a public resource does not change the fact that a balancing of competing uses must still take place.

Water in the Public Interest

Water is required to support a diversity of functions that promote the general public interest, including both environmental integrity and public welfare - a partial list includes supporting ecosystem quality, providing opportunities for outdoor recreation, ensuring safe drinking water, serving as an input to agricultural production, and allowing for new and existing economic activity.

To better define the purpose of water resource management, we propose the following statement to characterize the nature of water as a public resource:

> Water is a *public resource* that is to be managed in the *public interest* to support both *public* and *private uses*.

The *public interest* should be defined in terms of maximizing the twin-goals of *environmental integrity* and *public welfare*. *Environmental integrity* includes *environmental health* and *ecosystem integrity*. *Public welfare* includes economic, health, safety, educational, aesthetic, recreational, and other quality of life metrics.

One reason that Georgia is embarking on a comprehensive exercise to improve its water planning and allocation system is that determining how to use water to best serve the public interest is not a straightforward task. While there is general agreement that water uses should serve the public interest, there is substantial disagreement about what water uses and water allocations will best accomplish this goal.

Consumptive and Non-Consumptive Water Use

Any water allocation scheme must be concerned with the way that any water use affects the availability of water for other uses. It is critical to distinguish between uses that do not diminish the resource, termed *non-consumptive uses*, and those that diminish the volume or quality of water, termed *consumptive uses*. When surface or ground water is diminished in quantity or quality, less water is available or suitable for other uses. In many cases, water use is a combination of consumptive and non-consumptive use, in that return flows partially degrade the quality or alter the timing and/or location of water resource availability.

Non-Consumptive Water Use

A water use that does not cause a loss in quantity or quality is a non-consumptive use. Non-consumptive use is consistent with the *Riparian Doctrine* inherited from English Common Law that allows property owners to utilize water that is on, or lies next to, their land for a beneficial use. Incumbent upon the use is that the water is returned to its source in such a manner that no substantial *tort* (harm, injury, damage) is induced.[3]

The riparian doctrine relies on the *Reasonable Use Theory* - some harm may be induced, so long as the use giving rise to such harm is viewed by the court as reasonable. This underscores the fact that all uses of water are consumptive to some degree; the key challenge is defining the nature and extent of harm.

Georgia relies, in large part, on its English Common Law heritage, including the Riparian Doctrine. As a result significant technical challenges arise when defining the harm to downstream users and ecosystems, as well as in defining the conditions of reasonable use. Uses that induce torts (e.g., harm to recreation, navigation, property, or fish) include returning insufficient water to the stream, returning

water at undesired times and locations, or returning water of poor quality.

Uses that are close to pure non-consumptive uses are in-stream flows for ecosystem maintenance and small, run-of-the-river hydropower generators with minimal water storage and blockages to fish migration. Even these uses have some effect on other water uses; for example, run-of-the-river dams can alter downstream sediment delivery. Many recreational uses of water — fishing, boating, aesthetic enjoyment — are also very close to pure non-consumptive use of water.

Consumptive Water Use

A water use that diminishes the quantity or quality of the resource is a consumptive use. These uses include water lost to evapotranspiration, water that is discharged at a different location or that is stored for later use, or water that is returned to its source but diminished in quality.

The volume of consumptive water use does not necessarily equal the permitted water withdrawal rate. Water withdrawn from rivers, streams, ponds, and groundwater is applied as irrigation water, or is used by industries and cities. While some of this water is used consumptively (e.g., lost as evapotranspiration), some return flows are always present. For example, cities discharge water back into rivers, lakes, and streams. Farmers return some water to streams and groundwater as irrigation return flows.

Withdrawals without corresponding return flows are therefore consumptive to their source. Some consumptive uses, however, may return water to other parts of the hydrologic systems. For example, ground-water withdrawals from deep aquifers by industry, municipalities, and even agricultural irrigation may result in return flows to surface water and shallow aquifers. These return flows may augment streamflow during drought periods. Interbasin water transfers are consumptive to the source basin, but augment water supplies in the destination basin.

The key issue in defining consumptive use is the extent to which water is diminished in quantity and quality. For example, if return flow to surface waters or aquifers has minimal concentration of contaminants, then this water imposes minimal harm to other uses. However, water that has elevated contaminant loads is consumptive to a greater degree in that it significantly limits the ability of others to put that water to another beneficial use downstream. Downstream users may be affected because lower-quality water is less useful for their needs, or because it prevents additional waste discharges due to waste loading restrictions.

Allocation and management policy should primarily pay attention to consumptive use. This means that it is essential to develop information on both withdrawals and returns, including the quality and timing of those returns. The volume and timing of transfers within and between hydrologic systems should be characterized and considered. Returns that have sufficient quality and appropriate timing for other uses should not be counted against a user's allocation.

Georgia currently lacks adequate information to determine the degree to which water is being used consumptively. Water withdrawal permits are issued in terms of the average and maximum rates of diversion, or based on pump size. Separate discharge permits are issued for the average and maximum rates of effluent discharge. Coupling actual diversion with return rates in order to obtain estimates of consumptive use is not currently possible, but can and should be implemented.

Better information is needed to quantify water budgets by use (e.g., municipal, industrial, agricultural). Quantifying return flows may be difficult for some users, however. While cities that discharge treated wastewater into rivers, lakes, and streams may have good information on return flows (excluding stormwater infiltration and inflow), such information may be difficult to acquire for agricultural uses.

In such cases, crop consumptive use models may be required.

Consumptive uses that affect water quality must also be considered. While the federally mandated *Total Maximum Daily Load* (TMDL) program addresses point and nonpoint source inputs, TMDLs do not currently consider the effects of water allocation on the assimilative capacity of rivers and streams to waste loads.

The TMDL program requires states to determine the maximum amount of various pollutants that may be added to each water body, either from point (e.g., NPDES regulated permits for municipal and industrial dischargers) or nonpoint (e.g., nonpermitted discharges such as agriculture and forestry) sources[4]. Implementing TMDL limits requires that the contribution from each source be allocated.

TMDL limits are generally expressed in either units of concentration (i.e., mass of contaminant per unit volume of water), or load (i.e., mass of contaminant per unit time). This allocation means that the contribution by one party *consumes* part of the maximum pollutant discharge mass allowed to the water body. Both adding waste to the river and removing water from the river increases the concentration of wastes in the river. Clearly, allocations of water quantity and waste loads must be coupled.

Water Conservation

Water conservation strategies should consider the extent to which a water use is consumptive. Water that is used non-consumptively is available for reuse. No matter how much water is used, the water can be infinitely recycled if properly treated. Consumptive uses of water, on the other hand, result in a loss of water or waste assimilation capacity from the hydrologic system. Thus, consumptive water uses must be treated differently than non-consumptive uses.

While indoor water use is primarily non-consumptive in quantity (for cooking, laundry, bathing, sanitation, etc), it may be consumptive in quality due to effluent release limits on in-stream water quality below the point of wastewater discharge. Water conservation efforts that focus on indoor water demand include low-flow appliances and peak water use reductions[5].

While indoor water conservation programs save infrastructure costs, they do not necessarily affect the quantity of water that is available for subsequent reuse. Indoor uses primarily affect wastewater loading from point sources, which is a consumptive use of the assimilative capacity of receiving waters. Outdoor uses (for lawns, pools, etc.) are primarily consumptive with respect to quantity.

From an environmental protection perspective, limitations on water use during critical periods ought to first focus on consumptive uses. From the perspective of making decisions about infrastructure, time-of-day use for both indoor and outdoor use is important. Conservation can be achieved through regulation, dissemination of information and education, and by offering incentives. To be effective, conservation strategies should clearly focus on the consumptive, as well as time-of-day, use of water to encourage both systemic long-term and emergency short-term conservation.

Water Value, Price, and Scarcity Value

Water is an invaluable resource. No plant or animal life is possible without it, and virtually all economic activity depends on water to some extent. In this sense it is correct to say that water has infinite value. This extraordinary value makes managing water resources such an important task.

However, infinite value does not in and of itself provide sufficient guidance in allocating water among its many competing uses. This requires judgment about the

opportunity cost of water use, which in turn requires the assessment of water's *marginal value* in alternative uses.

Opportunity Cost

The *opportunity cost* is what is lost in other uses by using water in a particular use. If a city is deciding whether or not to appropriate some quantity of water for new development, the opportunity cost of this appropriation is its use in the highest valued alternatives. This use could be for in-stream flow to support ecosystems and recreation, or for agriculture, or for different residential development at another location.

Marginal Value

The *marginal value* of water is the value of increasing the currently available quantity. While the total value of water to a household is large, the value of increasing or decreasing use by a few gallons per day is much smaller. When examining the allocation and reallocation of any resource, a central tenet of management is the need to focus on the costs and benefits imposed by the small, marginal changes from the *status quo*, and not on the total value of the resource in affected uses.

For example, if a farmer were to add one additional inch of irrigation water to their crop during a drought, then the marginal value would be the net gain in value to crop yield from that additional unit of water. When comparing alternative uses of scarce resources, one can compare the marginal value between competing uses. A larger marginal value reflects a more economically beneficial use than a smaller one. For example, if a farmer has a choice between irrigating two fields, Field A and Field B, and if water has a higher marginal value in Field A, then the farmer should irrigate Field A because a larger profit will be realized.

The concept of marginal value can also be applied to the environmental benefits of water use. A river that flows freely with no alteration can provide a suitable habitat for a wide range of aquatic organisms. If elevated flows during wet weather do not have a beneficial effect on environmental health, then some water can be diverted for beneficial use elsewhere. The opportunity cost of this water (its value in other uses) may be large, while the marginal value of water in the stream may be near zero.

In a world of perfect markets and information, a pricing scheme that sets the price of water equal to its marginal value in all uses would result in protecting the water that most needs protecting.

The marginal value of water for ecological protection and enhancement depends on both how water is allocated and on mitigation programs, such as habitat improvements such as riparian restoration, etc. By coupling the allocation of water to the marginal price of protecting and enhancing the environmental integrity, then withdrawals that cannot afford to maintain or enhance the environment would not be viable.

Determining a precise marginal value of water used to maintain ecological health is a difficult and uncertain task. However, it can be a useful exercise to try to arrive at an approximate value or range of values, depending on the circumstances of the ecosystem. Valuing water's marginal contribution to ecological health at a given price means that there is a quantitative benchmark that puts the ecosystem value of water directly into economic calculation of optimal water allocation.

The history of acquisitions of water from other uses to support ecological health in western states provides strong evidence that the value of water for in-stream uses is significant relative to other uses[6]. In Georgia, where water users do not currently consider scarcity value, it is likely that a substantial quantity of water is used with a lower marginal value than it would have in critical in-stream uses.

One example of the utility of including an explicit environmental value in water management decisions is to con-

sider the operation of regional reservoirs. Regional, off-channel reservoirs are being developed to supply water during droughts. These reservoirs divert water from a nearby river to augment regional water supplies. The diversion of flows from adjacent rivers into off-channel impoundments is currently regulated using a proportion of the mean annual flow or the 7Q10 (seven-day low flow with a 10-year return period).

Georgia's is most recent experience with off-stream reservoirs, the Bear Creek Reservoir on the Middle Oconee River near Athens, is illustrative of the need for accounting for ecosystem impacts. The reservoir is now being filled during low-flow periods (above the 7Q10) when the diversion still has a large adverse effect on aquatic ecosystems downstream. Diversions from the Middle Oconee River to fill the impoundment are discontinued during high-flow periods[7] - operators would rather use higher quality water available during low-flow conditions than surplus water during high-flow periods because stormwater contains higher levels of pathogens, sediments, nutrients, and organic matter, making it more difficult to treat[8].

If the marginal value of water for enhancing environmental quality were considered as the opportunity cost of water going to reservoir impoundments, it would have a marked effect on operators' decisions. The additional costs of treating water impounded during high-flow periods would have to be compared with the opportunity cost of water diverted in times of low flow. This example is meant to illustrate the general proposition that avoiding deleterious environmental impacts of water use is made easier when the marginal value of water for environmental uses is explicitly considered.

Water Price

Water often has a price. We all must sometimes pay for water, either for bottled water at the grocery store, or from municipal distribution systems connected to our homes, or by paying to have a well installed. We may also have to pay for the treatment of this water before and after we use it.

Currently, the price of water is based only on its cost of delivery. The delivery cost is the sum of withdrawal costs (diversion structures for surface water, or well construction for ground water), storage costs (reservoirs), treatment costs (filtering, etc.) and transportation costs (pumping, pipelines, etc.). For many, if not most, users, decisions about water use do not include these individual costs because they are only aware of the final, delivered cost of water.

In addition to the delivery price, we must often pay a disposal fee for water that we have used. Wastewater has a disposal cost associated with its collection and treatment. Collection costs include the construction and maintenance of wastewater conveyance systems, as well as the construction, maintenance, and operation of wastewater treatment facilities. For homes not connected to regional wastewater sewer systems, home or neighborhood septic systems require construction and ongoing maintenance. Industries may have their own wastewater treatment or pre-treatment systems. The costs of wastewater disposal are usually represented by a price set by the local wastewater authority for regional facilities, or out-of-pocket costs for individual operators.

Scarcity Value

In a well-functioning market, the price of a good reflects the interchange between the varied demands for the good and the costs of supplying it. However, for many natural resources, such as oil or minerals, the relative scarcity of the resource causes a divergence between the cost of production and the price that is observed.

This is because buyers who value the resource more are willing to pay higher prices until the quantity demanded equals the amount supplied. This difference

between the cost of production and the price paid for the resource is the *"scarcity value"* or *"scarcity rent"* attributed to the last unit of the resource consumed[9].

The fact that water is now a scarce good -- there is not enough for everyone to use as much water as they want for all uses -- means that water should have a scarcity rent incorporated in its price. However, because water rights are not clearly defined in Georgia, a scarcity rent is not charged as it is for marketable commodities such as kaolin clay, marble, gravel, crude oil, gold, coal, or other natural resources.

By including the scarcity value in the price, then inefficient users who provide little economic benefit to the state would be motivated to transfer their water to more efficient users with greater economic and social benefits. Clearly, defining these benefits from a regional perspective is an important priority.

When a market economy is working efficiently, with well-specified rights and full information, price is an indication of the value of the resource in alternative uses. Users that place the highest value on the resource will be willing to pay the highest price. Under these circumstances, the opportunity cost of these goods or services are automatically taken into account when allocation decisions are made. Price *does not serve* this function for water in Georgia for two related reasons:

1. The scarcity value of water is not included in its price. Users can withdraw ground and surface water (if they are permitted) for the cost of extraction, conveyance, and treatment. This means that price does not serve to convey information about the opportunity cost of water use. A water management system uses price as a management tool to best effect when the scarcity value of water is included in its price.

2. Most public uses of water possess characteristics that make it difficult for their value to be determined in economic markets. The public nature of in-stream water uses means that individuals are ordinarily not expected to directly pay for the use of these resources. An inability to exclude people from enjoying public benefits of water would make it virtually impossible to charge such a price even if it were desirable to do so.

   In addition, water's contribution to environmental quality is difficult to define and explain with precision. The fact that markets are unable to determine an appropriate price for public uses of water does not mean that these public uses of water do not have a marginal value.

Water Rights

The fact that water has become scarce means that Georgia must develop and implement a water management system that more exactly defines who can use water, how much they can use, when they can use it, and how this allocation system can be adjusted in response to changing conditions. This means that water rights will need to be more precisely defined than they are now.

Water transfers and water markets have been frequently mentioned in the public debate over water, and have often been polarizing topics. Some feel that allowing transfers in return for compensation will harm the environment. There is also concern that water transfers and markets could result in large wealth transfers to private parties and a centralization of the control of water in the hands of large cities and industries. Others feel that the privatizing of water resources is the best mechanism for assuring efficient allocations.

To resolve these issues, it may help to separate the question of the assignment of water rights from the role of transfers and markets. The emphasis should first be on clearly assigning quantitative rights, and then on provid-

ing system flexibility to reallocate water in a way that reflects the validity of new or overlooked uses while protecting existing users and the environment.

Initial Water Allocations

Initial allocation of water will almost certainly be made by the government (either legislatively, administratively, or judicially) through a variety of state and federal processes and precedents. This process will result in a *de facto* allocation of water between public and private uses, as well as an allocation among private uses. It is important to recognize public uses of water explicitly in this allocation process, rather than allowing these uses to be assigned a residual share of unallocated water to be protected only through water quality rules and legislation.

Any initial assignment of water rights will also have to consider the water requirements of federal agencies and downstream and neighboring states, as well as existing uses within the state. The allocation should distinguish between consumptive and non-consumptive uses from both water quantity as well as water quality (i.e., TMDL) perspectives.

An initial allocation of Georgia's water resources could be performed based on patterns of historical use, legal precedent, and economic analyses, or based on concepts of fairness and equity. We expect that some combination of all of these factors will enter into the allocation process. In crafting any system of water allocations that defines and implements water rights, it should be recognized that Georgia is bestowing a valuable asset.

If water is granted as it has been historically to users who put it to beneficial use without any cost reflecting its scarcity value, then the holders of these rights are being given a public resource that enhances their private profit or enjoyment. Particularly, if existing water uses are honored (i.e., grandfathered) for specified or unspecified time periods, then the holders of these rights are being granted a right to the exclusion of others. There may be reasons for doing this, including recognition of previous investment in infrastructure associated with the development of these water resources. However, the central point here is that a water right conveys a valuable asset to the holder.

Water Transfers

The second essential step in defining a system of water rights is determining how they can be modified over time. This step raises a number of questions:

- Do water rights transfer to a new owner when property is sold?
- Do water rights transfer when a company or manufacturing installation is sold to new owners?
- Can water rights transfer from one use to another, say, from agricultural to domestic, or from industrial to municipal?
- Can water rights be transferred from one basin to another?
- And, perhaps most importantly, what happens when a new application is made for a permit for a legitimate beneficial use, and the fact of water scarcity means that the permit cannot be granted without diminishing some other existing water rights, including in-stream uses?

It is in this second step that water transfers come into play. Once water has been allocated through a comprehensive system of water rights, it is then possible to allow water transfers. Water transfers can help water allocation by providing flexibility to meet new conditions. Water transfers can:

- Allow new users the opportunity to obtain supplies while providing compensation to those whose water rights must be modified to provide these supplies;

- Reflect changing needs on the part of both public and private users;
- Provide incentives for conservation by municipal, industrial, power, and agricultural users by creating an explicit financial opportunity cost for water use;
- Account for short- and long-term changes in the availability of water due to rainfall conditions;
- Increase in-stream flows during critical periods through the purchase or lease of water for in-stream uses; and
- Provide incentives for the holders of existing rights to support institutional changes that measure and define use and allocation.

Water transfers must take place in the context of a state's system of water rights. These transfers must also be consistent with the goals of the state's water plan. Of particular importance is the manner in which transfers might affect the timing of water use, and the timing and quality of water returns. There must exist mechanisms for considering the effects of private transactions on in-stream uses[10].

Georgia needs to be able to have its regulated allocation system evolve to one that gives more explicit rights and duties to water users. The allocation will be more efficient if decisions are made that increase the allocation for public benefits associated with water (e.g., in-stream flows). This allows the remaining water for private use to be allocated and re-allocated as efficiently as possible, and provides widespread incentives for conservation. Water transfers are one of the tools that can help to accomplish this outcome.

Reallocation through voluntary transfers only works when water rights are defined and quantified; otherwise there is substantial risk that increasing amounts of diversion and pumping would result from transfers.

Water Markets

One characteristic of water transfers in return for compensation is that this system would cause users to begin to consider the scarcity value of water. For example, a farmer transferring water to an industry would receive a price from the industry that reflects not only pumping and storage costs, but also the fact that water is too scarce for the industry to be granted a permit at no cost.

The fact that transferring water may bring a greater return to the holder of a water right gives these holders a greater incentive to invest in water conservation. In the case of agriculture, incentives to invest in more efficient irrigation would be increased. In industry, less water intensive production would be favored.

Water rights and prices that reflect costs and benefits will help promote successful, efficient water conservation. Water that is used inefficiently cannot be sold, and so any users eligible for transfers with compensation would have a greater incentive to use less water. Rational pricing schemes will reinforce and complement other mechanisms for achieving conservation.

The allocation of water to private entities for resale is clearly an initial allocation decision. Yet, prohibitions on water transfers or markets would make these allocations meaningless. While speculative water rights (i.e., allocations based on unspecified future uses) should be discouraged in order to prevent hoarding, a prohibition on the later transfer of water allocations may block efficient water reallocation. Caution is certainly justified here: water should not be appropriated for free (especially where no historical use right exists) and then be re-sold to municipal water systems simply because a private entity asserts a water right.

On the other hand, it may be counter-productive to initiate a water allocation system which sets quantitative rights over water use and then prevents the water covered by those rights from being sold to those who value it more.

Concern about the transfer of wealth to speculators could potentially be addressed under some conditions by selling, rather than giving away, new water rights.

Finally, a general provision that prohibits the transfer of water out-of-state should be carefully deliberated -- particularly if Georgia ever anticipates purchasing water from other states in time of need. One way to lessen the fear of speculation is to establish mechanisms for state review of specified types of transfers.

Third Party Effects

Water transfers between two parties can cause gains or losses to other interests as well. There are two kinds of third party effects that have received significant attention for water transfers in other states: effects on the environment and other in-stream uses, and effects on regional economies. It is important that a water management system be clear about the importance of these third party effects in its water reallocation mechanisms. Both the rights of third parties as well as the process by which these rights are represented during the approval or disapproval of transfers should, ideally, be as unambiguous and transparent as possible.

Water transfers that affect the timing and location of water flows have obvious implications for environmental and recreational uses of water. As discussed above, safeguarding these uses is an essential element in a water management system. However, reallocation to beneficial use is needlessly hindered when challenges to transfers are expensive, time-consuming, or are, to any extent, arbitrary. It should be recognized that making transfers more difficult would create pressure to procure new sources of water for high-value uses through mechanisms that may have damaging effects on the public interest.

For example, if new residential or industrial users cannot effect voluntary transfers because of third-party challenges, those users will press for new off-stream reservoirs or greater groundwater allocations.

Effects on regional economies have been of significant concern in water transfers in other states[11]. Although the user that has the highest productive use for water may be willing to pay the highest price, the effect on the overall economy of the transferring region may be negative. Specifically, cities may purchase water rights from agricultural users. Although farmers may be better off because of the compensation they receive, schools and government might be adversely affected because of a decline in the tax base, local farm suppliers might not sell as many agricultural production inputs, and banks might lose their client base.

One way of approaching these concerns is to have differential standards of review for transfers within a water basin, and for transfers to other basins. Another potential approach is to require out-of-basin transfers to carry a higher price tag, with some of the transfer (either in the form of money or water) going to compensate damaged parties in the local economy.

The extent to which such measures are desirable is an open political, social, and economic question. It may be more constructive, and provide greater flexibility in the long-run, to approach this question by trying to determine what kinds of safeguards are desirable than to either prevent or allow all interbasin transfers.

More broadly, a water transfer process should have clear rules for when all transfers can or cannot take place. Water transfers within specific geographic areas and between similar industries do not have the same third-party consequences as transfers over longer distances and to different industries. Economic disruption can result if a major industry closes and the water rights are transferred elsewhere to a different type of industry. The degree of review should reflect the distance and change in use of water use transfers.

Conclusions

In this paper we have argued that Georgia's water resources should be managed in the public interest, and that both public and private uses of water can and do serve this interest. Allocating and re-allocating water among many competing uses is the central challenge for Georgia's water management system. Making progress in meeting this challenge requires measuring and quantifying the way water is used, and the ways that this use diminishes the resource in quantity and quality.

The economic value of water should reflect its scarcity. The economic benefits conferred by water could be enhanced by allocating water where its marginal value is highest. Considering the marginal value of water for environmental and recreation uses is essential, although measurement is difficult. More fully accounting for the marginal value of water in the price paid by users would help to improve conservation and overall efficiency of use.

Conditions of water scarcity require a more comprehensive and more precise set of water rights than currently exists in Georgia. In crafting an allocation system for existing and new uses, the state should recognize that the right to use water conveys an economic benefit on the holder of that right. The state also must provide for the reallocation of water to reflect changes in the needs of citizens, industry, and agriculture and to respond to changing hydrological conditions. Water transfers are one tool that can play an important part in efficiently reallocating water. Any process of reallocation will have to consider the effect of changes on third parties.

Forming a new water management system presents formidable technical, legal, and political challenges. We hope that the definitions and structure we have put forth in this paper will help to guide the debate in ways that make the important choices more clear. We believe that we have suggested some of the elements of a water management system that will best serve the needs of all of the citizens of Georgia.

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Notes

1 Bray, Paul M., “Introduction to The Government Law Center of Albany Law School Public Trust Doctrine Home Page”, http://stella.als.edu/glc/ptd-home.htm

2 Proposed Georgia Water Bill of Rights: athttp://www.legis.state.ga.us/Legis/2001_02/versions/sr85_LC_21_6223_SR85_2.htm

3 Goldfarb, William. 1984. Water Law. Boston: Butterworth Publishers.

4 US EPA, Introduction to TMDLs, http://www.epa.gov/owow/tmdl/intro.html

5 US EPA, How to Conserve Water and Use It Effectively, http://www.epa.gov/OW/you/chap3.html

6 for examples, see http://www.owt.org/ and http://www.environmentaldefense.org/pubs/Newsletter/2001/May/r_salmon.html

7 Unpublished data from http://water.usgs.gov/ga/nwis/current/?type=flow&group_key=basin_cd

8 Athens-Clarke County Water Treatment Plant, Personal Communication

9 Moncur, James E. T. and Richard L. Pollock. 1988. Scarcity rents for water: a valuation and pricing model. Land Economics 64(1): 62-72.

10 Colby, Bonnie G., “Negotiated Transactions as Conflict Resolution Mechanisms” in Markets for Water: Potential and Performance, Easter, Rosegrant, and Dinar eds.

11 Howitt, Richard, “Spot Prices, Option Prices, and Water Markets: An Analysis of Emerging Markets in California”, in Markets for Water: Potential and Performance, Easter, Rosegrant, and Dinar eds.