FINAL REPORT

WATER SUPPLY CHALLENGES FACING TENNESSEE: CASE STUDY ANALYSES AND THE NEED FOR LONG-TERM PLANNING

by

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EXECUTIVE SUMMARY

WATER SUPPLY CHALLENGES FACING TENNESSEE: CASE STUDY ANALYSES AND THE NEED FOR LONG-TERM PLANNING

1. STUDY OBJECTIVES. The objective of this study was to examine how emerging water conflicts affecting Tennessee may be resolved effectively and judiciously through legal and policy tools. We focused upon two principal case studies as a means of grasping how water conflicts - and the long-term problems giving rise to them - may be addressed:

(1) The possible diversion of the Tennessee River near Chattanooga to supply the needs of Atlanta, Georgia; and,

(2) Competition between water users in West Tennessee and Northern Mississippi over the Memphis Sand Aquifer.

Following a brief discussion of how we undertook our research into these cases and the underlying issues surrounding them ("Methodology"), we then provide our findings and recommendations in the order in which they appear in the final report.

Methodology. We began from the premise that water conflicts, their sources, and how to alleviate them can only be properly understood through focusing on *specific case studies* which provide a *context* in which physical, legal, political, and economic factors play out. The cases we selected were chosen because they constitute serious, long-term water supply challenges. They also exemplify a wide range of issues that are not only important to understanding potential *interstate* water conflicts affecting Tennessee and its neighbors, but because they reflect broader trends that affect *intrastate conflicts* among Tennessee communities, such as growing demands and competition among users.

Tennessee's water conflicts comprise three major parts: baseline conditions; threats to these conditions; & options for managing these threats. In our study, existing law and water supply constitute the "baseline;" the cases represent "threats;" and a water stakeholders' survey and legal and policy analyses comprise initial assessments of viable "options."

We studied these three major parts in the following ways:

(1) *"Baseline" issues* were examined by reviewing U.S. and Tennessee water law, including case law and riparian doctrine. Water supply conditions were studied by assessing previous studies on the distribution of Tennessee's water and water use patterns.

(2) *Threats to water conditions* were studied by examining press reports, government documents, and legal precedents relevant to these two case studies and to water supply problems in the state in general (e.g., drought).

(3) *Policy options* were examined in light of legal precedent and public opinion. A user group survey, administered to nearly 40 stakeholders, was administered to gauge the views of major water users and others regarding the conditions and problems facing the state's water supply and the impact and acceptability of possible reforms to its management.

2. A TUTORIAL ON AMERICAN WATER LAW - OVERVIEW & FINDINGS. To understand Tennessee's options in dealing with these conflicts, we first provided an overview of relevant

water law principles. This review led to five conclusions:

- **Tennessee is a *riparian* & *common law* state. Under riparian law, a land owner has the right to "reasonable" use of the water flowing past his property subject to the equal rights of other riparians.** Water used but not consumed must be returned to the watercourse without impairing its quality. Nonriparian use of water is prohibited *except* by municipalities. Diverting water from the drainage area of the watercourse without return flow is deemed unreasonable and, if a downstream riparian complains, forbidden.

- **Groundwater users can pump from an aquifer underlying their land for reasonable use.** Water use on non-overlying land is prohibited. Groundwater users' rights are *correlative* to those of others - this means that in satisfying reasonable use, a user must not pump in quantities that impair the ability of others whose land overlies the aquifer.

- **Common law water rights *are* property rights but *not* ownership rights. They are called "usufruct" - the right to use water as it is available.** Other riparian users must demonstrate damage to their present uses as a result of another's use before courts will grant an injunction or require compensation. However, if the user is a municipality, the courts usually won't prevent the use, even if damage is demonstrated.

- ***Interbasin diversion* may be stopped without proving actual damage.** Under riparian law, diversion is, per se, unreasonable. Even though the issue has never come before Tennessee Courts, given the riparian users likely to be affected by diversion, a suit by someone is likely.

- **Although riparian rights can't be lost through disuse, a user whose use is "unreasonable" may "vest" (secure) that use by *prescription*.** Prescription is continued use over a period of usually 20 years without action to stop the use by those whose rights are threatened. This is significant for the Memphis Sand Aquifer - it relates to Mississippi's ability to complain against Tennessee's ongoing water use.

3. TENNESSEE RIPARIAN LAW PRINCIPLES - SIGNIFICANCE TO THESE CONFLICTS.
Tennessee claims to own all the "waters of the state," including groundwater (and excluding atmospheric moisture; e.g., clouds) and to hold them in public trust. This *fiduciary responsibility* on behalf of its citizens, coupled with the state's *police powers* to protect public health, navigation, wildlife and aquatic habitat, and to act in time of drought, gives it considerable power to manage its water. The state does not have any actual property right to these waters except in cases where the state itself is a riparian (i.e., where state lands adjoin a watercourse).

- **The governor can act to prevent uses that would damage public rights in water.** Although the General Assembly hasn't enacted extensive administrative withdrawal permit programs, as have surrounding states, authority to prevent major damage is still considerable.

- **"Aquatic Resource Alteration Permit" (ARAP) rules could provide additional state authority to prevent interstate diversion of the Tennessee River.** Under these rules, supplemented by new rules being finalized, ARAPS can deny water withdrawals if they impose a negative impact on "instream" environments absent any polluting discharges (i.e., low river flow effects on fisheries). This supplements other traditional legal

protections.

- **Although the federal government generally defers to state law, where Congress has expressed a specific federal purpose (e.g., preventing pollution of interstate waters), federal law is supreme and states cannot regulate the federal government unless the latter waives its sovereign immunity.** Moreover, the Constitution provides that Congress has authority over interstate commerce and navigation. Thus, navigable waters have overriding federal interests that states cannot impair through law.

4. INTERSTATE WATER ALLOCATION APPROACHES & METHODS. In general, when a watercourse (surface or groundwater) flows through two or more states, and there is conflict between an upper and lower riparian over rights to that watercourse's flow, there are six ways the issue can be legally resolved:

(1) A private lawsuit between *water users* in different states - these are becoming rare because states now take an interest in interstate water allocation on behalf of their residents.

(2) An *equitable apportionment* lawsuit between different *states* - these are becoming more frequent and have led to a decline in private suits.

(3) Interstate allocation by act of Congress - without the need for consent by affected states' legislatures.

(4) Allocation through agreement among all states with rights to the watercourse (interstate compact).

(5) State regulation of interstate water export.

(6) Interstate cooperation to allocate water *without a compact* - this is thought to be of minor importance and uncertain prospects.

- **Allocation through *interstate compact* is the preferred method because unlike the others, it permits certainty, is durable, provides greater state discretion in allocating water, and is the least contentious in the long run.**

5. THE TWO CASE STUDIES AS "WATER ALLOCATION" CONTROVERSIES

(A) The possible diversion of the Tennessee River near Chattanooga to supply the needs of Atlanta, Georgia.

Background. Georgia is in the throes of a water war with Alabama and Florida, the focus of which is water allocation from two basins: the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint. Two compacts, ratified by Congress in 1997, and scheduled to take effect once the three states agree on an allocation formula, will place verifiable limits on Georgia's ability to draw water from both basins. Among other options, Atlanta has considered exploring purchasing water from Chattanooga's municipal supplier, the Tennessee American Water Company, and diverting it via pipeline. From a legal standpoint, we found that:

- **Although the Tennessee River is an interstate watercourse, since any hypothetical diversion would occur in Tennessee, it would likely be decided under Tennessee**

law. Although the headwaters of several Tennessee tributaries rise in Georgia, Georgia isn't a riparian to the Tennessee River. Courts are unlikely to apportion water to a state that isn't a riparian.

- **Although there are no cases deciding interbasin transfers in Tennessee, diverting large amounts of water without return flow is probably impermissible under Tennessee law if any downstream riparian complains.** The lower riparian may not even have to show damages to stop the diversion (e.g., large interbasin transfers). Generally, existing conditions are one factor which the courts consider when deciding the merits of such diversions.

- **While Georgia now receives some Tennessee River water, the amounts are small and the flow is returned to the river, generating no riparian conflicts.** Since 1997, Tennessee American Water Company has supplied water to Ft. Oglethorpe and Catoosa County, Georgia: communities experiencing high population growth. However, the volumes discussed for an Atlanta diversion must be greater than 30 Mgal/d to be "economically feasible."

- **The U.S. Supreme Court has never considered the allocation of interstate waters to a state that has no riparian right to the water.** Thus, if the issue went to the court because of an equitable apportionment suit, the diversion would probably be prevented. Legal scholars think it is unlikely that the Court would act in a manner that would create a property right where no such right now exists.

(B) Competition between water users in West Tennessee and Northern Mississippi over the Memphis Sand Aquifer

Background. Memphis is one of the largest cities in the world to rely on groundwater wells for its water supply. The city's water is provided by a publicly-owned municipal utility, Memphis Light, Gas, and Water (MLGW). MLGW's wells tap into the Memphis Sand Aquifer, a reservoir underlying nearly 7400 mi^2 of W. Tennessee and parts of N. Mississippi, SW Kentucky, and E. Arkansas. While MLGW is the largest aquifer user, DeSoto County, Mississippi, an area experiencing rapid population growth, views the aquifer as a potential source of future supply. 20-40 Mgal/d of Memphis' nearly 145 Mgal/d withdrawn from the aquifer come from beneath DeSoto County. Thus, demands have arisen to pursue a more integrated, regional approach to aquifer management.

- **Two major problems could give rise to legal conflict between Mississippi and Tennessee regarding the MSA - Mississippi's concern with declining water levels in the aquifer, and the MSA's susceptibility to contamination.** Aquifer recharge occurs along a broad belt encompassing parts of three states and this area needs protection from development to preserve the aquifer. A major cone of depression *has* developed in the Memphis area but it has not been determined if any "overdrafting" has occurred; i.e., that water levels could not return to normal if pumping ceased.

- **There is concern that pumping from the MSA - by parties in Mississippi *or* Tennessee - may impair the rights of users in the other state. Thus, under common law, MLGW could be held liable if it is shown that it is pumping in quantities that impair the rights of other land owners who overlie the aquifer in Tennessee or**

Mississippi. Some landowners in Mississippi have complained that pumping for Memphis' municipal use is damaging their ability to use the aquifer. In the future, Tennessee landowners might possibly lodge complaints. As of this writing, there has been no determination of a significant decline in water levels in Mississippi or of a measurable effect on well yields in north Mississippi.

- **A *judgment* against MLGW or other Tennessee water users regarding damage to the MSA could not only be brought to court in Mississippi but if the court rendered a judgment for injunctive relief against MLGW, it would probably have to be enforced by Tennessee courts.** Under the "Full Faith and Credit" clause of the U.S. Constitution, Tennessee must enforce a judgment from a Mississippi court. A suit could properly be brought against MLGW in Mississippi because, although the damage was "caused" by a Tennessee entity, it "occurred" in Mississippi.

- **It might be appropriate for Tennessee and Mississippi to act to restrain pumping of the MSA, to encourage Memphis and other large users to conserve on use, and to continue their efforts to better understand what is actually happening in the aquifer.** If the states of Tennessee and Mississippi do not act to protect their interests in protecting the aquifer, the issue may be taken to court, either by individuals claiming damage to their rights in Mississippi or Tennessee, or by a suit in the Supreme Court against one state brought by citizens of the other acting for its citizens.

6. LONG-TERM CHALLENGES TO WATER SUPPLY WHICH UNDERLIE THESE CASES

- **Water supply is generally plentiful statewide, but regional variations in use pose serious challenges.** E. Tennessee uses 2.5 times as much water as Middle Tennessee & 24 times as much as W. Tennessee due in part to power generation. Moreover, while surface water use predominates statewide, groundwater constitutes 89% of water used for non-power purposes in W. Tennessee - with half of the state's population (residing in the western one-quarter of the state) relying on groundwater for drinking water.

- **Periodic drought is a major challenge to water supply and quality in the state.** This is evidenced by problems arising in 1985-88 where precipitation statewide was 75 percent of normal and streamflow about *half* of normal, leading to emergency measures to allocate and conserve in a few local areas of the state.

- **Additional water conflicts arising from proposed diversions could arise in the future.** Projected population increases/shifts may generate new conflicts, even without drought. Existing water rights may be damaged or lost to new uses. Trends show that water use for thermoelectric generation increased between 1975-1995, while agricultural water use increased from roughly 50 Mgal/d to over 85 Mgal/d between 1975-1990 before declining.

- **Tennessee must act consistently toward in-state and out-of-state users.** Thus, water diversions cannot simply be fought against out-of-state uses while allowed for in-state uses. However, because in-state uses are, generally, more likely to return flow to the same system/basin than would be the case for out-of-state uses in a different basin, in-state uses would likely be more acceptable under riparian law and water quality statutes (i.e., the Utility District Act, Water Resource Act, and Water Quality Control Act).

7. INSTITUTIONAL MECHANISMS AND APPROACHES TO RESOLVE THESE CONFLICTS

- **The *viability* of solutions to Tennessee's water problems must be viewed in light of both legal precedent AND public opinion**. A survey of nearly 40 users representing various groups around the state, conducted last summer, suggests resistance to radical change in water management on the part of current users but willingness to accept moderate changes; including a statewide set of water supply data, a statewide planning process & drought management system, and mediation.

- **Changes to current law, & new laws and institutions that might be considered include interstate compacts, especially for MSA; permits for large water withdrawals or interbasin transfers; and some kind of water marketing scheme.** Our survey found that a withdrawal permitting system and the selling of water rights would probably not be favored. Most believe water is plentiful & free.

- **Neighboring states (AL, GA, KY, MS, NC, VA) employ many methods to avert intrastate & interstate conflicts. These have developed gradually, through consultation & coordination with many groups.** Drought emergency management plans, comprehensive assessment of vulnerabilities, and minimum stream flow regulations are some features of these approaches - and all these states require permits for most water withdrawals. AL and NC have passed legislation allowing for the designation of areas which are experiencing critical stress wherein withdrawals can be restricted. VA has groundwater management areas. Basin-wide management and long term planning for water supplies are being given increasing consideration by these states as they begin to experience supply problems due to population growth and urbanization. Finally, GA recently took steps to improve regional planning, including water planning, by requiring state involvement in land use planning in the 18-county Atlanta metro area. While these states also face problems in implementation, they have in place procedures for managing withdrawal and inter-basin diversion.

- **Interstate compacts are not panaceas.** Once consummated, they require regular, intensive, face-to-face negotiations and careful coordination of politically-neutral technical staffs. Congress no longer funds them, and disputes can still arise over demand projections & water allocation.

- **Water markets have arisen under extreme drought conditions, generally require a large physical infrastructure for "moving" water, and, if imposed by state statute, could be seen as a "takings" issue.** Under riparian law, there is no right to a specified amount of water, and no such thing as "excess" water. Thus, you one cannot contract delivery of a specific amount of water for a specified term. Statutory change would be required to make water marketing work in Tennessee. Moreover, if this market is mandatory, damages/compensation might have to be paid. If the market is voluntary, damages to downstream riparians might occur. Efforts to follow a market approach by allowing the sale and transfer of water rights brokered through state or local banks have had mixed success.

- **In the western U.S. where the prior appropriation doctrine allows more definite claims to specific quantities of water, there is growing movement away from**

absolute claims to "first in time, first in right." Despite water scarcity, there is greater emphasis on preserving and protecting in-stream flows regardless of existing appropriative rights.

- **International efforts to protect water sources and to fairly allocate supplies often fail in the face of unequal political power.** The situation between Israel and Jordan - and Israel and the Palestinian West Bank - are examples of this. However, at least in theory, all international schemes for water management espouse the principle of equitable apportionment employed by the U.S. Supreme Court to adjudicate interstate water disputes. The emphasis, ideally, is on a review of all relevant facts and fair consideration of all parties' rights and needs.

- **Any proposed administrative/legislative solution should take into account variation in water availability from one part of the state to another as determined by geology, social needs, and custom.** There is no one-size fits all solution to water shortages statewide, or to water conflicts.

8. CONCLUSIONS. Tennessee appears to lack institutional means for dealing with the emerging issue of adjoining states wanting a portion of the state's waters for their own needs - and the means to deal with localized water scarcity. In lieu of specific recommendations for legislative changes, which should be decided by elected officials not academics, we suggest that the first steps in policy reform are to support increased regional cooperation and sharing of information. Efforts to bring together water management professionals and policymakers to share experiences, problems, and information - and to identify conjoint problems - should help to define any desirable changes. Long-term support of cooperative efforts should be sought by all state governments in the southeastern region. And, last but not least, good, accurate and useful streamflow and groundwater level data - as well as data on actual water withdrawals - are needed to better understand and, if necessary, establish withdrawal regulations and track drought conditions and their impacts.

WATER SUPPLY CHALLENGES FACING TENNESSEE: CASE STUDY ANALYSES AND THE NEED FOR LONG-TERM PLANNING

> "The Indians viewed most affairs having to do with themselves and the world around them in a spiritual context . . . . The River was another powerful deity -- among other things, it could help a man of knowledge divine the future." - from *Tennessee's Indian Peoples: From White Contact to Removal, 1540-1840,* by Ronald N. Satz (The University of Tennessee Press, 1982).

CHAPTER 1. INTRODUCTION

Tennessee's economy, quality of life, and magnificent environmental amenities are in no small measure attributable to the state's abundant water resources. However, despite its vital importance to agriculture, industry, transportation, energy production, recreation, and the state's diverse flora and fauna, Tennessee's water is a finite and increasingly threatened resource. Periodic drought, population shifts, urban development and sprawl, and growing competition among users is generating concern over the availability of a stable, dependable supply of water for Tennesseans - now and into the future (e.g., Freeman, et. al., 1996; Hutson, 1998).

In addition, Tennessee's water resources are the subject of emerging *interstate* and *intrastate* conflicts. Competition between Tennessee and its neighbors over ground- and surface water supplies poses unprecedented challenges for which previous policy paths may be inadequate and future policy direction uncertain. Moreover, competing demands among users in different Tennessee communities is also raising questions about how to satisfy divergent needs equitably, efficiently, and amicably. These emerging conflicts may require innovative remedies, including dispute resolution, citizen involvement in monitoring problems and measuring progress toward their resolution, and renewed interest in applying water law.[1]

1.1 Study Objective and Framework

This study's primary objective is to examine how these emerging water conflicts may be resolved effectively and judiciously through legal and policy tools. We have focused upon two principal conflicts as a means of grasping how they - and the long-term problems giving rise to them - may be addressed:

- The possible diversion of the Tennessee River near Chattanooga to supply the needs of metropolitan Atlanta, Georgia; and,

- Competition between users in West Tennessee and Northern Mississippi over the Memphis Sand Aquifer.

These cases were selected because they constitute serious, long-term water supply challenges. They also exemplify a wide range of issues that are not only important to understanding potential *interstate* water conflicts affecting Tennessee and its neighbors, but because they reflect broader trends that affect *intrastate conflicts* among Tennessee communities. These trends include growing demands and competition among users.

The challenges posed by these case studies have not arisen in a policy vacuum. In order to understand their sources and how to alleviate them before they become intractable, we must first understand the context within which they have arisen. Tennessee's water problems are comprised of three major parts: baseline conditions; threats to these conditions; & options for

managing these threats. In our study, existing law and water supply constitute the "baseline;" the Atlanta and Memphis Sand Aquifer cases represent "threats;" and our legal and policy analysis, coupled with a water stakeholders' survey (see below) comprise initial assessments of viable "options." We studied these three major parts in the following ways:

(1) *"Baseline" issues* were examined by reviewing U.S. and Tennessee water law, including relevant constitutional law, legislation, case law and riparian doctrine. Water supply conditions were studied by incorporating information assessing the distribution of Tennessee's water and water use patterns.

(2) *Threats to water conditions* were studied by examining press reports, government documents, and legal precedents relevant to the two case studies and to water supply problems in the state in general (e.g., drought, inter- or intrastate diversion of water, climate change, and increased consumptive water use - human activities which remove water from streams or aquifers).

(3) *Policy options* were examined in light of legal precedent and public opinion. A user group survey, administered to nearly 40 stakeholders,[2] was undertaken to gauge the views of major water users and others regarding the conditions and problems facing the state's water supply and the impact and acceptability of possible reforms to its management.

In discussing options for managing these threats, we focused on how the constraints of political acceptability and public opinion may affect their likelihood of adoption. Thus, in our discussion of possible options (e.g., reforms to existing law, public information strategies, economic tools for water management) we consider the extent to which they would be *politically viable*.

Baseline Water Issues	Threats to Baseline Conditions	Policy Options (examples)
1. Surface water availability 2. Groundwater availability 3. Existing laws & regulations 4. Existing water institutions	1. Drought/low flow 2. Climate change 3. Interbasin demands/diversion 4. Supply deficits 5. Population & economic growth	1. Interstate compacts 2. Water markets 3. Water law reform 4. Water withdrawal permitting

Figure 1.1 A Framework for Assessing Threats to Tennessee's Water Resources

1.2 Summary of Major Findings

We were asked to address six major questions in this study. These questions encompass the water rights of Tennessee and neighboring states and the options policy makers may use to deal with interstate water conflicts. The questions are depicted below and followed by a summary of our answers to them. Expanded answers are embedded in various report chapters - as noted.

- What are Tennessee's rights to water supplies within its boundaries?
- What are its rights to be consulted regarding adjacent states' water development?
- What is the state's legal responsibility to upstream states?
- What are the "rights to use" held by adjoining states if Tennessee reduces current use or limits opportunities of users in those states?
- What legal and political strategies are currently being used by neighboring states, other U.S. regions, and other areas of the world to address water needs, and what have these

regions learned that can be of benefit to Tennessee?

- What changes to current law, or new laws or institutions, might be needed to better facilitate solutions to the state's water supply problems while avoiding, or significantly lessening, interstate conflicts?

1.2.1 Tennessee's Rights to Water Supplies Within its Boundaries

The State claims to own all the waters of Tennessee, including groundwater, but excluding atmospheric moisture (e.g., clouds) and to hold them in public trust. The state's role as fiduciary for its citizens, and as sovereign, gives it considerable power to regulate water use to protect public health, navigation, wildlife and aquatic habitat, and general public benefit. Tennessee has no actual property right to the waters of the state except to the extent that the state itself is a riparian (i.e., where state lands adjoin watercourses). Because Tennessee's legal system is largely common law riparian, the rights held by the state as a riparian are not ownership rights but rights to use water on land bordering watercourses, subject to availability and the rights of other riparians (see Chapter 3).

1.2.2 Tennessee's Rights to be Consulted On Adjacent States' Developments

The State has no statutory rights to be informed of other states' activities. However, as a downstream riparian, if an upstream state proposed to reserve or divert the flow of a surface stream, and that action damaged downstream riparians in Tennessee, or the waters of the state, Tennessee could go to federal court and attempt to prevent the action. Because most interstate waters that flow through Tennessee are all harnessed for flood control and navigation by either the Army Corps of Engineers or Tennessee Valley Authority, it is highly unlikely that a project in an upstream state could be undertaken without the cooperation and/or consent of one or both of these agencies. Moreover, these agencies would surely involve downstream states in planning.

If the water source is an aquifer, and the proposed action by another state whose lands overlay the aquifer would infringe on the rights of Tennessee water users overlying this aquifer, then Tennessee could: (1) go to federal court and seek an injunction; or; (2) claim damages for the actions of the other state. Such litigation would likely result in an equitable apportionment suit originating in the Supreme Court. Such conflicts are often dealt with through cooperation and negotiation of interstate compacts by all states sharing rights to the interstate waters, rather than litigation. If the activity were undertaken by a federal agency, Tennessee's remedies might be limited to political - not legal - options. However, if a federal project were to affect water rights in a state, the federal government might have to purchase those rights (see Chapters 2, 3, and 4).

1.2.3 Tennessee's Responsibilities Toward Upstream and Downstream States

Tennessee has no responsibility to upstream states, absent a clear impact on upstream waters. Any state action that might impair the flow of an interstate watercourse could result in suits by downstream riparians to prevent the action or to demand damage payments. Again, because of federal management of interstate watercourses, the federal government would probably become involved at an early planning stage. This would significantly affect the nature of the action. For groundwater aquifers, state action could result in a suit for injunction or damages by users of the same aquifer in a neighboring state. If the suit were brought by neighboring state(s) against Tennessee, because the state permitted actions that damaged citizens of other state(s), an equitable apportionment suit in the Supreme Court would result (see Chapters 2, 3 and 5).

1.2.4 "Rights to Use" of Adjoining States

Absent an equitable apportionment or interstate compact, Tennessee has no power to affect the actions of citizens in adjoining states regarding water use. As litigation over the Champion paper mill on the Pigeon River in North Carolina has shown, if the federal government has power to permit an activity, and does so, then affected, adjoining states may have to resort to political remedies which may take time to achieve, if they can be achieved at all (see Chapter 4).

1.2.5 Legal and Political Strategies Used Elsewhere and Their Lessons

Six of the eight states bordering Tennessee (Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia) require permits for most water withdrawals. Alabama and North Carolina have passed legislation allowing for the designation of areas which are experiencing critical stress. In these areas where the impacts of water withdrawal have become intensified, use can be restricted. Virginia has groundwater management areas as well. Basin-wide management and long term planning for water supplies are being given increasing consideration by these states as they begin to experience water supply problems due to population growth and urbanization. The U.S. EPA acts to improve water quality throughout the region (and, of course, the entire country) by addressing both point source and non-point source pollution. In Tennessee, TVA has considerable power to manage the waters of the state in the Tennessee River drainage. TVA works with local communities to improve watershed management and eliminate non-point source pollution. More watershed and recharge area protection needs to be done in every state but there is not a lot of activity on this front in the face of development. The State of Georgia recently took steps to improve regional planning - including water planning - by requiring state involvement in land use planning in the 18-county Atlanta metropolitan area.

In the western U.S., where water is scarce and the prior appropriation doctrine allows more definite claims to specific quantities of water, there is growing movement away from absolute claims of "first in time, first in right" and toward greater emphasis on preserving and protecting in-stream flows regardless of existing appropriative rights. Efforts to adopt a market approach by allowing the sale and/or transfer of water rights brokered through state or local banks have had mixed success. A constraint on water transfers is lack of infrastructure (i.e., diversion works) in most states to permit taking water from areas with relative surplus to areas in relative need.

International efforts to protect water sources and to fairly allocate supplies often fail in the face of unequal political power. Conflicts between Israel and Jordan - and Israel and the Palestinian West Bank - are examples of this (Hassoun, 1998; Luterbacher, et. al., 1998; Elmusa, 1995; Morris, 1993; 1992). However, it should be noted that all international schemes for water management espouse the principle of equitable apportionment employed by the U.S. Supreme Court to adjudicate interstate water disputes. The emphasis, at least ideally, is on a review of all relevant facts and fair consideration of all parties' rights and needs (see Chapter 7).

1.2.6 Needed Changes to Current Law or Institutions

We suggest that the first steps in policy reform are to support increased regional cooperation and sharing of information. Efforts to bring together water management professionals and policy makers to share experiences, problems, and information - and to identify conjoint problems - should help define any desirable changes. The type of information needed includes good, accurate streamflow and groundwater level data, and information on actual water withdrawals; including how much water is being withdrawn , by whom, and where, and anticipated future

demands should be tracked as well. Long-term support of cooperative efforts should be sought by all state governments in the southeastern region (see Chapter 7).

1.3 Remainder of The Report

Chapter 2 provides a tutorial on American water law with a focus on water rights and the major features of riparian law. Chapter 3 discusses Tennessee's riparian law principles for both ground- and surface waters, as well as the state's fiduciary responsibilities for the "waters of the state." Chapter 4 examines various approaches and methods that have been used worldwide, and could be used for dealing with Tennessee-related water issues regarding interstate water allocation. Chapter 5 discusses the two case studies as water allocation controversies by first reviewing the facts of the cases and policy challenges they represent, followed by a legal analysis of Tennessee's rights in both disputes. Chapter 6 describes the long-term water resource conditions and hydrological and water use challenges that underlie these cases. Finally, Chapter 7 concludes the analysis by discussing possible remedies to the state's long-term water problems. These remedies are discussed in two ways. First, we examine the perceptions of state water problems and the perceived viability of various remedies to them held by stakeholders who we interviewed for this study. Second, we assess the advantages and disadvantages of various mechanisms and approaches for managing water allocation which have been utilized in other regions of the U.S. and around the world. These mechanisms and approaches include water marketing, changes to law and regulation, and interstate compacts. We conclude by offering specific recommendations for consideration by state policy makers. In cases where the discussion cites relevant case law, statute, or legal argument, legal notation (i.e., "endnotes") are employed. These may be found at the end of each chapter. Appendices contain an overview of the state and condition of Tennessee's Water Resources by Hydrologic Region, a glossary, and a copy of the survey instrument used to assess stakeholder views.

Endnotes to Chapter 1

(1) For an example of such techniques in Tennessee-related water disputes see "Tennessee Valley Authority: Data Collection in Not Enough," in U. S. EPA (1997) *Top 10 Watershed Lessons Learned*, p. 37. For an example of a "within-Tennessee" effort to bring communities together to cooperatively manage water supply, see *Cumberland Plateau Regional Water Authority*, Resolution 599-8, May 18, 1999.

(2) We wish to thank Valerie Diden, an intern for the EERC at The University of Tennessee-Knoxville for her contributions. Valerie conducted the telephone survey of Tennessee stakeholders regarding their views on state water problems and possible remedies.

CHAPTER 2. A TUTORIAL ON AMERICAN WATER LAW RELEVANT TO OUR CASES

2.1 Introduction

It is necessary to apply several bodies of law in order to determine how to resolve the conflicts encompassed by our two case studies. In general, Tennessee follows the common law for matters dealing with water. Despite this fact, there are very few recorded cases in the state adjudicating water disputes. Gaps in the common law in Tennessee can be filled in by reference to decisions under similar common law regimes in states within the Southeast region, and which have comparable climate and similar variations of topography. While it is impossible to predict with certainty the positions Tennessee courts will take in the future on such undecided issues as inter-basin transfers or the correlative rights of groundwater users, it is likely that the courts will examine the decisions of similar cases in other riparian states before rendering decisions.

There are a few statutes dealing with water in the Tennessee Code. These statutes modify the common law and provide some mechanisms for state government to regulate water use. Several federal statutes also are relevant. The major river system in the state is the Tennessee River and its tributaries. This entire system is managed, under congressional mandate, by the Tennessee Valley Authority. The other major river system, the Cumberland River and its tributaries, is regulated by the U.S. Army Corps of Engineers. Both of these federal agencies have interests that support, and occasionally override, state interests in the waters of the state.

To provide a context for understanding the common law as it has developed in Tennessee, this chapter provides an overview of American water law, as well as a more detailed examination of riparian common law. Chapter 3, meanwhile, discusses the features of riparian law as they have been applied by Tennessee courts. We will also examine how federal statutes and statutes passed in Tennessee and neighboring states have modified riparian rights.

2.2 An Overview of American Water Law

States that follow the common law doctrine which is used in Tennessee are called riparian states. *Riparian law* is the common law of surface water flowing in defined watercourses. The word riparian comes from the Latin word *ripa* which means stream. Strictly speaking, the common law that governs groundwater is not riparian. However, for simplicity's sake, when we refer to riparian law the term is inclusive of both surface water and groundwater common law.

American riparian law developed from English common law. The U.S. is unusual in that it follows two general systems of water law. Eastern states are, for the most part, riparian. Many of these states have also adopted statutory modifications to riparian doctrine and are thus considered "regulated riparian" states. However, most states west of the Mississippi follow a system of law called "prior appropriation." *Prior appropriation law* has its own body of common law that has been codified in both state and federal statutes.

The historical reasons for this dichotomy, and the specific features of prior appropriation water law, are both relevant to our inquiry because many legal decisions and resolutions of conflict over water in American law have been made in prior appropriation states. The feasibility (or lack thereof) of applying these precedents in a riparian state can only be judged if the differences between the two systems are understood. Thus, a brief review of these differences follows.

The reasons for the development of two systems of water law in the U.S. can be found in the

history of the federal government's acquisition of the territory west of the Mississippi; the conditions under which this land was settled and acquired by private citizens; and the arid climate that predominates in this part of the country. The courts of the original thirteen colonies adopted, from English common law, a riparian system of water law. At that time, most of the land within the colonies was privately owned. Land in the Northwest Territories and other frontier lands east of the Mississippi River fairly quickly passed out of federal ownership and into the hands of settlers. The courts in these areas modified English riparianism to meet "the needs of an American society."[1]

2.2.1 The Law of Prior Appropriation: Differences from Riparianism

Most of the states west of the Mississippi River have been carved out of the public domain. The *public domain* refers to land, mostly in the west, acquired by the U.S. in treaties with France, Great Britain, Spain and Native American tribes. Public rights to the water on this land were initially complete, with the federal government having both the common law rights of ownership and the sovereign rights of regulation. Because of this, the federal government had complete legal power to control the allocation of both land and water in the west: "The overriding public land policy of the nineteenth century was disposition, and western lands were given to railroads, the states, and individuals under a variety of special grants and under the preemption and homestead laws."[2]

When large mineral deposits were found and exploited in the nineteenth century, miners took whatever water they needed. Farmers, ranchers and other settlers also needed water and took it from water courses. When conflicts arose, "western state courts began applying the 'first in time, first in right' rule applicable among trespassers."[3] The rule was eventually adopted legislatively and judicially by both the federal government and most western states - thus was born the law of prior appropriation.

As Figure 2.1 shows, most of this western land has fairly low annual rainfall, especially as compared to the eastern states. As previously noted, the impetus for settling many areas in the west was the discovery of valuable minerals. Gold deposits discovered on lands in California and the Black Hills of South Dakota brought large numbers of people to these areas hoping to make their fortunes. Mineral mining usually requires vast quantities of water to wash dirt from the ore and to move it to processing areas along flumes. Most of the valuable minerals found in the west were not found on land that bordered large watercourses. Water was a scarce and valuable commodity in many mineral rich areas. Early miners sought sources of water both for mining and to support settlement. As a result, there developed a system of acquiring water rights that did not tie the use of the water to the land from which it was drawn. Water rights were quantified and prioritized. As we will see, these are features *not* found in riparian law.

Not all western states follow prior appropriation: "The prior appropriation doctrine is the established rule for recognizing and administering water rights in 19 states."[4] These include eight of the arid states in the central Rocky Mountain region and Alaska which have adopted a "pure" version of the prior appropriation doctrine. The nine states bordering these mountainous states employ a mix of riparian and prior appropriation doctrine in their water laws.[5] The state of Mississippi, east of the river which bears its name, adopted a form of prior appropriation for a short time but has since reverted to a regulated riparian regime.

The rights under a prior appropriation regime differ from the traditional rights under riparian law in the following ways. First and most important, ownership of land is not the basis for the

appropriation water right. One can have a right to water from a watercourse or an aquifer without owning land bordering or overlying the water source. Even if the right to water has been acquired by purchase or other means, water rights exist only when water is appropriated (diverted and used) for a beneficial purpose. In most states following the prior appropriation doctrine, beneficial uses are defined, at least in general terms, by statute. State statutes may provide for preferred uses so that certain water uses are considered more beneficial than others. An example of this is irrigation. Although generally considered a beneficial use, certain kinds of irrigation, such as overflow or natural flood irrigation, have been held to be inefficient and thus, can be prohibited.[6]

When water is appropriated, the amount taken is a quantified amount. There is no reasonable use limitation; the extent of the water right is the amount that historically was put to a beneficial use. The holder of the oldest water right is entitled to full delivery of water. If shortages occur there is no duty to abate use so as to share the available amount with other appropriators, as there is among riparians. Appropriators whose rights are senior may take their full water rights even if the result is that there is not enough water left for junior appropriators to take for their needs. This approach can occasionally result in streams being pumped dry. Although this is not illegal under prior appropriation regimes, increasing concerns with environmental damage have caused some states to require that minimum flows be maintained in watercourses, even if to do so would impair senior appropriators' rights. Because of this, prior appropriation states are moving closer to the sharing that characterizes riparian regimes. If appropriated water is put to a beneficial use, the water need not be used on riparian lands. If the use is beneficial, the land on which the water is used need not even be within the same watershed. Appropriated waters may be used any place, regardless of distance from the stream.[7]

When we discuss riparian law in the next section, differences between the two doctrines will become more apparent. The significance of these differences for our two cases is that certain suggested solutions to water shortages, such as water marketing or water banks, are feasible where parties have rights to a certain quantity of water and those rights have seniority over other users of the same water source. With a defined right to a certain quantity of water, a water appropriator can transfer the right to that water to another entity at some stated value. In riparian regimes, by contrast, rights to water are not usually quantifiable and withdrawal rights are modified by the equal rights of all others who have riparian rights to the same source.

The climatological fact of aridity and the historical fact of the land having been taken into private ownership by people generally staking claims to it, rather than by purchase or device, make conflict over water in prior appropriation states a frequent fact of life. The region’s history also makes it inevitable that the federal government has played a large role in the outcome of litigation resulting from these conflicts. By contrast, water is fairly abundant in eastern riparian states. Conflicts occur but not as frequently as in the west; the federal government has not often played a role in the conflicts that have arisen; and water rights are tied to the ownership of land.

Contemporary concern with water pollution and environmental protection have increased the federal government's involvement in water conflicts arising in riparian states in recent years. To meet the requirements of federal legislation protecting water quality, riparian states have passed their own legislation. The result is "regulated riparianism." This term refers to the modification of riparian rights by statutory requirements for permits to discharge into water sources, standards for purity of discharged waters, and, in many cases, requirements that permits be obtained before riparians can withdraw water from watercourses and aquifers. The next section outlined

the general features of classic American riparian law.

2.2.2 Major Features of Riparian Law

'Past is prologue,' the Bard tells us. The statement distills the essence of common law. Years of human experience with conflict and its resolution are encompassed in the decisions of our courts that are based on common law. This is not to suggest that there is no wisdom embedded in legislation. Instead, legislation is crafted over a relatively short period of time by a small group, while common law develops incrementally over long periods of time through the actions of many. When great social and technological changes occur, the past may not provide adequate guidance to solve present problems. In this situation, it is the job of legislatures, and, to some degree the courts, to craft new legal means of solving problems without unnecessarily discarding the wisdom of the past that still applies.

The common law of water, or riparian law, is very old. Many of its features have their origins in the law that the Romans brought to Great Britain more than two thousand years ago. Riparian law has accumulated over many centuries of conflict. Because water, unlike air, is available in only a few places, the legal system of riparian rights responded to this fact by assigning rights to use the water to those whose property touched, or overlay, the water source. Water rights are generally described as real property rights. However "[a] riparian right is an incorporeal rather than a corporeal right because one cannot possess the flow of a stream; one can only use the water."[8] The right to use something in which one does not have a direct property right is called a "usufruct."[9]

(1) The important, overarching public rights in water are:

- Water is legally and historically a public resource. Although private property rights can be perfected in the use of water, it remains essentially public; private rights are always incomplete and subject to the public's common needs.[10]

(2) The resolution of conflicts between public and private users formed the basis for the reasonable use rule.

- The reasonable use rule entitles each riparian proprietor to make reasonable uses of the adjoining watercourse for the benefit of her riparian land. Under this rule, a riparian's rights are not absolute, for other riparians along the same watercourse also have an 'equal' right to make reasonable uses of water.[11]

(3) Public rights in water also include the theory of sovereign rights in water leading to federal and state legislation limiting and describing water rights.

> "[T]he idea of an incomplete property rights expressed as a usufruct [was used] to justify the idea of correlative rights among riparians. Courts then took the next step and used the theory of incomplete property to justify legislative regulation of water use.[12]

Under common law, water is treated differently depending on whether it is on the surface or underground and whether confined or diffuse. The reasonable use rule applies to surface water:

> Riparians have a right to make reasonable use of a watercourse so long as such

> use does not interfere with reasonable uses of the water by other riparians . . . . [E]ach riparian has a right equal to the rights of other riparians along the watercourse. [The] rule requires harm to other riparians before a use can be alleged to be unreasonable.[13]

(4) The reasonableness test involves balancing the uses of one riparian against those of the riparian claiming injury.

- Strictly speaking, a riparian has the right to use water only on, or for the benefit of, the riparian land itself. A non-riparian or off-site use is likely to be considered unreasonable if it interferes with another riparian's use of the same resource. If the off-site use does not injure another riparian's rights, only a few courts have allowed the use to be enjoined. On the other hand, off-site uses that remove the water to another drainage basin are generally not permitted. This is because, in inter-basin transfers, water is usually not returned to the watercourse after use. In short, the riparian expectation of the natural flow of the watercourse - reduced only by other riparians' reasonable uses - is injured when there is no return flow from others' uses. Along a watercourse, the same molecules of water may be withdrawn and used repeatedly. Although some uses are completely consumptive; for most uses, including municipal water supply, irrigation, and power production, water is cleaned or cooled and returned to the watercourse either at a particular point (e.g., a pipe) or by infiltration through the soil of land bordering on the watercourse.

In riparian law, much hinges upon the meaning of "reasonable," and it is in the course of interpreting this word that the courts and the common law derive much flexibility. The courts will allow large quantities of water to be withdrawn from major streams or bodies of water but lesser amounts from minor sources. Other factors considered by the courts in determining whether a particular use is reasonable include: the economic benefits of competing uses; the time when each use began; the amounts of water needed by other uses; adverse effects upon the other users; the amount of water wasted by use under consideration; the length of time the water is detained and the route of diversion; and such other factors as the court may deem relevant. The *Restatement (Second) of Torts* lists the following as traditional factors to be considered in determining what is a reasonable use:

- The purpose of the use of water.
- Its suitability to the water body.
- Its economic value.
- Its social value.
- The harm is causes.
- Its potential for coordination with competing uses.
- Its temporal priority relative to competing uses.
- The justice of imposing loss on the use.

The doctrine of reasonable use does not apply to groundwater under common law. The equivalent requirement of sharing is the doctrine of correlative rights, as discussed below.

2.2.3 Groundwater and Riparian Law

Groundwater is water confined in underground spaces. The area so saturated and confined is called an *aquifer.* For groundwater, the "American rule," which allows the owner of land overlying

an aquifer to pump all that he is able to pump to fulfill any of his needs, has been modified in almost all riparian states, including Tennessee. Now, groundwater rights are limited in most riparian states by the doctrine of correlative rights. This doctrine essentially holds that overlying landowners' rights are subject to consideration of the rights and needs of other landowners overlying the same aquifer. The essential questions in correlative rights disputes are: what right does a pumper have to a fixed quantity of water; and what right does a pumper have to a fixed pressure level?[14]

Legally, the most difficult allocation issue is deciding how to assign common property rights between prior and subsequent claimants. The Restatement (Second) of Torts incorporates the protection of prior groundwater users into the balancing for the express purpose of protecting small, as against large, users.[15] Section 858 provides that a landowner who withdraws groundwater and uses it for a beneficial purpose is not liable for interference with another's rights to the same groundwater source unless:

(1) The withdrawal of groundwater unreasonably causes harm to a proprietor of neighboring land through lowering the water table or reducing artesian pressure;

(2) The withdrawal of groundwater exceeds the proprietor's reasonable share of the annual supply or total store of groundwater; or

(3) The withdrawal of the groundwater has a direct and substantial effect upon a watercourse or lake and unreasonably causes harm to a person entitled to the use of its water.[16]

Recall that water rights are property rights *of a sort* (i.e., usufruct). Under property law, if a person uses and controls property for a period of years set by statute (often 20 years) knowing that s/he doesn't own it but represents himself as owning it, then s/he acquires ownership by prescription. *Prescription* is a form of adverse possession. The term is used when less than a fee simple is adversely possessed, as when a right-of-way is obtained by use. In riparian states, water rights can be obtained by prescription. For example, if a riparian withdrawal continues for the statutory period without complaint by other riparians, then courts will not later enjoin the withdrawal because of late complaints by the adversely affected riparians. Similarly, groundwater pumpers can obtain the right to pump at a volume that may prevent other landowners on the aquifer from pumping all they want in the future. If the pumper has withdrawn the volume for an extended period, without complaint from the other owners, the courts will probably not enjoin the use even if it can be shown to violate the principle of correlative rights.

The possibility of a riparian losing rights to water because of a prescriptive use complicates litigation under riparian law. Under the common law, which is tort or wrongdoing-based, a riparian must show that rights have been damaged by another's use of the water supply to get relief from the latter's actions. Thus, a withdrawal by one riparian may limit the future options of another. Unless the second riparian can show actual damage, (in the present, not just to future expectations) then continued use by the first riparian may vest the excessive right. However, under the reasonable use doctrine, if the use to which the water is put by the first riparian is seen as unreasonable as measured against the conflicting use of the second riparian, then it is likely that the courts will step in and enjoin or limit the first use.

2.3 Conclusions

Riparian water law assumes that supply will generally be adequate if demand is restricted to

reasonable uses on riparian lands. "The determination of reasonableness involves an *ad hoc* balancing process that considers a number of factors, including changing economic and social values. A use may be *reasonable* when in conflict with one use at a certain time but *unreasonable* when in conflict with another use, or even the same use, at another time."[17] Thus, reasonable use should always be understood with reference to the American law's expressed preference for economic development leading to economic good.

> The riparian doctrine is more responsive to changing needs and more able to make case-by-case adjustments than is the appropriation doctrine, at least in theory. Because reasonableness is only vaguely defined and includes economic and social values, water use may be shifted or altered to reflect new values and concerns.[18]

Riparian rights do not require extensive administrative machinery. Disputes are generally resolved by existing courts. However, judicial resolution of disputes is slow, expensive, and inefficient, particularly when conflicts are frequent. However, in riparian states in the past, the infrequency of disputes has made the development of more elaborate machinery unnecessary.[19] This has begun to change. In many regulated riparian states, administrative resolution of disputes is facilitated by the requirement that permits be obtained before water is withdrawn from a source.

Some legal commentators have said that regulated riparianism represents a move to a property rights system. The rights represented by a permit issued under regulated Riparianism are not as secure as are those represented by the prior appropriation doctrine. They are limited in time and administrative officials retain substantial discretion to alter permittees' rights.[20] Moreover, the right to withdraw water is usually limited to owners of adjacent or overlying land. The riparian expectation of the natural flow of the water source, reduced only by other riparians' reasonable uses is retained - even in the face of large withdrawals by municipal supply systems - by discouragement of inter-basin transfers. However, most regulated riparian systems do allow vesting of uses, thus protecting riparian owners from loss of water rights to new large users.

Endnotes to Chapter 2

(1) Laitos, Jan G. and Joseph P. Tomain, *Energy and Natural Resources Law in a Nutshell,* West Publishing, St. Paul, Minnesota, (1992), p. 357.
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(3) *Id.*
(4) Laitos *et al, p.* 363*.*
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(12) Tarlock, Law of Water Rights and Resources (CBC) § 3.02[1] Release #1, 3-5 (8/89).
(13) Laitos *et al.*, p. 359.
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(15) Ibid., Tarlock, p. 14.
(16) *Restatement (Second) of Torts §858* (1979).

(17) Wright, Kenneth R, Ed., *Water Rights of the Eastern United States,* American Water Works Association (
(18) *Id.*
(19) *Id.* p. 13.
(20) *Id.*

CHAPTER 3. TENNESSEE RIPARIAN LAW PRINCIPLES - SIGNIFICANCE FOR WATER CONFLICT

3.1 Introduction

Six states sharing common borders with Tennessee follow riparian law: Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. Each is a "regulated riparian" state. Tennessee is, to some extent, a regulated riparian state. The degree of regulation found in Tennessee is significantly less than that of these surrounding states because the state has had the good fortune to avoid the conflicts over water that led to increased regulation in surrounding states. Thus, the law governing water withdrawals in Tennessee is almost entirely common law. There has been very little legislation regarding water use in the state. In fact, there is very little common law specific to Tennessee because disputes have been infrequent. Conflicts that have reached the appellate courts have most often been about too much water rather than too little.

Many of the potential conflicts that can be expected to arise in the next decade or so in Tennessee have never been adjudicated in state courts. The legal issues raised by our two case studies have never been considered with any specificity in Tennessee courts. This chapter examines the principles of riparian law practiced in Tennessee in order to provide a basis for understanding these disputes.

3.2 Tennessee's Water Law Principles

Overall it can be said that water rights in Tennessee depend upon the location of the water and whether it is confined.[1] Slightly different rules are applied to surface and groundwater. If groundwater can be proven to flow in an underground stream channel, then surface water rules are applied to it. It is usually difficult to prove that an underground stream exists. Thus, most groundwater is treated as diffuse unless there are clear surface indications of its underground course. Diffuse groundwater can be confined in an aquifer or flow (percolate) through the ground. Diffuse surface water is, basically, runoff from precipitation. Any person can capture precipitation and runoff. The main legal issues with runoff arise when one landowner diverts or channels it from his land in a manner that causes damage to another's land.[2]

The foundation case for surface water law in Tennessee is *Webster v. Fleming,*[3] which states: "It is firmly established in Tennessee that allocation of water in watercourses and lakes is based upon the doctrine of riparian rights." This quotation from the 1841 case begins almost every discussion of water law in the state. The court goes on to say,

> One riparian proprietor has no right to drain the stream or reduce it below its natural level, whether it be navigable or nonnavigable, if it impairs or destroys the interest and use of another riparian owner. The riparian owner may by injunction in chancery protect his riparian rights, and prevent the draining of the stream or its impairment.[4]

Rights to use water in Tennessee, as in other riparian states, are acquired by ownership of property touching on a watercourse or overlying an aquifer. Property can be acquired by adverse possession; thus, riparian rights can be acquired by adverse possession of riparian land. It is not clear if water rights can be acquired by prescription separately from land. One case prevented a downstream riparian from enjoining a long standing diversion where the water was used on non-riparian land on the grounds that failure to previously complain that the diversion damaged his rights stopped him from lodging a later complaint.[5]

The legislature has given to municipalities, counties, water companies, watershed districts, charitable institutions, water treatment authorities, utility districts, the Department of Conservation (for parks), and the University of Tennessee powers to condemn riparian land and water rights by eminent domain. Under these statutes, the rights of downstream riparians may be acquired by condemnation.[6] "The use of this power will be narrowly and strictly construed within the terms of the delegation and must be limited to a public purpose."[7] It is unclear if water rights may be condemned for municipal purposes if the diversion unreasonably injures lower riparians. It is clear that a diversion that interferes with navigation is not permitted.[8] However, there is no cause of action for interference with navigation for a private individual or riparian unless s/he suffers a "special injury."[9] Protection of navigation is a state and federal power. The Supreme Court has held that the power of eminent domain, having been given by the state, is within the power of the state to limit or revoke. Further, "a revocation of that privilege is but a recall of a part of its sovereign power for which no price may be exacted."[10]

Several legal scholars suggest that a municipality may possess rights that are superior to a riparian's rights.[11] The theory is that the municipality is acting for the public; thus, the public has rights in all waters of the state and the municipality would not be limited to sharing among riparians.[12] This has considerable implications for water withdrawal rights in the state.

Complicating the picture even further is the problem of allocating water among competing condemners. An example would be when two adjacent municipalities along a watercourse both withdraw water for public purposes. If the combined withdrawals would degrade the watercourse, the issue arises as to which municipality's right to withdraw water must be curtailed. The legislature has not acted to clarify this problem. The courts appear to have adopted a "first in time, first in right" approach to resolve claims among competing public users.[13] This is not an adequate solution, especially in a time when public withdrawals are increasing statewide. In a case that was settled before reaching the appellate court, a conflict arose between the cities of Gatlinburg and Sevierville over a proposed withdrawal from the Little Pigeon River by the former. Sevierville claimed this would damage its use of the river for its citizens. A compromise was reached whereby Gatlinburg's withdrawal was returned to the stream bed after use, leaving Sevierville unharmed. Such compromises fail to solve conflicts where withdrawals result in consumptive uses so great that return flow is inadequate to protect the downstream public user.

Every riparian has an equal right to use the water in a stream. No riparian has the right to use water in a manner that damages other riparians without their consent. Some uses of water are considered preferred uses that take precedence over other uses. Two priority water uses seem to be recognized in Tennessee: water withdrawals for domestic use and instream water for navigation. In *American Association v. Eastern Kentucky Land Co.* the court found that a riparian has an absolute right to take water for domestic use, even if it exhausts the stream.[14] On the other hand, if a stream is navigable in any sense, the riparian must make allowances for, or yield to, the public interest in navigation.[15] Ordinarily, domestic preference is not available to municipalities and water supply companies, despite the fact that they provide water for drinking and washing. However, as mentioned above, municipalities may be able to rely upon their status as instrumentalities of the state to assert greater water rights than other riparians. On navigable streams, although there are no Tennessee cases on this, it is fair to assume that navigation might trump municipal uses where the two uses come into conflict.[16]

In deciding between two competing uses of water, one might ask if it makes a difference that one owner has used the water for a long time whereas the other owner has only recently begun to

use it. Under riparian law, generally not however, ["I]f none of the other factors provides a basis for preferring one riparian use over another, the courts typically protect the earlier user."[17]

3.3 Reasonable Use Issues

Tennessee follows the "reasonable use doctrine" for surface water. Under this doctrine, each riparian owner has the right to make a reasonable use of the water passing by his land. Generally, the definition of "reasonable" is limited to uses on or for the benefit of the riparian land itself. Clearly, municipalities and water companies often withdraw water from streams for uses on land not considered "riparian." In Tennessee, the courts have permitted nonriparian uses by customers of municipalities that are riparians.[18] The reasonable use rule imposes reciprocal duties on both upper and lower riparians. Lower landowners have a duty to take reasonable mitigation steps to avoid damage from actions taken by upper landowners.[19]

Nonriparian use is different from interbasin transfer. The latter involves withdrawing water from a watercourse in one drainage and transferring it for use on land that is not part of the drainage of the watercourse from which the water was withdrawn. While nonriparian use by a municipality may be reasonable under Tennessee law, interbasin transfers are considered *per se* unreasonable under riparian law if a lower riparian complains, and probably would be deemed so under Tennessee law. There are no cases published in Tennessee that touch on this point. The definition of "basin" is particularly important here. It is fairly common for municipalities and water supply companies to withdraw water from one stream and discharge effluent into another that flows into the same larger watercourse some distance downstream. There is no guidance from the courts as to what is permissible in this situation if a downstream riparian situated between the withdrawal and the discharge complains of damage. There is one case where the court did not stop the removal of water out of a watershed.[20] However, the issue of interbasin transfer was not raised in this lawsuit and thus, no precedent was established. The legality of interbasin transfers is likely to come before Tennessee courts in the future. The legislature could act to provide needed standards for diversions before problems become acute.

The riparian prohibition against nonriparian uses and interbasin transfers assures that water is returned to the source from which it was withdrawn. This preserves stream flow, aquifer recharge, and prevents damage to downstream riparians.[21] The fact that the rule is often ignored is not a problem when there are ample supplies of water. In times of drought or where development causes over-subscription of a water source, off-site and out-of-basin uses may be a problem.

In Tennessee as in other riparian states, a riparian does not have a fixed, permanent right to an exact quantity of water. The amount of water to which a riparian has rights varies depending upon the actual flow in the watercourse and the needs of other riparians along the watercourse at any given time. Riparian rights cannot be lost because they are unused. However, another user can obtain rights against a riparian by prescription or adverse possession.

3.4 Groundwater-Surface Water Management

Tennessee does not manage surface water and groundwater conjunctively. Conjunctive management is the development and management of all water resources, both surface and groundwater, in a manner that recognizes their interrelationship in the hydrological cycle.[22] Since ground and surface waters impact one another, depletion or pollution of one source would

ultimately, if not immediately, affect other sources.[23] Statutory law in Tennessee has modified this non-conjunctive management pattern to some extent. In the Water Quality Control Act of 1977, for example, Tennessee purports to own and exercise a public trust over all waters of the state - waters being defined as "any and all water, public or private, on or beneath the surface of the ground, which are contained within, flow through, or border upon the state of Tennessee or any portion thereof." [24] The only exception from regulation and state ownership are bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters. For pollution control purposes, Tennessee has enabled (although not actively promoted) conjunctive management of ground and surface waters.[25]

Because surface waters in watercourses have been more accessible and visible, they have also been subject to greater use as a water source, particularly by municipalities. There has been greater competition for surface water among users. The impacts from use (e.g., consumption leading to depletion of flow and pollution) are more obvious. Thus, more frequent disputes have arisen over surface waters, there is more case law, and more statutory regulation of water use. Diffuse surface waters have also received substantial attention because actions by one landowner to divert or channel runoff from his property often causes flooding and damage to another's.[26]

Groundwater, on the other hand, has been considerably less regulated, in part because the need to do so was not apparent. Groundwater is presumed to be percolating water unless proven to be an underground stream. Since this is usually expensive and difficult to prove, most groundwater is dealt with as if it were percolating.

The entire basis for groundwater law in Tennessee is a single case:[27] *Nashville, C. & St. L. Ry. v. Rickert*[28] involved a landowner who drilled a well near a sinkhole and pumped the sinkhole dry causing a spring on adjacent land to dry up. The landowner had sold the adjacent land to a railroad which purchased it in order to use the spring for its business. The holding of the case for purposes of defining Tennessee groundwater law is complicated by the landowner's duplicity in depriving the railroad of the object of their purchase after he completed the sale of the land. Nevertheless, the *Rickert* case has been interpreted as holding that in Tennessee groundwater rights are correlative to the rights of other landowner's reasonable use of the same aquifer.

Generally, under the correlative rights doctrine, there is no quantification of water rights, no priority of uses, and no lawful uses of water off overlying land or outside the recharge basin.[29] These issues were not raised in *Rickert* and remain undecided in Tennessee. Vincent Sikora suggests that the case could stand for the proposition that an overlying owner does not have a right to a certain water level or pressure if another owner is using water from the aquifer for reasonable purposes.[30]

While it is assumed by most legal scholars that Tennessee follows the correlative rights doctrine of groundwater law, there are few to no cases that provide legal precedent - for what this is worth. It is in looking to the court decisions in nearby riparian law states and in looking at the Restatement of Law that the factors determining the balancing test to be followed are found.[31] Moreover, consideration of the totality of the situation, and examining the facts on a case-by-case basis characterize the deliberations of state and federal courts as well as the Supreme Court on water rights matters.

3.4.1 Timing of Lawsuits

Riparian law is tort law. Ordinarily, unless one can prove damage to one's water rights, there is no cause for action against another riparian who uses the same water source even if their actions may damage the planned uses of one's riparian property. There are no cases in Tennessee that decide the issue of the timing of a lawsuit for damage to water rights. "Whether an injury occurs to a riparian whenever there is an unlawful diversion or only where there is damage, remains unclear.[32]

3.5 Water Supply Legislation

There has been very little legislation affecting water rights in Tennessee. Two statutes, however, should be noted. They are:

The Watershed District Act of 1955, which authorized the establishment of watershed districts with the power, including eminent domain, to develop their water resources.[33]

The Water Quality Control Act of 1977, which imposes specific controls over a user's right to pollute the waters of the state.[34] Included in the statute is the assertion that the waters of Tennessee are the property of the state and held in public trust for the use of the people of the state. The statute requires that a permit be obtained before a party carries out any activities that may result in the "alteration of the physical, chemical, radiological, biological, or bacteriological properties of any waters of the State. The definition of "activities" includes water withdrawals.[35]

Section 69-8-105 of the Water Quality Act as codified requires that "any person now withdrawing" over 50,000 gallons of water per day register with the Division of Water Supply of TDEC. The wording of the registration provision is unclear. No cases have applied it or interpreted it. No regulations have been promulgated under it. Legal scholars find the word "now" in the statute ambiguous. "'Now' may refer to 1963 when the section was passed which excludes all subsequent withdrawals, or to the present as a continuing registration requirement." The section also requires notice to the division by anyone "who renews a withdrawal" which ceased during the last three years, or anyone who is "currently" withdrawing 50,000 gallons per day and increases "withdrawal capacity" by 10 percent or more. The provision only pertains to "withdrawal capacity" and not actual withdrawals or use. Neither provision is regulatory. They are merely informational since the Division of Water Supply was given no authority to control withdrawals and notice may occur up to 30 days after operation. Failure to register as required by the law is a Class C misdemeanor.

To some extent, the Division of Water Pollution Control regulates water use and withdrawal by control of any activity that may in any way alter the "physical, chemical, radiological, biological, or bacteriological properties of any water of the state in any manner not already lawfully authorized under section 69-3-108(b)." The Division requires an "Aquatic Resource Alteration Permit" (ARAP) before the activity may take place. These rules encompass granting permits before engaging in any construction, installation, extension, or modification of water withdrawals which would alter the physical properties of any state waters, and grants to TDEC authority to consider the rate of flow of state waters and loss of stream length or water levels.

The Division currently has proposed rules out for comment that prescribe the procedures for these permits. The rules include water withdrawals as one of the activities subject to permitting if alteration of any water would result. Permits can be denied if there is "a significant change of

the physical condition(s) of the site or the waters" among other things. The proposed rules state: "In order to uphold the public trust and protect all present and future uses of waters, the following factors, in addition to all other requirements of this rule, shall be considered in making determinations concerning permit issuance: . . . direct loss of stream . . .waters due to the proposed activity, . . . reasonably likely cumulative or secondary impacts attributable to the proposed activity, . . hydrologic modifications resulting from the proposed activity, . . . and any other relevant factors." It is unlawful for any person to carry out the above mentioned activities except in accordance with the conditions of a valid permit.[36]

The State of Tennessee has powers to regulate water withdrawals that may affect public health or navigation under its fiduciary responsibilities. The State may also act under its police powers in time of emergency such as drought. In addition, any significant withdrawals probably must be registered with the state, any increases of capacity of more than 10 per cent where current withdrawals are 50,000 gallons or more per day must be reported to the State, and the State can require that an ARAP be obtained before withdrawals be carried out where there are relevant factors making such a permit appropriate. Because the State can deny an ARAP where a withdrawal will cause inappropriate alteration of state waters, withdrawals that would have that effect can be prohibited.

The Division of Water Pollution Control also requires permits for discharges of pollutants into streams. The division may attach conditions to a permit that direct the amount and location of water returned to a stream. By controlling the flow in this manner, the Division affects the amount of water available to other users. The Water Quality Control Act empowers the Director of the . . . Division to "implement the basic water resource policy of the state by creating and defining the rights of respective competing users of the water resources of the state" among other powers.[37]

3.6 Federal Agency Powers

No evaluation of water rights in Tennessee is complete without reference to federal water rights and powers in the state. Two federal agencies have major presence in Tennessee.

The Tennessee Valley Authority has statutory authority to manage the entire multi-state basin of the Tennessee River and its tributaries for flood control, power production and navigation. The TVA Act of 1933 gives great authority to the agency to oversee and manage most aspects of the flow of water in the Valley. Allocation of water for off stream use is left to the riparian state system. However, with regard to surface water withdrawals, TVA has sufficient power to have noticeable effect on the state's practices. Under Section 26a of the TVA Act, the agency has authority to approve construction of any structures on, in, or along the Tennessee River or its tributaries that could affect navigation or flood control or that could be hazardous to health or otherwise interfere with TVA operations - including water supply or intake lines.[38]

The powers of the U.S. Army Corps of Engineers extend to navigation and flood control. The powers granted the Corps of Engineers over the navigable waters in Tennessee are not as broad as those for TVA. Both agencies share the purpose of facilitating navigation for commerce and controlling floods. Managing rivers with dams and locks to carry out this purpose, as both agencies do, also allows the Corps a role in power production through the installation of hydroelectric generators at several of its dams. Control of flooding through channelization projects is a common Corps activity in the flatter, sandy land of west Tennessee. Recently, the Corps has considered charging for water withdrawn from the Cumberland River system - a new

policy development.

State law generally controls the allocation of water and, for the most part, the federal government defers to the law of the state. There are major exceptions to this deference, however. The Constitution confers the complete authority to regulate commerce and navigation on Congress. And, federal water resource agencies (e.g., the Corps and TVA) allocate water from their impoundments according to statutory mandates. In addition, where Congress has articulated a federal purpose, such as preventing pollution of interstate waters, federal law has supremacy over state law and states can only regulate the federal government's actions if Congress waives sovereign immunity. Where federal lands have been reserved for a particular purpose, or where land has been acquired for a federal project, the federal government may carry out the federal mandate, even if doing so would bring the federal government into conflict with state water law.

There are numerous federal statutes that affect water rights by mandating or forbidding activities that have an impact on water or water rights. Most of these statutes are considered "environmental law." Federal environmental law affects state water rights by requiring permits before certain actions can be carried out and by attaching conditions to the permits. The following comprise the most significant federal statutes that may override or modify supremacy state water law:

- **The National Environmental Policy Act (NEPA)** [39] - If a federal project or the granting of a federal permit is "a major federal action significantly affecting the quality of the human environment" then an environmental impact statement must be prepared which sets out what the proposed action will do to the environment and identifies any alternatives to the action. NEPA is essentially procedural. It does not mandate a particular outcome rather it requires proof that environmental effects have been given adequate consideration before a project goes forward or a permit is issued.

- **The Clean Water Act (CWA)** [40]–This is the principal environmental law that affects state water law. Whenever a federal license is required for a project that may result in a "discharge of pollutants" to the waters of the United States, the project proponent must obtain a "401 certification" from the state. Under Section 401, the certification must contain any requirements necessary to ensure that permitted actions do not cause a violation of Tennessee water quality standards, and these requirements become conditions of the federal license.

The Section 401 requirement **(of the CWA)** gives a state the power to veto a federal license or, alternatively, to impose requirements to protect water quality or aquatic habitats.[41] The Supreme Court has held that under Section 401, a state has the power to require that minimum stream flows be maintained.[42] The Clean Water Act requires that states maintain in-stream water quality standards. The Supreme Court has also held that the required minimum stream flow is an "appropriate requirement of State law." A water quality standard has both a "use" (for example, protection of fish and wildlife habitat) and a "criterion", which can be a numerical limit of a particular substance per quantity of water. The Supreme Court also held that a state may require a permit applicant to comply with the use independently of any criterion. In addition to water quality standards, every state is required to have an anti-degradation policy to protect waters that are cleaner than the water quality standards require. To accomplish the goals of the Clean Water Act, many states have begun basin-wide permitting and planning. Because much of the State of Tennessee is drained by the Tennessee River and its tributaries which are the subject of basin-wide management by TVA, this broader view is already practiced.

Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers before dredged or fill material can be deposited in the "waters of the United States" which includes wetlands.

- **The Endangered Species Act (ESA)** [43]- If a water supply project will affect endangered or threatened species, it may be restricted or prevented by the ESA. Section 7 requires that actions of federal agencies not jeopardize endangered species or destroy or seriously alter the species' habitats. Section 9 applies to any person subject to the jurisdiction of the United States and makes it a crime to "take" or "harm" an endangered species of fish or wildlife. The Fish and Wildlife Service, which has authority for ensuring compliance with the Act, has defined "harm" to include "significant habitat modification or degradation." The ESA is subject to reauthorization and, because it is controversial, standards may change.

- **The Rivers and Harbors Appropriation Act** [44]- passed in 1899, requires a permit from the Corps of Engineers to place any structure in a waterway that might affect navigation (Section 10). For the Tennessee River, Section 26a of the TVA act serves the same purpose. Such structures include intake and discharge pipes for water withdrawals and replacement of effluent.

- **The Tennessee Valley Authority Act** – created TVA and granted it broad powers to manage the entire watershed of the Tennessee River and its tributaries for flood control, power production and navigation. In addition, TVA is empowered to manage the waters of the Tennessee Valley to ensure the protection of the environment and to promote recreation and economic development.

- **The Wild and Scenic Rivers Act** [45]- is designed to preserve certain outstanding rivers in free-flowing condition and to protect these rivers and their immediate environments. The State of Tennessee also has a Wild and Scenic Rivers act.

3.7 Summary

Riparian law is flexible and reflects the experience of people living in relatively abundant moisture. Many commentators have stated that it is inadequate when water shortages are the norm. Most states faced with chronic water shortages have taken steps to more securely vest water use rights through some statutory modifications of the common law. The adequacy of riparian law for Tennessee under new demands on its waters is difficult to assess since the case law is scant. The following are issues in Tennessee water law not yet addressed by the courts, and for which greater attention may need to be paid in reform efforts (e.g., see chapter 7):

(1) Reasonable use – In riparian law, the definition of "reasonable" is subject to revision based on changed circumstances. It is unclear if, for example, off-basin sale to a reliant municipality would be held by the courts to be reasonable if it adversely affected agricultural use on riparian land.
(2) Acquisition of rights by prescription.
(3) Unreasonable use/damage – The difficulty of proving damage from one particular use in a large artificially controlled and generally well watered system such as the Tennessee River is the issue.
(4) Correlative rights – What water level and pressure can co-users of an aquifer be required to

preserve and what do they have the right to expect?

(5) Domestic preference – This once meant use by the riparian's household. Because many households today rely on municipal water, this term can be seen as referring to a shift in preference from agricultural and riparian use to off-site municipal use for households.

In the future, it appears that the General Assembly may need to address the following issues:

- Case by case resolution of disputes – This is always an appropriate strategy in riparian law and should probably continue to be the case. However, it is expensive, time consuming and the outcome is always uncertain. The last, in particular, has economic implications for development. A more comprehensive and consistent set of state standards for water supply could be useful to industry, government and the courts.

- The use of permits to solve conflicts among riparians - This is a change to law often recommended in times of water shortage. The state of Mississippi made this change after suffering an extended drought. The change came after state-wide consultation with affected interests coordinated by the Agricultural Bureau.

- Prohibition on some inter-basin transfers/permission for others - Under what circumstances will these be allowed and how far out of a given drainage (distance from point of diversion can affect likelihood of return flows)?

- Maintenance of minimum flows/instream flow.

- Eminent domain power granted to competing water districts.

- Nonconjunctive management of water sources.

Endnotes to Chapter 3

(1) Vincent A. Sikora, "*Tennessee*", in Beck, *Water and Water Rights* (1991 edition), Volume 6 (1994 Replacement volume) page 753 (1994).
(2) Sikora (1991-4).
(3) 21 Tenn. (2 Hum.) 518 (1841).
(4) *Id.*
(5) *Tennessee Coal, Iron, & R.R. v. Paint Rock Flume & Transp. Co.,* 128 Tenn 277,291-92, 160 S.W. 522, 526 (1913).
(6) *See* Tenn. Code Ann. § 69-1-116 (1998).
(7) City of Chattanooga v. State, 151 Tenn. 691, 272 S.W. 432 (1925), *Knox County v. Kennedy*, 92 Tenn. 1, 20 S.W. 311 (1842).
(8) Waite v. O'Neil, 76 F. 508 (6th Cir. 1896).
(9) Sikora, in Beck, *Waters and Water Rights, Part XI, Tennessee,* p. 757.
(10) *United States ex rel and for Use of Tennessee Valley Authority v. Powelson et al*, 319 U.S. 266, 274, 63 S.Ct. 1047, 1054 (1943).
(11) *See* Jones *et al*, p. 26, Sikora, Tenn. Bar J. Sept/Oct 1988 p. 17.
(12) *Id.*
(13) *Id.* and see also *Chattanooga v. Georgia,* 3 Tenn. App. 42 (Ct. App. 1925) a case involving eminent domain but not water rights.
(14) 2 Tenn. Ch. App. 132, 175, *aff'd* Tenn. Sup. Ct. (1901), quoted in Sikora, Tenn. Bar J. 1988. *Webster v. Harris*, 111 Tenn (3 Cates) 668, 676, 69 S.W. at 783 (1902).
(15) Jones *et al*, p. 32.

(16) Dellapenna, in Beck, *Water and Water Rights* (1991) at 252, 278, quoted in *Water Rights of the Eastern United States*, p. 26.
(17) Jones *et al*, p. 34.
(18) Tarlock, *Law of Water Rights and Resources* at § 3.05[1] Release # 9, 3-17 (7/97).
(19) *American Ass'n v. Eastern Ky. Land Co.,* 2 Tenn Ch. App. 132, 154.
(20) Jones *et al*, p. 57.
(21) Jones *et al*, p. 59
(22) Public Water Policy in Tennessee, by the State of Tennessee Water Policy Commission –created by Chapter 82, Public Acts of 1955; published by Public Administration Service, 1313 East Sixtieth St., Chicago 37, Illinois, 1956.
(23) Tenn. Code Ann. §§ 69-3-102 *et seq.* (1997).
(24) Jones *et al,* p.39.
(25) *Id.*
(26) Sikora, in Beck, *Waters and Water Rights, Part XI, Tennessee,* p. 764.
(27) 19 Tenn App. 446, 89 S.W.2d 889 (1935), *cert denied* (Tenn. Sup. Ct. 1936).
(28) Sikora, in Beck, *Waters and Water Rights, Part XI, Tennessee,* p. 765.
(29) Sikora, in Beck, *Waters and Water Rights, Part XI, Tennessee,* p. 765.
(30) The factors to be considered in groundwater allocation in the Restatement (Second) are presented in Chapter 2 *supra.*
(31) Jones *et al*, p. 44.
(32) Tenn. Code Ann. §§ 70-1818(D) (1983).
(33) Tenn. Code Ann. §§ 69-3-102 *et seq.* (1997).
(34) Tenn. Code Ann. §§ 69-3-108(b)(1) (1997).
(35) Tenn. Code Ann. §§ 69-8-103(4) (1997).
(36) Tenn. Code Ann. §§ 69-8-103(4) (1997); for proposed rules, see Chapter 1200-4-7 of proposed Rules, *Tenn. Admin. Regis*. September 30, 1999 ("Rules of the Water Quality Control Board").
(37) 16 U.S.C. §§1531-44, 40 U.S.C. §§4321-4370(b).
(38) 16 U.S.C. § 831y-1; also, see Misty Smith Kelley, 2000. "Current Statutory and Regulatory Provisions that Protect Tennessee's Water Resources," (unpublished manuscript). March 7: p.1.
(39) 33 U.S.C. §§401-426, 40 CFR Part 130.
(40) See *PUD No. 1 of Jefferson County and the City of Tacoma v. Washington Department of Ecology,* 511 U.S. 700 (1994).
(41) Id.
(42) 16 U.S.C. 1530, 50 CFR 400 ff.
(43) 33 U.S.C. 403, 33 CFR Part 322.
(44) 16 U.S.C. 1271ff.
(45) More certain is the outcome of a conflict between communities wishing to have higher water levels maintained in a reservoir for recreation balanced against instream use of the water for effluent dilution, protection of aquatic life, power production and navigation.

CHAPTER 4. INTERSTATE WATER ALLOCATION APPROACHES AND METHODS

4.1 Overview - Why Allocation Disputes Arise

In general, rivers often flow through more than one country or state on their way to the sea. It is also not unusual for a river to form the boundary between one country or state and another. Thus, disputes between countries or states within countries over rights to the waters of international or interstate rivers are fairly common. In the U. S., conflicts over interstate waters can occur between individuals living in different states or between the states themselves.[1]

The U. S. is, of course, a federal system under which the Constitution specifies certain powers to each of the three branches: executive, legislative, and judicial. Any powers not specifically allocated to one or more branch(es) of the federal government are reserved to the states respectively. In interstate water disputes, this system results in six possible methods by which a water dispute may be resolved. These include:

(1) A private lawsuit between water users in different states.

(2) An "equitable apportionment" suit between different states, originating before the Supreme Court, with the states as parties.

(3) Allocation by act of Congress, usually only of navigable waters, under the power of the Constitution's Commerce Clause.

(4) Allocation through agreement among the involved states resulting in an interstate compact, ratified by Congress and signed by the President, under the power of the Constitution's Compact Clause.

(5) Allocation through cooperation among the involved states that does not rise to the level of a compact requiring federal approval.

(6) State regulation of interstate water export under state law with the state acting as sovereign or fiduciary over the waters of the state.

A quick review of the relevant sections of the Constitution is useful as a prelude to our discussion of interstate allocations. States are "quasi-sovereign" entities in our federal system.[2] The U. S. Constitution, in Article III, § 2, clause 2, grants the Supreme Court original jurisdiction in "all cases . . . in which a state shall be a party." Further, in Article I, § 10, clause 3, the Constitution states that "No State shall, without the Consent of Congress, enter into any Agreement or Compact with another state." Not surprisingly, this is known as the "compact clause." Article I, § 8, clause 3 grants Congress exclusive power over interstate commerce.

At the time the Constitution was adopted, commerce relied almost exclusively on interstate waters for transportation of goods. Thus, early in our history the Supreme Court held that "the power to regulate commerce necessarily includes the power over navigation."[3] More recently, the Court has emphasized that the power of Congress to regulate water under the commerce clause extends not just to navigable waters but to any waters that affect interstate commerce.[4] Where Congress has not acted to regulate commerce, the states may do so provided that the states' regulations do not impermissibly burden interstate commerce. This is referred to as the "dormant" or "negative" commerce clause. The Tenth Amendment to the Constitution provides

that the powers not delegated to the federal government are reserved to the States or to the people. The Eleventh Amendment prohibits citizens of one state from suing another state in federal court. Each of these constitutional powers can be brought to bear on a specific problem of interstate water allocation, although some methods of resolution are considered preferable over others as discussed below.

4.2 Private Suits Over Water Allocation

Private suits by parties in one state against parties in another state are an infrequently used method of resolving interstate water disputes in the modern era. One of the reasons for this is that when state agencies administer water rights, the administering state would be an indispensable party if it has sanctioned the actions being complained about or criticized by citizens of another state. As previously noted, the Eleventh Amendment to the Constitution bars suits against a state by citizens of another state. However, the bar is against suits in *federal court* and does not affect the rights of citizens to sue in state court -- either in the administering state or in the aggrieved citizens' state.[5] There may certainly be issues of jurisdiction and state law immunity present, but there is also precedent for citizens of one state to sue citizens of another state in the courts of the first state for tortious activity that occurs in that state.

In interstate water disputes, harmful actions may be taken in the defendant's state, but the “tort” or wrongful effect can be said to occur in the plaintiff's state. The Supreme Court, in *World-Wide Volkswagen*, required a nexus with the state where suit is brought such that the defendant "should reasonably anticipate being hailed into court there."[6] It might be thought that water withdrawals in one state do not provide this nexus to a downstream state. However, in *Calder v. Jones*, the Court stated that intentional conduct in one state calculated to cause injury to the plaintiff in another state should result in the plaintiff reasonably anticipating being hailed into court there.[7] Douglas Grant notes, in a discussion of private interstate suits that, if a downstream user complains to an upstream user in another state about wrongful interference with water supply and the complaints are ignored, continued diversion might be considered "intentional" and "calculated to cause injury."[8] If jurisdiction is upheld, any judgement won in the downstream state's courts would have to be enforced by the upstream state under the *full faith and credit* clause of the Constitution.[9]

4.3 Equitable Apportionment Suits Over Allocation

The second possible method of resolving interstate water disputes is an equitable apportionment suit among states with rights to a particular body of water. As previously stated, these lawsuits, by Constitutional mandate, originate in the Supreme Court. The Court has noted that:

> One cardinal rule, underlying all the relations of the states to each other, is that of equality of right. Each state stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none.[10]

Because no state can impose its law on another state, The Supreme Court applies federal common law to make an apportionment.[11]

The Court is reluctant to take interstate disputes over water allocation. One way that the Court avoids such suits is by declaring that the issue is not yet ripe for resolution: "The governing rule is that this Court will not exert its extraordinary power to control the conduct of one State at the

suit of another, unless the threatened invasion of rights is of serious magnitude and established by clear and convincing evidence."[12] This criterion of “clear and convincing evidence” is broken down into three requirements: that the invasion of rights must be: (1) threatened; (2) of serious magnitude; and (3) clearly proved.[13] Thus, an upstream diversion that would prevent future uses but not existing ones, is not ripe for the Court's consideration. We might note that, in this issue, the Court is acting consistent with the rule in riparian common law.

The requirement of clear proof is complicated by the fact that one state has no statutory right to be informed of another state's actions. While federal actions may go through a state clearinghouse, there is no requirement that all state permits be routed to downstream states for comment before approval. In eastern states (i.e., east of the Mississippi River) at least, many uses can be initiated without state approval. While the bulk of these are small in scale, they may have a cumulative effect that can be seen in impacts upon a downstream state, even though the actual cause of the impact may be obscure to the downstream riparians who are injured. Thus, getting an equitable apportionment case before the Supreme Court is not easily done. However, most large-scale water projects on interstate rivers that involve diversions of water or its retention behind large dams have considerable federal involvement, either through funding or because of required permits for environmental protection. The federal involvement may trigger considerable public involvement, including coordination with downstream states. It is usually the case that a loud complaint from a downstream state to a federal permitting agency about a downstream effect from an action proposed for permitting will bear results. However, the federal government is under no obligation to follow the downstream state's dictates.[14]

When the Court does agree to hear an interstate suit over water rights, it always appoints a *Special Master* to gather the facts, make findings of law, and make recommendations to the Court.[15] The Court is not required to take the Master's recommendation, however. In a suit between Colorado and New Mexico over the Vermejo River, Justice Sandra Day O'Connor wrote: "Though the Master's findings on issues deserve respect and a tacit presumption of correctness, the ultimate responsibility for deciding what are correct findings of fact remain with us."[16] One of the hallmarks of equitable apportionment suits is that their outcome is not easily predicted.

The lack of predictability arises from the nature of the federal common law applied by the Court to decide the allocation. The use of local law as a basis for allocation is not compelled by the Constitution.[17] "Fair allocation rather than consistency with locally generated expectations [is] the touchstone of the principle of equitable apportionment."[18] Local law does have a role as a source of principles to apply, however, especially when the states party to the dispute apply the same type of law. Thus, where all states follow riparian law, this principle may have more weight than in disputes where one state follows prior appropriation law while another follows riparian principles. The most complete list of equitable apportionment principles or factors is found in *Nebraska v. Wyoming.* [19]

> Apportionment calls for the exercise of an informed judgement on a consideration of many factors. . . . [P]hysical and climatic conditions, the consumptive use of water in the several sections of the river, the character and rate of return flows, the extent of established uses, the availability of storage water, the practical effect of wasteful uses on downstream areas, the damage to upstream areas as compared to the benefits to downstream areas if a limitation is imposed on the former – these are all relevant factors. They are merely an illustrative, not an exhaustive catalogue. They indicate the nature of the problem of apportionment and the delicate adjustment of interests which must be made.[20]

It should be noted that where the underlying claim in an equitable apportionment suit is injury to citizens of one state by governmental entities in another, the eleventh amendment has been held by the Supreme Court not to bar suit in federal court. In *Kansas v. Colorado*, Colorado argued that the states were not real parties in interest, rather it was the landowners in the two states. The Court answered that the plaintiff, Kansas was "*parens patriae*, trustee, guardian, or representative of all or a considerable portion of its citizens" and was seeking to protect them from injury to their property, health and comfort.[21] Colorado, according to the Court, was the real defendant because Kansas was contesting action taken by Colorado through its officials. [22]

In crafting an apportionment, in those cases in which the Court has agreed to sit in judgment, the general principle about the form of relief is that, when possible, the Court will avoid appointing a federal water master to administer a river or otherwise entangling itself in continuing management. [23] While the Court is willing to make adjustments and has agreed to hear further suits about cases they have already decided - where there are allegations of a lack of compliance with earlier decrees - its desire to avoid lengthy entanglements can result in their allocation of a set amount of water to a state while disregarding the actual flow in the river. This can mean that existing uses may be impacted in ways that require the states themselves to decide who among their citizens loses. [24]

None of the equitable apportionment suits heard by the Supreme Court have involved an interstate groundwater aquifer. However (and significant for one of the cases discussed in this study - Memphis Sand Aquifer), it seems clear that the Court would apportion interstate groundwater if called upon to do so. The Court's power to decide controversies between states is not limited to the allocation of interstate rivers. The Congress might allocate a groundwater aquifer as well, if presented with a situation that spurred it into action.

4.4 Allocation of Interstate Waters by Act of Congress

The third way that interstate waters can be apportioned is, perhaps, the most rare: apportionment by act of Congress alone, without prior state agreement to a compact. It seems clear that Congress has the power to do this, at least on navigable rivers, in furtherance of commerce or where waters are to be released from storage in federal reservoir projects. In *Arizona v. California*, the Court noted, "Where Congress has so exercised its constitutional power over waters, courts have no power to substitute their own notions of an 'equitable apportionment' for the apportionment chosen by Congress."[25]

While Congress has only acted in this manner once or twice,[26] in no case was water apportioned to a state that did not currently have a claim to at least some of the waters in question. The subject of these controversies was surface water. However, Grant notes that, in *Sporhase v. Nebraska ex rel Douglas*,[27] the Court said *in dictum* that the commerce clause empowers Congress to regulate the overdraft of an interstate groundwater basin. Grant adds that this power to regulate may include the power to decide how much water each state can pump.[28] It is important to understand that Congress' actions in both the lower Colorado River controversy and the Lake Tahoe-Truckee-Carson controversy came only after the involved states were unable to reach any agreement among themselves.[29]

4.5 Allocation of Interstate Waters by Interstate Compact

Where states do reach agreement over interstate water disputes, the result is an apportionment

by interstate compact. This, the fourth approach in our list of apportionment methods, is by far the most desirable means to settle interstate disputes. As Felix Frankfurter famously said, in declaring compacts superior to litigation, compacts enable "sensible compromise, not following strictly legal lines [and] better provide for creative continuing administration to deal with changing conditions."[30]

Interstate compacts are provided for in the U. S. Constitution.[31] They require, first of all, agreement among the parties. The agreement must be adopted by the respective state legislatures. An agreement to form a compact must then be submitted to Congress for ratification and must be signed by the President. Interstate compacts are, therefore, both state law and federal law. A compact is also a contract among the signatory parties. In ratifying a compact, the Congress can permit the states to agree to actions that would otherwise be held unconstitutional, as, for example, violating the commerce clause.

The first step in developing a compact is usually congressional authorization of negotiation which may provide for a federal representative to participate.[32] Four more steps follow, in most cases. The second step is often the passage of enabling legislation by the respective state legislatures designating negotiators and authorizing them to act on behalf of the states in the matter. The third step is the negotiation. Often a federal representative observes or directly participates in the negotiations. A number of interstate compacts have federal signatories.[33] The fourth step is ratification by the legislature and governor of each state. The fifth step is the consent of Congress to the compact achieved by the passage of legislation.

The first step is not mandatory; however, the fifth step is required by the compact clause of the Constitution. That clause speaks only of the need for consent by Congress. However, the accepted understanding is that the President can veto congressional action giving consent.[34] President Franklin Roosevelt did so in 1942 when Congress consented to a compact concerning the Republican River. Roosevelt objected to provisions of the compact that withdrew the jurisdiction of the United States over the river system and restricted federal authority to construct irrigation works. A revised compact was negotiated that removed the objectionable provisions.[35]

Once a compact has been negotiated and ratified, it is binding on the signatories. There are currently 23 water apportionment compacts in force, including the recently enacted Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa compacts, whose apportionment provisions are still being negotiated. Four of the 23 include the federal government as a signatory.[36]

Compacts have several possible features that make them attractive beyond their flexibility and more complete consideration of all water uses. Under a compact, states may allocate unused water based on the future needs of the states.[37] The Supreme Court has never apportioned unused water.[38] At least one legal scholar doubts that Congress would be eager to allocate unused water in the future despite its having done so for the lower Colorado.[39] Compacts can deal with water issues besides allocation including flood control, project development, environmental protection and basin planning. Both the ACT and the ACF include consideration of pollution concerns. The consensual nature of compacts is an important strength that equitable apportionment litigation lacks. However, the requirement of consent is also a major problem if states cannot agree. In addition, because Congress must also consent, there may be federal considerations that conflict with state desires. Congress often has reserved the right to "alter, amend, or repeal" its consent. While there is some question whether the compact clause gives this power, Congress can always pass legislation superseding compact provisions.[40]

The existing interstate compacts focus on surface waters with only passing reference to groundwater. Of the four federal-interstate compacts, all mention groundwater but only the Delaware River Basin and Susquehanna River Basin Compacts treat groundwater on a par with surface water in terms of planning, allocation, and regulation of water use.[41] This does not mean that a compact allocating the waters of an interstate aquifer would not be possible. There would probably be greater difficulty in negotiating allocation formulae for a groundwater body for the reason that the amount of water to be apportioned is more difficult to ascertain than it would be for a river course, which can be measured at gauging-stations at different seasons of the year. "To apportion water between the states, a compact must either (1) limit how much water the upper state can use or (2) guarantee the lower state a certain amount of water."[42] With groundwater, although apportionment would take the same general form, there is no 'upper' and 'lower' state in the same sense as with an interstate river. The technical difficulties of determining how total volume and rate of flow are measured over time could be worked out for groundwater, as they are for surface water, but a greater amount of flexibility would have to be built into the compact. It should be noted that another way that compacts are superior to equitable apportionment suits is the fact that compacts usually protect existing water uses or rights.[43] This might also be harder for a groundwater aquifer if the aquifer is currently being overdrawn or "mined" (see, for example, Chapter 5)

4.5.1 Compact Enforcement - Structures and Functions

Compacts vary widely in the manner in which they are enforced. Nearly two-thirds of the existing compacts create a compact commission.[44] Most of these commissions, however, have little enforcement authority. Usually, if signatory states feel that the terms of a compact are being violated, the states will bring suit to enforce the compact. These suits usually lie within the original jurisdiction of the Supreme Court. The Court has laid down five principles about its role in enforcing compacts. First, if the compact provides that a commission is the exclusive forum for disputes, the Court will honor that provision, second, if there is a commission and it has an agreement on how to administer the compact, the Court will only review the agreement in "extraordinary cause." Third, if a commission is deadlocked, unless the compact expressly allows the Court to step in to break the impasse, the Court will decline to intervene. Fourth if actions by the commission are clearly inequitable because of a party exercising veto power, the Court will intervene. And, finally, the Court has stated, if disputes are amenable to judicial resolution, the Court will work to resolve them, if they are not so amenable, the parties should undertake further negotiations among themselves.[45]

The language of Interstate compacts often states that they should not be construed to impair the right of a signatory state to regulate water use within its borders so long as the state's actions are consistent with its obligations under the compact. This essentially means that inconsistent state laws must give way to compact provisions. The result is the same where a compact is silent on the intended effect on state law. A water compact is probably federal law for purposes of the supremacy clause of the Constitution.[46]

4.6 State Regulation of Water Export

The fifth means by which interstate waters can be allocated is through state regulation of water export. It was long thought that a state, acting as sovereign to protect the health and welfare of its citizens, could restrict water exports and that its actions would be immune from commerce clause scrutiny. However, in 1982, the U.S. Supreme Court held that state restrictions on interstate water export *are* subject to scrutiny under the dormant commerce clause.[47] The Court found that water is an article of commerce, reversing earlier decisions. The Court then applied

the balancing test it had previously articulated:

> Where the statute regulates evenhandedly to effectuate a legitimate local public interest, and its effects on interstate commerce are only incidental, it will be upheld unless the burden imposed on such commerce is clearly excessive in relation to the putative local benefits. If a legitimate local purpose is found, then the question becomes one of degree. And the extent of the burden that will be tolerated will of course depend on the nature of the local interest involved, and on whether it could be promoted as well with a lesser impact on interstate activities.[48]

Any provisions restricting water export must be "narrowly tailored to a legitimate purpose." No water export provisions have yet met this test but there is some hope that water allocation procedures that place some barriers on the export of water will be upheld.[49] A state may prefer in-state to out-of-state residents when it enters the market directly.[50] It is not yet clear whether this principle can be applied to water.[51] Of course, Congress may expressly consent to state legislation that would otherwise be unconstitutional. This is generally done through congressional ratification of an interstate compact.[52]

4.7 Cooperation in Lieu of Formal Compact

The final means of allocating interstate waters is through cooperation among states that does not involve the negotiation of an interstate compact. There is debate in legal circles about whether states can bind themselves without congressional consent. In fact, not every arrangement between states that is a “compact” in the constitutional sense requires congressional consent: "The Supreme Court has construed the compact clause to require consent only if an agreement tends 'to the increase of the political power in the States, which may encroach upon or interfere with the just supremacy of the United States."[53]

Whether states with considerable federal involvement in the interstate watercourses which flow through them could act to apportion the water in those course without federal assent is doubtful. However, such an approach to the regulation of use of an interstate aquifer might work and might, where agreement can be reached, be preferable to the greater difficulties inherent in an interstate compact requiring both congressional and presidential ratification.

4.8 Summary and Relevance to Tennessee

Allocation through *interstate compact* is the preferred method of dividing interstate waters. This is because, unlike other methods, it permits certainty, is durable, provides greater state discretion in allocating water, and is the least contentious in the long run. Finally, Tennessee has no statutory rights to be informed of other states’ activities regarding proposals to allocate interstate waters. However, as a downstream riparian, if an upstream state proposes to divert a surface stream, and that action damages downstream riparians in Tennessee (or the waters of the state) Tennessee can go to federal court to prevent the action. Because the interstate waters that flow through Tennessee are all harnessed for flood control, power and/or navigation by either the Army Corps of Engineers or Tennessee Valley Authority, it is unlikely that a project in an upstream state could be undertaken without the cooperation and/or knowledge of these agencies. These agencies, moreover, would surely involve downstream states in planning.

Endnotes to Chapter 4

(1) Grant, Douglas L., *Introduction to Interstate Allocation Problems,* in Beck, Robert E., Editor-in –Chief, *Waters and*
(2) Tarlock, A. Dan, *Law of Water Rights and Resources,* Clark, Boardman and Callaghan, Deerfield, Illinois, 1997
(3) *Kaiser Aetna v. United States*, 444 U.S. 164, 173-74 (1979).
(4) *Id.*
(5) Grant, *Private Interstate Suits* in Beck, §44.01.
(6) 444 U.S. 286, 297 (1980).
(7) 465 U.S. 783, 791 (1984).
(8) Grant, *Private Interstate Suits* in Beck, §44.04.
(9) U.S. Constitution, Article IV, Section 1.
(10) *Kansas v. Colorado*, 206 U.S. 46, 97 (1907), quoted in Grant, *Private Interstate Suits* §45.01.
(11) Grant, *id.*
(12) *Connecticut v. Massachusetts*, 282 U.S. 660, 669 (1931).
(13) Grant, *Equitable Apportionment Suits Between States*, in Beck § 45.04(a).
(14) Cf. State v. *Champion Int'l Corp.*, 709 S.W.2d 569 (Tenn. 1986).
(15) See *New Jersey v. New York*, 280 U.S. 533 (1930); *Connecticut v. Massachusetts*, 280 U.S. 523 (1929).
(16) *Colorado v. New Mexico*, 467 U.S. 310,317 (1984).).
(17) *Colorado v. New Mexico*, 459 U.S. 176 (1982).
(18) Tarlock, A. Dan, *Law of Water Rights and Resources,* Interstate Allocation § 10.04.
(19) 325 U.S. 589 (1945).
(20) *Id* at 618.
(21) *Kansas v. Colorado*, 185 U.S. at 142.
(22) Grant, *Equitable Apportionment Suits* in Beck § 45.03(a).
(23) *Id.* at 45.07(a).
(24) *Id.*
(25) *Arizona v. California*, 373 U.S. 546, 565 (1963)
(26) See *Arizona v. California*, 373 U.S. 546 (1963); Colorado River Basin Project Act, 43 U.S.C. §1521(b); Tr
(27) 458 U.S. 941, 953-54 (1982).
(28) Douglas L. Grant, *Apportionment by Congress*, in Beck § 47.01(b).
(29) *Id.*
(30) Frankfurter & Landis, *The Compact Clause of the Constitution – A Study in Interstate Adjustments*, 34 Yale L.J. 685
(31) U.S. Const. art I, § 10, cl. 3.
(32) Tarlock, *Law of Water Rights and Resources*, § 10.05.
(33) Cf. The Delaware River Basin Compact; the Apalachicola-Chattahoochee-Flint River Basin Compact; the Alabama
(34) Zimmermann, F. & M. Wendell, *The Interstate Compact Since 1925*, at 93 (1951), quoted in Grant, *Water Appor*
(35) Grant, *Water Apportionment Compacts*, in Beck §46.02.
(36) The Delaware River Basin Compact; the Susquehanna River Basin Compact, the Apalachicola- Chattahooch
(37) Tarlock, A. Dan, *Law of Water Rights and Resources,* Interstate Allocation § 10.05[1].
(38) Grant, *Water Apportionment Compacts*, in Beck §46.01.
(39) See *Arizona v. California*, 373 U.S. 546, 565 (1963).
(40) Grant, *Water Apportionment Compacts*, in Beck §46.03.
(41) *Id.*
(42) *Id.*
(43) *Id.*
(44) *Id.*
(45) *Texas v. New Mexico*, 462 U.S. 540 (1980), quoted in Grant, *Water Apportionment Compacts*, in Beck §46.03
(46) Grant, *Water Apportionment Compacts*, in Beck §46.04.
(47) *Sporhase v. Nebraska ex rel. Douglas*, 458 U.S. 941.
(48) *Pike v. Bruce Church*, 397 U.S. 137 (1970).
(49) Tarlock, A. Dan, *Law of Water Rights and Resources,* Interstate Allocation § 10.07[3].
(50) *White v. Massachusetts Council of Constr. Employees, Inc.*, 460 U.S. 204 (1983).
(51) Tarlock, A. Dan, *Law of Water Rights and Resources,* Interstate Allocation § 10.07[3].
(52) *Id.*
(53) Grant, *Introduction to Interstate Water Allocation Problems*, in Beck. § 43.02. quoting *New Hampshire v. Maine*, 42

CHAPTER 5. THE TENNESSEE RIVER-ATLANTA DIVERSION AND MEMPHIS SAND AQUIFER CASE STUDIES AS WATER ALLOCATION CONTROVERSIES

5.1 Introduction

It is important to remember that the rights in a water dispute tend to be extremely fact-specific. While the general principles of riparian law, as interpreted in Tennessee, apply - the outcome of their application depends on the particular facts of the case being analyzed. In looking at these cases, we will identify variations on the proposed actions that might be contemplated and provide legal analysis of foreseeable alternatives. Thus, for example, when we analyze the prospects for Tennessee-American to sell water to Georgia, we will also discuss the effect on water rights if the City of Chattanooga had succeeded in taking over the company and considered selling water to Atlanta itself. We will analyze the Atlanta case first.

5.2 Atlanta, Chattanooga, and the Tennessee River - Background

Atlanta and the state of Georgia are in the throes of a 'water war' with Alabama and Florida that has been fought since the late 1980s. The focus of this battle is the effort to manage and allocate water supplies in two river basins: the Apalachicola-Chattahoochee-Flint (ACF) and Alabama-Coosa-Tallapoosa (ACT) systems (see Figure 5.1). Two interstate compacts, ratified by Congress in 1997, and each scheduled to take effect once the three states agree on a water allocation formula, will have the result of placing fixed, presumably verifiable, limits upon Georgia's ability to draw water from these river basins.[1] As a result of these anticipated limits, one option that has fueled much speculation in local and regional media is purchasing water from Chattanooga's private, municipal supplier - the Tennessee American Water Company (TAWC) - and sending it to Atlanta via pipeline.

Atlanta's water problems, their degree of seriousness, and their implications for Tennessee are all open to contention. At current rates of consumption, the city will not run out of water for 30-40 years, if at all.[2] Atlanta currently consumes about 125 million gallons per day (Mgal/d) of water, and somewhat more during the summer. This figure is approximately half the production capacity of its principal municipal providers - the Atlanta Water Department and Atlanta-Fulton County Water Treatment Plant. Together, these have a permitted withdrawal limit of approximately 270 Mgal/d. Moreover, the Atlanta Regional Commission (ARC) has stated that "improvements in technology and changes in how water is used" ensure that Atlanta's water supply could last for at least 25 years. At that time, the metro area's current population of 3.5 million residents is anticipated to grow beyond 4.7 million.[3] It is not even certain that Atlanta's access to additional water will be severely curtailed by allocation limits agreed to under the ACF-ACT Compacts. The possibility of "internal" reallocation of waters within Georgia - from, for example, Lake Allatoona on the Coosa River to Lake Sidney Lanier on the Chattahoochee - is one option under consideration by local decision makers. Other options - contentious with regard to Alabama and Florida -- are being explored, including new dams on the Tallapoosa-Coosa system. The ARC has also studied, and recommended, adoption of water conservation measures, including public education, low-flow plumbing fixtures, and pricing reforms.[4]

The concept of purchasing water from TAWC was first raised in 1998 when the cities of Chattanooga and Atlanta -- which are gradually becoming parts of a single metropolitan area -- began discussions over the feasibility of developing a high-speed intercity passenger train and linking development of this train to cooperation over water. The concept of diverting water to Georgia is believed to have originated with the Atlanta Regional Commission. Three peripheral

issues have policy significance for the ultimate outcome of this case:

Chattanooga officials had expressed concerned with the decision-making process regarding possible diversion of water to Atlanta. Not only had the City expressed a desire for direct input into any plans to provide water outside TAWC's traditional service area (the company has 68,000 customers), but discussion of such plans exacerbated simmering conflict with the company over other issues. The City of Chattanooga filed suit to acquire TAWC's assets by eminent domain in the Spring of 1999, in part due to the latter's refusal to lower fire hydrant fees. The case that went to trial in August, 1999 was the so-called "franchise case." From the suit's beginning, a series of proposed compromises followed, including an offer by TAWC to give the city a voice in any decisions to ship water to other regions.[5] In addition, debate ensued over several issues, including the merits of public vs. private ownership (with most of the public, according to polling commissioned by the company, wanting TAWC to remain in private hands); disagreement over the net worth of TAWC's assets (the city claimed a worth around $86 million while the company believed its worth to be well over $100 million; and the legality of TAWC's "valid franchise" to operate within the city.[6]

The City of Chattanooga and TAWC have entered into a settlement agreement over the acquisition suit, and the court hearing the case dismissed the city's claim that TAWC did not have a valid franchise to operate within the city streets. Both developments are significant for any possible sale of water to Atlanta. In exchange for an agreement by TAWC to reduce its annual fire hydrant fees from about $1.4 million to about $1 million, the City - on October 26, 1999 - abandoned its lawsuit to acquire the company's assets by eminent domain. Among other things, the settlement provides that TAWC "will not pursue the sale of water to Atlanta if such sale is contrary to the public will of the community." Although this condition is not explicitly spelled-out, Mayor John Kinsey has stated that he believes the City Council represents the will of the people. Finally, the settlement agreement further provides that "(s)hould an agreement to sell water to Atlanta be consummated, the city may participate by making investments and realize benefits, if any, in proportion to its investment." [7]

In connection with its takeover attempt, the City re-opened a 1977 lawsuit challenging TAWC's franchise to operate in the city streets. This case went to trial on August 13, 1999. On October 13, 1999, the Hamilton County Chancery Court ruled in TAWC's favor by holding that the company's 1868 state-granted franchise to operate in the city's streets was perpetual. The City had claimed that TAWC's franchise had expired and that as a result, all of TAWC's distribution system located in the public streets already belonged to the City. The Court found the City's trespass argument "untenable," and held that even if the franchise had not been perpetual, the city had granted TAWC express permission to occupy the city's streets through its contracts and permits with the company. Despite the court's finding that TAWC has a valid franchise to operate in Chattanooga, the City has decided to appeal that part of the ruling which holds that the company's franchise is "perpetual" - an appeal which TAWC agreed to allow the City to initiate under the eminent domain suit's settlement agreement. Regardless of this appeal's outcome, the City has agreed to extend TAWC a 25 year franchise to use the public streets.[8]

TAWC views providing water to Atlanta as a potentially economically-attractive proposition, but only if "significant amounts" of water can be diverted. While the definition of "significant" remains unclear, sending 10, 20 or even 30 Mgal/d to Atlanta would not be "economically feasible," according to one official of the utility. The company also views selling water to Atlanta as a natural extension of its current business. Since 1997, TAWC has supplied water to Ft. Oglethorpe and Catoosa County, Georgia: communities experiencing high population

growth. By contrast, customer growth has been slow in Chattanooga, making out-of-service area sales enticing. TAWC has proposed that the city become an "investment partner" in making capital improvements to its system. At one time the City stated that such a joint public-private venture would be unconstitutional. However, as a result of the settlement of the City's lawsuit, the city and TAWC have agreed to meet regularly to coordinate planned street openings and they "may jointly invest in new water pipes and filtering facilities in the future." [9]

5.3 Relevant Legal Principles Regarding the Selling of Water to Georgia - Overview

Tennessee-American Water Company (TAWC) is a corporation doing business in Tennessee. The company was originally chartered in Tennessee and subsequently organized under state statute as a water supply company. TAWC is currently a wholly-owned subsidiary of a New Jersey corporation. The company owns riparian land along the Tennessee River off Amnicola Highway in Chattanooga. Thus, TAWC is a riparian with all of the rights and duties of a riparian under common law. The company is currently withdrawing water from a point on this riparian property and selling it to the City of Chattanooga and other municipalities in the general area.

TAWC apparently does not treat return wastewater from these municipalities. Instead, each entity served by the company treats its own waste and returns the effluent to the Tennessee River or to streams within the drainage of the Tennessee River. In the absence of any information to the contrary, we have assumed that the most likely point of withdrawal for water to be sold to Atlanta is on the Amnicola Highway site. Thus, the diversion would take place in Tennessee and any conflicts that arose would be decided under Tennessee law and in Tennessee courts. The diversion would also potentially be modified by the interests of TVA and the navigation interests of other federal agencies in the larger Mississippi system.

TAWC's service territory encompasses a major portion of Hamilton County and a small portion of Marion County in Tennessee. It also includes sections of Catoosa, Dade, and Walker Counties in Georgia. Within Hamilton County the Company operates in the cities of Chattanooga, East Ridge, Red Bank, Ridgeside, and the town of Lookout Mountain. The service area in Georgia includes the cities of Rossville and Lookout Mountain in Walker County and unincorporated areas of Catoosa and Dade Counties. Additionally, the company sells water for resale to the Eastside Utility District, and the town of Signal Mountain in Tennessee as well as the town of Fort Oglethorpe, Georgia. Tennessee-American serves a population of about 240, 000. It has 68,000 customers in 5 counties. Over a 12-month period the system delivers 13,111,396,000 gallons of water. The average daily demand for the system is 38 million gallons of water all drawn from the Tennessee River. In addition to 1,210 miles of water mains, the company has 26 storage vessels with capacity of 19.44 million gallons. [10]

5.3.1 Riparian and State Sovereignty Issues

The Tennessee River forms north of Knoxville, in East Tennessee, from the confluence of the Holston and French Broad rivers. The river is augmented by flows from the Little Tennessee, Clinch, Hiwassee and other rivers before it flows past Chattanooga. The headwaters of some of the tributaries of the Tennessee, or of rivers that flow into these tributaries arise in the mountainous area of northwest Georgia (i.e., Lookout and South Chickamauga creeks). No part of the Tennessee River, as such, flows through Georgia.
The Tennessee River first flows through Tennessee, then into Alabama, Mississippi, back into Tennessee, and then into Kentucky before emptying into the Ohio River in Kentucky shortly before the Ohio empties into the Mississippi. The river is navigable throughout its reach. There

are numerous dam and reservoir projects along it, all of which have locks to allow river traffic to pass. Releases from these dams, and thus flows in the river, are controlled by TVA for the statutory purposes of enhancing navigation, providing flood control, producing hydro- and thermal-electric power, supporting recreation, and promoting economic development in the river basin and its tributaries.[11] TVA manages the river in coordination with the Army Corps of Engineers which manages the Ohio and the Mississippi rivers for flood control and navigation.

We have previously noted that the federal government generally defers to state law regarding water withdrawals for private, municipal, or industrial use. However, on federally managed rivers, the federal government regulates any actions, such as the placement of pipes to withdraw water, which may affect navigation. In addition, the flow of a regulated river (that is, the amount of water in the watercourse) is greatly affected by decisions that are made daily by the federal managing agency in carrying out its mandated purposes. Furthermore, federal agencies with responsibilities for programs to protect water quality (e.g., the Environmental Protection Agency [EPA]), fish and wildlife (the Fish and Wildlife Service [USFWS]), or with other responsibilities may have a say in any action affecting waters in an interstate watercourse that might affect them. This is true even if the action is carried out completely within one state.

Landowners in Tennessee, Alabama and Mississippi whose property abuts the Tennessee River are riparians and have rights to withdraw and use water equal to TAWC's rights. These riparians share the legal expectation that the flow of the river will not be artificially diminished by the unreasonable actions of an upstream riparian.[12] Some landowners whose property abuts the reservoirs created by TVA are not riparians as such. Rather, they have rights to use the water as granted to them by that agency. When the federal government buys or takes land by eminent domain for reservoir projects, it acquires the riparian rights that go along with the land. In Tennessee, TVA is authorized to flood to a certain elevation, but does not always own the shoreline. In instances where TVA only purchased flowage easement rights and not the land fee simple, the landowners *are* riparians. Moreover, if land bordering on the reservoirs is later sold or transferred to a non-federal entity, any rights to water that go with the land are determined by the agency in the deeds to the land.

The State of Tennessee, as both sovereign and trustee for its citizens, holds title to all of the waters of the state. The State has the power to regulate all activities on navigable streams that might affect their navigability. The State has police powers that can be used to control uses of state watercourses where such action is required to protect public health, aquatic life and habitat, or existing reasonable uses. If the state's use of its powers comes into conflict with a clearly articulated federal purpose, the supremacy of federal law will probably prevail.

5.3.2 Implications of Aquatic Resource Alteration Permits

The General Assembly of Tennessee has passed legislation that requires registration of all withdrawals of 50,000 gallons per day or more with the Division of Water Supply.[13] The legislation requires that the state be notified of any increase in capacity of 10% or more to withdraw water at an existing installation.[14] If a water withdrawal would affect aquatic resources, the state can require that an Aquatic Resource Alteration Permit (ARAP) be issued before the withdrawal is allowed.[15] The state is empowered to refuse to issue an ARAP if damage to aquatic environments would be unavoidably significant. If the state has refused to issue an ARAP and an entity persists in withdrawing water, the state can go to court and have the withdrawal enjoined permanently, or until water conditions change.

TAWC's right to withdraw water from the Tennessee River is subject to the rights of all downstream riparians, both within Tennessee and in downstream states. Generally, in a common law state such as Tennessee, no action is taken to control withdrawals and use unless another riparian complains about, and proves injury to, his/her rights. However, under riparian law, inter-basin transfers do not usually require proof of damage for issuance of an injunction if a complaint is made. There has never been a case deciding this issue under Tennessee law. TAWC is currently selling water to municipalities in Georgia. The locations of these municipalities lie within the Tennessee River drainage. The wastewater return flow from all of Tennessee-American's sales is not returned to the watercourse at the same point from which it was withdrawn but is, in apparently all cases, returned to the drainage basin of the Tennessee River. The proposed sale of water to Atlanta and/or its suburbs would take Tennessee River water *completely* out of the Tennessee River basin and, in fact, out of the larger Mississippi drainage. The return flow would likely be released into watercourses that ultimately drain into the Chattahoochee or Coosa Rivers and thence, into the Gulf of Mexico.

TAWC has stated that, to be economically feasible, the amount of water proposed for diversion would have to be 30 million gallons per day or more (about 1.5% of the lowest average daily flow of the Tennessee River from April to October each year). This amount is almost double what is currently being withdrawn and sold by the company. If the company were to proceed with a project to supply water to Atlanta it would probably have to enlarge its facility. TAWC might, of course, acquire additional riparian land and install withdrawal facilities there. If existing intake structures were modified, then it would have to acquire a 26a permit from TVA for the new pipes and would have to notify the State of Tennessee Water Supply Division of the new installation. The Water Supply Division might require that the company apply for an ARAP. If, in evaluating the impact on the existing uses and aquatic habitats of the Tennessee River, either TVA or the State concludes, as is likely, that such a large diversion without return flow is unacceptably damaging to the river or its current uses, TAWC would not be able to proceed with the diversion.

If no new installation requiring a permit is needed, TAWC would still have to notify the Water Supply Division of a greater than 10% increase in capacity. Statute requires notification "within 30 days of the increase." Even if TAWC waits to notify the Division until it has increased its capacity, the State would not be barred from requiring an ARAP or seeking an injunction. If no notification to the state is made, the state can act on knowledge of the impending or present diversion if it would adversely affect navigation, water quality, or aquatic habitat.

5.3.3 Downstream Impacts and Their Implications

If TVA and the State of Tennessee allowed a diversion, all downstream riparians in Tennessee, Alabama, Mississippi, and Kentucky would potentially have a cause of action to enjoin TAWC or to require the company to pay them damages for impairment of their rights to the water of the Tennessee River. These actions could be brought under Tennessee law in a Tennessee court, or they could be the basis for a suit to adjudicate rights to the water of an interstate watercourse, brought either in the lower riparian state court or in federal court. As previously noted, under common law, inter-basin transfers do not usually require proof of damage before an injunction can issue. Such transfers are *per se* unreasonable because the riparian expectation of flow being returned to the watercourse cannot usually be satisfied. If the courts rule that damages must be proven, under riparian law, the damage must be to existing uses, not future expectations. Because the flows in the Tennessee River are regulated by TVA, it is difficult to perceive the seasonal changes that occur naturally. Nevertheless, existing uses, especially for thermal-electric power generation, have stressed aquatic life at some locations because of low

dissolved oxygen concentrations in past droughts. Drought years must be used as the standard for judging damage. [16]

One argument advanced to support the notion of diverting Tennessee River water to help alleviate possible water shortages in Georgia is that there is "excess" water in the Tennessee River that no one is using. In riparian law, there is no such thing as "excess" water. Riparians along the river have the legal expectation that they will receive the natural flow of the river reduced by the reasonable uses of other riparians. Whether under flood conditions or drought, their right is to the river's natural flow. Of course, the natural flow is considerably changed by the actions of TVA, which impounds water to prevent flooding and diverts water to produce hydro- and thermal-electric power. This does not change the riparians' rights, however. [17]

Figure 5.2 depicts daily withdrawals from the Tennessee River and its tributaries and illustrates the uses to which the withdrawn water is put. Each use provides a different percentage of return flow because of the nature of that use. Return flow for each use also varies throughout the seasons depending on climatological conditions. Figure 5.2 shows that there are two existing inter-basin transfers which remove water from the river but have no return flow. These are the 20 Mgal/d diversion to the Fort Payne Water Works (half of which actually goes to the Sand Mountain area in the Tennessee Valley watershed) and 268.5 Mgal/d diversion through the Tennessee-Tombigbee Waterway. The latter diverts water out of the Tennessee-Ohio-Mississippi drainage. These subtractions from the natural flow of the river increase the likelihood that downstream riparians would complain about an inter-basin diversion of 30 Mgal/d at Chattanooga, and that such a diversion would be found by the courts to be unreasonable.

There are three other ways that Tennessee River water might be diverted for use in Georgia. First, if the City of Chattanooga succeeded in taking over Tennessee-American, it might see the increased sale of water to Georgia as a means of raising revenue to pay off the bonds issued to acquire the company. The City of Chattanooga would be subject to the same strictures of law as would TAWC when acting as a publicly-held corporation. The City would then be a riparian with riparian rights and duties. As a municipality, it is possible that rights could be found to be greater than other non-municipal riparians. Nevertheless, other downstream municipalities and government entities would be co-equals with the City of Chattanooga, and their rights would have to be respected.

Second, the State of Georgia might buy riparian land along the Tennessee and try to withdraw water and ship it to the Atlanta area. Again, the restrictions would be the same. The State of Georgia would be a riparian in the State of Tennessee and thus, subject to Tennessee law. Georgia might bring suit for the equitable apportionment of an interstate water course. The suit would originate in the U.S. Supreme Court. However, the Court has never allocated interstate waters to a state that has no existing rights to the water. [18] While it is never wise to state unequivocally what the Court will do in an area where it has never before acted, it is unlikely that the Court would hear the case because it does not create rights; rather it adjudicates under existing law and the Constitution. Georgia is not a riparian to the Tennessee River. Hence, it has no rights in the river.

A third possibility is that Congress might mandate and fund a project to build water lines from the Tennessee River to Atlanta in connection with, for instance, construction of a federally-funded high-speed rail project. While this is probably within Congress' power under the Commerce Clause, it is not likely to happen given the cost to federal taxpayers as well as the potential disruption to existing federal interests in commerce and navigation along the Tennessee, Ohio and Mississippi and the Tennessee-Tombigbee Waterway. Again, the disruption must be

evaluated at the *lowest* flow, not at times of abundant flow. In past drought years, navigation on the Mississippi has been halted because there was insufficient water in the river to float barges. A large diversion from the Mississippi basin to Georgia which would return directly to the Gulf of Mexico would make such disruption more likely. Moreover, the costs of such a project would not be limited to construction of a pipeline and pumping works. Such a large-scale diversion might be considered a taking, post-*Lucas*,[19] and require compensation to affected downstream riparians. Alabama, because of existing conflict over the waters of the Chattahoochee and the Alabama-Coosa, might be uncertain about the advisability of diverting the Tennessee River. However, it appears certain that Mississippi, Kentucky and other states benefiting from navigation on the Mississippi would oppose such an action by Congress.

5.3.4 Summation - Diverting Tennessee River Water to Georgia

Tennessee-American has riparian rights to withdraw and use water from the Tennessee River but those rights are limited by the equal rights of downstream riparians. The company has no right to withdraw a large amount of water from the river for sale completely out of the Tennessee River basin if any downstream riparians object. The State of Tennessee holds the waters of the state in trust for the people of the state. Even absent specific statutory requirements that a permit be issued before water is withdrawn, the state can act to prevent withdrawals that may damage aquatic environments or existing uses of the river. Moreover, although the headwaters of several Tennessee tributaries rise in Georgia, Georgia is not a riparian to the Tennessee River. Courts are unlikely to apportion water to a state that is not a riparian.

5.4 West Tennessee, Northern Mississippi, and the Memphis Sand Aquifer - Background

Memphis is one of the largest cities in the world to rely solely on groundwater wells for its water supply.[20] The city's water is provided by a publicly-owned municipal utility, Memphis Light, Gas, and Water (MLGW). MLGW's wells tap into the Memphis Sand Aquifer and the Fort Pillow Sand Aquifer. The former aquifer is an underground reservoir that underlies nearly 7400 mi^2 in West Tennessee, an appreciable extent of Northern Mississippi, a small section of Southwestern Kentucky, and a portion of Eastern Arkansas (see Figure 5.3). Memphis is currently the largest user of the aquifer. However, DeSoto County, Mississippi - an area experiencing rapid economic and population growth, in part due to the "suburbanization" of Memphis - views the aquifer as a potential source of future water supply. According to one estimate, twenty to forty Mgal/d of the City of Memphis groundwater withdrawn from the Memphis Sand Aquifer is thought to come from beneath DeSoto County.[21] Consequently, demands have been increasing to pursue a more integrated, regional, interstate approach to management of the aquifer.

The aquifer, consisting of a 400 - 900 ft. thick layer of very fine to very coarse sand interlaced with beds of clay and silt, has long provided moderate to large volumes of water for public and industrial use in Tennessee and smaller quantities to domestic, farm, municipal, and industrial users in southwestern Kentucky and northwestern Mississippi. Public and industrial wells in the aquifer range from 80 - 922 feet deep and yield from 10 - 2300 gallons per minute.[22] Withdrawals from the aquifer have been steadily growing in recent years. For example, in 1983, withdrawals averaged 227 Mgal/d - 183 Mgal/d of which were in the Memphis-Shelby County metro area. In 1995, groundwater withdrawals in Shelby County alone totaled 208 Mgal/d.[23] In addition to growing aquifer use, however, there are four major policy challenges facing its management which underscore the complexity of this issue and its policy challenges:

Memphis Sand Aquifer recharge occurs along a broad outcrop belt that stretches across

***West Tennessee*.** Its source is precipitation falling above the outcrop, combined with downward infiltration from overlying fluvial deposits and alluvium. Water moves westward down the dip of the aquifer and toward the major streams draining the area. In recent years, scientists have learned that the recharge area begins just inside southeast Shelby County - where high levels of development are occurring.[24] Thus, balancing local growth against the need to protect the recharge area remains a major challenge which has sparked local efforts (e.g., Collierville, Germantown) to require 'open space' and to place limits on development so as to permit natural 'ponding' of standing water and aquifer recharge.

As a result of long-term pumping (begun in 1886), a cone of depression has developed in the Memphis area. However, it is unclear what long-term effects this may have. Data from observation wells shows that the water level in Shelby county declined nearly 77 ft. between 1928-1985, an average rate of decline of 1.3 ft/yr. Water levels also are declining in areas away from a "cone" at the center of the aquifer in Memphis., and smaller cones are found around major well field in the city of Memphis. In DeSoto County, Mississippi, for example, declines of one foot or more a year have been reported due to the effects of local pumping, as well as pumping in Memphis.[25] It has not been determined if any "overdrafting" has occurred; i.e., that water levels could not return to normal if pumping ceased. Nor has it been proven that there has been a significant decline in water levels in Mississippi or a measurable effect on well yields in northern Mississippi.

***The Memphis Sand Aquifer is susceptible to contamination*.** Trace constituents of arsenic, barium, cadmium, chromium, copper, lead, mercury, strontium, and zinc - in very small concentrations - have been found in the aquifer. While well below EPA's maximum allowable concentrations for drinking water supplies, their discovery is a cause for concern because the aquifer system constitutes the principal potable water supply source for Memphis and outlying areas. Moreover, it had previously been thought that the aquifer was overlain by a thick, impermeable clay layer protecting it from contamination. Officials now realize the potential for contamination in the vicinity of waste disposal sites, and contaminants are known to be present in water-table aquifers in the Memphis area at several abandoned dump sites.[26]

Mississippi is concerned with declining water levels in the aquifer. Currently, that state derives 80% (2.6 out of a total of 3.3 BGD) of its daily potable water supply from underground sources. Calls for a comprehensive study of groundwater use, groundwater movement between the two states, and the causes of groundwater level declines have been growing, particularly among Mississippi officials. Uncertainty still surrounds the movement of groundwater beneath the two states. It is possible that parties in *either* Tennessee or Mississippi could be impairing the rights of users in the other state if they pump in high quantities. Local experts concur that any multi-jurisdictional approach to managing groundwater will require consensus among many stakeholders. At least one study has attempted to gauge stakeholder attitudes regarding these issues and has concluded that stakeholders in each state perceive a potential threat to its groundwater from users in the other state. In addition, a collaborative study involving several institutions has begun, with involvement by USGS and the Groundwater Institute of the University of Memphis.[27] Mississippi's Department of Environmental Quality is also expected to become a study participant.

The Memphis Sand Aquifer currently faces three interrelated challenges. First, an increase in the current rate of water withdrawal in and around Memphis could have various "recharge" effects. It might serve to continue to lower the water table. On the other hand, it might actually accelerate

groundwater recharge by downward leakage from the near surface water tables - so called alluvium and fluvial deposits. This, too, is problematic because the quality of the groundwater varies between different aquifers and even within the same aquifer.[28] Second, as DeSoto County and other areas of northwestern Mississippi continue to grow, competition over available groundwater, and debate over who properly "owns" it, also will grow. Finally, increased water withdrawal as well as improperly managed patterns of land use development may threaten both the recharge of the aquifer and its possible contamination.

5.5 Relevant Legal Principles Regarding the Memphis Sand Aquifer - Overview

MLGW, as the name suggests, supplies electric power and natural gas, as well as water to the population of the City of Memphis and surrounding suburbs. In 1998, MLGW's maximum pumpage to its distribution system was 227.4 Mgal/d, while its minimum pumpage was 118.9 Mgal/day. Daily averages from increased from 140.6 Mgal/d in 1994 to 153.4 Mgal/d in 1998. Most of this water is withdrawn from wells in the Memphis Sand Aquifer, a portion of which underlies the city. MLGW has 10 water pumping stations in Shelby County drawing water from more than 170 wells. MLGW advertises that the aquifer beneath the city has "an abundant supply of high quality water that could accommodate the daily needs of a city several times the size of Memphis."[29]

The common law of groundwater in Tennessee has not been the subject of much litigation. The general view of legal scholars is that Tennessee holds that landowners overlying an aquifer have rights to pump water from the aquifer that are correlative to the rights of other landowners whose land overlies the aquifer. It has been stated that "correlative rights are simply surface riparian law applied to groundwater."[30] While some may disagree with this view, the appellate court in Tennessee has rejected the absolute dominion rule which allows a surface owner to pump any amount of water from an aquifer regardless of the damage it does to the rights of other landowners overlying the same aquifer.[31] The court concluded that overlying landowners are restricted to a reasonable exercise of their mutual rights in the common source.

MLGW has rights to pump water from the Memphis Sand Aquifer by virtue of the company's ownership of land overlying the aquifer. Under Tennessee law, it is unclear whether MLGW can legally use water from the aquifer to supply water to residents of the city who live on land not overlying the aquifer, if there are any such residents. Under common law, water pumped from an aquifer can only be used on land overlying the aquifer that is owned by the pumper. This is a situation where the common law has not yet caught up with the contemporary reality of large scale pumping for use off-site. However, because MLGW has been pumping water from this aquifer for a considerable period of time, thus far without legal action taken against it, it is unlikely that Tennessee courts would enjoin the company from continuing to pump water and selling it off-site. Whether the amount that is currently being pumped would be allowed by the courts, if there is a complaint by another landowner, is another matter.

If MLGW has been pumping water from the aquifer so as to diminish the flow and pressure to others wells for a period sufficient to allow the company to acquire rights to the water through *prescription* (probably 20 years), then the company may have acquired rights to this water. However, MLGW must have been pumping during that period with the knowledge that, in fact, it had no right to do so. Some scholars are of the opinion, based on California cases, that for prescriptive rights to groundwater to be obtained, the loss of pressure and flow must have existed for the entire prescriptive period.[32]

5.5.1 Tennessee-Mississippi Liability Problems

Whether or not MLGW has acquired prescriptive rights to more than its share of the water from the Memphis Sand Aquifer, MLGW - *or any other user of the aquifer* - could potentially be held liable for damages to the ability of other landowners to pump water from the aquifer. Such parties could also be held liable for creating a public nuisance by creating conditions leading to the contamination of the aquifer.

If MLGW pumping has damaged the ability of landowners in Mississippi to pump water for their own land, MLGW may be subject to a suit for damages or an injunction brought by the Mississippi landowners in either Tennessee or Mississippi state court. While the pumping is being done in Tennessee, the damage is occurring in Mississippi. Likewise, the same scenario would hold true in reverse if *Mississippi users impaired* Tennessee users' rights - that is, their courts would have to uphold Tennessee users' rights, as determined by a court of law.

Under Tennessee law, incomplete as the record is, if the volume that MLGW is pumping is unreasonably high, much more than their share of the water from the aquifer, their actions are illegal if another overlying user complains. The courts in Tennessee may only grant damages and not an injunction, however, because the pumping is for municipal purposes

Landowners in Mississippi could bring suit in Mississippi state court if a Tennessee user has damaged the landowners' ability to pump water on their land in Mississippi. The landowners would have to acquire jurisdiction. If such a suit were brought and a judgment favorable to the plaintiffs were rendered in Mississippi, the courts in Tennessee would be required to enforce the judgment under the constitutional requirement of "full faith and credit." If such a suit were brought upon MLGW, the risk is that courts in Mississippi may not have the same concern for maintaining the City of Memphis' access to groundwater, and may direct that MLGW find another source (e.g., the Mississippi River, whose waters are much less pure - see Chapter 6). In any case, should it be determined that MLGW's pumping is excessive, it would probably be illegal under Mississippi law. Mississippi law, which is a regulated riparian system, allows groundwater pumping only by permit for specified amounts.

Because the Memphis Sand aquifer underlies land in several states, it is entirely possible that this dispute could also lead to a suit for apportionment of the waters of the aquifer. MLGW may be vulnerable to suit by the State of Mississippi, acting in the interests of its citizens, to prevent continued pumping of the aquifer in excess of a reasonable amount. The State of Tennessee could be joined in the suit, in its role as trustee for the waters of the state. Such a suit would likely originate in the U.S. Supreme Court as an equitable apportionment suit. The Supreme Court has never apportioned the water in an underground aquifer. The Court has apportioned anadromous fish migrating in interstate waters, however. Thus, its powers to apportion resources are not limited to surface watercourses. Because the State of Mississippi and the overlying landowners in that state clearly have rights to the water in the Mississippi portion of the aquifer, and because actions by an entity in another state are affecting those rights, it is highly likely that the Court would hear the case. Again, the outcome might be unfavorable to MLGW and Memphis water users because there is another source, the Mississippi River, and MLGW's current use of the aquifer is not legal or equitable under the laws of either state, nor, probably, under the federal common law used by the Court in making an apportionment.

5.5.2 Legal and Political Options for Resolving Potential Aquifer Disputes

Rather than allowing the current situation to continue and possible lawsuits to be filed, a far better approach would be for the States of Tennessee and Mississippi to work with MLGW and other aquifer users to lower reliance on the Memphis Sand Aquifer, increase recharge and protect existing recharge areas and the aquifer as a whole, and to continue their efforts in working together to better understand the flow dynamics of the aquifer. The State of Tennessee and the State of Mississippi could work together toward an agreement or even an interstate compact to apportion the aquifer and seek ways to protect it from pollution and overdraft. Because most interstate compacts must be ratified by Congress and signed by the President, they appear may to be daunting endeavors. However, there is no reason that the states cannot work together to find solutions to any over-pumping problems that may exist. It is reasonable to assume that Mississippi would have an interest in such a joint solution because a lawsuit that charges no present damages but, rather, claims that future development opportunities are being lost will not succeed. Lost opportunities cannot be recovered under riparian law. Even Mississippi, which requires permits for water withdrawals and so is no longer strictly a common law state, would not likely allow recovery for lost opportunity.

5.5.3 Summation - Avoiding Memphis Sand Aquifer Disputes

Under common law, MLGW could be held liable if it is shown that it is pumping in quantities that impair the rights of others whose land overlies the aquifer. Some Mississippi landowners have complained that pumping for Memphis' use is damaging their ability to use the aquifer. If it is shown that the utility has made no effort to fix the problem, it could be held liable. A lawsuit against MLGW or other Tennessee water users for damages to the rights of Mississippi water users could be brought in court in Mississippi. Although the damage was caused by a Tennessee entity, it occurred in Mississippi. Any judgments rendered by the courts in Mississippi would probably have to be accepted by Tennessee *and vice versa*. Under the Full Faith and Credit clause of the U. S. Constitution, Tennessee must enforce a judgment for damages rendered by the courts of another state. Thus, it might be appropriate for Tennessee to act to restrain the pumping by MLGW and to encourage the city to conserve water. If the state does not act, the issue may be taken to court, either by individuals claiming damage to their rights in Mississippi or by a suit in the Supreme Court against Tennessee brought by Mississippi acting for its citizens. As noted earlier, the same scenario would hold true in reverse. If Mississippi users impaired Tennessee users' rights, their courts would have to uphold Tennessee users' rights.

Endnotes to Chapter 5

(1) See, for example, Gregg, 1996; Jaffe, 1996; H. J. Res. 91, 1997; Graham, 1999; Seabrook, 1999; Arrandale, 1
(2) See: Michael Pare,1998. "Atlanta Says Doesn't Need City's Water," *Chattanooga Free Press,* December 9
(3) Robert T. Dunphy, 1997. *Moving Beyond Gridlock.* Washington, D.C.; Urban Land Institute, p. 67.
(4) Tom Arrandale, 1999. "The Eastern Water Wars," *Governing* (August): 30-34; and Michael Pare, 1998. "Wate
Regional Commission - unpublished report.
(5) Flessner, 1999; Gilbert, 1999a; McAllister, 1999; Walton and Pare, 1999).
(6) Michael Pare, 1998. "Water Company Eyes Role," *Chattanooga Free Press*, July 21: B-1; and "TAWC Boosts Partnership Idea to Chamber," *Chattanooga Times and Free Press*, May 12, 1999; "City Officials Dismiss Water Poll," *Chattanooga Times and Free Press*, May 29, 1999; Judy Walton, "Court Case Crucial to Water Company Takeover," *Chattanooga Times and Free Press*, August 13, 1999; and Judy Walton, "Water Company, City Spar in Court," *Chattanooga Times and Free Press*, August 14, 1999.
(7) Kathy Gilbert (1999). "City Drops Water War," *Chattanooga Times and Free Press*, October 26: A-1; also, for a de
Unpublished manuscript, Misty Smith Kelley, Attorney-at-Law.
(8) "Summary of the Resolution of the City of Chattanooga's Efforts to Acquire Tennessee-American Water Comp

(9) For details, see Kathy Gilbert (1999). “City Drops Water War,” *Chattanooga Times and Free Press*, October 26:
(10) Source: www.tawc.com, J. Frances Alexander, Director of Communications, (423)755-7606
(11) See the TVA Act (1933).
(12) This is not to suggest that Tennessee still subscribes to the "natural flow" theory of water law. Expanding definitions of "reasonable use" and increasing reliance on municipal water systems have made t
(13) Tenn. Code Ann. § 69-8-105.
(14) *Id.*
(15) Tenn. Code Ann. § 69-3-108(b)
(16) See *Public Water Policy in Tennessee*, State of Tennessee Water Policy Commission, Public Administration Service, Chicago, Illinois, 1956.
(17) *See* Note 10 *supra.*
(18) Grant, Douglas L., *Equitable Apportionment Suits Between States,* in Beck, *Waters and Water Rights* § 45.01-577.
(19) *Lucas v. South Carolina Coastal Council*, 112 S.Ct. 2886 (1992), held that land-use regulation that denies an ov thereby deprives them of economically viable use of their riparian land.
(20) Nicki Robertshaw, 1999. “Memphis’ Fine Groundwater a Growing Factor in Construction,” *Memphis Business Jo*
(21) Tom Charlier, 1999. “Memphis Taps into DeSoto County Well Levels,” *The Commercial Appeal - Memphis, Te*
(22) See: W. Parks and J.K. Carmichael (1990) *Geology and Ground-Water Resources of the Memphis Sand in Wes the Memphis Aquifer in Western Tennessee.* Water-Resources Investigations Report 88-4180. Memphis, Tennessee: U.S. Geological Survey. Also, see: J.V. Brahana, et. al. (1987) *Quality of Water from Freshwater Aquifers and Principal Well Fields in the Memphis Area, Tennessee*. Prepared in Cooperation with the City of Memphis, Memphis Light, Gas and Water Division. Water-Resources Inve known as the ''500-foot'' sand because the aquifer is, in general, about 500 ft. below the surface in the Memphis area. The thickness of the aquifer is from 500-890 ft. in the Memphis area. The aquifer is recharged to the east of Shelby County (see: Ground Water Institute (1995) *A Ground Water Flow Analysis of the Memphis Sand Aquifer in the Memphis, Tennessee Area*. Technical Brief #7, Memphis, Tennessee: University of Memphis, February).
(23) See, “Tennessee Water Use-Data Tabling,” 1998. (no author). USGS Website (http:// www.usgs. gov/edu-cgi-Prepared in Cooperation with the City of Memphis, Memphis Light, Gas and Water Division. Water-Resources Investigations Report 93-4075. Memphis, Tennessee: U.S. Geological Survey. Kingsbury and Parks, 1993).
(24) Parks and Carmichael, 1990; also, Robertshaw, 1999.
(25) Charlier, 1999: A9; Ground Water Institute, 1995; Parks and Carmichael, 1990, *Altitude of Potentiometr* Report 89-4048. Memphis, Tennessee: U.S. Geological Survey.
(26) Parks and Carmichael, 1990a; Brahana, Parks, & Gaydos, 1987; Robertshaw, 1999.
(27) For a summary of this stakeholder interview study, see John Wingard (2000), *The Community Dynamics of Source Water Protection: the Structure and Dynamics of the Human Dimensions of Source Wate the Minds. Source Water Protection Workshops, Coordinated by the Ground Water Institute of the University of Memphis (*Memphis, TN: University of Memphis); also, Charlier, 1999).
(28) Brahana, Parks, and Gaydos, 1987.
(29) <www.mlgw.com.>
(30) Tarlock, A. Dan, *Law of Water Rights and Resources,* § 4.06(3)
(31) See *Nashville, Chattanooga & St. Louis v. Rickert,* 19 Tenn. App. 446, 89 S.W.2d 889 (1935), *cert denied* (193
(32) Tarlock, *supra* note 11.

CHAPTER 6. LONG-TERM CHALLENGES TO TENNESSEE'S WATER SUPPLY

6.1 Baseline Issues Affecting Tennessee Water - Overview

Considerable research has been done by federal and state agencies on the condition of Tennessee's water resources. Studies have identified and assessed many of the threats facing these resources today, as well as likely pressures they will face in the future. Excellent sources of information include U.S. Geological Survey reports on surface and groundwater supply and *estimated* use, and various water quality assessments undertaken under their auspices. Additional studies by U.S. EPA, TVA, and others shed light on such issues as climate change, growth in consumptive uses, and population shifts likely to affect these water resources (Hampson, 1995; Solley, et. al., 1998; Hutson, 1998; U. S. EPA, 1999). We provide a primer of major water supply, demand, and water use issues *synthesized* from this research. The purpose of this synthesis is to provide a basis for understanding how the two water conflicts that constitute the focus of this study may be affected by these baseline conditions. Unfortunately, there is little systematic information about water withdrawals and *known* uses. Appendix A contains additional, detailed information on the Water Resources of Tennessee's three "grand divisions," as well as a discussion of statewide precipitation variation.

6.2 The 'Ambivalent Abundance' of Tennessee's Water

Tennessee's surface and groundwater resources are abundant (see Figure 6.1). This abundance is exemplified by, and documented in, many ways, including average annual precipitation[1] (parts of East Tennessee experience the heaviest precipitation in the continental U.S. outside of the Pacific Northwest), surface water storage capacity (man-made impoundments along the Tennessee and Cumberland Rivers alone store over 2.65 trillion gallons of water),[2] and groundwater storage capacity (an estimated 200 trillion gallons of water underlie the state in rock fractures and cavities formed by the dissolution of carbonate rock (Hutson, 1998; Hampson, 1995; Parks and Carmichael, 1990b, c, d; Broshears, 1986).[3]

While water abundance is a welcome fact of life, it is also a relative and somewhat elusive concept . As one U.S. Geological Survey/Tennessee Department of Environment and Conservation report puts it: "How (water) resources are developed and used in the face of changing water demands determines the actual availability and quality of water in the State (Hutson, 1998)." Some experts believe the state's abundant water resources are subject to considerable demand pressures, including power generation (a major water user), growing per capita demand, and, in the long-term, climate change (Hutson, 1998; EPA, 1999).

6.2.1 Instream and Offstream Uses

Hydrologists and other water experts distinguish between *instream* and *offstream* water uses. *Instream* uses are those that do not divert water from the stream channel, thus ensuring that all of it is continually available for further downstream use. Major instream uses in Tennessee include hydroelectric power generation, navigation, recreation, aquatic habitat, and assimilation of wastewater discharge. In 1995, hydroelectric plants used 122 billion gallons of water/day (Hutson, 1998).

Offstream uses remove water from streams or aquifers. While much of this withdrawn water is eventually returned to streams or aquifers, some is permanently diverted into other drainages, incorporated in manufactured goods, or lost to evaporation/transpiration (also called

"consumptive" use). Major categories of consumptive use include thermoelectric power generation, industry and mining, domestic and commercial use, and agriculture. In Tennessee in 1995, total offstream use averaged more than 10 billion gallons/ day, with 82% of this total accounted for by electric power generation alone - a figure that "dwarfs all other offstream categories "(Hutson, 1998). Table 6.1 depicts Tennessee's water uses.

By "grand division," the distribution of water use in the state offers an intriguing picture. East Tennessee used about 2.6 times as much water in 1995 as Middle Tennessee and 24 times as much as West Tennessee. If power generation is excluded, the comparison is 2.3 and 3 times as much, respectively. This variation, in part, reflects physiographic as well as economic differences between regions. In addition, while surface water use predominates in each "grand division," (nearly 96% of total offstream water used in 1995 was surface water as opposed to 4% groundwater) groundwater is a significant source of supply in West Tennessee (see Figure 6.2).

Groundwater constitutes 89% of the water used for non-power purposes in that region. Moreover, approximately half of Tennessee's population, residing in the western one-quarter of the state, relies on groundwater sources for drinking water. Reasons for this high reliance include the presence of large quantities of good quality groundwater, the relative absence of suitable dam sites along streams in the region, and high sediment loads and poor water quality in streams draining to the Mississippi (Broshears, 1986; Hutson, 1998).

Table 6.1 Tennessee Water Use in 1995, by Region (millions of gallons/day -- Mgal/d)

Instream	***West***	***Middle***	***East***
Hydroelectric power	3,083	30,890	88,367
Offstream			
Thermoelectric power	430	4,119	3,747
Industry & mining	100	154	744
Domestic/commercial	194	237	213
Agriculture	21	20	20
Conveyance losses	23	27	28
Total offstream	768	4,557	4,752
Total, all uses	3,851	35,447	93,119

Source: Susan S. Hutson, *Water Use in Tennessee, 1995.* U. S. Geological Survey and TDEC, 1998.

6.2.2 User Trends and Their Significance for Future Conflicts

One major issue not revealed by Table 6.1 is trends in water use in Tennessee. Studies of water use over five year intervals between 1975-1995 (by major categories depicted in Table 6.1) reveal "no consistent pattern of increase or decrease" (Hutson, 1995). However, trends *within* various categories of water use, and the vulnerability of these trends to variations in precipitation, give rise to concern. In general, water use for thermoelectric generation increased between 1975-1995, while agricultural water use increased from roughly 50 Mgal/d to over 85 Mgal/d

between 1975-1990 and then declined (Hutson, 1998).

A decrease in water use for electric power generation in 1985 has been attributed, at least in part, to an extended drought (see Hutson, 1998). Meanwhile, projected population increases, new tourism, numerous proposals for new industry, and other sources of water demand are also important trends affecting water use.

Of the 10 fastest growing states in the United States, in terms of population, 8 are in the southeast. Florida is experiencing the second greatest population growth in the nation while Georgia is third and Tennessee is ninth (Solley, 1998). Both Florida and Georgia have already had severe problems with water supply as a result of the growth the states have experienced. While Tennessee has considerable water resources, both Florida and Georgia also have high precipitation and considerable surface water. Nevertheless, the water resources in these states have not been adequate to meet the demands being made on them.

The implications of projected population growth and increased industrial and tourist related development for water management in Tennessee is considerable. When growth puts strains on existing supplies, older uses, such as agriculture, may have to give way to allow water supplies to be diverted for new development. This means lost value from riparian agricultural land. Clearly, even without the added presence of external conflicts or outside water demands, such issues pose numerous challenges for Tennessee.

If development outstrips supply, new sources of water must be found or development must be limited. Tennessee already has numerous reservoirs to hold back water in wet months for use in dry months, but there is resistance on the part of recreation and environmental groups to new impoundments on the free flowing streams that the state still has. New impoundments also have impacts on existing uses of downstream flow. One apparent need is for accurate information on current and projected water withdrawals to help in long-range planning.

Another issue related to overall baseline trends, and relevant to our case studies, is reliance on groundwater by the state's population. While groundwater use is, for reasons discussed in sect. 6.2.1, highest in West Tennessee, groundwater is an important source statewide. For example, in the upper portion of the Tennessee River basin in 1990, groundwater comprised only 3.2 percent of total water use. However, about 42 percent of the population of the basin relied upon groundwater sources for drinking water (Hampson, 1995; Solley, Pierce, & Perlman, 1998: 31).

6.3 Drought and Low Flow as Actual and Perceived Problems

Particular regional vulnerabilities directly play a part in the potential water conflicts which comprise the focus of this study. While Tennessee is clearly blessed with a high average annual precipitation rate, periodic drought, as well as periods of greater than normal precipitation, pose a major challenge to water supply and quality in the state. As shown in *Appendix A*, much of the precipitation falling on Tennessee comes during the winter months. Summer and early fall are dry seasons for most of Tennessee. Yet, during this period, many uses, and especially irrigation, are at a maximum. While agricultural irrigation constitutes a small percentage of overall use, together with climatic factors such as wind, humidity, and temperature (bringing the rate of evaporation to a peak during the summer) may produce local impacts to some farmers.

The period 1985-1988 was one of severe drought in Tennessee, particularly in the eastern part of the state. During 1987-88 alone, precipitation statewide was about 75 percent of normal and

even less during the summers. Moreover, streamflow was about *half* of normal and during the summer, was dominated by groundwater discharge (Hoos, 1992: 500). By contrast, precipitation in 1989 was about 130 percent of normal. The definition of drought in this context is a period of at least 21 days with less than 0.25 inches of precipitation. Tennessee has often had more than one drought per year. During the period 1871-1953, there were a total of 112 droughts (1.3 per year). Recurring dry spells are normal even during "wet" years (State of Tennessee Water Policy Commission, 1956: 34).

To underscore the importance of drought on streamflow, it is important to bear in mind that five major tributaries -- the Clinch (4,413 square miles), Holston (3,776 square miles), French Broad (5,124 square miles), Little Tennessee (2,627 square miles), and Hiwassee (2,700 square miles) -- account for about 86 percent of the annual mean discharge of 35,450 ft^3 per second of the Tennessee River at Chattanooga. Not only does this make total streamflow subject to variations in a few tributaries but, each of these basins exhibits distinctive climatic and runoff characteristics which make it hard to generalize about the impacts of “drought” or “above normal” precipitation on the Tennessee River (e.g., Hampson, 1995).

While below normal precipitation patterns can have dramatic and obvious adverse effects upon water supply including decreased hydropower generation, disruptions to navigation, degraded recreational opportunities, and decreased water availability for municipal supplies, precipitation *extremes* and variations between above- and below-normal flows can also affect water *quality* in streams and reservoirs (see Hoos, 1992: 500). In 1991, for example, about 1 percent of the state’s stream miles were posted as being unusable or unsafe (by 1998, this figure had fallen to 0.2 percent). This problem is attributed to excessive concentrations of fecal coliform in reaches downstream of municipal sewage treatment plants. Moreover, other water quality problems in 1991, including nonpoint pollution from agriculture, were partly exacerbated by low-dissolved oxygen concentrations as a result of this drought (Hoos, 1992). As of this writing, Tennessee is experiencing another sustained drought, underscoring the importance of this issue to the long-term security of water supply.

We must measure the impact of new water withdrawals at the lowest point of water availability. In drought, existing uses are already straining the resources. Nevertheless, every one of the municipal water suppliers that we contacted while doing the survey, reported that they had plans to increase capacity and withdrawals. A perusal of the business sections of any of the newspapers in the state will find announcements of new development plans. Almost all development, whether for tourism (motels, water parks, etc.), industry or residences, requires additional water withdrawals. Even if water used for these new developments is cleansed and returned to the water source for use by others, some consumption will take place. While matching opportunities for growth with available water resources would be an optimal solution, this is easier said than done.

6.4 Climate Change and Tennessee’s Water

One possible trend which is beginning to attract the attention of water experts is the potential impact of global climate change on the state’s - and region’s - water supply. In general terms, climate change constitutes a major departure in natural conditions which may affect water supply and quality. Over the last century, the average temperature in Nashville, Tennessee, has increased nearly 1°F, and precipitation has increased by up to 10% in many parts of the state. Experts concur that these past trends may or may not continue into the future. Over the next century, Tennessee’s climate may change even more.[4]

Impacts of these temperature changes on water supply are, of course, highly uncertain. EPA estimates that precipitation will increase slightly in winter (with a range of 0-10%), by 20% in spring and fall (with a range of 10-30%), and by 30% (with a range of 10-50%) in summer. Other possible changes in precipitation include a possible increase in the frequency and intensity of summer thunderstorms but overall decreased runoff due to a warmer climate. Impacts could include declines in hydropower generation, disruptions to navigation, degraded recreational opportunities, and decreased municipal water supply along the reservoir systems of the Tennessee and Cumberland rivers. Lower flows and higher water temperatures also could degrade water quality by lowering dissolved oxygen levels and concentrating pollutant levels, especially in the state's urban areas. Finally, higher water temperatures could impair cold water fisheries below many dams, reduce the efficiency of industrial and power plant cooling systems, and make more difficult efforts to meet regulatory standards for acceptable downstream water temperatures (U.S. EPA, 1999).

Conversely, if rainfall and runoff increase in the Tennessee region, then higher streamflows and lake levels could benefit hydropower production, enhance recreational opportunities, and improve water availability for water supplies. Although higher flows would dilute pollutants, erosion and levels of pesticides and fertilizers in runoff from agricultural areas could increase, as could pollution from runoff from mining areas. Many river basins in western Tennessee are susceptible to sedimentation and nutrient enrichment from farming activities. Increased rainfall also could increase flooding, currently a problem in the steep terrain in eastern Tennessee, along the many unregulated streams throughout the state, and in growing urban areas. Increased rainfall also could disrupt navigation during periods of high flow. In short, the potential for climate change - like so many other factors beyond policy makers immediate control - *aggravates* existing water problems due both to periods of both low and high precipitation by *compounding* uncertainty in an already uncertain picture.

Endnotes to Chapter 6

(1) Annual precipitation ranges from about 40 inches in some low-lying, sheltered areas to more than 90 inches at ele
for the Holston River to almost 60 inches for the Little Tennessee River. About 30 of this 50 inches
evaporates or is otherwise lost for use within the state. Annual runoff, then, is on average something like
20.2 inches per year. This is the average amount of water that is available for use or capture.
(2) The Tennessee and Cumberland rivers are major arteries in the eastern and central regions of the state and co
sources for municipal water supply.
(3) Most public and industrial water supplies in West Tennessee depend on groundwater sources. These sources, whi
(4) For example, based on projections made by the Intergovernmental Panel on Climate Change and results from
in summer, slightly more in fall) (see U.S. EPA, 1999).

CHAPTER 7. INSTITUTIONAL MECHANISMS AND APPROACHES TO RESOLVE THESE CONFLICT

7.1 Toward a Set of Policy Solutions

While there are several short-term remedies policy makers might adopt to manage, mitigate, or negotiate solutions to the conflicts embodied in our case studies, longer-term efforts must be undertaken to address the underlying problems that gave rise to them. This chapter discusses such long-term efforts in two ways. First, we examine the perceptions of state water problems and the perceived viability of various remedies to them as viewed by a sample of stakeholders interviewed for this study. Second, we assess the pros and cons of various mechanisms and approaches for managing water allocation utilized in other regions of the U.S. and around the world. These include water marketing, changes to law and regulation, and interstate compacts. We conclude by offering general recommendations for consideration by state policy makers.

7.2 Stakeholder Analysis Survey - Selection of Interviewees

We define a *stakeholder* as someone who has a stake or interest in the consequences of a decision and who can influence that decision. Such an individual may speak for himself or might represent an organization with a salient interest. In this study, a stakeholder is defined as an individual or group with an interest in the use of water in Tennessee, especially from the Tennessee River downstream of Chattanooga or from the Memphis Sand Aquifer. Stakeholders also include voters, citizens, and residents who can influence the decisions made by governmental organizations.

Because this definition is broad, we sought to limit stakeholders in this study to relevant geographical and categorical groups. We emphasized representatives of large-scale interests, rather than mere individuals, and we sought to contact representatives of such groups who reside along the Tennessee River downstream of Chattanooga, or on the Memphis Sand Aquifer. Because these stakeholders obtain the majority of their water supplies from these two sources, they are more likely to be heavily affected by decisions made regarding them. While all Tennessee residents could theoretically be affected by any large water withdrawals, the effects on these Tennesseans would probably be greater and more immediate.

Thirty-six (36) survey respondents were contacted from eight major groups: agriculture; municipalities; state agencies (including those of Tennessee's neighbors); utility districts; industry/ business; federal agencies; conservation/environmental groups; and, recreationists. Individual respondents were chosen principally by reputation. For example, county agricultural extension agents were chosen for their expert knowledge of farming in a narrow geographical area. Likewise, certain government agency contacts were chosen according to perceived interest in, and knowledge of water supply issues in Tennessee and other states.

7.3 Survey Questions

After building a contact list of possible stakeholders, a survey was developed and administered. Survey results were grouped according to respondent category, and then according to specific answers, to permit comparison with actual political/legal options which have ben introduced. The survey (see Appendix B) was used to obtain specific, detailed information regarding stakeholders' histories of water use, predictions about likely future use, and reactions to hypothetical policy responses by the state. By focusing on drought history and changes in water use, potential problems and perceived benefits of future action could be acquired.

The first set of questions dealt with the late 1980s' drought. This event was chosen for its relatively recent occurrence and severity to Tennessee's baseline water conditions. We believed that most stakeholders would recall this event and would be able to remember specific characteristics about it. Those who could recall the drought were then given specific follow-up questions, including: indicators of its presence (i.e., "how did they know we were experiencing a drought?"), implications for their organization, and how it changed their management of water. Next, all respondents were asked their perceptions about the current drought; i.e., "are we now experiencing a drought?" Those who believed a precipitation shortage was being experienced were then asked about possible changes in water management they would endorse as a result.

Subsequent questions assessed stakeholders' water sources and uses. Issues of future water use, worries about supply, and competition for available supply were included. These questions were used to sort respondents according to water source, as well as examine their perceptions of Tennessee's current and future water supply. The final section of the survey assessed stakeholders' opinions and reactions about six *hypothetical* ideas for dealing with competition over water supplies. Based on a limited knowledge of plans used in other states, stakeholders simply gave their reactions to specific, hypothetical actions that Tennessee *could* take.

7.4 Data Analysis

Completed survey responses were placed into a database for ease of analysis. In order to quickly and easily assess stakeholders' reactions to proposed plans, their answers were placed into one of five categories: unqualified support, qualified support, no opinion, qualified against, and unqualified against. Based on their comments on each idea, a generalized answer was assigned. For example, if a respondent seemed to generally support a position but expressed some hesitancy regarding its administration or viability, we interpreted this as "qualified" support.

Once responses were classified and entered into the database, two major groupings were established. The first was categorical; i.e., to compare responses within a specific sector such as agriculture. The second was by source of water use, ground vs. non-ground (surface, combination of ground and surface, and so on). The latter was a basic geographical distinction placed on the responses, since most, if not all, groundwater users surveyed obtain their water from the Memphis Sand aquifer. These two groupings allowed comparing attitudes between ground- and surface-water users.

7.5 Sector Analysis - Agriculture

Agriculture has historically been an important economic sector and political constituency in Tennessee. Livestock and cash crops, such as soybeans and cotton, are important to the state's economy. Water is, of course, vital to the agriculture. Crops and livestock cannot survive without it. Therefore, it is important to understand how farmers respond in times of shortage. After surveying several agricultural extension agents and representatives of various agricultural interest groups, we observed four trends regarding water supply problems.

First, those who depend on groundwater (10 surveyed) as their primary source seemed less likely to have changed water management during drought in the past. They also tended to expect little or no change in water management in the future. Second, however, those who depended primarily on surface water (11 surveyed), or upon a combination of ground- and surface-water, tended to have changed management of water in the past or expect a change in

the future. These inclinations were observed in responses to questions about past practices during drought and perceived worries about water supply. Third, agricultural interests using groundwater seemed to voice little or no worry about their water supply, either currently or for the foreseeable future. However, one stakeholder did voice a concern about heating and cooling systems taking water and possibly running the wells dry. Another believed that water pollution would be a major supply concern. Fourth, several surface water users (or combination ground and surface water users) voiced various concerns. For one, it was sediment deposits changing stream flow. Four stakeholders mentioned the possibility of running out of water, especially during severe drought conditions. One even stated that "everyone" has a long-term concern about water supply.

Reactions toward possible solutions (question 12) did not seem to as closely follow differences in water source. In general, if an association did exist, it tended to be the result of groundwater users' belief in a seemingly endless supply of water for their use. As a general rule, agricultural interests were predictably wary of intrusion by outside sources, especially state or federal bureaucracy. However, many of those surveyed were against these solutions only because they did not see a need for them. This was most evident on "proposal" for statewide data on water withdrawals (12a); a statewide planning process for communities (12b); and a permitting process for withdrawals (note: most would resort to the latter only in extreme situations) (12c).

A drought management plan (12d) was the most universally accepted plan among agricultural interests surveyed. Many even said that it should already be in place, and under local control. A mediation process (12f) also seems to be widely acceptable. The selling of water rights (12e), however, was the single instance where a fairly prominent distinction could be seen between ground and surface water users. Groundwater users tended to be strongly opposed to markets, while *some* surface water users could accept it. One reason for this could be that surface water users felt that they would have more control over a resource they could see and, perhaps measure, something impossible to do with groundwater.

Overall, the most acceptable solutions for agricultural interests surveyed appear to be a drought management system or a mediation process. However, others (including withdrawal permitting) would not be ruled out if a case could be made for their need. For agriculture, the most important part of the process seems to be demonstrating that there is a problem. Most respondents would be averse to any government intrusion without clear justification.

7.6 Sector Analysis - Water Utilities

Water utility districts are knowledgeable sources of information on water use in a given area. Because of this, we interviewed ten municipal utility district officials who met the geographical requirements for inclusion in this study. Like agriculture, their responses tended to cluster into general trends. Utility representatives who recalled the late-1980s' drought tended to cite increased water use as a major problem. Of the eight who recalled the drought, and who depended on groundwater, two changed their water usage during the drought. In addition, the single utility official who believed we are currently experiencing a drought stated that a change in water management would result. For surface water, one of the four utility officials who remembered the drought changed water use. Of the two who believed we are currently experiencing a drought, both expected to change water usage, through increased pumping or limiting usage.

Three of the ten groundwater utility officials surveyed expressed concern over water supply. Two

stated that contamination was a concern, while the other saw low water pressure and the possibility of depletion water supplies as major worries. Among surface water utilities, one out of five officials surveyed said that growth within the next fifty years would exceed their production capabilities. Overall, most utilities were not concerned about their water supply. No general trends regarding ground versus surface water users emerged.

Reaction to possible water supply remedies was mixed. Both ground and surface water supply officials tended to support a statewide data set (12a). Those who opposed it stated that it was not needed (especially in groundwater utilities) or that it would create more work for individual utilities. A statewide planning process (12b) met with support from both groups. In contrast, most surface water contacts did not support a permitting process (12c), although groundwater contacts were more supportive with most giving either unqualified or qualified support to such a program. The same was true for a drought management system (12d), with only one out of five surface water contacts giving unqualified support. Groundwater users expressed support for such a measure, though responses were mixed. Almost all who supported such a measure agreed that local control would be better. Selling water rights (12e) generated mixed responses. A large number of groundwater contacts supported this solution, but only one surface water contact gave it any support. The last hypothetical strategy for managing water, a mediation process (12f), had less support from utilities than agriculture. Most groundwater utilities liked the measure, but surface water utilities did not.

Overall, most utilities seem more open to change than agriculture. They did not, for the most part, display the same attitudes toward government regulation as did agricultural officials. However, groundwater utilities, in contrast to groundwater agriculture contacts, were more supportive of all the measures described. Surface water utilities were less likely to support these measures, unlike their agriculture counterparts. In all, there was no single issue that utilities would categorically not support, although they displayed no dominant general trend.

7.6.1 Sector Analysis - Recreation, Conservation, Industry

For the remaining six categories, a much smaller number of contacts was surveyed. The numbers are not large enough in any of these categories to discern trends. Thus, we simply provide a brief overview of findings. Two conservation organizations responded via e-mail. Both respondents expressed concerns about water supply, citing the refusal of some to ration during drought and the impact of new water supply projects as their main concerns. They were also concerned with the construction of new dams and the impact they could have on aquatic ecosystems. These officials offered their support for a statewide data set (12a), a statewide planning process (12b), a process for water withdrawals permits (12c), and a drought management system (12d) with local control. However, they both opposed selling water rights or developing a mediation process.

Three industrial contacts were surveyed from both Chattanooga and the West Tennessee area. One recalled the drought of the 1980s and claimed his firm had to change the kind of dye it used in its manufacturing process. Two of the three expect an increase in water use over the next ten years. None of the three expressed concern about their water supply, however. When the ideas about managing water were described, all three offered support to the statewide set of data (12a), statewide planning process (12b), and drought management system (12d). The permitting system (12c), selling water rights (12e), and mediation were viable options for two of the three contacts. Overall, industry's main concerns were self-preservation and economic. They were receptive to some regulation if it would enhance benefits or maintain their current position.

Only one recreation contact, an official of a recreation organization, was interviewed. This contact provided information about how recreational businesses, specifically those dealing with rivers and streams, are affected by water shortages. While this contact did not express major concern about the supply of water, he was concerned about TVA water management strategies. The statewide set of data (12a) and mediation process (12f) ideas were most favorable. All other hypothetical plans were opposed, on ground they were unnecessary.

State and federal agencies and municipalities were not contacted directly. However, they did provide other contacts for the survey as well as general suggestions regarding survey format and content. Chambers of Commerce were contacted as sources for industry information.

7.7 Summary of Survey Results

Overall, those contacted generally favor establishing a statewide set of water supply data, forming a statewide planning process, developing a drought management system, and mediating disputes. The least favorable options are a withdrawal permitting system and selling water rights. The greatest obstacle to any policy change is convincing stakeholders that they are needed in the first place. A lack of concern about water supply is prevalent in almost all groups. While they may be worried about water quality, they believe that water is plentiful and free. This attitude is especially noticeable in stakeholders that use groundwater as their primary water source. Surface water users who can actually see changes in streamflow are more likely to perceive that there are limits in the amount of water that can be used. It would probably be easier to convince these users to use conservation strategies or to support proposed plans than to convince groundwater users of the same. In short, the survey suggests that there would be considerable resistance to radical change in water management on the part of many current users. If their rights can be seen to be in jeopardy, then the state should consider acting to inform these citizens about impending or contemplated changes.

7.8 Water Allocation Mechanisms - A Brief Overview

This section discusses mechanisms and approaches for managing water allocation which are utilized in other regions of the U.S. and around the world. These include water marketing, changes to law and regulation, and interstate compacts.

7.8.1 Water Marketing

Water markets have arisen under extreme drought conditions, generally require a large physical infrastructure for “moving” water, and, if imposed by state statute, could be seen as a “takings” issue (Frederick, 1998). Three issues should be considered in weighing the adoption of some sort of water market for managing water supply.

First, under riparian law, there is no right to a specified amount of water, and no such thing as “excess” water. Thus, it is not really possible to contract delivery of a specific amount of water for a specified term. Statutory change would be required to make water marketing work in Tennessee. Moreover, if this market is mandatory, damages/compensation might have to be paid. If the market is voluntary, damages to downstream riparians might occur.

Second, efforts to follow a market approach by allowing the sale and transfer of water rights brokered through state or local banks have had mixed success, depending to some extent on the

legal “base” of the community. In the western U.S. where the prior appropriation doctrine allows more definite claims to specific quantities of water, there is growing movement away from absolute claims to “first in time, first in right.” Despite water scarcity, there is greater emphasis on preserving and protecting in-stream flows regardless of existing appropriative rights (Anderson and Leal, 1988).

Finally, water marketing can be politically unpopular, particularly among residents of the “importing” region. Consistent with the findings of previous studies, a recent study in the San Joaquin Valley of California and the Grand Valley of western Colorado found that residents of a water-exporting area are more likely to oppose water transfers than are residents of a water-importing area. Moreover, regardless of area, residents are likely to have strong reservations of free markets as a means of allocating water (Keenan, Krannich, Walker, 1999). Water exporting region concerns include potentially adverse impacts, and fairness in allocation. While no one particularly approved of water markets, agricultural interests had a stronger tendency to agree with water transfers generally and to have a greater acceptance of water marketing.

7.8.2 Alternatives for Legal Reform - What do Tennessee’s Neighbors Do?

The six states that surround Tennessee all follow the riparian doctrine of water law. All of these states have enacted statutory modifications to riparian law that go farther than the modifications that the Tennessee General Assembly has adopted (See Figures 7.1 through 7.6). Georgia has experienced considerable population growth that has led the state to adopt permitting for both surface and groundwater. Alabama, meanwhile, requires the registration of all public water supply withdrawals and other withdrawals over 100,000 gallons/day. Alabama's water resources are shared, in part, with Georgia. Conflicts with Georgia over shared water sources have led to the enactment of two interstate compacts that may result in increased state regulation of water use in Alabama.

Kentucky has had considerable problems with water use by the mining industry. The state has adopted permitting for both surface and groundwater withdrawals as a result. Statewide planning carried out by area development commissions is mandated by state law.

Pressures on water supplies created by large withdrawals by industrialized agriculture coupled with several extended droughts have led Mississippi to enact legislation requiring permits for all water withdrawals except for domestic use. In fact, Mississippi has what is probably the nation’s most comprehensive water supply statute. The original groundwater permit statute and the subsequent 1985 Omnibus Water Resources Act were adopted with considerable consultation and involvement with the agricultural interests in the state that would be most affected by the laws.

North Carolina has experienced fewer development pressures than Georgia. Nevertheless, the state legislature has passed legislation allowing capacity use areas to be designated. Permits are required for water withdrawals in designated capacity use areas. All other withdrawals over 100,000 gpd must be registered. North Carolina has adopted a study and permit requirement for all interbasin transfers of more than 2 MGD or increases in existing transfers of more than 25%. Much like the preparation of an environmental impact statement, the study must be completed before issuance of a permit to transfer water will be considered.

Finally, Virginia requires registration and annual reporting on all withdrawals from either surface or groundwater of 30,000 gpm or more. A Virginia Water Protection Permit is required in any

case where a federal permit is required under Section 401 of the Clean Water Act.

As Tennessee faces increasing demands on its water supplies, there is much that the state can learn from its neighbors. The political processes that brought about the registration and permitting requirements in the states surrounding Tennessee are of particular interest. We have noted that there is considerable resistance to increased regulation of water use expressed by agricultural interests in Tennessee in particular. We can assume that similar resistance arose in surrounding states. The manner in which this resistance was overcome and consensus reached will be of interest to Tennessee officials who are looking to avoid the problems with water supply that these other states have faced.

7.8.3 Interstate Compacts - Pros and Cons

Interstate compacts, which derive their legal authority from the U.S. Constitution, are legally-binding contracts negotiated by states in order to formally allocate interstate waters, regulate water quality, manage interstate bridges or ports, provide for flood control, and/or reduce water pollution. Compacts provide an ongoing mechanism for negotiation among parties to shared water sources (McCormick, 1994; Sherk 1994; Caldwell, 1947; Curlin, 1972; Kenney and Lord, 1994; Weston, 1984).

The Delaware and Susquehanna River Basin Commissions (DRBC and SRBC), among the nation's oldest federal interstate water compact commissions, have been granted a broad scope of authority in all matters relating to the water resources of their respective basins, ranging from flooding to fisheries to water quality. The DRBC was the first to include the federal government as a partner, a model later followed by the SRBC (Cairo, 1997; Derthick, 1970; Sheridan, 1998). Both commissions emerged from a number of water quality and supply concerns that developed in the late 1950s and early 1960s. Over time, following informal discussions among middle-level managers and water planners, they evolved into formalized commissions with well-funded staffs and presidentially-appointed directors.

Structurally and functionally, the DRBC and SRBC share many similarities. They are comprised of state representatives (governors and their appointed "alternates") and a federal representative (currently, the Secretary of the Interior and his alternate). The DRBC and SRBC are directed to "formulate and adopt a comprehensive plan . . . for the immediate and long-range development and uses of the water resources of (their respective) basin(s) (Cairo, 1997); Delaware River Basin Compact, P.L. 87-328, 75 Stat 688, and Susquehanna River Basin Compact, P.L. 91-575, 89 Stat 1509 et seq). These plans carry "legal clout," include all public as well as private facilities and projects, and bind the actions of both commission members and signatory states.

Both commissions have the authority to allocate interstate waters in accordance with the doctrine of "equitable apportionment," although they may not allocate water in any way that disturbs or impairs rights awarded to parties under Supreme Court decree without unanimous consent of the parties (DRBC Annual Report, 1997; Weston, 1999; Weston, 1995). In recent years, both have also adopted numerical groundwater withdrawal limits and pumping regulations in areas designated as subject to water demand outstripping supply. The DRBC may also prescribe special surface water withdrawal and diversion regulations, declare drought emergencies, and force adoption of conservation strategies. It has even used water budgeting for managing depletive use. While both compacts are similar in structure and function, however, the SRBC, coming into operation in 1972, not long after the Hurricane Agnes floods, has placed a greater stress on flood control and long-term planning (DRBC, 1997; Weston, 1995).

These compacts' experiences, as well as those of the much newer Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa (ACF-ACT) compacts - formed in 1997, and still negotiating water allocation formulae - offer five major lessons. First, to function effectively, interstate compacts must be comprehensive in their scope of authority and viewed as legitimate in order to render decisions on a broad range of water-allocation issues. In the words of one observer intimately familiar with both the DRBC and SRBC processes, the "parties in a basin need to recognize common problems."

Second, parties to an interstate compact must be willing to settle subsequent disputes surrounding the management of regional waters through negotiation and alternative means of dispute resolution rather than through litigation or U.S. Supreme Court petition. The means by which they agree to do this is important. Disputes addressed by both the DRBC and SRBC, especially in their first years of operation, tended to revolve around such issues as allocation of waters among the states, and the sale of water to urban areas "outside" the basin (e.g., Baltimore). These disputes were resolved through intensive, face-to-face negotiations on a regular basis (facilitated by getting respective signatories together several times a year), careful coordination among technical staffs who remained politically-neutral, sharing of study findings among partners, and a willingness to sacrifice institutional independence when necessary. In addition, both compacts have the power to implement, as well as to make, decisions (Cairo, 1997; Weston, 1984). These experiences taught both commissions that it simply takes time to develop an atmosphere of trust and confidence to bring parties together in a non-litigious setting.

Third, the importance of regionally-credible data and information in facilitating recognition of common problems cannot be underestimated. One of the elements which has most effectively facilitated the coming into being of the ACF-ACT compacts was a comprehensive study conducted by a team of federal and state agency representatives, and led by the Army Corps of Engineers. Using 2050 as a planning horizon, the study focused on water demand, availability, and comprehensive management. A key outcome of the study was the decision to employ an interstate compact as a tool for managing water resources. This resulted from a careful review of previously used tools for managing natural resources in the region, input from the public, and outcomes of facilitated sessions among state and Corps of Engineer representatives.

In short, in the absence of formal, legal mechanisms for cooperation, the study served as a forum for ongoing dialogue in both basins. It has also served as a catalyst for a public scoping process in both basins, begun under the auspices of the National Environmental Policy Act (NEPA). The scoping process was initiated to assess the environmental impacts of potential water allocation formulas, while the NEPA assessment itself was derived, in part, from models developed for, and data collected in, the Comprehensive Study. In addition, there is some evidence that the negotiating parties have learned to work together amicably and constructively. This evidence of constructive negotiation, moreover, provides lessons pertinent to the quest for a bona fide regional approach to water management in the Southeast (Jaffe, 1996; Kundell and Tetens, 1998; Graham, 1999).

Fourth, baseline comprehensive assessments can also be sources of divisiveness as decision makers move to the *next* level of decision-making: allocating water. For example, some sub-state regions within the three contending states involved in the ACF-ACT disputes have already begun to express concern over the methodological assumptions and demand projections surrounding the ACF-ACT comprehensive study undertaken by the Corps, contending that too little regard is being given to realistic population and economic growth projections in these

subregions (Cason, 1997; Wade and McMahon, 1999).

Finally, negotiating parties must be willing to settle subsequent disputes surrounding the management of regional waters through negotiation and alternative means of dispute resolution rather than through litigation or U.S. Supreme Court petition. And finally, reliance on intensive, face-to-face negotiations on a regular basis, careful coordination among politically-neutral technical staffs, sharing of study findings among partners, a willingness to sacrifice institutional independence when necessary, and the authority of the commission to implement, as well as to make, decisions are all of inestimable importance (Cairo, 1997; Weston, 1984).

Recent events suggest at least some doubt among members of Congress as to a compelling federal interest in continuing direct support of such commissions. Since FY1997, the DRBC and SRBC have functioned without federal appropriations as a result of Congressional adoption of the recommendations of a report by the Heritage Foundation -- a Washington-based policy institute which recommended that Congress "defund" certain programs and activities whose benefits were viewed as more regional than national in their scope (DRBC, 1997; Cairo, 1997). Fortunately, because the value of the DRBC and SRBC is deemed sufficiently high within their operating regions, both have been able to sustain themselves despite the absence of federal appropriations. Moreover, Congress did not vote to remove the federal government from the compacts. However, one can reasonably ask whether there remains a federal role in the management of interstate rivers, what that role should be.

Ironically, just as their esteem has diminished in the eyes of Congress, the significant scope of authority granted to both commissions by their partners has attracted the attention of Southeast decision makers confronted by water conflicts - and who are seeking innovative structural solutions to them. In 1997, the DRBC's Executive Director was invited to advise and consult with officials of Alabama, Florida, and Georgia during formulation of their compacts, and the DRBC and SRBC were explicitly adopted as models by the framers of the ACF-ACT compacts.

7.9 Conclusions: Some General Recommendations

In lieu of specific recommendations for legislative changes, we suggest that the first steps in policy reform are to support increased regional cooperation and sharing of information. Efforts to bring together water management professionals and policymakers to share experiences, problems, and information - and to identify conjoint problems - should help to define any desirable changes. We believe that five axioms follow from this:

(1) Any proposed administrative/legislative solution should take into account variation in water availability from one part of the state to another as determined by geology, needs, and custom. There is no one-size fits all solution to water shortages or water conflicts.

This report has discussed the features, as well as the pros and cons, of basin compacts, water marketing, and other possible institutional and economic reforms. It is not our place to recommend specific instruments for regional cooperation. Such instruments, we believe, should be selected only after careful consideration by elected officials, and with the thoughtful input of stakeholders and citizens. However, it is worth bearing in mind that such institutional innovations can be fine-tuned to the state's needs. For example, the "basin compact commission" can be applied to groundwater needs, if desired. Thus, an interstate groundwater compact could be developed for the Memphis Sand Aquifer, if the state felt it to be advantageous to pursue this form of cooperation.

(2) Greater inter-community cooperation in water supply planning is a workable, yet underutilized strategy.

The status of inter-community cooperation exemplifies how this option might work, as well as the challenges in making it work. In the fall of 1997, six independent water districts in Cumberland County, on the Cumberland plateau, for example, have signed a letter committing to work together to find a spot for a regional water supply reservoir to serve the county's 42,000 residents. The Corps of Engineers has asked for funding to facilitate it. In December, 1998, the Corps' Nashville district office completed a study designed to aid the county and its constituent communities in planning long-term needs, and in 1999, several communities concluded a compact, called a "regional water authority" (Rich, 1997; Boatman, 1999; Cumberland Plateau Regional Water Authority, 1999). The authority's purpose includes:

> Planning, acquiring, constructing, improving, extending, furnishing, equipping, financing, owning, operating, and maintaining a water and wastewater system, including treatment, storage, distribution and collection facilities, properties, and services provide; the selling, donating, conveying, or otherwise disposing of water and wastewater; and undertaking any project or work related therewith . . . . The purpose of the authority is also to plan and develop the water resources of the geographic region and to provide necessary wastewater collection and treatment . . . to secure economic benefits to the geographic region that it encompasses (Cumberland Plateau Regional Water Authority, 1999).

The challenges facing this authority may be viewed as lying on two distinct, but interrelated, levels: that of engineering design and planning. Rapid population growth on the plateau, projected water shortages by 2010, and limited options for new supply continue to limit options for the authority. Environmental groups remain opposed to a dam on Clear Creek, a tributary of the Obed River, because of its impact upon a national wild and scenic river in the area. By pooling funds, Cumberland county communities figure that they can tap an outside water source and avoid the dam altogether. However, questions over projected water demand, and available sources of outside supply remain unanswered. Also, experience in working together prior to consummating the water authority has made some officials skeptical (Rich, 1997: S5).

(3) Because water rights attach to land and are valuable, the state should consider ways to protect these land values for the current holders in the face of changing uses. One way might to be to encourage voluntary registration of use, vest registered uses (subject to abatement in time of shortage) and allow transfer or leasing of withdrawal rights to other riparians for short terms in time of shortage.

Tennessee might want to consider adopting some form of regulated water withdrawal system, at least for those withdrawals that are intended to divert water across basins. As we have seen, neighboring states have adopted such a strategy. One advantage this could afford is to make less ambiguous the state's interest in protecting against adverse impacts to established users. Currently, as we have seen, while courts generally require return flows to the *same* basin from whence water is withdrawn, some withdrawals may be so large and consumptive as to inadequately protect downstream users.

(4) Tennessee has little ability to control water sales out of state if they are legal under Tennessee law, even though interbasin transfers are usually not permitted under riparian law if complaints are made.

Tennessee might consider instituting a program to require consultation, study, and permitting before large interbasin transfers can be allowed even if no lawsuit is filed. The regulation of interstate commerce is a congressional prerogative. No state law can be upheld as constitutional if its purpose is to usurp this prerogative. Any legislation or regulation that \ Tennessee considers to manage its water resources must treat in-state and out-of –state uses consistently. Any greater restrictions on out-of-state water transfers must be shown to be narrowly tailored to protect a compelling state interest. Control of interbasin transfers is not a matter for constitutional scrutiny. It is consistent with the common law of water use in the eastern states. Much can be done to protect the state's water resources from exploitation by other states by controlling interbasin transfers.

(5) There are a number of data collection and educational tools that could be utilized to better protect Tennessee water resources. Assuming such tools already exist in some form - they could be enhanced. Or, if they do not currently exist - they should be developed.

These tools include a clearinghouse for water supply data that would include a compendium of information on water withdrawals by major users, withdrawal capacity, and return flow. Such a clearinghouse should identify who owns the data, why it is being collected, and the criteria used for its assessment. Another set of tools would be a state-sponsored water conservation program at the K-12 level, as well as one for adults.

In short, while the challenges of protecting long-term water supply are formidable, the opportunities for learning from the mistakes of others - and for making genuine improvements to management and policy - are ample.

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APPENDIX A:

A Guide to Tennessee's Water Resources by Hydrologic Region[1]

1. River Basins, Geology, and Regional Water Supply

The three "grand political divisions" of Tennessee can be further divided into six regions or provinces based on geology and physiography. These are the Blue Ridge Mountain Province, the Valley of the Tennessee or the Ridge and Valley Province, and the Cumberland Plateau which comprise East Tennessee; the Highland Rim and the Nashville Basin which comprise Middle Tennessee; and the Gulf Coastal Plain which is equivalent to West Tennessee.

The physiography and soil characteristics of the various provinces of the state have very important consequences for water policy. Where soils are shallow and the base rock is relatively impermeable, both ground and surface supplies are undependable. Major portions of Tennessee fail in this category. On the other hand, important areas of the state do have large and dependable ground or surface water supplies. This means that it may be necessary to have a water policy that makes separate provision for different areas of the state. The amount of planning and regulation needed in an area of shortage may be quite different from what is needed in a surplus area.

Nearly all of Tennessee lies in the Cumberland, Tennessee, or lower Mississippi River Basins. One per cent of the state drains into the Green and Conasauga Rivers in Kentucky and Georgia, respectively. Of the 41,800 square miles of land in the state, the Tennessee River drains about 55 %, the Cumberland drains 25 %, and the Mississippi drains 19%. The population of the state is concentrated around these rivers and their major tributaries. Each of the four largest cities of Tennessee is on the main stem of Mississippi, Tennessee, or Cumberland. Most towns of more than 5,00 population are on an important watercourse.

2. Water Resources in the Blue Ridge Province

The Blue Ridge Province of Tennessee is the mountainous area lying along the entire eastern boundary of the state. The mountains are the Unaka Range of the Appalachian Mountains and elevations range up to nearly 7,000 feet. The underlying rock structure consists of crystalline granites, schists, and gneisses and partly crystalline sandstones, shales, and conglomerates. Soils tend to be rocky and sandy and are productive for timber. In some valleys and on general slopes there are soils of agricultural value. About half of the land is in forest.

Ground Water. The generally low-quality soils and the transportation difficulties created by the terrain have restricted population growth in the Blue Ridge province. Although a few towns do obtain water from wells and many large springs exist, it seems unlikely that this area will be developed to use ground water as a major source of supply.

Surface Water. The streams of the eastern mountains are large and their flows are dependable. Several of the major tributaries of the Tennessee River rise in North Carolina and flow across the Blue Ridge province and the Valley of East Tennessee. Flows for the lowest month on

[1]This material was excerpted from *Public Water Policy in Tennessee (1956).*

record usually range between 0.1 and 0.3 cubic feet per second (c.f.s.) per square mile drained, and are more than for any other region of the state. Average flows per square mile drained are about the same as for other parts of the state, and usually range from 1 to 2 c.f.s. In the southern part of the area runoff is somewhat higher, being from 2 to 3 c.f.s. on the average, and as much as 0.7 for the maximum month on record.

Low flows during the average year are substantially higher than record flows. USGS investigations indicate that on the average only once in two years will the minimum discharge for a three-day period fall below 0.44 c.f.s. per square mile for the area drained by the French Broad River above Newport. Equivalent minimum flows for other areas in the mountain region are mostly about 0.3 or 0.4 c.f.s. per square mile. Where the discharge of a stream is 0.3 c.f.s. per square mile, the yield of the stream will be 20 million gallons a day for each 100 square miles drained. The quality of the surface water in this region is generally very good. The tributary streams have very soft water, usually less than 25 parts per million of hardness.

3. Water Resources of the East Tennessee Region or 'Ridge and Valley' Province

The Valley of East Tennessee lies between the Blue Ridge Mountains and the Cumberland Plateau and consists of low ridges and broad valleys running from the northeast to the southwest. Limestone, sandstone, and shales are 2,000 to 6,000 feet thick and usually form red and grey loams valuable for general farming in the valleys. Considerable acreage is in forest. Although the valley is not the largest geographic region of the state, it contains nearly one-third of the population of the state.

Ground Water. General geological evidence indicates that large wells would be difficult to develop. However, actual ground water development by industries and municipalities in the valley is second only to the development of the Gulf Coastal Plain in west Tennessee. Many towns and industries use from several hundred thousand to two million gallons of ground water daily. Pollution of ground water is a problem, as it is in other limestone areas of the state.

Surface Water. The Tennessee River and its tributaries, the Holston and the Clinch, traverse the entire length of the valley. Other major tributaries such as the French Broad, the Little Tennessee, and the Hiwassee Rivers cross many miles of the valley before joining the Tennessee. Flows on these main streams and on many tributaries are large. Natural flows have been substantially modified by the extensive system of TVA dams.

4. Water Resources of the Cumberland Plateau

The Cumberland Plateau is the highest area between the Smoky Mountains and the Mississippi River; it extends from eastern Kentucky southeast through Tennessee and Alabama. The plateau is relatively flat except in the northeast, and beds of sandstone, conglomerates, shales and coal underlie it. The soils of the plateau are usually moderately fertile loams. Over two-thirds of the region is forested.

Groundwater. In general, wells must be drilled into the permeable sandstone beds in order to obtain water. Sufficient quantities for domestic supplies can usually be had from wells less than 100 feet deep. Larger supplies can be obtained at greater depths, the water usually rising to easy pumping distance of the surface. A number of towns on the plateau depend on wells for public water supplies. Other towns depend upon springs, but these are usually in areas where the plateau has been eroded to the level of the Highland Rim or the Sequatchie River basin.

Surface Water. Stream flows of the Cumberland Plateau are not dependable, and a number of streams draining over 100 square miles have, at times ceased to flow. Flows for the lowest month on record range from 0.00 to 0.06 c.f.s. per square mile.

5. Water Resources of the Highland Rim

The Highland Rim surrounds the Nashville Basin and extends from the Cumberland Plateau to the Tennessee River. The rim is from 500 to 1,000 feet lower than the plateau and is underlain by sandstone, limestone, shales, and chert. The soils formed from Highland Rim rocks vary from fertile loams at the higher levels to cherty barrens and grey silt loams where the rocks are worn down to the lower levels. The western part of the rim near the Tennessee River is heavily forested, while over the remainder of the region less than one acre in two is forested.

Ground Water. Water is available in gravel, sandstone, and solution channels in limestone. The underlying limestone is dense, so that water is usually found in joints and openings formed by solution. There is little assurance that any particular well drilled will hit one of these openings. Yields are usually low, and few wells drilled will exceed 5 to 10 gallons per minute. Domestic and stock water is usually obtained from dug wells less than 100 feet deep on the southern part of the Highland Rim. Throughout most of the area water can be obtained in small quantities from drilled wells less than 200 feet deep. It is generally inadvisable to go deeper than 350 feet because the rock becomes more dense and the chemical quality of the water decreases. Water supplies often are reduced or disappear during summer months, and bacteriological contamination is not uncommon.

Over the region, springs form the most reliable source of ground water. Springs yielding over 100 gallons per minute are common and a number are known to exceed 1,000 gallons per minute. Many communities depend upon springs for public water supplies.

Surface Water. The Cumberland and the Tennessee Rivers are the major surface waters of the Highland Rim. The Cumberland enters the state at the northeast corner of the rim and leaves at the northwest; the Tennessee crosses the entire width of the state at the western boundary of the rim. The discharge of each of these rivers is large and control through upstream reservoirs is extensive.

Uncontrolled stream flows are well sustained on the southern part of the Highland Rim, but are less adequate in the north. Flows for the minimum month of record are about 0.05 c.f.s. per square mile in the north and in some areas overlapping on the Cumberland Plateau or the Nashville Basin. In the southwest and to a lesser extent in the southeast, erosion and surface drainage have progressed further and here minimum flows ranges between 0.1 and 0.3 c.f.s. per square mile. Most of the Highland Rim is underlain by limestone and the streams tend to be fairly high in dissolved minerals and fairly hard. The areas drained by the Elk, Duck, parts of the Cumberland and the Collins River yield water of about 100 parts per million total hardness.

6. Water Resources of the Nashville Basin

The Nashville Basin is a plain in the center of the Highland Rim. The boundaries of the basin are slowly expanding through erosion at the edges of the rim. The underlying rock is limestone and calcareous shales. The soils are very fertile and suitable for general farming; however, they are often so shallow that they are suited only to pasture or timber. The largest concentration of

population is in the Nashville urban area on the Cumberland River. Secondary streams intersecting the basin include the Duck, Stones, Harpeth, Caney Fork, and Elk rivers.

Ground water. Over parts of the Nashville Basin water is unobtainable at shallow depths. Where shallow water is available, drilled wells yield only about 3 to 5 gallons a minute. Most areas can be expected to yield domestic quantities of water at less than 200 feet depth; yields will usually be less than 10 gallons a minute. A high percentage of dry, or non-water bearing wells, occurs.

There are aquifers in the upper part of the Knox dolomite section underlying the basin. This section is within 400 feet of the surface in the center of the basin, and drops to more than 1,000 feet at the fringes. In some areas of the Nashville Basin, usually near the Highland rim, there are flowing artesian wells. There are also a number of large springs in the region, and several towns use these for their public water supply. The quality of ground water in the basin is often unsatisfactory. Water from deep wells tends to contain excessive minerals, hardness is often fairly high, and many wells yield nonpotable sodium chloride or calcium-sulfate water.
Of the three heavily populated regions of the state, the Nashville Basin has the least to offer for ground water resources.

Surface Water. The dams on the Cumberland and its tributaries help to maintain rather large, minimum flows on this river as it passes through the basin. For no other part of the region can it be said that there are large, assured water supplies, either ground or surface. Two important tributaries of the Cumberland River originate in the central basin; one is the Harpeth River and the other is the Stones River. The Duck and the Elk rivers and their tributaries drain the southern half of the basin. In general Duck River tributaries in the Nashville Basin will cease to flow during moderate or extreme drought. Low flow is somewhat better for the Elk River tributaries.

7. Water Resources of the Gulf Coastal Plain

The Gulf Coastal Plain, or the Mississippi Embayment, of western Tennessee extends from the Tennessee River and the Highland Rim to the Mississippi River. Deposits of sand and clay range from 3,000 feet in thickness at Memphis to a vanishing point at the Highland Rim. The early deposits are of marine origin, and rise to the surface in the east; while in the west near the flood plain of the Mississippi is the more recent loess.

Ground Water. Without question the ground water resources of west Tennessee are much better than for any other region of the state. The unconsolidated strata of sands constitute large reservoirs and means of replenishment for ground water. The three principal water-bearing beds are the sand formations named Wilcox, which is up to 1,900 feet thick; McNairy, which is up to 400 feet thick; and Eutaw, which is 250 feet thick in some places. Because of the physical properties of this sand it appears that large quantities of water are available throughout the region. The immense size of the storage space is a product of the depth of the water-bearing sands and the tens of thousands of square miles that constitute the Gulf Coastal Plain. These ground waters are recharged over the extensive areas of the plain where these formations surface and where overlying strata are permeable to any extent.

Surface Water. The Mississippi River forms the western boundary of the Gulf Coastal Plain in Tennessee, and most of the plain drains into the Mississippi through the Obion, Hatchie, and Wolf rivers. The Tennessee River forms the approximate eastern border of this region, and its

tributaries, the Big Sandy, Beech, and smaller streams, extend short distances into west Tennessee. In general the minimum monthly flows are dependable and range between 0.1 and 0.2 cfs per square mile. West Tennessee is relatively flat and the underlying formations are unconsolidated so that silting and turbidity are common problems.

8. Precipitation and Its Variation: Policy Relevance

Much of the precipitation falling on Tennessee comes during the winter months. The summer and early fall are dry seasons for most of Tennessee. It is during this period that many uses, and especially irrigation, are at a maximum. The combination of various climatic factors such as wind, humidity, and temperature is such as to bring the rate of evaporation to a peak during the summer months. Important portions of reservoir storage and soil moisture are lost through evaporation. Evaporation from vegetation and soil probably exceeds rainfall during the summer and early fall in many parts of the state. This rainfall deficiency accounts in large part for both the low stream flows and the large withdrawals of water by various users at the critical season.

Normal rainfall is usually high in all parts of Tennessee but is highest in the southern and eastern parts of the state. While most of the state has experienced a thirty-year average of from 50 to 55 inches of rain, a few areas have had over 55 inches. In the north there are regions with less than 50 inches of precipitation, while one substantial area of less than 45 inches centers around Johnson City and Morristown. Some months of the year are relatively dry in Tennessee even when annual precipitation is normal. Rainfall of less than 4 inches a month can usually be expected in August, September, October, and November. The first part of this period is accompanied by high rates of evaporation due to summer temperatures, so that more, rather than less, rain is needed to maintain runoff and ground water levels at that time.

National Weather Service reports show that in five out of every seven years droughts have occurred during the July through October period. For this purpose a drought is a period of at least 21 days with less than 0.25 inches of precipitation. The occurrence and frequency of such periods is important, especially for agriculture. Tennessee often has more than one drought a year. During the period 1871-1953 there were a total of 112 droughts, or 1.3 per year. Recurring dry spells are the normal thing, then, even during wet years; and a suitable water policy for the state of Tennessee must take account of this fact. The four-month period with the highest rainfall is December through March. This high rate of precipitation is coupled with the lowest rate of evaporation for the year; thus there is an excess of water that must go into temporary storage or into stream runoff. The months of December through March are a period of frequent floods.

In order to plan for predictable shortages of water and for measures to alleviate them, it is necessary to know how rainfall varies between one year and another and how this variation influences the amount of water available for use. During the period since 1884 annual rainfall in Tennessee has ranged between 36.7 and 62.9 inches. Merely as an illustration, rainfall was less than 45 inches during seven of these twenty-five years between 1929 and 1955 and during six of the years from 1884 through 1929.

More than half of the water falling on the state evaporates and does not run off. The amount that evaporates depends upon the amount and timing of rainfall and upon temperatures, soil conditions, and many other factors. Evaporation cannot be measured directly for Tennessee but it can be computed for various watersheds in the State.

Rainfall minus runoff nearly always falls within the range of 25 to 35 inches in Tennessee watersheds. For the larger watersheds the range is narrower. Evaporation approximates rainfall minus runoff in most watersheds, the difference being a net gain or loss in ground flows. For example, in 1954 rainfall minus runoff in sixteen Tennessee Valley watersheds ranged from 27.6 to 36.0 inches and the median was 30.5 inches. Twelve of these sixteen were 1.9 inches or less from the median. The size of drainage areas ranged from 104 to 2,571 square miles, while rainfall ranged from 41.2 to 59.5 inches, with a median of 48.3 inches. Runoff varied from 11.0 inches to nearly three times as much, 30.9 inches. Rainfall in the Tennessee Valley above Chattanooga in 1954 was 48.0 inches while unregulated flow at Chattanooga was the equivalent of 18.1 inches, a difference of 29.9 inches.

The average loss of water to evaporation in Tennessee -- 30 inches -- tends to be less during dry years and more in wet years. When rainfall is 45 inches in Tennessee, not more than 15 inches of runoff can be counted upon. In 1941, a record dry year, rainfall was 36.7 inches, and runoff was an estimated 6.7 inches, or 13,500 million gallons a day. This is one-third of the normal supply statewide of 40,600 million gallons a day and less than half of what has been available during some recent dry years.

APPENDIX B:
Stakeholder Survey

Thank you for agreeing to participate in this study. We are doing a study with the University of Tennessee regarding challenges facing future water use in our state and its communities. This will take a few moments of your time. The responses will remain confidential. If you prefer not to answer a question, that's fine. Please e-mail the completed survey to Valerie Diden at vdiden@utk.edu.

1. Can you recall the drought of the late 1980s (especially 1989):
   No
   Yes, remember (go to #2).

2. How did you know that there was a drought? What indicators were there?

3. Did this drought affect you, or the people (or organizations) that you work with in any way?
   Yes. Please describe how:
   No (go to #5).
   Don't know, can't recall (go to #5).

4. As a result of this drought, did you, and/or the people (or organizations) you work with change the way they used or managed water?
   Yes. Please describe how:
   No.

5. Would you say that we are currently experiencing a drought, or a below-normal level of precipitation/rainfall in this region?
   Yes.
   No (go to question #7)
   Uncertain/don't know (go to question #7).

6. In your opinion, will this current drought affect the way you, the people you work with, or the organizations you work with, use or manage water?
   Yes. Please describe how:
   No. Our organization is concerned with protecting the streams and rivers of the state but feel they have no control over drought situations. It will effect our recreational times on water but feel it is out of our control.
   I work at a hospital and they are usually are not effected by this type of situation.
   Uncertain, don't know.

7. What is (are) the source(s) of water you use? Metro Water System

–

8. Do you know how much water is used, on an average annual basis, by you(r) (constituents)?

Yes, amount:

_ No

Don't know, uncertain

9. What do you forecast for your constituents' water use for the next 10 years?

Cannot predict the usage

10. Do you have any worries about your water supply?

Yes. What are they?

No.

Uncertain, don't know.

11. One challenge the state of Tennessee is facing in regards to water supply is competition among people over the same ground- and surface water sources. In your experience, does this competition pose a problem to the way you, or the people or organizations with whom you work, conduct business? Or, do you foresee this as a problem in the future?

Yes. Please describe: Concerned over impoundments/dams, etc. that some cities are trying to do to insure a water supply for their communities…

No.

Uncertain, don't know.

12. Across the nation, a number of ideas have been discussed on how a state facing competition over sources of water supply might better deal with its problems. Some of these ideas are discussed below, and we would like your reaction to them (i.e., support, don't know, don't like.) If you prefer not to answer one, that's fine.

a. Develop and maintain a *statewide set of data* on stream flow, groundwater levels, water withdrawals from surface and groundwater sources, and projected use by major users. One possible use for this could be to make decisions over water allocation:

b. Develop and maintain a *statewide planning process* that would require communities to plan water resource investment decisions, such as where, when, and how to acquire more water:

c. Develop and maintain a *process for permitting water withdrawals* from streams and groundwater sources, including diversion of water *across or between* different watersheds or basins:

d. Develop and maintain a *drought management system* that would allow communities, or the state, to impose limits on water withdrawals from streams or groundwater sources in a drought emergency:

If such a system were developed, would you prefer local or state control of it?

Local
State
Other,

e. Develop and maintain a system for being able to *sell water rights* from a user who doesn't need the water to another user(s) who does:

f. Develop and maintain a process for *mediating, negotiating, or resolving disputes* among competing individuals or groups seeking to use the same supply of water:

13. Finally, are you familiar with any approaches to managing water supply in other states in the region that you think should or shouldn't be adopted in Tennessee? If so, please describe:

This concludes the survey.

Thank you so much for your time. If you have any additional comments or questions, please include them with your survey or call Valerie Diden at (423) 974-4573.

APPENDIX C: GLOSSARY OF TERMS

This glossary was prepared as a reference for use with the research report and the database. Terms that may be unfamiliar or whose precise meanings might need clarification were included. It is not intended to be comprehensive.

Aquifer – A geologic layer of material that is porous and permeable to water and thus is capable of containing or carrying groundwater.

Appropriation doctrine – The system of water law dominant in the western United States under which (1) the right to water is acquired by applying it to a beneficial use, and (2) a right to water is superior to a similar right acquired later in time. Usually under modern statutes, state agencies regulate the acquisition of new water rights or changes in the use of water.

Area of origin – In an inter-basin transfer, the region exporting water.

Artesian – A reference to groundwater that is confined under such pressure that it will rise above the overlying confining beds if provided the opportunity to escape upward.

Assimilative capacity – The ability of a body of water to purify itself by absorbing or diluting waste discharges and through chemical and biological degradation without violating standards.

Available water supply – the quantity of water in a stream or groundwater basin, over and above the quantity needed to supply all water rights and demands.

Basin – The area drained by a stream and its tributaries. Also an area in which the strata or layers of rock dip toward a common point. ***Syn.*** **Catchment area, drainage basin, watershed.** ***See also*** **recharge basin.**

Catchment area – A watershed, an area from which water drains to a single point or a single stream.

Compact – An agreement between states, entered into with the consent of the federal government, defining the relative rights of two or more states on an interstate stream to use the waters of that stream.

Compact clause – "No State shall, without the consent of Congress, . . .enter into any Agreement or *compact* with another state . . ."Art. 1, Section 10, Cl.3 of U.S. Constitution.

Cone of depression – The funnel-shaped area around a well, where the water table has been lowered by the withdrawal of groundwater through the well. Subsidence may or may not occur as a result.

Consumptive use – Use of water in a manner that makes it unavailable for use by others, generally because of absorption, evaporation, transpiration or incorporation in a manufactured product. In some instances, when water is returned to a stream at a distance downstream from the point of diversion, the use may be consumptive as to users immediately below the point of

diversion, but nonconsumptive as to users below the point where water is returned.

Cooling water – Water used for cooling in an industrial process or in generation of power. After use, it usually has a higher temperature than that of the stream or lake into which it is discharged and so may constitute a source of thermal pollution.

c.w. consumption – The amount of cooling water lost primarily by evaporation caused by increase in temperature.

Correlative rights doctrine – (1) A doctrine requiring the sharing of groundwater shortages by overlying landowners; accomplished in some states by prorating the supply on the basis of overlying acreage. (2) A doctrine that applies surface riparian law to groundwater.

Depletion – withdrawal of a resource, such as surface water or groundwater, at a faster rate than it is being replaced.

Diffused surface water – Water lying or running on the surface of the land, but not in defined streams or water bodies, because of rain, melting snow, or floods. This water is generally not subject to water allocation rules.

Divide – The boundary between two drainage basins, frequently along a ridge line or a line connecting peaks.

Domestic uses – Household uses of water, such as drinking, cooking, washing, and watering livestock and a garden. Under traditional riparian law, these uses are given preference over "artificial" uses such as commercial irrigation or manufacturing.

Doctrine – A rule, principle, theory, or tenet of the law; as, e.g. Clean hands doctrine, Public trust doctrine.

Drainage basin – An area of the land surface that gathers water resulting from precipitation and contributes it to a stream, a stream system, another body of water or to a central point. The entire drainage basin therefore possesses a common outlet for its surface runoff. ***Syn***. **Catchment area, water shed.**

Drawdown – The distance by which the surface of a waterbody is lowered by the withdrawal of water through pumping, artesian flow or other release.

Groundwater d. – (1) The lowering of the piezometric surface or water table as a result of groundwater withdrawal. (2) The difference between the height of a water table and the height of the water in a well. (3) Diminished pressure in an aquifer as a result of groundwater withdrawal.

Drought – A prolonged period of dry weather characterized by an absence of or a deficiency in rainfall. There are various quantitative measures established to try to determine a drought. In qualitative terms, however, it usually causes a partial crop failure, a hydrologic imbalance or an interference with the ability to meet normal water demand.

Ecosystem – A population of interdependent living organisms and the distinct environmental context to which they relate. The whole is characterized by biological, chemical, and physical linkages.

Effluent – (1) An outlflowing of a stream or other waterbody. (2) Any fluid emitted by a source such as a stream, reservoir, or a basin, including a partially or completely treated waste fluid that is produced by and flows out of an industrial or wastewater treatment plant or sewer.

Ephemeral stream – A stream or a portion of a stream whose channel is dry except after

precipitation. The stream channel is above the water table and receives little or no water from springs or snowmelt.

Excess water – the amount it is believed safe to withdraw from a water source from whatever flow is available at the source (cf. Water withdrawn at a given river mile in a river or drawn from a spring and not returned to the streambed. and stored or drawn from a well or several wells over an aquifer. Water held in storage capacity is a factor here. *See* Safe Yield (below)

Federal land – Any land belonging to the United States, either by virtue of sovereignty or by acquisition from state or private ownership.

Foreign water – Water in a stream or other body of water that originated in another drainage basin. By definition this only happens by human action or natural catastrophe. If an area drains naturally into another (usually larger) drainage basin, it is not foreign. Cf. Water flowing from a tributary to the Tennessee to the Tennessee, thence to the Ohio River, into the Mississippi and to the Gulf can be said to flow in one large drainage that is a part of the Mississippi River drainage.

Groundwater – Subsurface water from which wells and springs are fed. In a strict sense groundwater applies only to water below the water table.

Groundwater recharge – Replenishment of groundwater naturally or artificially.

Hydrologic budget – An accounting of the inflow, outflow, storage and evaporation of water from an hydrologic unit, such as a drainage basin, aquifer, soil zone, lake or reservoir, and expressed by the hydrologic equation as the relationship between evaporation, precipitation, runoff, and water storage.

Hydrologic cycle – The process involving the continuous circulation of water from the oceans and the land surface of the earth to the atmosphere through transpiration and evaporation, and its eventual return to the earth's surface through various forms of precipitation.

In-stream use – Any use of water that does not require diversion or withdrawal from the natural watercourse, including in place uses such as navigation and recreation as well as power generation that requires a continuous flow.

In-stream appropriation – An appropriation in which water is left in a stream, river or lake (rather than diverted from the stream, river, or lake) at a particular place to provide for fish, wildlife, scenic beauty, waterborne recreation, environmental protection, or similar purpose. In-stream appropriations generally may only be made by a government agency.

Interbasin transfer – The physical conveyance of water from one watershed to another.

Irrigation – The application of water to lands to meet the water needs of plants not met by precipitation.

Irrigation return water – Water from irrigated farmlands that has been leached out of the upper layers of the soil.

Mine – To use up a resource without making provision for replenishment, as, for example, water from an underground reservoir.

Municipal water supply – Water to be distributed through a central system, whether municipally or privately owned, to users in an urban area, for both domestic and commercial uses.

Natural uses – These include traditional domestic water uses, such as drinking, cooking, laundry, and other uses necessary for the immediate sustenance of a household.

Navigable water – A stream, river, lake, arm of the sea, or other body of water that could be used for commerce, trade, transportation, or fishing. There is a federal definition and also a Tennessee state definition which differ slightly.

Nonconsumptive use – Use of water with return to a stream or body of water of substantially the same amount of water as was withdrawn, thus a use in which only insignificant amounts of water are lost by evapotranspiration or incorporation in a manufactured product.

Nontributary groundwater – Underground water (in an aquifer) that is so situated that it neither draws from nor contributes to a natural surface stream in an measurable degree.

Percolation – Movement through the pores or interstices of a substance, as water moves through rock or soil.

Farm waste percolation – Irrigation water in excess of what is consumptively used in a crop area, including both surface drainage to other areas and water intercepted by drainage systems moving through the root zone to the water table.

Perennial stream – A stream that carries water throughout the year and is generally fed by groundwater. The water surface of a perennial stream generally lies below the water table of the groundwater source.

Piezometric surface (potentiometric surface) – An imaginary surface representing the level to which groundwater will rise in a well as a result of the pressure under which it is confined in an aquifer. If, at a given location, water from different depths in the aquifer will rise to different levels, then the aquifer has more than one piezometric surface.

Point source - An origin of waste discharges that can be identified specifically, such as a municipal sewage system, an industrial plant or an animal feed lot.

Potable – Suitable for drinking.

Precipitation – The discharge of water, in either liquid or solid form, from the atmosphere to the surface of the earth, including rain, drizzle, sleet, snow, snow pellets, snow grains, ice crystals, ice pellets, hail, dew, and frost, usually measured in inched and hundredths of inches of equivalent depth in water.

Preferred uses – Water uses that have been given legal preference over other uses during times of water shortage.

Prescription – The use of water, exclusive and uninterrupted, for a certain period of time, which confers the right to continue the use of the water.

Public domain – Land owned, controlled, or heretofore disposed of by the United States federal government.

Public trust doctrine – This doctrine holds that the government has a trust responsibility toward certain natural resources, including water. The acceptance and effects of the doctrine vary from jurisdiction to jurisdiction. Among its effects, the doctrine can (1) provide the basis of government authority to regulate with regard to trust resources, (2) require heightened judicial scrutiny with regard to agency actions involving trust resources, (3) require governments to protect trust resources, and (4) limit the creation of private rights in trust resources. Although it is an old concept, the doctrine has been given renewed vigor and power as a tool for addressing Environmental concerns. ALSO Provides that submerged and submersible lands are preserved for public use in navigation, fishing and recreation and state, as trustee for the people, bears responsibility of preserving and protecting the right of the public to the use of the waters for those purposes.

Reasonable use doctrine – Also known as the American Rule, this doctrine allows a landowner to withdraw groundwater for reasonable uses on the overlying land without liability for harm to adjoining landowners; any beneficial use on the overlying land is considered reasonable.

Recharge – Addition of water, especially to a groundwater aquifer, to replace that which is withdrawn.

Artificial recharge –Recharge accomplished through the efforts of man, including seepage of irrigation water and induced infiltration from streams or wells.

Recharge area – An area through which an aquifer is replenished by force of gravity, usually where a permeable layer lies close to the surface.

Recharge basin – An artificial basin constructed in sandy deposits in order to promote infiltration thereby replenishing a groundwater supply.

Return water – Water diverted from a stream for irrigation purposes that, not having been consumed, passes directly back to a stream or other body of water or downward to the water table.

Return flow – Any water that is returned to a stream channel, a groundwater source, or a waterbody after being diverted or withdrawn for a purpose. Water diverted by a riparian for use\ which is then returned to the source after treatment. Return flow is legally required under riparian law and should take place within the same riparian landholding at which the water was originally withdrawn. Riparian land – Land lying along the banks of a stream or waterbody.

Riparian character is generally held to extend only to those lands in a single chain of title, so that a riparian owner's conveyance of the upland portion of the tract will remove the riparian character of the portion conveyed.

Riparian rights – The right of the owner of land abutting a stream or other natural body of water to use such water. At an early date, each riparian had a right to the natural flow of the stream, "undiminished in quantity and unaffected in quality", except for domestic use. More recently, the right to the natural flow has been modified to allow each riparian landowner to make a "reasonable" use of water on riparian lands. The "reasonableness" of a landowner's use is usually determined on a case-by-case basis by considering a number of factors associated with the use in question and the uses being made by competing riparian landowners.

Runoff – That portion of precipitation that would ultimately reach a stream without the intervention of man.

Safe yield – An ambiguous term that may refer to withdrawal of groundwater from an aquifer at a rate that (1) does not exceed average annual recharge to the aquifer, (2) does not result in continued withdrawing of groundwater from storage, (3) does not result in an "overdraft" or "mining" condition, or (4) does not produce an undesirable result.

Seasonal storage – Storage of water during that portion of the year when an excess occurs in the source. *See* Extra water (above).

Spring – A place where, without human modification, water issues from a rock or soil onto the land or into a body of water. The occurrence of a spring is dependent upon the location of permeable and impermeable rock layers, the level of the water table and on the local topography.

Storage – the long term collection of water, either in surface or underground reservoirs, for future use.

Storage capacity – Extent of ability to hold or accommodate.

Active storage c. – The volume of water normally available for release from a reservoir, the amount contained between the maximum level for which the dam is designed and the minimum level below which water will not normally be released.

Conservation storage c. – Amount of water that can be held in a reservoir for purposes other than flood control.

Dead storage c. – The volume of a reservoir below the level of the lowest outlet; the amount that cannot be drained by gravity through the outlets.

Flood control storage c. – The space in a reservoir allocated for retention of flood inflows to prevent or abate downstream damage.

Gross reservoir c. – The total volume of a reservoir from the bottom of the reservoir to the normal maximum operating level, including dead storage but not surcharge.

Surcharge storage c. – The volume of a reservoir above the maximum level for which the dam is designed, up to either the crest of an uncontrolled spillway or to the full-pool level with the gates closed.

Storage right – Water interrupted in its natural gravity flow and detained for later beneficial use.

Stream flow – The water that is flowing in a stream channel. The term is used synonymously with stream discharge to indicate the rate or quantity of water flowing in a stream.

Stream flow depletion – The amount of water lost from a stream in a particular area as measured by the difference between the amount flowing into and the amount flowing out of the area.

Sustained yield – (1) the quantity of a resource, such as groundwater, that can be withdrawn within a given period of time without reducing the total quantity available over the long run. (2) The amount that will be replaced or is renewable.

Thermal pollution – Impairment of water quality by rise in temperature from geothermal, industrial, or other cause.

TMDL – Total maximum daily load. The entire quantity of a pollutant that a body of water can receive without exceeding water quality standards. Used as a legal device, it includes point sources and nonpoint sources of the pollutant and may include a margin for error and a margin for future growth. The TMDL is arrived at based on the flow of water in a stream. For entities relying on calculations to set discharge rates, when water flow is diminished by increased withdrawals and/or drought, margins may disappear. When this happens, either excess must be spilled resulting in pollution (as with a municipal water treatment system);or process interruption may be required (as with an industrial use).

Transbasin removal – The removal of water of a natural stream from its natural basin into the natural basin of another stream.

Transpiration – The process by which water vapor is transferred to the atmosphere from living plants or the amount of water lost in this manner.

Tributary - A stream that empties into and contributes its waters to another stream.

Tributary drainage – The area from which water drains by gravity into a watercourse.

Tributary groundwater – Groundwater hydraulically connected to a stream so that groundwater withdrawals affect the stream supply and thus may be administered in conjunction with a surface water allocation system.

Unsaturated zone – A subsurface soil zone, also called the aeration zone, that lies above the zone of saturation (the water table), and is characterized by the saturation of soil interstices partially by water and partially by air. The interstitial water tends to move under gravity despite being held by molecular capillary forces.

Water course – A place on the earth's surface where water flows, regularly or intermittently, in a defined channel.

Water cycle – The continuing process by which atmospheric water condenses, falls to the surface of the earth in any form of precipitation, runs through surface or subterranean passages toward the sea and again returns to the atmosphere by evaporation from either water or land

surface.

Water quality standard – An in-stream standard specifying, usually, the maximum allowable concentration of a pollutant. Water quality standards may be numeric (for example, one part per million of copper) or narrative ("no toxic substances in toxic amounts"), may be chemical specific or stated in terms of whole-effluent toxicity. They may be designed to protect humans, aquatic organisms, or wildlife, such as eagles and mink that eat fish. Special water quality standards may be developed for sediments, groundwater, or the protection of wetlands.

Water right – A legally enforceable right to use water. Typically, a water right refers to the right to water from a naturally occurring source, such as a stream, river, lake or aquifer.

Water-right value – The value of the right to use water from a given source.

Watershed – (1) The region that is either drained by or contributed water to a body of water such as a river, stream, or lake. (2) The area within a divide above a specified point in a stream.

Water table – The upper surface of an underground layer saturated with water; the level to which water will naturally fill an excavation or the surface between the zone of saturation and the zone of aeration.

Well – An artificial pit, hole, or other excavation that is often walled or lined and is sunk into the ground in order to penetrate water-yielding rock or soil in order to withdraw, usually by pumping, water for use at the land surface.

Artesian well – A well releasing groundwater under such natural pressure that pumping is not required to bring it to the surface.

This glossary is taken in large part from the *Glossary of Water Related Terms* prepared by Elizabeth Slusser Kelly, in Beck, *Waters and Water Rights.* Other sources include: *Black's Law Dictionary* 6th Edition (1990) and *Glossary* by Patricia Pinson in Wright, Kenneth R., Ed., Water Rights of the Eastern United States, American Water Works Association, (1998) (She cites Titlebaum, O.A., Glossary of Water Resource Terms, US Environmental Protection Agency (1970); Getches, D. H., Water Law, St. Paul, Minn,: West Publishing (1984); and American Society of Civil Engineers, Glossary Water and Wastewater Control Engineering, 3rd ed., New York: ASCE (1981)).