The Senate Interim Committee on Natural Resources

Interim Report to the 77th Legislature

Texas Groundwater Resources

November 2000

TEXAS SENATE
NATURAL RESOURCES COMMITTEE

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November 1, 2000

The Honorable Rick Perry
Lieutenant Governor of Texas
Members of the Texas Senate
Texas State Capitol
Austin, Texas 78701

Dear Governor Perry and Fellow Members:

The Committee on Natural Resources of the Seventy-Sixth Legislature hereby submits its interim report including findings and recommendations for consideration by the Seventy-Seventh Legislature.

Respectfully submitted,

Senator J.E. "Buster" Brown, Chair

Senator Ken Armbrister, Vice-Chair

Senator Gonzalo Barrientos

Senator Teel Bivins

Senator Bill Ratliff

Senator Tom Haywood

Senator Eddie Lucio

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“Reaching solutions this way is never a neat, tidy, organized concerto; it is a messy, sprawling, exasperating cacophony. Like pluralist democracy it is the very worst way to reach consensus -- except for all the others.”

Kader Asmal
Chairman,
World Commission on Dams

“As we’ve all heard before, integrated water resource management is necessary to ensure sustainability. Sifting through various competing and complex issues to implement reforms without bowing to political pressures requires real leadership.”

Fidel V. Ramos
Former President of
the Phillippines

Senate Interim Committee on Natural Resources
Report to the 77th Legislature
TEXAS GROUNDWATER RESOURCES

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ACRONYMS

BFZ . . . . Balcones Fault Zone

BLWMP . . . . Brown Lewis Water Management Plan (SB 1)

GAM . . . . Groundwater Availability Model

GWCD . . . . Groundwater Conservation Districts

LEPA . . . . Low Energy Precision Application

PGMA . . . . Priority Groundwater Management Area

RWPG . . . . Regional Water Planning Groups

TNRCC . . . . Texas Natural Resources Conservation Commission

TWDB . . . . Texas Water Development Board

WAM . . . . Water Availability Model

UWCD . . . . Underground Water Conservation District

TFB . . . . Texas Farm Bureau

TDLR . . . . Texas Department of Licensing and Regulations

INTRODUCTION

> *By constitutional amendment, Texas voters made groundwater regulation a duty of the Legislature, and by Senate Bill 1, the Legislature has chosen a process that permits the people most affected by groundwater regulation in particular areas to participate in democratic solutions to their groundwater needs. It would be improper for courts to intercede at this time by changing the common-law framework within which the Legislature has attempted to craft regulations to meet this state's groundwater-conservation needs. Given the Legislature's recent actions to improve Texas' groundwater management, we are reluctant to make so drastic a change as abandoning our rule of capture and moving into the arena of water-use regulation by judicial fiat. It is more prudent to wait and see if Senate Bill 1 will have its desired effect, and to save for another day the determination of whether further revising the common law is an appropriate prerequisite to preserve Texas' natural resources and protect property owners' interests.*[1]
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> **Sypriano v. Ozarka Supreme Court Decision**

In 1999, Lieutenant Governor Rick Perry directed the Senate Interim Committee on Natural Resources to study, and report to the 77th Texas Legislature on eight major environmental issues, one of which focused on the state's groundwater resources. The Natural Resources Committee conducted a series of public hearings across the state in order to provide citizens from all regions of Texas an opportunity to testify. The Committee heard invited and public testimony on the groundwater charge at hearings held in Austin (September 29, 1999), Amarillo (October 26, 1999), Victoria (November 22, 1999), San Antonio (January 31, 2000), El Paso (February 23, 2000), Galveston (March 8, 2000), Brownsville (May 12, 2000) and Corpus Christi (June 29, 2000). See Appendix A for a list of the witnesses who testified to the Senate Interim Natural

[1]Sypriano v. Ozarka, 1 S.W. 3d 75, 80 (Tex. 1999).

Resources Committee on groundwater issues.

INTERIM CHARGE

Develop a comprehensive study of the state's groundwater resources, keeping a strong focus on the need for conservation. The Committee shall examine a regional approach to groundwater management, inventory the availability of groundwater, and consider the future regulation of groundwater and the role of groundwater conservation districts.

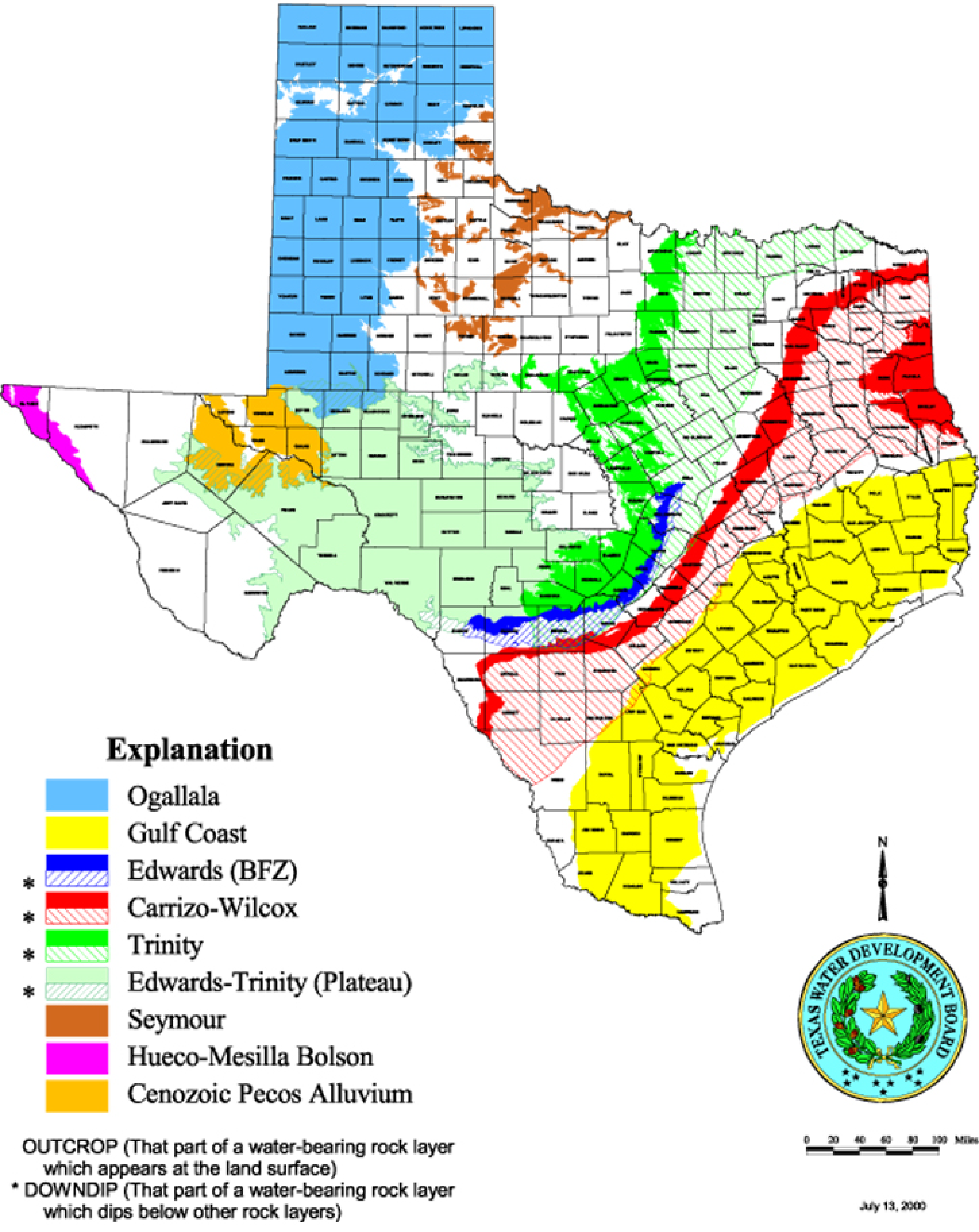
STATE OF THE STATE'S GROUNDWATER RESOURCES

Inventory of Texas Groundwater Resources

Approximately 81 percent of Texas overlies groundwater. The Texas Water Development Board (TWDB) has identified and characterized nine major and 20 minor aquifers in the state (see Maps 1 and 2), based on the quantity of water supplied by each of the underground formations. Generally, a major aquifer is one that supplies a large amount of water over a large geographic area. A minor aquifer typically supplies either a large amount of water over a small area, or a small amount of water over a large area. The nine major aquifers supply 97 percent of the groundwater used in the state.[2]

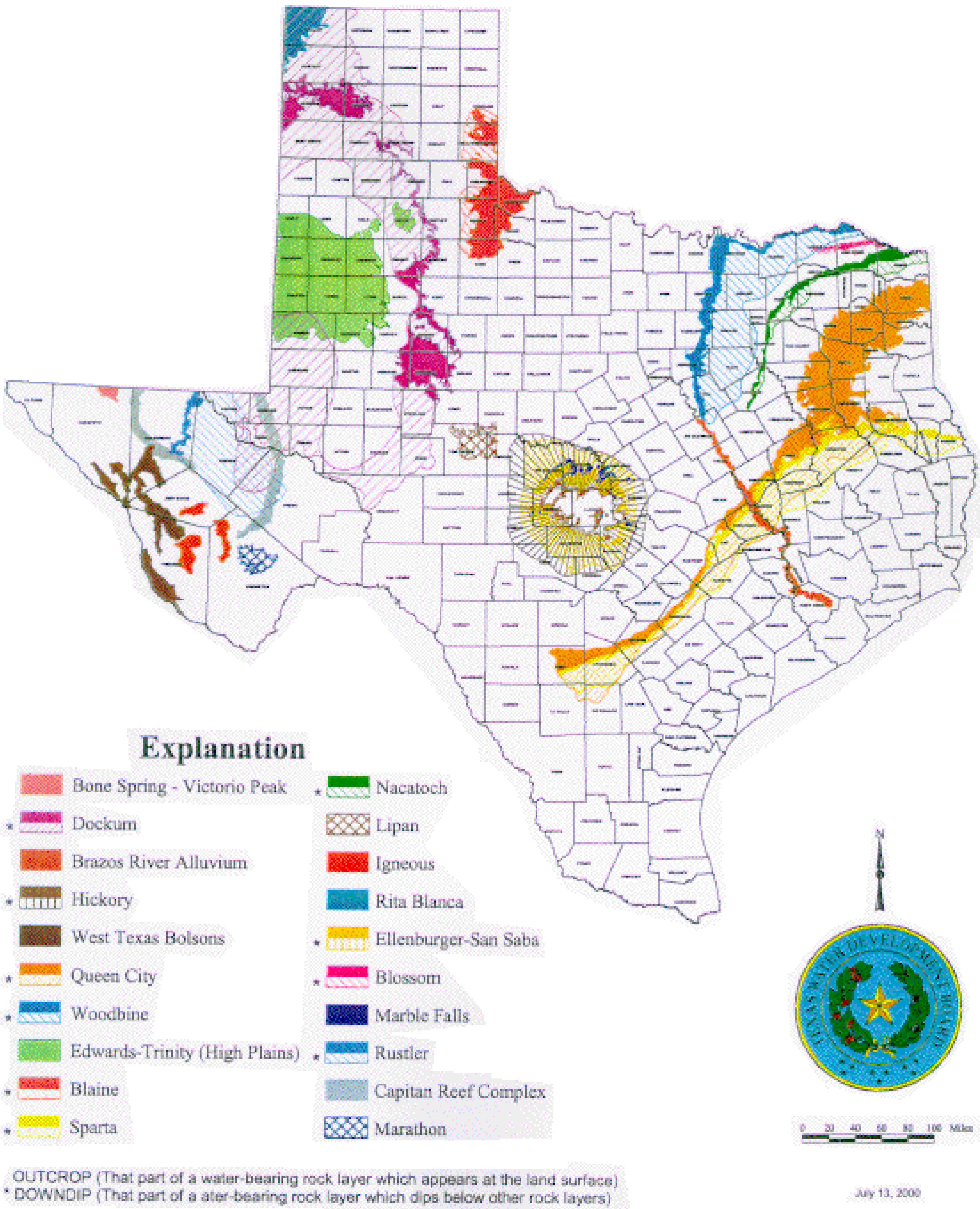
[2] *Water for Texas: A Consensus-Based Update to the State Water Plan, Vol. 11,* Texas Water Development Board, 1997, Document No. GP-6-2..

Major Aquifers of Texas



MAP 2

Minor Aquifers of Texas



Texas aquifers are as disparate as Texas geography. The aquifers have different geologic origins, different amounts of water, different rates of recharge, different susceptibilities to contamination, and pose different management challenges. The following discussion highlights information on a few of the state's major aquifers to illustrate some of the unique aquifer characteristics. This brief overview of the Ogallala, Edwards (BFZ), Carrizo-Wilcox and Gulf Coast Aquifers is drawn from the 1997 "Water For Texas" State Water Plan and a paper submitted to the Senate Natural Resources Committee on groundwater management options for Texas.[3]

Ogallala (or High Plains) Aquifer

The Ogallala Formation occurs at or near the surface over much of the High Plains area of northwest Texas. The Ogallala is a huge aquifer that contains water deposited during the ice age. The formation consists of alternating beds of silt, clay, sand, gravel, and caliche, reaching a maximum thickness of more than 900 feet in southwestern Ochiltree County. The Canadian River has cut through the formation dividing it into two parts, the North Plains and the South Plains.

The zone of saturation in the aquifer ranges in thickness from only a few feet to more than 500 feet. The thickest saturated sections occur in the northeastern part of the South Plains. In the large irrigation area north and west of Lubbock, the saturated interval generally ranges between 100 and 300 feet. South of Lubbock, the saturated

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[3]Ronald Kaiser, Frank Skillern & Bruce Lesikar, "Groundwater Management In Selected Western States: Options for Texas. A Report to the Senate Natural Resources Committee" October 6, 2000

zone is generally between 50 and 150 feet thick.

Depth to water in the aquifer ranges between 100 and 200 feet throughout much of the South Plains, but depths commonly exceed 300 feet in parts of the North Plains. Yields of wells range from less than 100 gpm (gallons per minute) to more than 2,000 gpm, averaging about 500 gpm.

Small quantities of natural recharge to the Ogallala Aquifer result from precipitation on the land surface and underflow from that part of the aquifer in New Mexico. Water moves slowly through the formation in a generally southwesterly direction toward the eastern escarpment of the High Plains.

As of 1997, more water was pumped from the Ogallala than from any other Texas aquifer. In 1994, approximately 5.9 million acre-feet was pumped from this aquifer, 96 percent of which was used for irrigation. Many communities in the High Plains use the Ogallala Aquifer as their sole source of drinking water supply.[4] Historically, the Ogallala has supplied about two-thirds of all the groundwater used in Texas, and 38 percent of all the water used in Texas. Today's declining water levels in the Ogallala will have a significant impact on small cities in the High Plains of Texas. The larger cities of Amarillo and Lubbock have diversified their sources of supply and are not totally reliant on groundwater to meet their domestic and industrial needs.

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[4]*Water for Texas: A Consensus-Based Update to the State Water Plan, Vol. 11,* Texas Water Development Board, 1997, Document No. GP-6-2..

Edwards (Balcones Fault Zone) Aquifer

The Edwards (Balcones Fault Zone) Aquifer extends from central Kinney County east and northeast into southern Bell County. It includes the Edwards Limestone and associated limestone beds of Cretaceous age. Conditions favorable for the accumulation of large volumes of water in these formations have resulted from faulting along the Balcones Fault Zone.

This aquifer supplies municipal and industrial water to numerous cities and towns, including the total municipal supply of the City of San Antonio. Capacities of some of San Antonio's wells are among the largest in the world, some wells yielding over 16 thousand gallons per minute each. Industrial and irrigation water supplies are also pumped from the aquifer.

Some of the largest springs in the State result from the discharge of water from the aquifer. These include Leona Springs at Uvalde, San Pedro and San Antonio Spring in San Antonio, Comal Springs at New Braunfels, San Marcos, Barton Spring at Austin, and Salado Springs at Salado.

The aquifer is recharged partly by precipitation on the recharge zone, storm runoff which enters the recharge zone, and streams which head in the Edwards Plateau. The West Nueces, Nueces, Frio, Sabinal, Medina, and Blanco Rivers and Seco, Hondo, and Cibolo Creeks, flow across the Balcones Fault Zone, losing water into the extensive fracture system of the aquifer. Water moves rapidly through the aquifer, and the volume of water in storage and the rate of springflow change rapidly in response to rainfall. For example, the depletion of water in storage resulting from continuous heavy pumpage during the drought years 1948-1956 was almost completely restored during the wet years 1957 and 1958.

Highly saline water, containing hydrogen sulfide gas, occurs in the Edwards and associated limestone beds south of the heavily pumped areas. Even as water needs increase, pumping from this aquifer is constrained by the possibility of saline water intrusion and the necessity to maintain springflow at adequate levels for environmental and recreational purposes.

Carrizo-Wilcox Aquifer

The Carrizo-Wilcox Aquifer, one of the largest in Texas, furnishes water to wells in a wide belt extending from the Rio Grande near Laredo northeastward into Arkansas and Louisiana. The aquifer consists of hydrologically connected sand, sandstone, and gravel of the Wilcox Group and overlying Carrizo Formation.

The Carrizo-Wilcox Aquifer is recharged by precipitation and storm runoff on the outcrop areas and by streams which cross the outcrop area. Water in the Carrizo-Wilcox Aquifer is generally under artesian pressure, and flowing wells are common in areas of low elevation. However, in heavily pumped irrigation areas, such as throughout the four county Winter Garden area (Dimmit, Frio, La Salle and Zavala), and in municipal and industrial well fields, such as those north of Lufkin, water levels have declined and pumping costs have increased significantly.

Yields of wells vary widely, but yields of more than 1,000 gallons per minute (gpm) from large-capacity wells are common, and some wells yield as much as 3,000 gpm. Usable quality water occurs at greater depths (up to about 5,300 feet) than in any other aquifer in the state.

Water from the Carrizo-Wilcox Aquifer is used for irrigation in the Winter Garden area and for municipal and industrial use. The municipal and industrial use in just two counties (Angelina and Nacogdoches) has exceeded 20 million gallons of water per day.

Gulf Coast Aquifer

The Gulf Coast Aquifer underlies most of the Coastal Plain from the Lower Rio Grande Valley northeastward into Louisiana, extending about 100 miles inland from the Gulf. The aquifer consists of alternating clay, silt, sand, and gravel beds belonging to the Catahoula, Oakville, Lagarto, Goliad, Willis, Lissie, and Beaumont Formations, which are hydrologically connected to form a large, leaky, artesian aquifer system.

Fresh water occurs in the aquifer to depths of more than 3,000 feet, and large quantities of water are pumped for municipal, industrial, and irrigation use. In the Houston metropolitan area, from 300 to 350 million gallons are pumped daily for municipal and industrial use. Large-capacity wells yield as much as 4,500 gpm in this area. In the central and southern parts of the coast, the net thickness of water-bearing zones in the aquifer decreases, and wells yield somewhat less, although locally wells may yield as much as 3,000 gpm.

The aquifer is recharged by precipitation and seepage from streams crossing the outcrop area. The rate of natural recharge is estimated to be sufficient to sustain present levels of pumpage from the aquifer; however, in heavily developed areas withdrawals must be limited to quantities equal to local area recharge, otherwise the water table will be lowered further and additional subsidence will occur. In some areas where the aquifer is essentially undeveloped, substantial volumes of potential recharge are rejected. Problems related to withdrawal of water from the Gulf Coast Aquifer are: (a) land-surface subsidence, (b) increased chloride content in the water of the southwest portion of the aquifer, and (c) salt-water encroachment along the coast.[5]

Groundwater Availability Modeling

Sound science is necessary for the effective management of both surface and groundwater. Proper planning and management of the state's groundwater resources cannot occur until we have the answers to basic questions such as: what are the characteristics of each aquifer; how much groundwater is in each aquifer; what are the sources and the quality of the water; how accessible is it; what is the rate of recharge; what is the groundwater/surface water interaction; and how sustainable is the supply given current and projected pumpage.

One feature of the Brown Lewis Water Management Plan (BLWMP), or Senate Bill 1 (75th Legislature, 1997), is the requirement that, by December 31, 2001, the Texas Natural Resources Conservation Commission (TNRCC) must develop surface water availability models (WAMs) for each of the state's river basins. The Texas Water Development Board (TWDB) has undertaken a comparable effort with regard to preparing groundwater availability models (GAMs). The following information on

[5]Ronald Kaiser, Frank Skillern & Bruce Lesikar, "Groundwater Management In Selected Western States: Options for Texas. A Report to the Senate Natural Resources Committee" October 6, 2000

groundwater availability modeling can be found on the TWDB's website (www.twdb.state.tx.us/data/groundwater/GAM/).

Groundwater Availability Modeling (GAM), is a new initiative by the Texas Water Development Board to develop state-of-the-art, publicly available numerical groundwater flow models to provide reliable information on groundwater availability in Texas. The goal of this modeling effort is to provide reliable, timely data on groundwater availability to the citizens of Texas to ensure adequacy of supplies, or recognition of inadequacy of supplies, throughout the 50-year planning horizon.

The Groundwater Availability Modeling (GAM) program will result in computer models of groundwater flow in the major aquifers in the State, which currently supply about 95 percent of the groundwater produced in Texas. The GAM models will assist Groundwater Conservation Districts to manage groundwater resources and will help the Regional Water Planning Groups (RWPGs) to plan future water supplies. The groundwater models will result in a greatly improved understanding of groundwater resources in the state. Each of the models will be thoroughly documented and available to the public over the Internet.

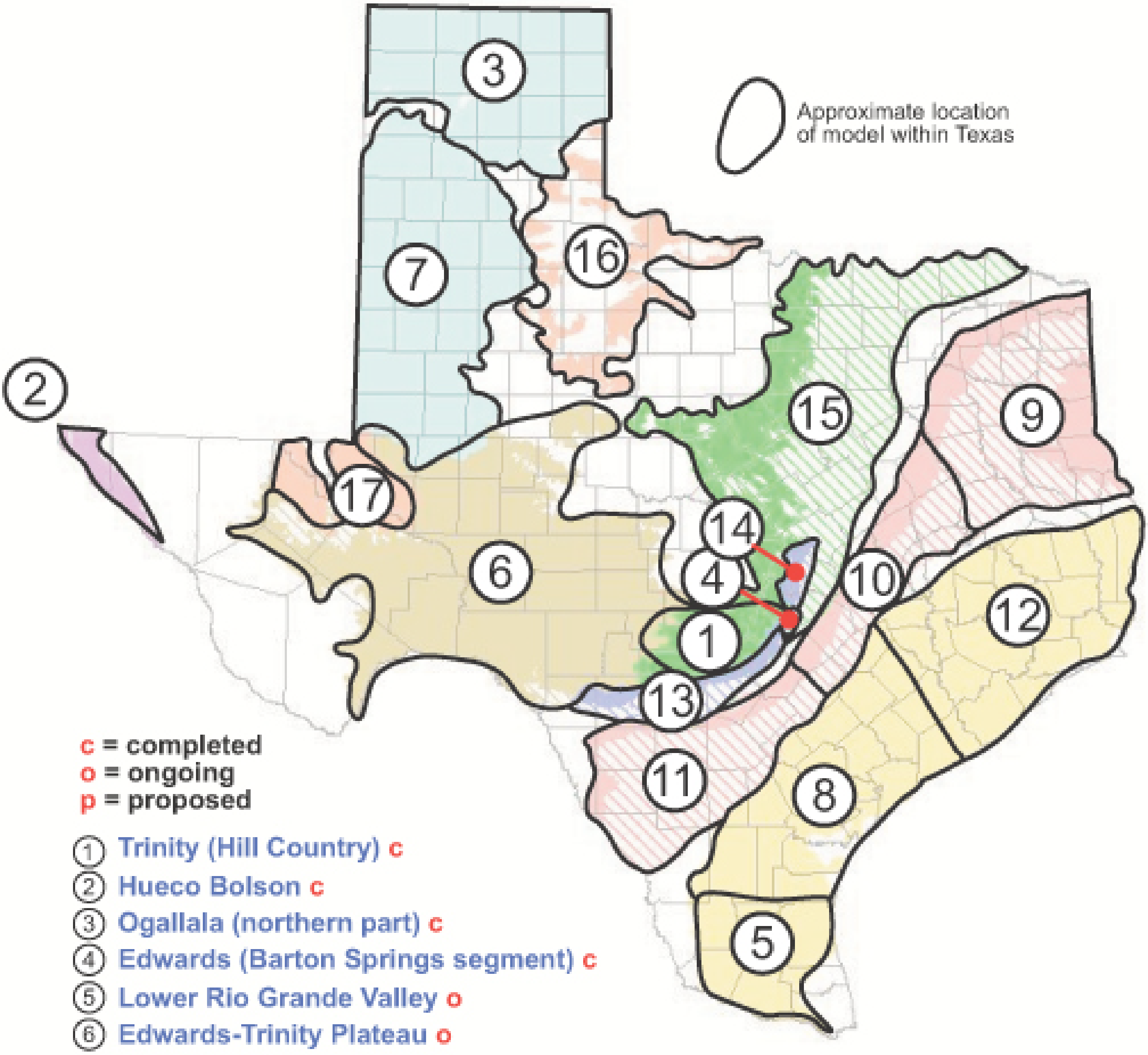
How and When Will the Groundwater Availability Models (GAMs) Be Done?

The development of GAMs will be a public process and will include input from all levels of the public and private sector. The different groundwater models will be completed by

Texas Water Development Board staff and its contractors. Some models are currently being worked on by Regional Water Planning Groups and the U.S. Geological Survey. Computer models of the major aquifers are scheduled to be complete by September of 2004.

Currently, the TWDB plans to develop models for all of the nine major aquifers. These aquifers include the: (1) Ogallala, (2) Gulf Coast, (3) Edwards (Balcones Fault Zone), (4) Carrizo-Wilcox, (5) Trinity, (6) Edwards-Trinity (Plateau), (7) Seymour, (8) Hueco-Mesilla Bolson, and (9) Cenozoic-Pecos Alluvium. However, as indicated on Map 3, a total number of seventeen models are underway or planned for the nine major aquifers, because separate models are being developed for each of the distinct groundwater formations within the aquifers.

Location of Completed, Ongoing, and Proposed Models for GAM



c = completed
o = ongoing
p = proposed

1. Trinity (Hill Country) c
2. Hueco Bolson c
3. Ogallala (northern part) c
4. Edwards (Barton Springs segment) c
5. Lower Rio Grande Valley o
6. Edwards-Trinity Plateau o
7. Ogallala (southern part) o
8. Gulf Coast (central part) o
9. Carrizo-Wilcox (northern part) o
10. Carrizo-Wilcox (central part) o
11. Carrizo-Wilcox (southern part) o
12. Gulf Coast (northern part) o
13. Edwards (San Antonio segment) o
14. Edwards (northern segment) p
15. Trinity (northern part) p
16. Seymour p
17. Pecos Alluvium p

GAM
Groundwater Availability Modeling

texas water development board

October 2000

The Texas Water Development Board (TWDB) is in the process of developing models for the Hill Country portion of the Trinity aquifer, the Gulf Coast aquifer in the lower Rio Grande Valley, and the Edwards Trinity (Plateau). The northern portion of the Ogallala aquifer in Texas, the Barton Springs segment of the Edwards aquifer (BFZ), and part of the Gulf Coast aquifer near Corpus Christi are being modeled by the TWDB and the Bureau of Economic Geology, U.T. Austin, as part of Senate Bill 1 water planning. The U.S. Geological Survey is developing a model for the Hueco-Mesilla Bolson (which will encompass both the Texas and the Mexican components of the Bolson) and part of the Gulf Coast aquifer near Houston. The Edwards Aquifer Authority is planning to develop a new model for the San Antonio segment of the Edwards aquifer. Appendix B of this report provides a complete listing of the 17 GAM models, which includes the authoring entity and status of each model.

What Is A Groundwater Availability Model?

A numerical groundwater flow model is the mathematical representation of an aquifer in a computer. Using the basic laws of physics that govern groundwater flow, the model author instructs the computer to consider the physical boundaries of the aquifer, recharge, pumping, interaction with rivers, or other phenomenon to model the behavior of the aquifer over time. These groundwater models will then be used to make predictions of how water levels might change in the future in response to changes in pumping and climate.

An accurate groundwater model requires a tremendous amount of information about the aquifer. The general steps in developing a groundwater model include: (1) developing the conceptual model, (2) defining the model architecture, (3) calibrating and verifying the model, and (4) making predictions. The conceptual model represents the best available information about how the aquifer works. Developing a good conceptual model requires compiling detailed information on the geology, water quality, recharge, rivers, water levels, hydraulic parameters, and pumping. The model architecture refers to the software core of the model: which computer program is used and how many layers and cells make up the model. Calibrating and verifying involve showing that the model can reproduce water levels measured in the past. A good calibration and verification yields confidence that the model produces reasonable predictions of water levels in the future.

After all of the above is complete, the model can be used for making predictions. After deciding how pumping and recharge will vary in the future, the model can be used to predict how water levels will change over time. A major decision that will have to be made on an aquifer-by-aquifer basis will be deciding the desired future condition(s) for teh aquifer. Once that decision is made, the models can be used to quatify the amount of groundwater supply that will be reliably available in the future. Future droughts can also be factored into the model to see how the aquifer responds to increased pumping and decreased recharge. Considering droughts in model predictions will be an important feature of the groundwater availability models.[6]

[6]http://www.twdb.state.tx.us/data/groundwater/GAM/

GROUNDWATER CONSERVATION DISTRICTS: TEXAS' PREFERRED METHOD OF MANAGING GROUNDWATER

How Groundwater Conservation Districts Function in Texas

In response to a severe drought in the early 1900s, Texas voters in 1917 added the "Conservation Amendment" to the Texas Constitution, through the elected approval of Article 16, Section 59. This amendment vested with the Legislature the responsibility of ensuring a sustainable water supply for the state. However, it wasn't until 1949, through the passage of the Texas Groundwater Act, that the Legislature first exercised its constitutional authority to provide for the management of groundwater. The 1949 law authorized the formation of groundwater conservation districts for the protection of groundwater supplies, and established a petition process for the designation of groundwater management areas.

The first groundwater conservation district created in Texas was the High Plains Underground Water Conservation District No. 1, which was established in 1951 and covers all or part of 15 counties overlying the Ogallala Aquifer.

The drought of the 1950s spurred the creation of the following groundwater districts: North Plains Groundwater Conservation District, Panhandle Groundwater Conservation District, Hudspeth County Underground Water Conservation District No. 1, and Dallam County Underground Water Conservation District No. 1.

There are presently 63 groundwater conservation districts in Texas (see Map 4). This figure includes 13 temporary districts that were the subject of legislation during the 76th

Texas Legislature's Regular Session (discussed in detail later in this report, in section titled "**Senate Bill 1911 and Why**"). As illustrated in Figure 1, it is estimated that the 63 districts cover approximately 80% of the groundwater that is currently pumped across the state.

Confirmed Groundwater Districts Within the State of Texas

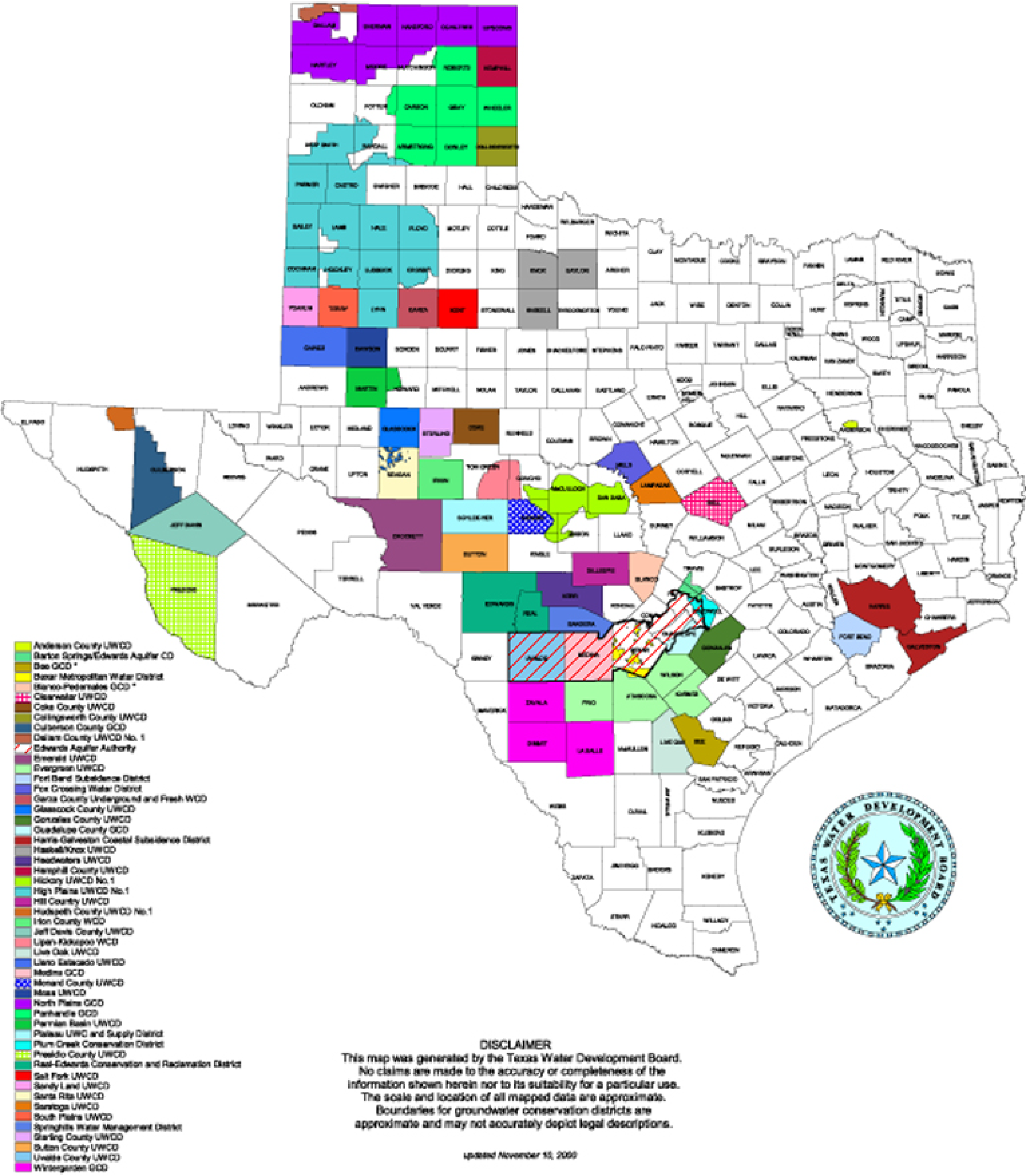
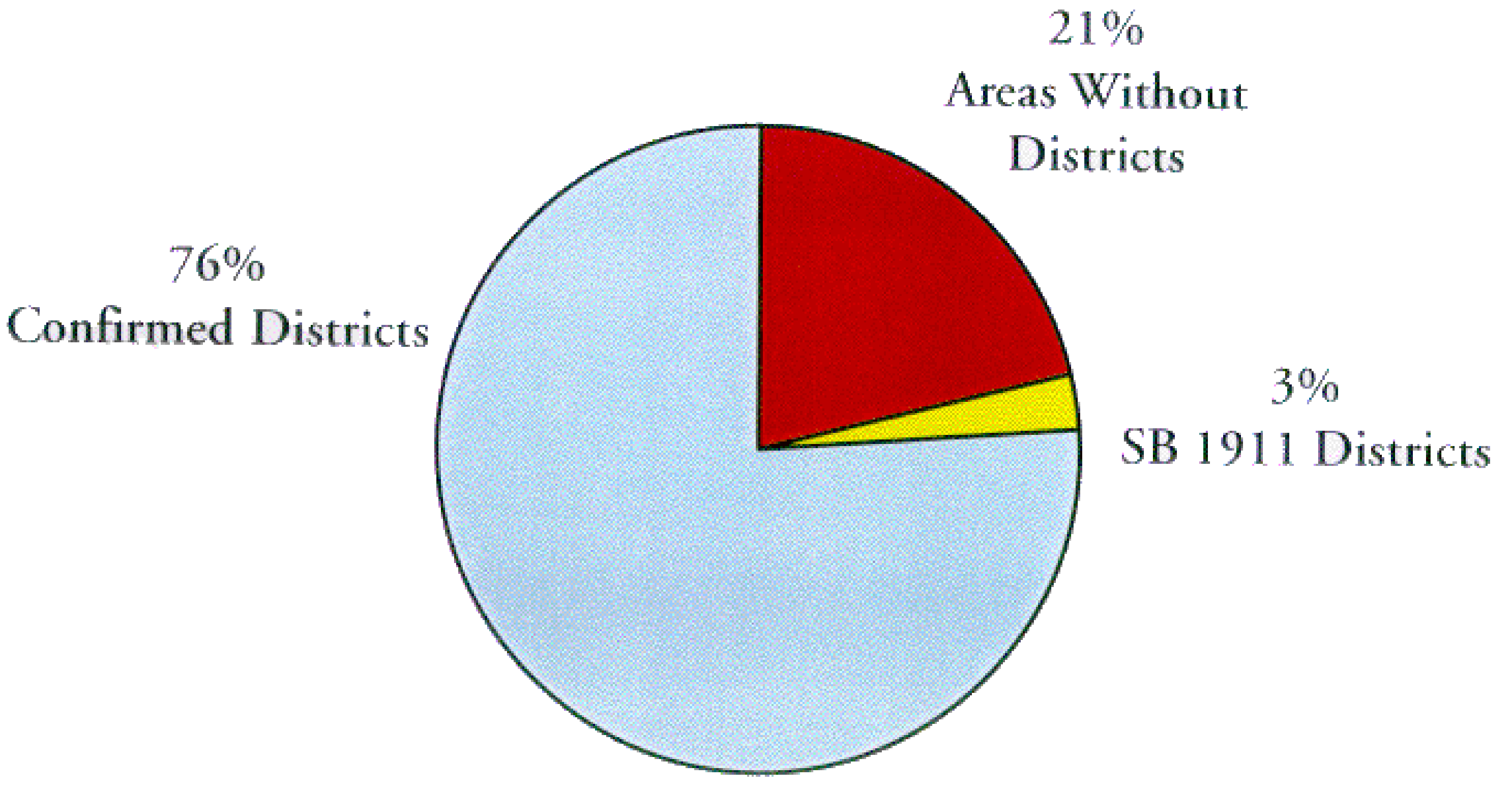


FIGURE 1

Groundwater Pumpage in Texas



District Creation Processes

Groundwater conservation districts (GWCDs) can be created in Texas by using one of three procedures:[7]

Special Law.

Groundwater conservation districts (GWCDs) can be established through the action of the Texas Legislature. Typical district-creation legislation follows a consistent framework for authorizing district powers and duties, appointing temporary directors, and establishing procedures for confirmation and subsequent directors' elections. However, each individual piece of special (local) legislation may differ in certain ways. District creation legislation may enable a district with additional authorities such as water control and improvement; or may limit the powers available to a district, such as the power of eminent domain. For example, a number of GWCD-creation bills were filed during the 76th Texas Legislature's Regular Session with the intent to prohibit the export of groundwater.

Landowner Petition.

Groundwater conservation districts (GWCDs) can also be established through a landowner petition process as set out in the Texas Water Code. These procedures start when property owners within a proposed district's boundaries file a petition for consideration by the TNRCC. Initially, the TNRCC considers what management area boundaries should be established and whether a district should be established. The

[7] See, TEX. CONST. Art. XVI, § 59 and TEX. WATER CODE ANN. §§ 36.011-36.021 (Vernon Supp. 2000).

TNRCC also considers the benefit of the proposed district's programs in its decision about district creation. If the petition is accepted, then temporary directors are named and a district confirmation election is held.

Priority Groundwater Management Area (PGMA) Process.

A priority groundwater management area (PGMA) is an area which the TNRCC has determined, after a study with consultation from the Texas Water Development Board and the Texas Parks and Wildlife Department, is likely to experience critical groundwater problems within the next 25 years. Groundwater districts can be created by the TNRCC, on its own motion, as part of the Priority Groundwater Management Area (PGMA) process, in a procedure similar to the landowner petition process. The TNRCC may only initiate a district creation in a PGMA if, and after, local officials have failed to take action in response to the TNRCC's PGMA designation. If the voters act favorably on the proposed creation, temporary directors are named and a district confirmation election is held.

Powers and Duties of Groundwater Districts

Groundwater conservation districts (GWCDs) are authorized with powers and duties designed to enable them to manage groundwater resources underlying the district. A GWCD's primary duties include: 1) permitting of water wells; 2) development of a comprehensive district management plan; and 3) adoption and enforcement of rules necessary to implement a district's management plan. The principal power GWCDs have to prevent waste of groundwater is to require that all wells, with certain exceptions, be permitted. Through this permitting system, GWCDs may place production limits on the amount of groundwater a well may extract. Permitted wells are also subject to a

GWCD's rules governing spacing from other wells, spacing from property lines, and procedures for the drilling, equipping, and completion or alteration of wells.

Groundwater conservation districts (GWCDs) conduct groundwater quantity monitoring to establish a water availability baseline and to characterize groundwater use trends. They can also provide a range of technical support services to help water users with water conservation efforts. Such services include monitoring precipitation and aquifer water levels. Several districts do testing of wells, pump plant efficiency, and irrigation system efficiency. These techniques have been used extensively in districts with large agricultural water uses, in which the proliferation of low energy precision application (LEPA) center pivot sprinklers, drip irrigation systems, and furrow diking have helped to improve water use efficiencies.

To facilitate the implementation of such water conservation practices, some GWCDs have made the necessary equipment available for loan. Laser land leveling equipment and furrow dikers may be made available for increasing agricultural irrigation efficiencies. GWCDs may also participate in the TWDB's Agricultural Water Conservation Equipment Loan Program, through which, the districts can make low interest loans to farmers for the installation of LEPA center pivot systems, for example.

Pollution of groundwater is considered to be a "waste" of groundwater, and GWCDs have the statutory authority to adopt and enforce rules to prevent such waste. Sources of pollution may be from either surface water or from improperly constructed wells. Accordingly, GWCDs conduct groundwater quality monitoring to establish a baseline for tracking water quality trends and identifying possible contaminants. Water quality testing can vary from biological evaluations (coliform and fecal coliform bacteria) to more complete water quality analyses (including alkalinity, hardness, chloride, specific conductivity, total dissolved solids, fluoride, iron, ammonia, nitrate, sulfate, and pH). In some districts, water quality analysis is offered free of charge to residents of the district and may be offered on a fee basis to residents outside the district.

One example of a district focused on water quality issues is the Santa Rita Underground Water Conservation District, which has a program to plug more than 350 abandoned wells to prevent contamination of groundwater. Another example that could be (and is) replicated by myriad districts is Mesa Underground Water Conservation District's Used Oil and Filter Collection Program, through which more than 40,000 gallons of waste oil have been collected and recycled annually since 1993.

Groundwater conservation districts (GWCDs) - when properly funded and structured - carry out research projects and collect information regarding the use of groundwater, water conservation, and the practicability of aquifer storage and recovery projects. GWCDs have participated in special projects including groundwater modeling, area subsidence measurements, groundwater mapping, recharge enhancement, and weather modification programs. For example, GWCDs have worked with the TNRCC to fund five separate weather modification programs across the state including: the West Texas

Weather Modification Association; High Plains Precipitation Enhancement Program; South Texas Weather Modification Program; Southwest Texas Rain Enhancement Program; and the Edwards Aquifer Authority Precipitation Enhancement Program.

GWCDs have historically taken what they have learned from their research and served an important role in public education about the need for water conservation and, specifically, for the efficient use of decreasing groundwater supplies. They use a variety of programs and media to inform the public, ranging from news releases and public service announcements to mailings of newsletters, fact sheets, and bulletins, as well as posting information on the internet.

GWCDs also target some of their educational efforts specifically for schoolchildren, including field trips and water conservation-related curricula. For example, the Harris-Galveston Coastal Subsidence District has promoted the "Learning to be Water Wise and Energy Efficient" program in the Houston area. The City of Houston performed a cost-benefit analysis on the program, which revealed that the city will gain $5.60 for every dollar spent on the program. Further, the water savings per educational kit distributed was determined to be nearly 23 gallons per household per day.

Role of Groundwater Conservation Districts in Export of Groundwater

GWCDs may also purchase, sell, transport, and distribute surface water or groundwater for any purpose; exercise the power of eminent domain; and require permits for the transport of groundwater out of the district. The factors that a GWCD must consider before approving a sale of groundwater outside the district mirror the factors that TNRCC must review in granting an interbasin transfer application, including:

- The availability of water in the district and in the proposed receiving area during the period for which the water supply is requested;
- the availability of feasible and practical alternative supplies to the applicant;
- the amount and purpose of the use in the proposed receiving area for which water is needed; and
- the projected effect of the proposed transfer on aquifer conditions, depletions, subsidence, or effects on existing permit holders or other groundwater users within the district.

Moreover, if the district approves an application for an out-of-district transfer, then the district must specify the amount of water that may be transferred and the period for which the water may be transferred.

However, to perform all of these tasks requires revenues. Under current state law, groundwater conservation districts (GWCDs) may levy ad valorem taxes at a rate not to exceed 50 cents per $100 assessed valuation, in order to pay for maintenance and operating expenses. Further, GWCDs may assess fees for administrative services such as permit application fees or water analysis fees, and GWCDs may receive grants and/or donations from local, state, or federal agencies, private individuals, companies, or corporations for specific projects or research. Finally, GWCDs may issue and sell bonds for capital improvements such as building dams (for recharge), installing pumps and equipment, and providing facilities for aquifer recharge or the transportation and sale of water.

Oversight and Enforcement of Groundwater Conservation Districts

Recognizing that approximately 60% of the state's water need is supplied by groundwater, SB 1 (75th Session, 1997) established increased oversight of, and accountability for, GWCDs' activities. Specifically, SB 1 requires TNRCC to initiate appropriate enforcement actions against a GWCD that fails to submit a district management plan or that fails to have their plan certified by the TWDB. The range of responses for such failure could include dissolution of the district or the district's board. Additionally, SB 1 directs the State Auditor to conduct performance reviews every five years of each GWCD. The point of the audit is to determine whether a district is operational, i.e., actively engaged in meeting the goals and objectives set out in the district's management plans. Results of the audits are to be reported to the Legislature and to the TNRCC. SB 1 requires the TNRCC to initiate enforcement actions against a GWCD that is found to be non-operational by the State Auditor. Reports of the Audits and enforcement actions involving GWCDs are submitted to the Legislature biennially.

In August, 2000, the State Auditor's Office released its "Phase One" audit report in which it reviewed nine GWCDs. Of the nine local GWCDs audited, six were determined to be operational. By implementing their management plans, these districts were considered to be making good-faith efforts to conserve and protect the groundwater they administer. However, two of the districts were not operational and failed to provide any assurances that they appropriately manage their groundwater. In November 2000, the

TNRCC sent letters encouraging these two districts to voluntarily move toward compliance. The last district's status could not be determined because its two objectives were not auditable. The auditor's report stressed that they assessed only the implementation, not the quality, of the districts' plans.

Key Facts and Findings of the State Auditor's Review of Districts

- Six districts were deemed operational: Barton Springs/Edwards Aquifer Conservation District, Headwaters Underground Water Conservation District (UWCD), High Plains UWCD, Irion County Water Conservation District (WCD), Lipan-Kickapoo WCD, and Mesa UWCD. These districts were also found to be in full or partial compliance with audited statutory requirements.
- Two districts were determined to be non-operational: Hudspeth County Underground Water District and Live Oak UWCD. These districts were also found to be not in compliance with one or more of the audited statutory requirements.
- The auditor's office could not determine whether the final district, Sterling County UWCD, is operational. The Auditors review noted that this district is not in compliance with one of the statutory requirements audited.
- Across districts, the main areas of noncompliance or partial compliance with statute are development of certain policies and budget components.
- Two of the nine districts' management plans lack goals or objectives to manage the majority of their programs or activities.

SB 1911 (76th Session) and Why

In the half century following the passage of the Texas Groundwater Act in 1949, approximately 45 groundwater conservation districts were created, either by special law, general law, or petition process through the TNRCC. However, during the 140 days of the 76th Texas Legislature's Regular Session in 1999, legislation was filed seeking to create 23 new districts – primarily along single-county lines and with no apparent focus on the need for coordinated management of underlying aquifers.

This attempted proliferation of single-county districts stood in marked contrast to the earliest development of groundwater districts in Texas. Of the groundwater districts created from 1949 through 1984, more than 70 percent were organized along multi-county lines, primarily in an attempt to manage significant portions of major aquifers threatened by overpumping, such as the Ogallala. These early districts recognized the need for a district to have a size and revenue stream that would allow them to address the problems they were created to solve in the first place.

Since the passage of the Brown-Lewis Water Management Plan in 1997 (SB 1, 75th Session), much reliance has been placed on the statutory admonition that "locally controlled groundwater conservation districts are the state's preferred method of managing groundwater resources."[8] Everyone from the individuals advocating single-county groundwater districts to the Texas Supreme Court has taken notice of that phrase. However, the context in which that phrase was adopted must also be taken into consideration.

[8] TEX. WATER CODE ANN. §36.0015 (Vernon Supp. 2000).

During the deliberations over groundwater management provisions in SB 1, considerable attention was focused on the issue of "shell" districts – groundwater districts that had been historically inactive and/or demonstrated little inclination to pursue significant management of the underlying groundwater supply. One way in which SB 1 sought to strengthen groundwater management in Texas was through increased accountability for groundwater districts, primarily through stiffer management plan and enforcement provisions and a regular review by the State Auditor's Office.

Thus, groundwater districts are the preferred method for groundwater management in Texas – with the significant proviso that the district is in compliance with Chapter 36 of the Texas Water Code, especially those provisions that require the district to be actively engaged in efforts to achieve the goals and objectives set out in a district's management plan.

As noted above, during the 1999 legislative session, interests from across the state sought to create groundwater districts - nearly exclusively along single-county lines. The justifications for seeking a district were varied. In some instances, counties were seeking a means to prevent increased or continued drawdown of groundwater supplies as a result of rapid growth and development within unincorporated areas. In many cases, people were seeking to create groundwater districts primarily to prevent export of groundwater from rural areas to large metropolitan areas. In a few instances, districts were sought as a vehicle for marketing excess groundwater supplies to urban areas.

Predominant unifying themes linking these 1999 district-creation efforts were:

- serious concerns that groundwater districts were necessary to **protect** groundwater supplies, because the junior rights provision on interbasin transfers of surface water was forcing those seeking water to turn away from surface water, and look to groundwater, thus increasing pressure on less-renewable groundwater supplies; and
- the proposed districts were based on political boundaries as opposed to hydrologic boundaries. (For example, representatives of two adjacent, single-county proposed districts, overlying the same groundwater source, testified that they had tried to work with their adjacent counties but that they couldn't find significant interest in coordinated management.)

One of the reasons the 76th Legislature chose to delay the creation of this plethora of new groundwater districts was the schedule for development and adoption of the regional water plans under the state water planning process set out in the Brown Lewis Water Management Plan (BLWMP). The BLWMP requires the **initial** round of regional water plans, which are due to the Texas Water Development Board by January 5, 2001, to "consider" the certified district management plans of any groundwater district within the respective water planning region. Thereafter, groundwater district management plans must be "consistent" with the approved regional water plans. One concern raised during the 76th Session was that a proliferation of new districts (all of which would then be developing district management plans) could unnecessarily complicate the planning efforts already in progress.

The Brown Lewis Water Management Plan embodied the maxim that groundwater districts are the state's preferred method of groundwater management in this state, by allowing a framework for proposed districts to opt into a temporary status over the subsequent biennium. SB 1911 requires that the temporary districts it created would not achieve permanent status unless ratified by a positive act of the 77th Texas Legislature. In addition, SB 1911 was enacted with the understanding that groundwater management would be the subject of an intense legislative interim study. SB 1911 was not intended as a punitive measure, nor as an enduring moratorium on the creation of new groundwater districts. Rather, SB 1911 sought to ensure that the newly-proposed districts would have the benefit of a considered and measured approach to groundwater district creation.

Indeed, testimony and studies presented to the Committee throughout the interim attest to widespread consensus that pressures on groundwater supplies across the state are increasing dramatically, and are largely attributable to the junior rights provisions' chilling effect on interbasin transfers of surface water. The logical development arising from the interim Committee's deliberations is that future water legislation will need to conjunctively address both surface water and groundwater management scenarios.

Existing and future groundwater districts across the state will be faced with making difficult and likely unpopular decisions as they manage the state's dwindling groundwater supplies. However, those types of decisions are more easily made and implemented when those affected by the decisions understand why they have to be made and that they have to be made. To that end, SB 1911:

- sought to ensure that any newly created groundwater districts would be headed down a road to effective groundwater management; and
- advanced the fundamental tenet of SB 1 – that water management policy in Texas requires the participation and input of all significantly affected parties.

Whether future groundwater conservation districts are created along single-or multi-county boundaries, or some other boundary, it is indisputable that they should be structured so as to be able to support themselves financially and to optimally manage the underlying aquifer. Of the 63 permanent and temporary groundwater conservation districts in Texas at this time, 43 are single-county or partial-county districts and 20 are multi-county districts.

Certainly there may be justification in some instances for single-county districts, such as when the differing tax bases in adjacent counties could result in an unfair subsidization of one district's activities by the property owners in the other district. However, this does not obviate the need for coordinated management of a finite natural resource necessary for the continued economic vitality of an area.

It is desirable, and achievable, for single-county districts to find ways to address concerns about regional groundwater management, while seeking to maintain, as practicable, a focus on the "local control" aspects of groundwater conservation districts. The Texas Water Code provides for joint planning by districts within the same Groundwater Management Area (GMA) or Priority Groundwater Management Area (PGMA). Specifically, Water Code Section 36.108 requires districts within the same management area to share their management plans and provides for voluntary meetings between districts to compare the effectiveness of their overall management plans and goals. Critics, however, contend that Sec. 36.108 does not go far enough in requiring an adequate level of cooperation between districts. This is due in part to the fact that only four of the seven general-law districts and 23 of the 56 special-law districts are within GMAs or PGMAs that contain another district with the potential for coordination. Also, although districts within management areas are required to share plans, the district boards are not required to meet or attempt to coordinate their plans.

There are model examples of voluntary coordination efforts. For example, in 1988, four districts in the San Angelo area formed the West Texas Regional Groundwater Alliance in an attempt to coordinate planning and management of the Edwards-Trinity Aquifer. The alliance has grown to include 11 districts today. These districts meet regularly and, in addition to learning from each other's experiences and expertise, have been able to "ratchet up" their regulations, particularly on well-spacing, to make them more coordinated with one another.

Another potential solution to the boundary debate is to appoint one manager for more than one district. Currently, four districts have managers that each manage two adjoining districts. For example, a single manager oversees the South Plains Underground Water Conservation District in Terry County and the Llano Estacado Underground Water Conservation District in Gaines County. Under this system, particularly for districts with less revenue, sharing the cost of a manager allows for increased funding for data collection efforts and education programs. Also, managers of two or more districts have been able to coordinate goals and management plans for the districts. Jointly managed districts operate under more of a hydrological management concept, yet the manager answers to each locally controlled board and each district retains its autonomy.

IMPROVING THE CURRENT SYSTEM -- WORK OF THE CONSENSUS GROUNDWATER STAKEHOLDERS GROUP

One component of the Senate Natural Resources Committee's interim study of the state's groundwater resources was the work of the Consensus Groundwater Stakeholder Group. In the interest of replicating the successes of the stakeholder process that led to the development of Senate Bill 1, the Senate Natural Resources Committee sought out the knowledge and insights of stakeholders actively involved in groundwater and groundwater district issues across the state.

The Committee's goal was to empower this Consensus Stakeholder Group to, free of political or legislative pressures, independently identify the most pressing groundwater management challenges facing Texas and to develop consensus policy recommendations to resolve those challenges.

To that end, in the Spring of 2000, the Senate Natural Resources Committee convened an initial forum of approximately 200 stakeholders. Through a self-selection process, this large forum evolved into the core group of about 31 individuals viewed as representing identifiable and diverse groundwater interests. The core group identified key issues to be addressed and met as breakout groups throughout the Summer months, with several meetings of the entire core group to consider recommendations. The Stakeholder Group developed significant and meaningful recommendations representing near-unanimous agreement in the following issue areas:

- **Science** (groundwater availability models and other groundwater data);
- **Groundwater District Boundaries, Coordination and Cooperation** (Management Areas and Joint Planning);
- **Groundwater District Permit Exemptions;**
- **Groundwater District Funding;**
- **Water Marketing and Exports; and**
- **Conservation and Drought Conditions Planning.**

The Consensus Stakeholder Group's complete report, which includes signature pages for all participants and a few brief dissenting opinions, can be found on the Texas Water Development Board's (TWDB) webpage. The following sections of this report provide a brief summary of the conclusions/recommendations developed by the subgroups, adopted by the full Consensus Groundwater Stakeholder Group, and submitted to the Senate Interim Natural Resources Committee.

1. SCIENCE

Problem/Policy Statement:

Sound science is necessary for the proper planning and management of groundwater. **The goal** of these recommendations is to improve groundwater availability data to be used by the state's groundwater managers and planners.

Recommendations:

1.1. Support the TWDB's groundwater availability modeling (GAM) program. (amend §16.012, Water Code)

1.2. Continue and expand the TWDB's Grants for Conservation Equipment Purchases program to include an increase in legislative appropriations and conservation-related equipment such as meters and data collection equipment. (amend §§15.434 and 15.471, Water Code)

1.3. Require the TWDB's currently voluntary water use survey to become mandatory, in order to improve its effectiveness in projecting future water use. (amend §16.012, Water Code)

1.4. Expand the state's real-time monitoring network for groundwater level measurements. (§16.012(b)(8) - (10), Water Code, authorizes current sampling. This recommendation would require additional appropriation to expand sampling program to include up to 400 monitoring wells.)

1.5. Provide additional appropriations and pay flexibility for the TWDB's staff for conducting groundwater modeling and data collections efforts -- due to private sector competition for technical positions.

2. Boundaries, Coordination and Cooperation: Management Areas and Priority Groundwater Management Areas (PGMAs)

Problem/Policy Statement:

The management of groundwater by locally-controlled districts has often created a tension between the desire to provide for local control of the resource and the need to implement effective management of a common, regional resource for the benefit of the public at large.

The primary concern regarding boundaries of groundwater districts is whether a district that only covers a portion of the aquifer can effectively manage that portion that is within its jurisdiction, since the district can not regulate pumpage outside of its jurisdiction. A district that covers a larger portion of an aquifer is typically better able to gather data and conduct studies of the aquifer as a whole, and in some cases, a multi-county may have more financial resources.

The existence of multiple districts over a single aquifer also has an impact on the effective management of that resource, due to differing regulatory objectives between districts.

Despite the potential benefits of managing larger portions of an aquifer under a single district, the political realities of the legislative process and the administrative burdens of the TNRCC-creation process often make it difficult for local citizens to create a multi-county district. **The goal** of this proposal is to create a system whereby locally-controlled districts can effectively manage what is in most cases a regional resource. This could be accomplished by encouraging the creation of regional or multi-county districts in areas of the state where it is feasible, and by dividing the state's aquifers into designated management areas, which would facilitate collaborative management efforts between districts sharing that management area.

Recommendations:

2.1. Streamline the process for designating management areas, and direct the TWDB, with assistance from the TNRCC, to complete, by September 1, 2003, the designation of management areas so as to cover all major and minor aquifers. (amend Chapter 35, Water Code)

2.2. Streamline the process for designating PGMAs, and direct the TNRCC, with assistance from the TWDB, to complete, by September 1, 2005, the designation of PGMAs where needed across all major and minor aquifers. Also, increase the study period for designating PGMAs from 25 to 50 years to be consistent with SB 1 regional water planning provisions. (amend Chapter 35, Water Code)

2.3. Direct the TNRCC to create districts in PGMAs within a specific time period of designating the PGMA. (amend Chapters 35 and 36, Water Code)

2.4. Encourage the TNRCC creation of districts by streamlining the process for landowner-petition creation and TNRCC creation. (amend Chapter 36, Water Code)

2.5. Encourage the boundaries of new districts to be based on designated management areas or PGMAs. (amend Chapter 36, Water Code)

2.6. Increase TNRCC flexibility in district creation. (amend Chapter 36, Water Code)

2.7. Authorize the TNRCC to recommend to the legislature the creation of a special district or amendment of an existing district, if the TNRCC determines that a pure Chapter 36 district is not appropriate for a certain management area or that territory should be added to an existing district. (amend Chapter 36, Water Code)

3. Boundaries, Coordination and District Creation: Joint Planning

Problem/Policy Statement:

Concerns were raised about the ability of districts to effectively manage groundwater outside their district boundaries, and the ability of the state to hold districts accountable. **The goal** of these proposals is to provide greater accountability for districts to their own constituencies, to other districts within their same management area, and to the state -- by enhancing regional communication and planning between districts.

Recommendations:

3.1. Require the coordinated development of consistent management plans by districts that share a management area. Authorize the TNRCC, in cases where no plan is submitted or when another district requests state action, to enforce the joint management of groundwater in designated management areas. (amend §§36.108 and 36.303, Water Code)

3.2. Delete provision related to removal of a district's taxing authority and replace it with language allowing the TNRCC to place a non-performing district into receivership. (amend §36.303, Water Code)

3.3. Amend Chapter 36, Water Code, to allow districts within the same management area, and possibly with adjoining management areas, to pool financial resources on an equitable basis to allow for joint aquifer modeling and studies, education programs, equipment, brush control projects, weather modification, etc.

4. Exemptions

Policy/Problem Statement:

These recommendations address the concern that statutory exemptions (§36.117, Water Code) prevent districts from being able to adequately manage the groundwater within their district boundaries. Critics of the exemptions argue that the exemptions provide an opportunity for abuse of groundwater resources and prevent the districts from procuring accurate data on groundwater resources. **The goal** of this proposal is to address the potential for harm to aquifers by abusing the current statutory exemptions by targeting the immediate problems caused by the current exemptions, while maintaining justified exemptions from district regulation for certain wells. (There are 11 recommendations, 4.1. though 4.11, proposed under this "Exemptions" Issue. All of them include statutory language to amend Chapter 36, Water Code.)

Recommendations:

Generally, these recommendations focus on existing exemptions for oil and gas production, mining operations, and wells for less than 25,000 gallons per day if for domestic or livestock or poultry uses (see explanations below). In addition, these recommendations would continue districts' ability to exempt wells on a district-by-district basis, and would also allow for an export fee to be assessed on any water withdrawn from exempted wells, if that water is transported for use outside the district.

- oil and gas production exemptions -- Consensus Group recommendations would limit existing district permit exemptions to only water supply wells that are (1) on the drilling rig site; (2) supplying a rig that is currently drilling or exploring, and (3) the responsibility of the person holding the drilling permit.
- mining operations exemptions -- Consensus Group recommendations would clarify that existing mining exemptions still apply for water being produced for "mining purposes" and for any use of that water in addition to mining purposes; but district permit requirements would apply for any water produced in addition to the water withdrawn for mining purposes.
- wells for less than 25,000 gallons per day if for domestic or livestock or poultry uses -- Consensus Group recommendations would limit this

exemption to wells on tracts of land **larger than 10 acres**. This recommendation addresses a concern that a current exemption from groundwater district permit requirements is beginning to have unintended consequences. Historically, the types of wells targeted by this exemption were traditional livestock and rural domestic wells -- but now, farms and ranches are being sold and divided into ranchettes and housing developments. These wells, by definition being exempted as domestic wells, are now viewed by some as posing a threat to the groundwater resources and to the remaining neighboring rural and agricultural users.

5. DISTRICT FUNDING

Problem/Policy Statement:

Funding for some districts is inadequate to accomplish their directive of efficient conservation and management. **The goal** of this proposal is to provide districts with adequate funding by clarifying and amending their ability to assess production fees.

Recommendations:

5.1. Production fee authority should be explicitly provided in Chapter 36, but only to newly created districts, and should include reasonable caps on the amount of fees that may be charged, as set forth under recommendation 5.2 below. Existing tax-funded districts that desire production fee authority should seek such authorization from the legislature. Districts that require fee authority exceeding the proposed caps should seek authorization from the legislature. The legislature should enable a district to ensure revenue adequate to support the district's activities. (amend §36.205, Water Code)

5.2. District production fees should be statutorily capped so that districts may assess an annual production fee of no more then one dollar per acre foot for water produced for use in irrigating agricultural crops or raising livestock and no more than ten dollars per acre foot for water produced for other purposes. (amend §36.205, Water Code)

5.3. Groundwater districts should be allowed to charge production fees on exempt users if the water is being sold. (amend §36.205, Water Code)

5.4. Groundwater districts should be authorized to charge production fees on groundwater used for secondary recovery of oil and gas, as such water is permanently lost from the hydrologic cycle. (amend §36.205, Water Code)

5.5. Support additional general revenue appropriations for Texas Water Development Board (TWDB) programs related to groundwater district funding and operations, including loans for district start-up costs and equipment utilized by districts, as well as additional appropriations to the TWDB for technical assistance to districts and to provide substantive review of groundwater management plans.

5.6. Support the legislative creation of a state fund for plugging abandoned and deteriorated water wells.

6. Water Marketing and Exports

Problem/Policy Statement:

For water markets to work effectively in Texas, both buyers and sellers need more certainty and consistency in the way groundwater is managed and permitted, including fees associated with exportation of water outside of a groundwater district's boundaries. **The goal** of this proposal is to reduce impediments to water marketing while ensuring the effective management and equitable regulation of the groundwater resources of the state.

Recommendations:

6.1. Remove junior water rights provision on interbasin transfers of surface water due to extensive balancing test in TWC §11.085 and to attempt to equalize the pressure on both surface water and groundwater resources of the state. (amend §11.085, Water Code)

6.2. Repeal export limitations and state that any movement of water outside of district boundaries would be subject to an export/transfer fee with some limitations to clarify that exports outside of district boundaries can not be prohibited and to provide the district with compensation for exporting a resource outside of their boundaries. (amend §§ 36.121 and 36.122, Water Code)

6.3. Support existing state policy that groundwater districts are the appropriate body to manage and regulate groundwater withdrawals in the state.

6.4. All groundwater production should be managed, regulated or limited based on a balance of right to use and the goals and objectives of management plans and on a rational, defensible, science-based district management plan. In addition, water produced for use outside of a district's boundaries should be managed, regulated, or limited based on these factors the same as in-district use. (amend 36.122, Water Code)

6.5. Authorize groundwater districts to assess an export fee or surcharge for water used outside of a district's boundaries with specific limitations. The statutory language suggested in this recommendation from the Consensus Group would authorize a district to assess an export fee not to exceed: (1) a fee negotiated by the district and the transporter; (2) the equivalent of the district's tax rate per hundred dollars of valuation for each thousand gallons of water transferred, or $0.025 per thousand gallons if the tax rate is less than $0.025 per hundred dollars of valuation; or (3) an additional 50 percent export surcharge in addition to their production fee, for water transferred. (amend § 36.122 Water Code)

7. Water Conservation and Drought Condition Planning

Problem/Policy Statement:

Existing statutory language does not go far enough to facilitate the regulation of groundwater to avoid waste and encourage beneficial use of the resource. **The goal** of this proposal is to provide districts with the ability to include water conservation and drought contingencies as management goals in district management plans.

Recommendation:

7.1. Include conservation and drought contingencies as management goals in district management plans. (Includes statutory language to amend §36.1071, Water Code)

ALTERNATIVE GROUNDWATER MANAGEMENT OPTIONS: APPROACHES USED BY OTHER STATES

The following section of this report, denoted by italic print, is excerpted from a paper submitted to the Senate Natural Resources Committee in October, 2000, by Ronald Kaiser, Frank Skillern and Bruce Lesikar entitled "Groundwater Management In Selected Western States: Options for Texas."

Prior to discussing four legal doctrines that have been used to allocate and manage groundwater in other states, the economic and environmental importance of groundwater may be illustrated by a few observations. These observations are equally applicable throughout the country and especially in the West.

First, groundwater is one of the Nation's and the West's most important natural resources. It is a principal reservoir of fresh water and is an important source of drinking water. About 25 percent of the nation's fresh water is estimated to be stored as groundwater.[9]

Second, groundwater supplies a diversity of agricultural, domestic, economic and environmental uses. Groundwater provides about 40 percent of the nation's public water supply, and is an important source of drinking water in every state.

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[9] Alley, W. *et al*. 1999, Sustainability of Ground-Water Resources, U. S. Geological Survey Circular 1186, p 7.

Third, groundwater is also the source for much of the water used for irrigation. Nationally, about 150 million acre-feet of surface and groundwater is withdrawn and used for irrigation with most of this used in the West. Nearly 40 percent of the irrigation water used in the United States comes from groundwater.[10] *By state, California is the largest user of irrigation water and together with Idaho, Colorado, Texas, Montana and Nebraska account for 60 percent of the nation's irrigation water use. Except for Nebraska which gets 77 percent and Texas which gets 67 percent of its irrigation water from groundwater, these other 3 western states rely predominately on surface water for irrigation.*[11]

Fourth, groundwater contributes to flow in many rivers and streams and has a strong influence on wetland habitat for plants and animals. Hydrologists estimate that groundwater may contribute up to 50 percent of stream flow in small and medium sized rivers. Groundwater contributions to all stream flow in the United States may be as great as 40 percent.[12]

Given population and growth trends in the West the pressure on groundwater resources is likely to increase in the future. In many regions of the country and in Texas, pumping demands on groundwater resources exceed natural recharge rates.

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[10] Solley, W. *et al.* 1998, Estimated use of water in the United States in 1995: U.S. Geological Survey Circular 1200, p 71.

[11] *Ibid.*

[12] Alley, W., *et al*. 1999, p 7.

Overdrafting of aquifers intensifies the pressure on state legislatures to carefully manage groundwater resources. A factor complicating this responsibility is that nearly all activities which effect groundwater management also impinge on private property rights to use groundwater. Property rights to use groundwater are based on four legal theories or doctrines. All states use one or a combination of these doctrines to allocate and protect private rights to use groundwater and to resolve disputes when resources become scarce.

OVERVIEW OF GROUNDWATER RULES[13]

Four systems or doctrines have been used in the United States to determine who should have the privilege to use groundwater and how should conflicts be resolved when groundwater resources are not sufficient to satisfy all users. These doctrines are:

(A) Absolute Ownership/Capture Rule;

(B) Reasonable Use Rule;

(C) Correlative Rights Rule; and

(D) Prior Appropriation Rule.

At first, the rule of capture was adopted in early cases applying the common law of England. Later, states in the Eastern United States modified that rule by tempering it with "reasonableness" requirements. More recently, reasonable use has undergone

[13] Research for this section was provided by Katarzyna Brozynski, Jason Byrd, Brian Croyle, Russell Frost, and Majory Stewart, Law Students at Texas Tech University School of Law, under the direction of Frank F. Skillern, George W. McCleskey Professor of Water Law, TTU.

further changes that were developed largely in the Restatement (Second) of Torts, and its system is known as the Restatement Reasonable Use Doctrine. The third method of allocation is "Correlative Rights," which has been refined primarily in California. Lastly, several Western states have applied the doctrine of Prior Appropriation to groundwater resources, drawing on the rules applied to surface water rights. Most of these systems were developed by the courts on an ad hoc basis as cases arose.

These four rules address landowner rights and liabilities. The rights portion of the rules govern the withdrawal and consumption of groundwater for various purposes, such as agricultural, municipal, industrial and manufacturing, among competing users. Specifically, who may use ground water, in what quantities, for what purposes, and on what lands are some of the questions that have to be resolved.
The liabilities portion of the rules deal with resolving disputes when there is an insufficient supply of water to satisfy the needs of all rights holders. The types of problems that arise include well interference (one or more pumpers "drying up" shallower wells), overdrafts (withdrawals exceed recharge), mining (withdrawals from aquifer having no natural recharge), shortages (drought conditions reduce available supply), ecosystem impacts (critical environment supported by aquifer), and contamination (loss of supply by intrusion of chemicals or pollutants). How to conserve available supplies to meet future needs and how to avoid waste of available waters also must be addressed.

<u>Absolute Ownership/Capture Rule</u>

Background

Absolute ownership is the genesis doctrine from which the other groundwater rules have evolved. The basis for absolute ownership has been traced to the 1843 English case of Acton v. Blundell,[14] which established exclusive rights in a landowner to percolating groundwater beneath his land. The English rule "is founded on the idea that a landowner should have dominion over the percolating groundwater which underlies his land in much the same sense that he has dominion over the other elements in his subsoil."[15] It derives from the common law maxim of property, "cujus est solum, ejus est usque ad coelum et ad infernos" or "to whomever the soil belongs, he owns also to the sky and to the depths."[16] As such, it is a rule of property law and inherent in the ownership interests to land.

Rights under the Capture Rule

Basically, the rule of capture is an unqualified right of a landowner to withdraw unlimited amounts of water found beneath the land.

Liability under the Capture Rule

No liability is imposed on a landowner for harm caused to a neighbor by interfering

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[14] 152 Eng. Rep. 1223 (1843).

[15] JOSEPH L. SAX, WATER LAW PLANNING AND POLICY 460-461 (Bobbs-Merrill Co. 1968).

[16] BLACK'S LAW DICTIONARY 341 (West 5th ed. 1979)

with or drying up the neighbor's well. The water extracted may be put to any use whether on the overlying land or elsewhere. The landowner does not have to "share" the loss by reducing withdrawals in times of drought or shortages, nor restrict withdrawals to "reasonable" amounts for the use of the land or for "beneficial" purposes. "Landowner owns percolating or diffused and percolating waters under his land and may make nonwasteful use of such waters at his will."[17] An appropriate conclusion is that a landowner is not allowed to waste groundwater. Waste is defined by statute in terms of beneficial use.

States that Follow the Capture Rule

Historically, many states followed the English common law rule, but today Texas is the last major state to adhere to it in its traditional form.

Arguments For and Against the Capture Rule

For:

+ Favors private decision-making regarding withdrawal and use of ground water.

+ Pumper not limited in the amount withdrawn and not liable to other pumpers for well interference, lowering the water table, or "mining" an aquifer.

+ Pumper free to use the water on overlying land or off-tract for any purposes that are not wasteful or maliciously injurious to others.

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[17] Pecos County WCID #1 v Williams (Civ. App. 1954) 271 S.W. 2d 503, ref. n.r.e.

Against:

– Could encourage short term benefit of individual pumpers without adequate consideration for future generations.

– Could encourage faster short-term development to assure that the supply is not lost to other pumpers.

– Could displace small pumpers who cannot afford the higher costs to deepen wells.

– Could discourage conservation because other pumpers will capture the savings.

– Can be a threat to rural domestic users without access to other water sources.

A Note on Texas Regarding Capture Rule

The common law rule of capture, commonly known as the "absolute ownership rule," was first applied in Texas by the supreme court in Houston T & C Ry. Co. v. East[18] *in 1904. In East the company withdrew ground water from land it owned and used it in maintenance shops nearby and for water for its locomotives. The company's pumping dried up wells of neighboring landowners, including East. The Texas*

[18] 98 Tex. 146, 81 S.W. 279 (1904).

Supreme Court expressly rejected East's arguments that a landowner's right was "correlative" or limited by a "reasonable use principle"[19] as well as the claim that the ground water had to be used on the overlying lands.

The Texas Supreme Court refused to limit the amount of water withdrawn by the company to avoid injury to a neighbor's well or to impose any monetary liability on the company for causing the neighbor's well to dry up. With the exception of wasting ground water or withdrawals made to maliciously injure another, no restrictions were suggested about the use of withdrawn water.

In areas outside of groundwater conservation districts, this rule has been consistently applied by Texas courts as a property right of a landowner without any liability for a) interference with a neighbor's well, b) excessive loss of withdrawn water by evaporation during transit to a distant point of use, or c) drying up springs. Notwithstanding the fact that Texas is the last major state to adhere to the rule of capture in its historical form, in 1999 the Texas Supreme Court unanimously re-affirmed the rule in Sipriano v. Great Spring Waters of America, Inc.[20] In Sipriano, the company was using larger wells to pump groundwater that was bottled and distributed for sale nationwide. Although allegations were made that the company's wells dried up the plaintiffs' smaller, domestic wells, under the rule of capture, no liability was imposed.

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[19] *Ibid.* at 281.

[20] 1 S.W.3d 75 (Tex. Sup. Ct. 1999).

Reasonable Use Rule

Background

Most eastern and mid-western states have modified the capture rule by adopting reasonable use criteria to resolve conflicts between competing well owners. The reasonable use rule developed out of a series of conflicts between cities that sunk high capacity wells in rural areas to extract groundwater for use in the city. To protect farmers and rural landowners from what the courts considered unfair competition and disparate economic power bases, courts modified the capture rule by imposing reasonableness restriction on all pumpers.[21]

Two variations of the rule have evolved based on where the water is ultimately used. The American Reasonable Use Rule, creates a preference for using water exclusively on the overlying land, or land within the basin. The second rule, the Restatement of Torts Rule, allows, under limited circumstances, water to be taken outside the confines of the basin. Both rules grant rights to the overlying landowner but they differ on the criteria used to measure reasonableness for off property uses.

Rights under the Reasonable Use Rule

As in the capture rule, overlying landowners have a legal right to pump water, from beneath their land and use it for a beneficial purpose.[22] *Under the "reasonable use" rule, no owner of overlying land can withdraw more than a reasonable amount of*

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[21] *Ibid.,* 4-12.

[22] Looney, *Modification of Arkansas Water Law: Issues Alternatives*, 38 Ark. L.Rev. 221, 245 (1984).

groundwater.[23]

Liability Under the Reasonable Use Rule

Under both the onsite use and the offsite use rules (see more detail below), conflicts between overlying landowner pumpers involving well interference and aquifer overdrafting are resolved by examining the pumping rates and uses against reasonableness criteria. This is usually done on a case-by-case basis. If landowner A's use of water is reasonable, even it if causes harm to landowner B, landowner A can still pump without liability to B. If the requirements of the rule are met, a landowner may withdraw groundwater even if doing so deprives another landowner of the reasonable use of the groundwater.[24]

Reasonableness of use is determined based on factors such as well location, amount of water, and the proposed use and placement of the water.[25] The rule prohibits waste to the extent that it deters unreasonable use.[26] Furthermore, the reasonable use rule does not create a right in a senior pumper to maintain the pressure of groundwater

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[23] See e.g., *Jarvis v. State Land Dep't*, 106 Ariz. 506, 479 P.2d 169 (1970); *Basset v. Salisbury Mfg. Co.*, 43 N.H. 569 (1862).

[24] A. Dan Tarlock, *Law of Water Rights and Resources*, § 4.02 [1] (2000).

[25] T. Henderson, J. Trauberman, & T. Gallagaher, GROUNDWATER STRATEGIES FOR STATE ACTION 31 (1984).

[26] See generally Moses, *Basic Groundwater Problems*, 14 Rocky Mtn. Min. L. Inst. 501, 509 (1969).

necessary to support the least expensive means of withdrawal.[27] The reasonable use doctrine does not provide a basis for adjusting or apportioning rights to a common ground water supply that is insufficient to satisfy all the demands or requirements of overlying landowners.

Reasonable Use–On Site.

Groundwater use is an incident of landownership under the reasonable use provided; (1) the use is reasonable, (2) the use is for the benefit of the overlying land, and (3) use on non-overlying land is per se unreasonable.[28] A number of states that have faced this issue have not strictly adhered to the on site rule and have allowed the transportation of groundwater off the land, or outside the boundaries of the aquifer so long as the use does not unreasonably interfere with neighboring landowners.[29] In some jurisdictions , the overlying landowner may withdraw water for reasonable use on the overlying land without incurring liability, even if the withdrawal causes

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[27] See A. Tarlock, *supra* note 25, §6.04[3]

[28] *Henderson v. Wade Sand & Gravel Co.*, 388 So.2d 900 (Ala. 1980); *Koch v. Wick,* 87 So.2d 47 (Fla. 1956) and Fla. Stat. Ann. Sec. 373.013 (1988 & Supp. 19890; *Bridgman v. Sanitary Dist. Of Decatur*, 164 Ill. App. 3d 287, 517 N.E.2d 309 (Ill. App. 4th Dist. 1987); *United Fuel Gas Co. v. Sawyers*, 259 S.W.2d 466 (Ky. 1953), *Finley v. Teeter Stone, Inc.*, 251 Md. 428, 248 A.2d 106 (1968); *Forbell v. City of New York*, 47 App. Div. 371, 61 N.Y.S. 1005 (1900), aff'd, 164 N.Y.522, 58 N.E. 644 (1900); *Rouse v. City of Kingston*, 188 N.C. 1, 123 S.E. 482 (1924); *Nashville C. & St. L. Ry. v. Rickert*, 19 Tenn. App. 446, 89 S.W.2d 889 (1935).

[29] *Paloma Inv. Ltd. Partnership v. Jenkins*, 978 P.2d 110 (Ariz 1999) and *Springer v. Kuhns,* 571 NW.2d 323 (Neb. 1997).

subsidence of surrounding land.[30] *Waste in a reasonable use state, in most instances, will only be enjoined if there is a concurrent injury associated with the waste.*[31]

Reasonable Use–Off Site

Although the Restatement (Second) of Torts Sec. 858 resembles aspects of the reasonable use and correlative rights rules, it significantly differs from both. The Restatement seeks to provide specific criteria for comparing the reasonableness of competing uses of groundwater. Accordingly, an overlying landowner is not liable for withdrawal of groundwater and use outside overlying land unless:

> *(1) the withdrawal unreasonably causes harm to a neighboring landowner by lowering the water table or reducing artesian pressure;*
>
> *(2) the withdrawal exceeds a reasonable share of the annual supply or total store of groundwater; or*
>
> *(3) the withdrawal has a direct and substantial effect upon a watercourse or lake and unreasonably causes harm to a person entitled to the use of such*

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[30] *Finley v. Teeter Stone, Inc.*, 251 Md. 428, 248 A.2d 106 (1968).

[31] *Prohosky v. Prudential Ins. Co.*, 767 F.2d 387 (7th Cir. 1985), *rev'g, Prohosky v. Prudential Ins. Co.,* 584 F.Supp. 1337 (N.D. Ind. 1984).

water.[32]

While this rule protects against overdrafting, it does not prevent water from being used outside the confines of the aquifer. Commentators suggest that the Restatement functions like the rule of capture for large pumpers but it gives a remedy to smaller pumpers who have been injured by the entry and actions of larger pumpers who are new to the basin.[33] *For example, where one irrigation well becomes inadequate when new irrigation wells are drilled into the same aquifer, the harm to the original well is not unreasonable if the owner is merely forced to deepen his well to the same level as the other wells and pay the same pumping costs.*

However, where a well is used only to supply a relatively small amount of water for domestic purposes -- a use that does not ordinarily support the cost of deep wells and expensive pumps -- the harm may be unreasonable where the bigger pump materially lowers the water table by making large withdrawals of water. This rule means that large irrigators should not be allowed to impose excessive economic costs upon smaller water users.[34]

States that Follow the Reasonable Use Rule

Alabama, Arizona, Florida, Iowa, Kentucky, Maryland, Michigan, Nebraska, New

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[32] A. Tarlock, *supra* note 25, § 4.06[5].

[33] *Ibid.* § 4-30.

[34] *See* Restatement (Second) of Torts, Section 858A, comment d (Tent. Draft No. 17, 1971).

Hampshire, New York, North Carolina, Ohio, Pennsylvania, Tennessee, West Virginia and Wisconsin have adopted the reasonable use rule.[35] *Illinois by statute has declared the rule of reasonable use applicable to groundwater withdrawals, and defined reasonable use as "the use of water to meet natural wants and fair share for artificial wants."*[36] *Other states, like Nebraska, adopted the reasonable use rule at one time but later replaced it with one that requires greater sharing among groundwater users, or with an administrative permit system.*

Oklahoma's Groundwater Law of 1972 altered the historical reasonable use standard for groundwater. The 1972 Groundwater Law provides regulations for the allocation of water for reasonable use.[37] *Under that law, groundwater users may now take water even though it will result in depletion above the average annual rate of recharge.*[38] *Several states that have dual systems of surface rights or an exclusive prior appropriation system for surface water also apply the American or reasonable use rule to groundwater. For example, Arizona applies a reasonable use standard for groundwater withdrawals outside of active groundwater management areas.*[39]

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[35] For a detailed discussion see Beck, R. (ed) Waters and Water Rights, Ch 23, pp 291-391.

[36] Ill. Rev. Stat ch. 5, p 1606.

[37] Okla. Stat. Tit. 82, § 1020.2 (1991).

[38] *Ibid*. at 42-43.

[39] *Bristor v. Cheatham*, 255 P.2d 173 (Ariz. 1953).

Arguments For and Against the Reasonable Use Rule

For:

+ Protects private property rights of overlying landowner.

+ Protects domestic wells from unreasonable pumping by cities and irrigators.

+ Provides protection to overlying landowners from harm caused by unreasonable pumping.

+ Protects landowners by reducing aquifer overdrafting, mining and loss of well head pressure.

+ Allows water to be transported off site to higher valued uses.

+ Prevents excessive pumping and water hogging.

+ Encourages social and political harmony by encouraging reasonable landowner negotiations by preventing unreasonable actions by larger pumpers.

+ Requires proof of actual harm.

+ Recognizes the connectivity of surface and groundwater and encourages conjunctive management.

+ Prevents any one person from overusing a common pool resource.

Against:

– Requires case-by-case, after-the-fact resolution.

– No proportional sharing.

– No precise measure of amount of water than can be pumped–amounts will vary over time.

Correlative Rights Rule

Background

This rule was developed by the California courts at the turn of the century, just before Texas adopted absolute ownership.[40] *California originally adopted the absolute ownership rule but found it unworkable in resolving a dispute between orange growers who used the water for irrigation and homeowners who used the water for domestic purposes.*

Rights under the Correlative Rights Rule

Correlative rights allocates the use of groundwater based on ownership of land above a basin or aquifer. Owners of land over an aquifer or basin are entitled to a reasonable share of the total supply. Each has an equal right of use that is not subject to temporal priority.

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[40] *Katz v. Walkinshaw*, 74 P. 766 (1903).

Liability under the Correlative Rights Rule

During shortages, each landowner is entitled to a fair and just proportion of the common pool. The share is determined by the ratio of the land owned overlying the basin, and the right of a non-pumping landowner is "inchoate" and may be undertaken at any time. In times of shortages, pumping is restricted to use on overlying land. However, of the states covered in this report, only California actually restricts pumpage to the overlying landowner. Oklahoma, for example, uses the correlative rights system and does not restrict pumpage to the overlying landowner.

States That Follow the Correlative Rights Rule

Initially, California was the state that developed and honed the correlative rights doctrine, and the system received attention from commentators. Minnesota has applied the rule for years, and Arkansas, Delaware, Missouri, Oklahoma and New Jersey have adopted it.[41]

Arguments For and Against the Correlative Rights Rule

For:

+ Protects property rights in water for landowner.

+ Proportional sharing of water determined by the ratio of land owned above the basin to its total area.

[41] A. Dan Tarlock, *supra* note 25 @ § 4.17.

+ Prevents landowners who own small tracts from taking more than their fair share.

+ During drought or water shortage, each owner gets a proportionate share of the available supply (definitions vary by state).

Against:

– Complicated calculations often are needed to determine safe annual yield to determine whether any water is surplus, not needed for use on overlying land, and thus, available for off-tract uses.

– Basin-wide district or management agency may be needed to administer correlative rights among users.

– Adjudication may ultimately be required to determine water rights in each aquifer.

<u>Prior Appropriation System</u>

Background

The prior appropriation doctrine is based on a temporal principle, "first in time, first in right." A person develops a right to use groundwater based on "appropriating" it by withdrawal from a basin and application to a beneficial use. The appropriation is perfected when water is put to a beneficial purpose, and that event determines the date for the appropriation. An appropriator is granted a permit for the quantity of water *actually applied to a beneficial use. Typically, a groundwater appropriator is protected to a "reasonable pumping level," not necessarily the historical level in cases of shallower wells.*

States that Follow the Prior Appropriation Rule

All the western states, except Arizona and California adhere to the doctrine or to a permit system. Thus, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming allocate groundwater based on the doctrine.

Arguments For and Against the Prior Appropriation Rule

For:

+ Assures a user of a quantified amount of water over a specified term for specific beneficial use(s).

+ Protects senior rights holders by providing certainty, consistency and predictability in the amount of water the permit holder can use.

+ Water marketing and transfers allowed.

+ Conjunctive management of interconnected surface and groundwater sources is possible.

Against:

– Requires an administrative system to administer permits.

– Without a safe yield mandate, aquifer overdraft and depletion are possible.

– New appropriators, typically larger users, have to consider impact on senior, often shallow, wells.

– Senior wells may be protected to a "reasonable pumping level" from interference by junior appropriators.

– Rights to groundwater use may be cancelled or subordinated by regulatory authority.

A Summary of the Groundwater Allocation Rules

The following table illustrates in summary form the similarities and differences among the various state systems of allocation for groundwater. In some areas of the country, increased demand for groundwater has resulted in aquifer overdrafting and mining. In response to these concerns most states have found the basic allocation rules to be lacking and have established critical basin study areas and experimented with some administrative regulations to address the specialized problems. Table 2 outlines how allocation rules function to address well interference, overdrafting and mining problems.

TABLE 2 Features of Ground Water Allocation Systems

GW Systems	Rights Holders	Amount of Water	Liability for Well Interference	Off-tract Use	Water Transfer	Aquifer mining	Conjunctive Magmt
Rule of Capture	*overlying landowner*	*unlimited*	*NONE*	*YES*	*YES*	*YES*	*Possible (Court Order or voluntarily e.g. Edwards)*
American Reasonable Use Rule	*SAME*	*"Reason-able" for beneficial use*	*YES, if unreasonable amount or off-tract use*	*NO*	*YES, within basin*	*NO*	*Possible*
Restatement Reasonable Use Rule	*SAME*	*SAME as ARU*	*YES, if unreasonable Amount and injurious*	*YES, if reason-able & no harm*	*YES*	*NO*	*Possible*
Correlative Right	*SAME*	*proportional share based on owner-ship of overlying land*	*YES, if exceed share and injurious*	*NO, unless surplus*	*YES, within basin and surplus*	*NO*	*NO*
Prior Appropriation	*SAME*	*specific quantity for beneficial use*	*NO, unless interfere with "reasonable pumping level" of other users*	*YES*	*YES, if not cause injury to other users*	*YES, unless public policy or admin. ban*	*YES, if PA applies to surface water rights*

Critical Areas Designations and District Approaches

Experiences from other states indicate that one, or a combination, of these four allocation rules cannot resolve all groundwater problems. States have legislatively supplemented the allocational rules by crafting groundwater management programs *to address specialized problems.*

States experiencing overdrafting, mining or subsidence problems, have adopted critical area legislation supplement state allocational rules (critical areas in Texas are now called priority groundwater management areas). This legislation typically allows states to designate areas for study. When the amount of available water has been established and it is determined that withdrawals exceed a numerical or conservation recharge rate, pumping can be controlled, limited, or suspended. In prior appropriation states new pumping can be prohibited. Arizona, California, Colorado, Idaho, Kansas, New Mexico, Nevada, Montana, Oregon, Texas, Washington and Wyoming all have legislation that allows for critical area designation and regulation. Designation, degree of control and local input patterns vary extensively among the states.

States following the prior appropriation system typically vest most of the supervisory authority for critical groundwater areas in a state water official, usually a state engineer. Local input in district creation and a local governing board may be authorized but these local boards are generally advisory in nature to the state water official. Colorado, Florida, Idaho, Kansas, Montana, Nevada, Washington and Wyoming exemplify this approach. In states that don't follow the prior appropriation system, such as California, and Texas, local officials have greater autonomy in aquifer control, regulation and management. Typically, these districts address specific problems that are not adequately handled under the general allocation rules.

Texas, for example, generally applies the common law rule of capture for groundwater, *except for areas located within a subsidence district or a local groundwater conservation district. Within a district, the rules adopted by the district's board will apply for allocation and use of the groundwater.*

A review of approaches used in selected states reveal the following types of specialized rules. The approaches include:

- *Legislative "cap" on withdrawals (Texas-Edwards Aquifer Authority);*
- *Conservation by waste reduction requirements and limitations on rights (Arizona);*
- *Retiring existing rights to reach level of "safe yield" (Arizona);*
- *Moratorium on new wells (Nebraska, Colorado);*
- *"Pooling arrangement" with flexible application provisions (Nebraska);*
- *"Critical township" districts' well spacing requirements limiting new wells (Nebraska);*
- *Division into 5 groundwater basins with different powers for management (Arizona, Florida);*
- *Municipal preference during overdraft (Florida);*
- *Aquifer management by State Engineer (New Mexico);*
- *Conservancy districts based on artesian basins (New Mexico);*
- *Critical groundwater districts based on overdraft conditions (Colorado, Kansas, Idaho, Nebraska).*

Critical area legislation offers the advantage of faster response to problems. The *legislature can set forth specific objectives to be attained and specific problems to be addressed by district management that is not possible under the four allocational rules.*

OPTIONS FOR THE FUTURE

Just as water has determined Texas' past, so too will water guide the state's future growth. The fundamental issue regarding the management of groundwater in Texas is the question of whether the state will continue to follow the rule of capture. As the Texas Supreme Court has observed: "Water regulation is essentially a legislative function."[42]

The Texas Legislature has delegated to groundwater conservation districts the responsibility for determining when, and how, the rule of capture is to be modified or limited. Since the first districts were created, the Legislature has also inexorably increased the powers of groundwater conservation districts. In the interests of accommodating the SB 1 planning efforts; the state's growing population and water demand projections; and optimizing the management of Texas' water resources, it is likely that the pace of increasing groundwater district powers will continue to accelerate. To this end, the Senate Interim Committee on Natural Resources recommends that the 77th Texas Legislature consider taking the following actions.

RECOMMENDATIONS

C Support the TWDB's groundwater availability modeling (GAM) program and support expansion of the program to include the state's minor aquifers.

[42]Barshop v. Medina County Underground Water Conservation Distr., 925 S.W. 2d 618, 633 (Tex. 1996)

- Continue and expand the TWDB's Grants for Conservation Equipment Purchases program to include an increase in legislative appropriations and conservation-related equipment such as meters and data collection equipment.

- Require the TWDB's currently voluntary water use survey to become mandatory, in order to improve its effectiveness in projecting future water use and to recognize outstanding water conservation.

- Expand the state's real-time monitoring network for groundwater level measurements.

- Streamline the process for designating management areas, and direct the TWDB, with assistance from the TNRCC, to complete, by September 1, 2003, the designation of management areas so as to cover all major and minor aquifers.

- Streamline the process for designating PGMAs, and direct the TNRCC, with assistance from the TWDB, to complete, by September 1, 2005, the designation of PGMAs where needed across all major and minor aquifers. Also, increase the study period for designating PGMAs from 25 to 50 years to be consistent with SB 1 regional water planning provisions.

- Direct the TNRCC to create districts in PGMAs within a specific time period of designating the PGMA.

- Encourage the TNRCC creation of districts by streamlining the process for landowner-petition creation and TNRCC creation.

- Encourage the boundaries of new districts to be based on designated management areas or PGMAs.

- Increase TNRCC flexibility in district creation.

- Authorize the TNRCC to recommend to the legislature the creation of a special district or amendment of an existing district, if the TNRCC determines that a pure Chapter 36 district is not appropriate for a certain management area or that territory should be added to an existing district.

- Require the coordinated development of consistent management plans by districts that share a management area. Authorize the TNRCC, under the following circumstances, to enforce the joint management of groundwater in designated management areas:
  - in cases where no plan is submitted,
  - when another district can show good cause for, and requests, state action, or
  - if depletion rate in the aquifer exceeds the rate of depletion projected for that aquifer in the regional water plan or in the districts' management plans.

- Amend Section 36.303, Water Code, to delete the provision related to removal of a district's taxing authority and replace it with language allowing the TNRCC to place a non-performing district into receivership.

- Allow districts within the same management area, and possibly with adjoining management areas, to pool financial resources on an equitable basis to allow for joint efforts such as aquifer modeling and studies, education programs, equipment, brush control projects, weather modification.

- The legislature should enable groundwater conservation districts to ensure revenue adequate to support the district's activities.

- Remove junior water rights provision on interbasin transfers of surface water due to extensive balancing test in TWC §11.085 and to attempt to equalize the pressure on both surface water and groundwater resources of the state.

- Repeal groundwater export limitations.

- Support existing state policy that groundwater districts are the appropriate body to manage and regulate groundwater withdrawals in the state.

- Groundwater produced for use outside of a district's boundaries should be managed, regulated, or limited based on the same factors used to manage, regulate or limit in-district use, including the number of and procedures associated with district permit application requirements.

- Authorize groundwater districts to assess an export fee or surcharge for water used outside of a district's boundaries with specific limitations, including stipulation that such a fee or surcharge can not be used to prohibit exports. Provide that fifty percent of revenues from export fee or surcharge go to a state fund earmarked for water infrastructure financing.

C Include conservation and drought contingencies as management goals in district management plans.

C The Legislature should evaluate the temporary districts created by SB 1911 (76th Session) and ratify those SB 1911 districts that have demonstrated good faith efforts to implement the directives laid out in SB 1911.

APPENDIX A

WITNESSES APPEARING BEFORE THE INTERIM COMMITTEE ON NATURAL RESOURCES REGARDING TEXAS GROUNDWATER RESOURCES

September 29, 1999 - Austin, Texas
Jeff Saitas, TNRCC
Craig Pedersen, TWDB
Melanie Best, Office of the Secretary of State
Robert Garza, Office of the Secretary of State

October 26, 1999 - Amarillo, Texas
Susan Combs, Department of Agriculture
C.E. Williams, Panhandle Groundwater District
Richard Bowers, North Plains Groundwater Conservation District
Michael Diller, Dallam County UWCD1
Patricia Neusch, STAND
A. Wayne Wyatt, High Plains UWCD
Harvey Everheart, Mesa UWCD
Jeri Osborne, Carson County resident
Ross Wilson, Texas Cattle Feeders Association

November 22, 1999 - Victoria, Texas
Gary Middleton, City of Victoria
John Burke, self
Carolyn Brittin, TWDB
Bob Weiss, Region P
Ronald Gerston, Wharton County Water Council

January 31, 2000 - San Antonio, Texas

Mary Q. Kelly, San Antonio Water System

Michael Thuss, San Antonio Water System
Russell Johnson, San Antonio Water System
Clyde Haak, BMA Water District
Thomas C. Moreno, Bexar Metro Water District
Jay Millikin, Comal County
Jill Sondeen, Southeast Trinity Groundwater Conservation District
Gregory Ellis, Edwards Aquifer Authority
Luana Buckner, Medina County Groundwater District
Bill Clayton, Uvalde Underground Water Conservation District
Retta Martin, City of Blanco
Mike Mahoney, Evergreen Underground Water Conservation District
Catherine Itz, Citizens for Groundwater Conservation
Shirley Beck, Citizens for Groundwater Conservation
Dennis Clark, Crockett County W.C. & I.D. #1
Mary Fenstermaker, N.W. Bexar County
Victor Tellez, Blanco County

February 23, 2000 - El Paso
Cindy Cawley, Plateau UWCSD/Sutton County UWCD
Janet Adams, Jeff Davis County UWCD
Katy Hoskins, Culberson County Groundwater Conservation District
Kerr Mitchell, Presidio County UWCD
Scott Holland, Irion County WCD & Sterling County UWCD

March 8, 2000 - Galveston Texas
Carolyn Brittin, TWDB
Ronald Neighbors, Harris Galveston Coastal Subsidence District

April 20, 2000 - Dallas, Texas
Carolyn Brittin, TWDB
Ron Pedde, TNRCC
Todd Chenoweth, TNRCC
Frank Espino, TNRCC
Sid Slocum, TNRCC

Michael Honeycutt, TNRCC
Bill Riley, Brazos Valley Groundwater Conservation District
John Burke, Lost Pines Groundwater Conservation District
Terrace Stewart, City of Dallas Water Utilities
Irvin M. Rice, Trinity Improvement Association

May 12, 2000 - Brownsville, Texas
John Baker, TNRCC
Carolyn Brittin, TWDB
Wayne Halbert, TX Irrigation Council

June 29, 2000 - Corpus Christi, Texas
Carolyn Brittin, TWDB
James Dodson, Nueces River Authority
Pat Hubert, RWPG
Jack Nelson, Lavaca-Navidad River Authority

APPENDIX B

Groundwater Availability Models

1. Trinity (Hill Country)

Description: The Trinity aquifer in the Hill Country
Author: Texas Water Development Board
Status: Model is completed and a final report posted on the TWDB Web page. Printed Report to be available in December 2000.

2. Hueco Bolson

Description: The Hueco Bolson aquifer in the El Paso area
Author: U.S. Geological Survey
Status: Model is completed and a final report is expected at the end of 2000.

3. Ogallala (northern part)

Description: The northern part of the Ogallala aquifer in Texas (including Amarillo and north of Amarillo)
Author: Bureau of Economic Geology/Texas Water Development Board through the Panhandle Water Planning Group
Status: Model is completed and a draft report has been delivered. A final report is expected in January 2001.

4. Edwards (Barton Springs segment)

Description: The Barton Springs segment of the Edwards aquifer (south of the Colorado River and north of Kyle)
Author: Bureau of Economic Geology/Texas Water Development Board through

the Lower Colorado Water Planning Group
Status: Model is completed and a draft report has been delivered. A final report is expected in January 2001.

5. Lower Rio Grande Valley

Description: The Gulf Coast aquifer in the Lower Rio Grande Valley
Author: Texas Water Development Board
Status: Work on the model continues. A final report is expected at the end of 2001.

6. Edwards-Trinity Plateau aquifer

Description: The Edwards-Trinity Plateau aquifer
Author: Texas Water Development Board
Status: Work on the model continues. A final report is expected at the end of 2001.

7. Ogallala (southern part)

Description: The southern part of the Ogallala aquifer (south of Amarillo)
Author: Contractor to the Texas Water Development Board
Status: We are currently reviewing contractor qualifications and expect work to begin in January 2001. We have funding for FY 2001 for this project.

8. Gulf Coast (central part)

Description: The central (Coastal Bend) part of the Gulf Coast aquifer (south of Houston and north of the Rio Grande Valley)
Author: Contractor to the Texas Water Development Board
Status: We are currently reviewing contractor qualifications and expect work to begin in January 2001. We have funding for FY 2001 for the project.

9. Carrizo-Wilcox (nothern part)

Description: The southern part of the Carrizo-Wicox aquifer (approximately north of the Trinity River)
Author: Contractor to the Texas Water Development Board
Status: We are currently reviewing contractor qualifications and expect work to begin in January 2001. We have funding for FY 2001 for this project.

10. Carrizo-Wilcox (central part)

Description: The central part of the Carrizo-Wilcox aquifer (approximately south of the Trinity River and north of Cibolo Creek)
Author: Contractor to the Texas Water Development Board
Status: We are currently reviewing contractor qualifications and expect work to begin in January 2001. We have funding for the FY 2001 for this project.

11. Carrizo-Wilcox (southern part)

Description: The southern part of the Carrizo-Wilcox aquifer (south of Cibolo Creek)
Author: Contractor to the Texas Water Development Board
Status: We are currently reviewing contractor qualifications and expect work to begin in January 2001. We have funding for the FY 2001 for this project.

12. Gulf Coast (northern part)

Description: The northern part of the Gulf Coast aquifer
Author: U.S. Geological Survey for the Harris-Galveston Coastal Subsidence District, Texas Water Development Board, City of Houston, San Jacinto River Authority, and the Fort Bend Subsidence District
Status: Work started in 2000 and continues with a final report expected at the end of 2003. The Texas Water Development Board has contributed $300,000 of GAM money to this project.

13. Edwards (San Antonio segment)

Description: TheSan Antonio segment of the Edwards aquifer
Author: U.S. Geological Survey and Bureau of Economic Geology fot the Edwards Aquifer Authority
Status: Work started on this model in summer 2000, and a final report is expected at the end of 2003. The Edwards Aquifer Authority and U.S. Geological Survey are funding this project.

14. Edwards (northern segment)

Description: The Northern part of the Edwards aquifer (north of the Colorado River)
Author: Texas Water Development Board
Status: Work is expected to start at the end of 2001, and a final report is expected at the end of 2003.

15. Trinity (northern part)

Description: The northern part of the Trinity aquifer (north of the Colorado River)
Author: Contractor to the Texas Water Development Board
Status: Work is expected to start at the end of 2002, and a final report is expected at the end of 2004.

16. Seymour

Description: The Seymour aquifer
Author: Contractor to the Texas Water Development Board
Status: Work is expected to start at the end of 2002, and a final report is expected at the end of 2004.

17. Pecos Alluvium

Description: The Pecos Alluvium aquifer
Author: Contractor to the Texas Water Development Board
Status: Work is expected to start at the end of 2002, and a final report is expected at the end of 2004.