HOUSE COMMITTEE ON NATURAL RESOURCES
TEXAS HOUSE OF REPRESENTATIVES
INTERIM REPORT 2000

A REPORT TO THE
HOUSE OF REPRESENTATIVES
77TH TEXAS LEGISLATURE

DAVID COUNTS
CHAIRMAN

COMMITTEE CLERK
JENNIFER B. MODGLING

Committee On
Natural Resources

December 5, 2000

David Counts
Chairman

P.O. Box 2910
Austin, Texas 78768-2910

The Honorable James E. "Pete" Laney
Speaker, Texas House of Representatives
Members of the Texas House of Representatives
Texas State Capitol, Rm. 2W.13
Austin, Texas 78701

Dear Mr. Speaker and Fellow Members:

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

Respectfully submitted,

David Counts, Chairman

Robert L. “Robby” Cook

Frank Corte

Peggy Hamric

Tracy O. King

Ron E. Lewis

Robert Puente

John Shields

Gary L. Walker

Tracy O. King
Vice-Chairman

Members: Robert L. “Robby” Cook, Frank Corte, Peggy Hamric, Ron E. Lewis, Robert Puente, John Shields, Gary L. Walker

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INTRODUCTION

At the beginning of the 76th Legislature, the Honorable James E. "Pete" Laney, Speaker of the Texas House of Representatives, appointed nine members to the House Committee on Natural Resources ("the committee"). The committee membership included the following: Representatives David Counts (Chairman), Tracy O. King (Vice-Chairman), Robert L. "Robby" Cook, Frank Corte, Peggy Hamric, Ron E. Lewis, Robert R. Puente, John Shields, and Gary L. Walker.

During the interim, the committee was assigned four charges by the Speaker:

1. Study all issues related to groundwater availability, including the role and needs of groundwater conservation districts to ensure effective management of the resource. Consider the effectiveness and feasibility of aquifer-based management, and the adequacy of data and modeling for regional water planning efforts. Assess the implementation of SB 1911, enacted by the 76th Legislature.

2. Assess the condition of abandoned or deteriorated water wells and the need for state and local involvement to address potential problems.

3. Study the state's criteria and regulations for determining potential sites for wetlands mitigation efforts.

4. Conduct active oversight of the agencies under the committee's jurisdiction.

In order to undertake the charges efficiently and effectively, Chairman Counts appointed subcommittees to address two of the charges. The first interim charge related to groundwater management and the charge to conduct active oversight of agencies under the committee's jurisdiction were undertaken by the committee as a whole.

The committee and subcommittees have completed their hearings and investigations and have issued their respective reports. The Committee on Natural Resources has adopted and approved the reports of all subcommittees, which are incorporated along with the report undertaken by the committee as a whole, as the following final report for the entire committee.

Finally, the committee wishes to express appreciation to the federal and state agencies, local governments, public and private interests, and concerned citizens who testified at the hearings for their time and efforts on behalf of the committee.

HOUSE COMMITTEE ON NATURAL RESOURCES

INTERIM STUDY CHARGES AND SUBCOMMITTEE ASSIGNMENTS

SUBCOMMITTEE ON ABANDONED WATER WELLS

CHARGE Assess the condition of abandoned or deteriorated water wells and the need for state and local involvement to address potential problems.

Tracy O. King, Co-Chair
Robert R. Puente, Co-Chair
Frank Corte
David Counts
Gary L. Walker

SUBCOMMITTEE ON WETLANDS MITIGATION

CHARGE Study the state's criteria and regulations for determining potential sites for wetlands mitigation efforts.

Robert L. “Robby” Cook, Chair
David Counts
Peggy Hamric
Ron E. Lewis
John Shields

GROUNDWATER

GROUNDWATER

INTRODUCTION

In December 1999, the Honorable James E. "Pete" Laney, Speaker of the Texas House of Representatives, charged the House Committee on Natural Resources with studying all issues related to groundwater availability, including the role and needs of groundwater conservation districts to ensure effective management of the resource. This charge also included considering the effectiveness and feasibility of aquifer-based management, and the adequacy of data and modeling for regional water planning efforts, and assessing the implementation of SB 1911, enacted by the 76th Legislature. This charge was undertaken by the committee as a whole.

BACKGROUND

Groundwater is a major water resource in Texas, supplying approximately 9.4 million acre-feet of water or 57 percent of the total water used statewide according to data supplied by the Texas Water Development Board in Water for Texas: A Consensus-Based Update to the State Water Plan (August 1997). Adequate groundwater supplies are crucial to the state's future and economic growth, and Senate Bill 1 (SB 1), Acts of the 75th Legislature 1997, clearly recognized the importance of this water supply to individual citizens, cities and counties, agriculture, and industry. SB 1 authorized more aggressive management of groundwater resources at local levels, provided more tools to adequately manage the resource, and required more accountability when management of that resource is undertaken.[1] This legislation also recognized that groundwater conservation districts are the state's preferred method of groundwater management. In light of this, at least 30 groundwater conservation districts were proposed in the 76th legislative session. However, due to concerns raised in the Senate, these districts did not become law. Instead, a compromise bill, SB 1911, was passed into law which created 13 temporary districts with limited regulatory authority. These districts will have to be ratified by the next Legislature in order to continue.

GROUNDWATER AVAILABILITY

Agricultural and Municipal Uses

According to Water for Texas: A Consensus-Based Update to the State Water Plan, more than 80 percent of the 9.4 million acre-feet of groundwater used in Texas is for agricultural water use followed by only 15 percent for municipal purposes. However, total groundwater use in Texas is expected to decline to around 4.6 million acre-feet by the year 2050, and agriculture's share of groundwater resources will decline to about 59 percent of total state use. With the use of groundwater for irrigation falling and municipal groundwater use expected to remain constant statewide, municipal's share of total groundwater use should more than double by the year 2050.

Most groundwater used for agricultural purposes is used for irrigation. In fact, irrigated agriculture is the largest water user in Texas, accounting for more that 64 percent of the state's total water use. In

1990, water used for on-farm irrigation purposes totaled more that 9.5 million acre-feet. However, since 1974, water used for irrigation purposes has been steadily declining. There are several reasons for the decline in the amount of surface and groundwater required for irrigating crops in Texas. Namely, irrigation management practices have improved, more efficient irrigation systems have been implemented, more irrigated cropland has been set aside in compliance with federal farm programs, and there has been a decline in the number of farms in the state. With continuing implementation of more water efficient irrigation systems, potential annual agricultural water savings are anticipated to reach 386,000 acre-feet by the year 2020 and are expected to increase further to 658,000 acre-feet by the year 2050.

Groundwater and surface water are also used in another major Texas agricultural industry. Texas is a major producer of livestock for domestic and foreign markets, and many livestock wells are supplied by groundwater sources. Many types of livestock are produced in Texas, including cattle, poultry, hogs, sheep, and goats. While livestock production in Texas generates about eight billion dollars for the Texas economy, surface and groundwater requirements for this industry are relatively minor in proportion to other water use categories. In fact, in 1990, water used for livestock watering is estimated at 274,000 acre-feet or about 1.7 percent of the state's total surface and groundwater use.

Oil and Gas Uses

In 1995, oil and gas exploration and production operators reported using 29,111 acre-feet of the total groundwater and surface water used statewide. Further, additional water used for oil and gas activities including drilling, cementing, completion, and stimulation amounted to approximately 5,155 acre-feet statewide. The combined total shows that the oil and gas exploration and production industry uses about 0.21 percent of all the fresh surface and groundwater used statewide.[2] However, most oil and gas production is limited to certain regions of the state. For instance, in many areas of West Texas, the percentage of fresh groundwater from the Ogallala Aquifer used for oil and gas exploration and production is significantly higher. In other words, while total fresh water used by the oil and gas industry statewide is marginal, in some areas of the state, this industry could be using a more significant portion of the population's total fresh water supply.

According to the Texas Oil and Gas Association, water is essential in almost every aspect of oil and gas exploration and production. They reported that of the total water used, however, only a fraction is fresh water, and, when fresh water is used, it is only used as a last resort. Statutes governing the use of fresh water in the oil and gas industry are found in Section 27.0511, Texas Water Code, which prohibits the use of fresh water for oil and gas production if another substance is "chemically compatible and economically available." Consequently, most water used in the oil and gas industry is produced water, which is often brackish, salty, and of poor quality.

Of the water used by the oil and gas industry, a significant amount is supplied by underground aquifers through the use of groundwater wells. Initially, water is used during road construction for surface compaction and dust control. Then, drilling the water well requires the use of water in order to protect any groundwater resources. While drilling, surface casing is set and cemented in the well (using water)

in order to seal off the aquifer formations from the drilling fluids used for the rest of the well. This casing is designed to withstand any anticipated pressure while the pipe is exposed to drilling fluids and is necessary to ensure that the casing does not rupture and result in contamination of the groundwater resources. Further drilling may also require the additional use of water in order to get the right mix of additives and weight to prevent an uncontrolled well situation and to protect formations.[3]

Water is also used by the oil and gas industry in enhanced oil recovery projects. In fact, a large majority of the oil produced in the Permian Basin is recovered using a production technique called "waterflooding." Using this technique, water or another substance is injected into the reservoir to increase the pressure and recover more oil. In waterflooding, the water most commonly produced with oil is usually saltwater. According to the Texas Oil and Gas Association, "waterflooding has increased our oil production in Texas by hundreds of thousands of barrels per day and our oil reserves by billions of barrels." [4]

Groundwater Availability Models

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 to the citizens of Texas. This data is being generated to help citizens ensure adequacy of groundwater supplies or recognition of inadequacy of groundwater supplies throughout a 50-year planning horizon.

GAM will result in computer models of groundwater flows in the major aquifers in the state which currently supply 95 percent of the groundwater produced. GAM will assist both groundwater conservation districts and regional water planning groups in managing groundwater resources and planning for future water supplies. Further, GAM will result in a greatly improved understanding of groundwater resources in the state, and each of the GAM models will be thoroughly documented and available to the public over the internet.

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, programmers instruct 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 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. After all of these steps are completed, the model can be used to make predictions. Further, after deciding how pumping and recharge will vary in the future, the model can also be used to predict how water levels will change over time. This includes consideration of possible future droughts to see how the aquifer responds to increased pumping and

decreased recharge. In fact, the consideration of droughts in model predictions will be extremely important for GAM.

Like many things technological, groundwater models can become obsolete over time. Computers and software are much more powerful today than they were 10 years or 20 years ago, and more powerful computers allow us to develop more powerful models. Also, as the aquifers are studied, we gain a greater understanding of how they work: an understanding that may not be included in the older models. GAM will result in models using an established and widely supported code, will standardize the organization of the model data, and will make the models freely available to the public. This standardization will make it easier to update the data sets and the models over time to ensure that these models exist as "living tools." Finally, the GAM models will build and improve upon previous models.

Further, GAM will be completed by Texas Water Development Board staff and its contractors, and it will be a public process that will include input from all levels of the public and private sector. Computer models of the major aquifers resulting from GAM are scheduled to be completed by September of 2004. These aquifers include the: Ogallala, Gulf Coast, Edwards, Carrizo-Wilcox, Trinity, Edwards-Trinity (Plateau), Seymour, Hueco-Mesilla Bolson, and Cenozoic-Pecos Alluvium. Currently, some of the aquifers are already in the process of having new models developed for them.

GROUNDWATER PROTECTION

The regulatory protection of groundwater is primarily the responsibility of the Texas Natural Resource Conservation Commission (TNRCC). However, certain aspects of groundwater regulatory protection are under the jurisdiction of the Railroad Commission of Texas (RRC), the Texas Department of Agriculture, and the Texas State Soil and Water Conservation Board. The Texas Alliance of Groundwater Districts, as an organization, has no regulatory or enforcement mandate, but individual groundwater districts often have authorities for action with regard to groundwater contamination. Further, the Texas Water Development Board (TWDB) has certain groundwater monitoring responsibilities and other state agencies conduct research activities related to groundwater.

The state's groundwater protection policy sets out nondegradation of the state's groundwater resources as the goal for all state programs and requires that quality should also be restored where possible. This policy recognizes the variability of the state's aquifers, the importance of maintaining water quality for existing and potential uses, the protection of the environment and the public health and welfare, and the maintenance and enhancement of the long-term economic health of the state.[5]

GROUNDWATER CONTAMINATION

According to the *Joint Groundwater Monitoring and Contamination Report - 1998* prepared by the Texas Groundwater Protection Committee, "groundwater contamination is the detrimental alteration of the naturally occurring physical, thermal, chemical, or biological quality of groundwater reasonably suspected of having been caused by the activities of entities under the jurisdiction (of the proper

regulatory state agencies)." The report also recognizes that groundwater contamination may result from many sources, including current and past oil and gas production and related practices, agricultural activities, industrial and manufacturing processes, commercial and business endeavors, domestic activities, and natural sources that may be influenced by, or may result from, human activities. In addition, the report states that the most common contaminants reported include gasoline, diesel, and other petroleum products.

In the report listed above, there are 7,627 individual documented cases of groundwater contamination. Approximately 99 percent of these cases are under the jurisdiction of the TNRCC. Another 94 cases are regulated by the RRC and 20 others by groundwater conservation districts which make up the Texas Alliance of Groundwater Districts.

TEXAS GROUNDWATER LAW[6]

In Texas, water rights depend on the location of water in the hydrological cycle, or the flow of water from rainfall to collection within the earth. Despite the connection between surface water and groundwater, the state has developed two different management systems.

Surface water in lakes and streams is owned publicly, and the use of such water is subject to permission by the TNRCC. The doctrine of "prior appropriation," codified in Water Code, sec. 11.027, gives priority to permit holders on the basis of seniority. Groundwater, on the other hand, is owned privately and controlled by the owner of the overlying land. Under the rule of capture, landowners may withdraw unlimited amounts of water lying beneath their land without liability to surrounding landowners.

The rule of capture originated with English common law and was applied first to the ownership of wild animals, providing that a person does not capture an animal until it is reduced to possession. The rule eventually was applied to oil and gas, minerals, and groundwater under the rationale that technology cannot locate these natural resources beneath the earth as it can locate surface water. Consequently, common law dictated that a landowner could use all the oil and gas, minerals, or groundwater that could be captured beneath the landowner's land and reduced to possession.

In 1904, the Texas Supreme Court adopted the rule of capture in *Houston & T.C. Ry. Co. v. East*, 81 S.W. 279 (Tex. 1904), allowing a landowner to pump as much groundwater as the landowner chooses, without liability to neighbors who might claim that pumping has depleted their wells. In *East*, the court explicitly rejected the "reasonable use" doctrine, which limits the use of water to the reasonable amount for the land from which it is produced. Under this doctrine, groundwater may be used without waste on overlying land. If used on non-overlying land, that use may not interfere unreasonably with use by other overlying landowners.

In adopting the rule of capture, the court cited two public policy reasons. First, the court noted that the "secret, occult, and concealed" nature of groundwater and its movement made regulation hopelessly uncertain. Second, the court determined that any attempt to apportion groundwater would discourage

both established and future water-development projects.

In 1917, Texas voters added Art. 16, sec. 59 to the Texas Constitution, known as the Conservation Amendment. This establishes that conservation, preservation, and development of the state's natural resources are duties of the state and that the Legislature shall enact all laws appropriate for this purpose. After droughts in 1910 and 1917, the Conservation Amendment was intended to enable lawmakers to fight water depletion and to make clear that the responsibility for a sustainable water supply lay with the Legislature. In all subsequent groundwater decisions, the Texas Supreme Court has reiterated the Legislature's broad power to regulate groundwater use, even within the common-law framework established by the rule of capture.

By the 1950s, scientific advances began to strip away the mysteries of groundwater. While the courts clung to the rule of capture, exceptions developed. In *East*, the Supreme Court had stated that captured water must be put to beneficial use and may not be wasted. In *City of Corpus Christi v. Pleasanton*, 276 S.W.2d 798 (Tex. 1955), the high court affirmed the rule of capture but prohibited a landowner from taking groundwater to injure a neighbor maliciously. In *Friendswood Development Co. v. Smith-Southwest Industries, Inc*., 576 S.W.2d 21 (Tex. 1978), the court held that a well owner can be held liable for negligently causing subsidence of surrounding land.

In May 1999, the Texas Supreme Court again considered the rule of capture in *Sipriano v. Great Springs Waters of America, et. al.*, 1 S.W.3d 75 (Tex. 1999). The plaintiff, a domestic well owner who claimed that nearby pumping by Great Springs, a.k.a. Ozarka Natural Spring Water Co., had dried up his well, asked the court to impose liability on landowners who "unreasonably" use groundwater to their neighbor's detriment. The court declined, unanimously affirming the rule of capture and citing the court's long-time reliance on the Legislature to regulate groundwater.

In *Sipriano*, the court cited the Legislature's 1997 enactment of SB 1, which, as part of a comprehensive water-management plan, streamlined the process for creating groundwater conservation districts and gave districts more authority to establish requirements for groundwater withdrawal permits. According to the court, before revising the common-law framework under which the Legislature crafted SB 1, it is appropriate to wait and see if this legislative action results in more prudent water management.

Many commentators agree, however, that the court's *Sipriano* opinion shows that it may not feel bound to the rule of capture in the future should SB 1 and any subsequent legislation prove unsuccessful in relieving groundwater over pumping. In his concurring opinion, Justice Nathan Hecht stated: "I agree with the Court that it would be inappropriate to disrupt the processes created and encouraged by the 1997 legislation before they have had a chance to work. I concur in the view that, for now — but I think only for now — *East* should not be overruled."[7]

GROUNDWATER LAW IN OTHER STATES[8]

The doctrine of *correlative rights*, which originated in California, pro-rates water among overlying

landowners. When conflicts or shortages occur, each owner is entitled to a proportionate share of available supplies. Unlike reasonable use, a correlative-rights system attempts to accommodate all overlying owners through ratable reductions when all reasonable needs cannot be met. Some argue, however, that such reductions, while guaranteeing all users some amount of water, do not take into account that some uses are more beneficial than others and perhaps warrant a larger ratable share.

Under *prior appropriation*, a state permit is required before a landowner may install or use a groundwater well. Permits reflect seniority, recognizing the better legal right in the first user. Landowners whose usage predates the permitting system receive "grand fathered" rights. Usually, groundwater permits are similar to surface water permits in requiring actual and beneficial use. Prior appropriation can apply to all groundwater, although in some states, the doctrine applies only to particular sources, such as underground streams (not defined as groundwater in Texas), or to areas where conflict is likely to arise.

Prior appropriation is designed to protect established investments in land, equipment, or business made with the expectation of a stable water supply. However, strict adherence to this doctrine usually is not practical as a means of allocation, as all pumping by junior water-rights holders will affect other, more senior, wells. Most prior-appropriation states temper the doctrine by setting reasonable pumping levels.

Sec. 858 of the *Restatement of Torts* (second edition) is entitled "Liability for Use of Groundwater." The restatement, developed by the American Law Institute, lays out the general common law of the United States in the form of model laws. Sec. 858 provides criteria for comparing the reasonableness of competing uses of groundwater. According to this rule, a well owner is not liable for withdrawal of groundwater unless the withdrawal:

- causes well interference by lowering the water table or reducing water pressure;
- results in pumping more than the well owner's reasonable share; or
- interferes with levels of streams and lakes that depend on groundwater.

Commentators argue that while the restatement protects against over pumping, it does not favor on-land use explicitly to encourage recharge of the underlying aquifer. Unlike correlative rights, allocation of groundwater under the restatement rule is not dictated by proportions of land ownership and can take into account uses that are more beneficial than others. Most states with a reasonable-use approach rely on some of the considerations discussed in the restatement.

Another common practice among western states with respect to groundwater is conjunctive management. Groundwater often is connected hydrologically to surface water. For example, seepage from a stream may recharge an underlying aquifer, or a particular stream may be aquifer-fed. Several states are managing interconnected, or tributary, surface and groundwater in a single system.

States such as California, Colorado, and New Mexico administer groundwater sources affected by or affecting surface water as part of the surface appropriation system. Oregon does not treat tributary water as part of the surface water system, but imposes certain conditions on groundwater that is

interconnected with surface supplies. Proponents argue that such a system recognizes the importance of the whole hydrological cycle and enables better management of water resources.

Some states, including Texas, operate under the legal assumption that surface and groundwater always operate independently. However, recent efforts to take a more hydrological approach in Texas include a requirement under SB 1 that groundwater districts coordinate their management plans with area surface-water management entities. Also, SB 1 requires the Texas Natural Resource Conservation Commission to consider groundwater or groundwater recharge effects of applications for surface-water permits.

GROUNDWATER CONSERVATION DISTRICTS

With the passage of SB 1, the Texas Legislature expressly recognized Groundwater Conservation Districts (GWCDs) as the state's preferred method of groundwater management.

Background

GWCDs were first authorized by the Texas Legislature in 1949, and the first districts were formed in 1951. Since that time, GWCDs have played an important role in the management of privately owned groundwater resources and the development of groundwater conservation education and research.[9] Specifically, GWCDs are charged to manage groundwater by providing for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater resources within their jurisdiction.

With few exceptions, GWCDs are governed by an elected board of five directors to eleven directors that generally serve staggered four-year terms. The board is responsible for the management of the district including the adoption of the district's policies, rules, and procedures. The board is also subject to open meetings and open records requirements.

In addition, all GWCDs operate from an annual budget with spending limited to budgeted items. Generally, GWCDs are financed through property taxes. Under state law, GWCDs may levy ad valorem taxes and assess fees for the maintenance and operation of the district.

Groundwater District Creation

GWCDs can be created in Texas by using one of three procedures:

(1) GWCDs can be established through the action of the Texas Legislature. Typical GWCD 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 legislation may differ in certain ways. For example, creation legislation may enable a district with additional authorities such as water control and improvement or limit a district's powers such as eminent domain or limit ad valorem

tax rates.

(2) A GWCD can also be created through landowner petition procedure based on law established in Subchapter B, Chapter 36, Texas Water Code. This procedure begins with a petition filed by property owners within the proposed district's area which is then considered by the Texas Natural Resource Conservation Commission (TNRCC). Initially, the TNRCC considers what management area boundaries would be appropriate and whether a district should be established. Then, the TNRCC considers the benefit of the proposed district's programs in its decision to create the district. If, after these considerations, the TNRCC acts favorably with regard to the petition, temporary directors are named and a confirmation election is held.

(3) Finally, a GWCD can be created by the TNRCC on its own motion in a designated priority groundwater management area through a procedure similar in principle to the petition method (2) above. However, in this instance, action is initiated by the TNRCC rather than landowner petition. This procedure involves extensive local participation through an advisory committee. If the TNRCC acts favorably on the proposed creation, temporary directors are named and a confirmation election is held.

With the passage of SB 1, some changes were made to the groundwater district creation process. Namely, SB 1 directed groundwater conservation districts created (but not confirmed) by Acts of the 71st through the 74th Texas Legislatures to hold a district confirmation election by September 1, 1999, or be automatically dissolved by the TNRCC.

Powers and Duties of Groundwater Districts

GWCDs are authorized with powers and duties that enable them to manage groundwater resources. The three primary GWCD authorities include: permitting water wells, developing a comprehensive management plan, and adopting the necessary rules to implement the management plan. The principal power a GWCD has to prevent waste of groundwater is to require that all wells, with certain exceptions, have permits. Namely, groundwater districts may adopt production limitations on the amount of groundwater a well may extract. These limits are typically based on the number of gallons a well may pump per minute, day, or per year. Wells with permits are also subject to rules governing spacing, drilling, equipping, and completion or alteration, which could result in a limitation of the number of wells in a given area.

Pollution is considered to be "waste" of groundwater, and a district has the statutory authority to make and enforce rules to prevent such waste. Sources of pollution may be from either surface water or from existing and future wells. GWCDs conduct groundwater quality, monitoring, establish a base for tracking water-quality trends and identifying possible contaminants. GWCDs also conduct groundwater quantity monitoring to establish a water availability baseline and characterize water use. In addition, GWCDs carry out research projects and collect information regarding the use of groundwater, water conservation, and the practicability of recharging groundwater to provide educational services about the resource and proposed conservation measures to the residents of the

district. 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.

Groundwater conservation districts are also authorized to create comprehensive management plans. These plans should identify the use and value of groundwater resources, existing and potential groundwater problems, and propose solutions to the problems. The management plan should also serve as a framework in establishing, guiding, and budgeting for district programs and activities to address the district's groundwater concerns. Finally, the GWCD must adopt rules to implement the management plan and address identified groundwater problems.

Under state law, GWCDs may also 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, installing pumps and equipment, and providing facilities for aquifer recharge or the transportation and sale of water.

Groundwater Conservation Districts and SB 1

With the passage of SB 1 in 1997, GWCDs were provided more resources and statutory options for managing groundwater. For example, SB 1 clarified the statutory authority of GWCDs regarding water well permitting and spelled out the information that a GWCD may require for a permit application for drilling, equipping, completing, or substantially changing the size or productive capacity of groundwater wells. Also, the TNRCC and TWDB were directed to provide technical assistance to the GWCDs, particularly in the development of their district management plans.

Greater accountability was also required from GWCDs with the passage of SB 1. For example, SB 1 requires that groundwater district management plans must be more comprehensive than past plans, and the plans must be reviewed and certified by the TWDB. In addition, groundwater conservation districts' plans must also now be consistent with regional water plans.

Further, if a groundwater district does not submit a management plan, then SB 1 requires the TNRCC to initiate appropriate actions to produce a comprehensive management plan, which could result in dissolution of the district. Finally, SB 1 directed the State Auditor to conduct a performance review on groundwater conservation districts in order to determine that the district is actively engaged in achieving management plan objectives.[10]

In response to this mandate, the Office of the State Auditor issued "An Audit Report on Groundwater Conservation Districts: Phase One" in August of 2000. In this report, the auditor's office outlines its findings for nine local groundwater conservation districts. The report represents the first phase of auditing by that office, and other groundwater districts will be audited in later phases. The report found

that six of the nine districts audited are operational, two are not operational, and the last district's status could not be determined because its two objectives are not auditable.[11]

Required Duties of Groundwater Conservation Districts

U Develop and adopt a comprehensive management plan for the most efficient use of groundwater, for controlling and preventing waste of groundwater, and for controlling and preventing subsidence, specifying in the management plan the acts, procedures, performance, and avoidance measures to effect the plans; adopt amendments as necessary; readopt the plan at least every five years (management plans and amendments must be submitted and certified by the TWDB and filed with other districts in a common management area)
U Adopt necessary rules to implement the management plan
U Require permits for drilling, equipping, or completing wells which produce more than 25,000 gallons per day or for alterations to well size or well pumps (districts must promptly consider and pass on permit applications; all wells producing at least 25,000 gallons per day in existence prior to the district's creation must be granted a permit)
U Require records to be kept of the drilling, equipping, and completion of water wells and the production and use of groundwater
U Require that water well driller's logs and electric logs be kept and filed with the district
U Make information on groundwater resources available to the TNRCC and the TWDB upon request
U Operate on the basis of a fiscal year
U Hold regular board meetings at least quarterly
U Prepare and approve an annual budget
U Name one or more banks to serve as the depository for district funds
U Have an audit of financial accounts prepared annually
U Keep a complete account of all meetings and proceedings and preserve minutes, contracts, records, notices, accounts, receipts, and other records
U Submit bonds and notes issued by the district to the Attorney General for examination

U Register board members with the TNRCC

Authorized Powers of Groundwater Conservation Districts

U Adopt rules to conserve, preserve, protect, recharge, and prevent waste of groundwater and control land subsidence
U Provide for the spacing of water wells and regulate the production of wells
U Enforce rules by injunction, mandatory injunction, or other appropriate remedy in a court of competent jurisdiction
U Acquire land to erect dams or drain lakes, draws, and depressions; construct dams, drain lakes, depressions, draws, and creeks; install pumps and other equipment necessary to recharge the groundwater reservoir; and provide facilities for the purchase, sale, transportation, and distribution of water
U Make surveys of the groundwater reservoir or subdivision and facilities for development, production, transportation, distribution, and use of groundwater
U Purchase, sell, transport, and distribute surface water or groundwater for any purpose
U Exercise the power of eminent domain to acquire by condemnation a fee simple or other interest in property located inside the district if the property interest is necessary to the exercise of the authority conferred by Chapter 36
U Carry out research projects and collect information regarding the use of groundwater, water conservation, and the practicability of recharging a groundwater reservoir
U Promulgate rules to require permits for transferring groundwater out of the district
U Require the owner or lessee of land on which an open or uncovered well is located to keep the well permanently closed or capped
U Levy taxes on an annual basis to pay bonds, operation, and maintenance expenses
U Set fees for administrative acts of the district and services provided outside of the district

U Apply for and receive grants or donations from local, state, or federal agencies, private individuals, companies, or corporations for specific projects or research
U Issue and sell bonds and notes in the name of the district

Groundwater District Boundaries[12]

Long-range planning efforts, originating with the enactment of SB 1, continued in the 1999 legislative session. The 76th Legislature considered creating at least 30 new groundwater districts. Considering the substantial authority of districts to restrict a landowner's ability to pump without limits, the abundance of proposed districts caused concern, especially since only 44 districts had been created and confirmed in the previous 50 years.

Sen. J.E. "Buster" Brown, chairman of the Senate Natural Resources Committee and author of SB 1, raised concerns that too many of the proposed districts were based on political boundaries (county lines) rather than on aquifer boundaries and that the districts' management activities might interfere with regional water-planning efforts under SB 1. Brown was concerned that the many districts' plans might conflict with recommendations from the 16 regional planning groups whose efforts will be part of the state's updated water plan in 2002. Therefore, Brown recommended that the Senate not consider the creation of those districts.

Senate Bill 1911, 76th Texas Legislature[13]

Lawmakers enacted a compromise measure, SB 1911, creating 13 temporary districts with limited regulatory authority under Water Code, Chapter 36. SB 1911 districts lack the authority, for example, to elect permanent directors, impose taxes, or prepare management plans. However, they may require pumping permits, charge user fees, and establish rules for well spacing and construction. These districts will dissolve if not ratified by the 77th Legislature in 2001. If ratified, the districts presumably will receive broader power, including the authority to prepare management plans.

Single-County Districts, Multi-County Districts and Aquifer-Based Management[14]

In the case of large aquifers, such as the Ogallala, that underlie a large portion of Texas, unified groundwater management efforts necessarily will cross county lines. Each of Texas' 254 counties has its individual political will. When a call comes to put aside historical divisions, even in the interest of managing an important and finite natural resource, the fear of losing local control may hinder unified efforts.

In the past, landowners have resisted creating single-county districts, much less regional districts, because of apprehension about the effects of pumping limitations and the cost of additional property taxes. However, recent events such as the *Sipriano* ruling and the prospect of increasing groundwater

exports from rural to urban areas have increased awareness of the need for more water management, leading to the proliferation of proposed single-county districts last session. Texas now has 43 single- or partial-county districts and 20 multi-county districts.

For purposes of groundwater management, critics of the single-county district concept decry the arbitrariness of political boundaries in relation to the more logical and efficient use of aquifer boundaries. For example, a single-county district regulates only the portion of the aquifer that underlies the county, leaving pumping that occurs outside the county either mismanaged or managed by another single-county district with possibly different objectives and rules for the same water source. Also, proponents of multi-county districts claim that the economies of scale produced by the larger tax base of such a district can provide the funds needed to obtain engineering and technical expertise, whereas many single-county districts cannot afford to hire engineers or do the computer modeling and data collection needed to manage an aquifer effectively.

Others argue that political boundaries, while arbitrary in the hydrological sense, are a reality that must be addressed. When adjoining counties overlie an aquifer, hydrologically, the most effective solution would be a multi-county district. The tax base of each county, however, will differ in size, causing one or more counties to fear that they will wind up subsidizing the other counties by bearing a greater share of the costs. Similarly, a county with a small tax base might seek to join with an existing district pursuant to provisions in Water Code, Chapter 36, rather than form a single-county district. The existing district, however, might have to raise taxes to support the additional county and, therefore, might reject the addition of the new county. Rather than forgo any management at all, the county could choose to form its own district.

Aside from their differing tax bases, adjoining counties may use different amounts of groundwater for different reasons. One county may depend heavily on an aquifer for irrigation, while the adjoining county may depend on the same aquifer mostly for domestic uses that require less water. Landowners in each district may not feel that their interests are the same as those of landowners in neighboring counties with respect to the same water source. This can lead to the creation of single-county districts.

Groundwater Well Permit Exemptions and Exceptions

There are several statutory exemptions and exceptions to the district's water well permitting authority found in Section 36.117 of the Texas Water Code. The exemptions include:

Wells incapable of producing more than 25,000 gallons of water per day. This exempts most single-family households,

Domestic wells supplying ten or fewer households,

livestock wells, and

hydrocarbon production wells.

This section of the Texas Water Code has been amended over numerous sessions as the powers and duties of groundwater conservation districts have evolved. During the 75th Legislative Session, SB 1 specified that water wells drilled after September 1, 1997, to supply water for hydrocarbon production activities must meet the spacing requirements of the groundwater conservation district unless no space is available within 300 feet of the production well or the central injection station. Recently, in the 76th Legislative session, an exemption for jet wells was removed from the code.

In addition, all water wells exempted under this section must be registered with the groundwater conservation district before drilling, and they must be equipped and maintained to conform to the district's rules requiring installation of casing, pipe, and fittings in order to prevent the pollution of groundwater resources in the district's jurisdiction.

Despite these changes, groundwater conservation districts have noted that the current language of the groundwater permit exemptions section, Chapter 36.117 of the Texas Water Code, is "confusing, difficult to administer, and obstructs uniform, local management of groundwater resources."[15] For example, Section 36.117 provides exceptions and limitations on wells incapable of producing 25,000 gallons per day. A number of aquifers within the state are not capable of producing this volume of water, and this restriction often prevents the protective measures that local districts have been created to address. This "floor-of-regulation" has also discouraged the creation of groundwater conservation districts in some parts of the state since most wells would be outside a potential district's authority to protect, conserve, and preserve the groundwater resource.[16]

In addition, groundwater districts have also encountered problems in association with the exemption of single-family residential wells. In some districts, single-family residential wells are completed in area subdivisions by the hundreds. This can potentially have dramatic short and long-term effects on groundwater resources in the area, and, due to the exemption, groundwater conservation districts have virtually no authority over these types of wells. In some instances, a more indicative and divisive condition occurs regarding this exemption. For example, neighborhoods and subdivisions can be built on the same aquifer but use different mechanisms to obtain their water supply. Neighbors on a water system must pay fees to local groundwater districts, follow rules of the water system, and limit water use as required. However, their neighbors with exempt private wells pay no fees, use water at will and without consequence, and enjoy the benefit of the water conserved by their neighbors.[17]

Groundwater district managers report that exempting some classes of groundwater users from groundwater district permitting requirements makes management of the resource impossible and completely unfair to the regulated sector. Further, local landowners and users contend that their conservation efforts are less effective when exempt users are allowed to pump without regulation. In addition, local landowners and users further assert that the exemptions may be contributing to over-pumping and larger declines than is deemed appropriate for their managed area. Finally, new spacing requirements for hydrocarbon production wells have been difficult to enforce due to the fact that most hydrocarbon producers seem unaware of the new spacing requirements.

Groundwater Conservation Districts and Exports[18]

With Texas in its third drought in four years, large urban areas are desperate for more water. In the absence of a groundwater district, the rule of capture is law.

In response to the rise in groundwater marketing, many communities have proposed districts to protect against rampant water exports as well as to manage groundwater use. Many of the groundwater districts proposed during the 1999 legislative session included prohibitions or severe limitations on exporting water from the district. SB 1911 specifically provides, however, that with respect to the 13 temporary districts created under the act, transfers of water from the district may be regulated as provided in the Water Code but may not be prohibited. Currently, only the Edwards Aquifer Authority, a special-law district, explicitly prohibits groundwater export. Although the constitutionality of the Edwards Aquifer Act in its entirety was challenged unsuccessfully in 1996 in *Barshop v. Medina County Underground Water Conservation District, et al.*, 925 S.W.2d 618 (Tex. 1996), the export prohibition itself has not been challenged in court thus far.

Interstate export: In 1966, the U.S. District Court for the Western Division of Texas held unconstitutional a Texas statute prohibiting export of groundwater out of state, in *City of Altus v. Carr*, 255 F. Supp. 828 (W.D. Tex. 1966), *summarily aff'd*, 385 U.S. 35 (1966). Altus, in southwest Oklahoma, contracted with landowners in Texas for transport of groundwater over the state border. In response, the Texas Legislature enacted a law prohibiting interstate export without legislative authorization. The city filed suit, claiming that the statute violated the Commerce Clause of the U.S. Constitution. The federal court found the Texas law an unconstitutional burden on interstate commerce, noting that the prohibition against export bore no relationship to Texas' stated conservation goals, as the state had placed no corresponding restrictions on the intrastate transfer of water. The court also rejected Texas' claim that groundwater was not an article of commerce, stating that the transport prohibition was directed at water that had been captured by the landowner, which, under Texas law, constituted private property.

A U.S. Supreme Court case, *Sporhase v. Nebraska*, 458 U.S. 941 (1982), concerned Nebraska's attempt to limit interstate transfers of groundwater. Nebraska enacted a law requiring anyone who wished to transfer Nebraska groundwater for use in an adjoining state to obtain a permit from the Nebraska Department of Water Resources first. To obtain the permit, the applicant had to show that:

- the requested withdrawal was reasonable;
- the withdrawal was not contrary to the conservation and use of groundwater;
- the withdrawal was not otherwise detrimental to the public welfare; and
- the state in which the water was to be used would grant reciprocal rights to withdraw and transport groundwater into Nebraska.

First, the court found that groundwater was an article of commerce, noting that 80 percent of U.S. water supplies are used for agricultural products distributed worldwide. The court also referred to the multi-state coverage of the Ogallala aquifer, and its role in agricultural production. The court accepted Nebraska's stated conservation purpose for the limitations, citing the state's creation of groundwater conservation districts and similar limitations on intrastate groundwater transfers. According to the court,

withdrawal restrictions imposed on state residents as well as out of state indicated no discrimination against interstate commerce. The court, finding no evidence of a relationship to the conservation goals claimed by the state, rejected the requirement that states receiving water from Nebraska grant reciprocal rights to their water. The court stated, however, that "[a] demonstrably arid State conceivably might be able to marshall evidence to establish a close means-end relationship between even a total ban on the exportation of water and a purpose to conserve and preserve water." *Sporhase*, 458 U.S. at 958. Thus, the court left open the possibility, however remote, that state statutory limitations on interstate transport of groundwater could be crafted narrowly to meet constitutional scrutiny.

Since *Altus* and *Sporhase*, the situation in Texas has changed. Arguably, with predicted shortfalls in water supply, the increasing use of groundwater districts to monitor groundwater use, and intrastate permitting of groundwater exports, the state may have a stronger case to make in defending some form of limitation on interstate export against a constitutional challenge.

Intrastate export: In 1995, the Panhandle Groundwater Conservation District's rule prohibiting any groundwater export out of the district was challenged in *Quixx Corporation v. Panhandle Groundwater Conservation District No. 3*, No. 79-687C, 251st District Court, Potter County. The court rejected the rule, finding that any rule attempting to regulate or prevent transportation of water out of the district was beyond a district's authority. Absent any express statutory authority given to the district to limit export, an owner of groundwater may transport all or any part of its lawfully produced water for any non-wasteful and beneficial use, and the district may not impose more onerous permitting standards or restrictions for water use outside the district than it imposes for water use inside the district.

In 1997, in response to concerns about groundwater export, SB 1 added Sec. 36.122 to the Water Code, authorizing regulation of such transfers. This section allows a district to promulgate rules requiring a person to obtain a permit to increase, on or after March 2, 1997, the amount of groundwater to be transferred out of the district under existing contracts, or to transfer water out of the district, on or after March 2, 1997, under a new contract. The district must consider certain criteria in determining whether or not to issue a permit, including:

- availability of water in the district and in the receiving area;
- availability of alternative arrangements;
- amount and proposed uses of water in the receiving area;
- effects of the transfer on the aquifer and existing permit holders; and
- provisions of both the regional and district management plans.

Sec. 36.122 also allows a district to limit a permit issued under this authority and provides that a district may not prohibit the export of groundwater if the purchase was in effect on or before June 1, 1997.

In the spring of 2000, the Texas Water Development Board funded a study to work with stakeholders to build consensus recommendations for improving future groundwater management in Texas. The initial meeting of stakeholders included approximately 200 interested parties in a forum which provided an overview of the issues and breakout sessions to discuss specific issues related to groundwater management in the state. At that forum, the parties were asked to self-select specific persons to represent the interests involved in the issues to participate in a consensus building effort for the next few months. Ultimately, 32 participants were selected, of which all but three actively participated in the effort and one declined to participate.

The group discussed five issues over the course of approximately five months. These issues included: science; boundaries, coordination, and cooperation; exemptions; district funding; and water marketing and exports. The participants agreed to work toward a consensus, meaning everyone could "live with" a recommendation going forward in a final report. They also agreed that brief dissenting opinions would be allowed in their final report. The group completed their efforts, and a final report containing their identified issues, recommendations, and dissenting opinions will be available at the Texas Water Development Board this fall.

PUBLIC HEARINGS

The committee conducted public hearings around the state on January 28, 2000, in Cedar Creek, (Bastrop County), on February 17, 2000, in Hondo, on February 18, 2000, in San Antonio, and on July 11, 2000, in Brownwood. The following persons testified before the committee on groundwater issues (listed alphabetically):

Cedar Creek (Bastrop County)

Ms. Laura Bass, representing herself
Ms. Shirley S. Beck, representing herself and Citizens for Groundwater Conservation
Mr. Travis Brown, representing himself and Neighbors for Neighbors
Mr. John Burke, Aqua Water
Commissioner Susan Combs, Texas Department of Agriculture
Mr. David Houghtling representing himself
Ms. Susan Houghtling, representing herself
Ms. Margaret Ingram, Texas Legislative Council
Professor Corwin W. Johnson, representing himself
Mr. James Kowis, Alcoa
Mr. Craig D. Pedersen, Texas Water Development Board
Mr. John R. Prager, Bastrop Co. Environmental Network
Mr. Jeff Saitas, TNRCC
Ms. Cindy Shelp, representing herself
Mr. Haskell Simon, Matagorda Co. Water Council and LCRVF
Mr. Michael Strange, representing himself
Mr. Bob Weiss, representing himself

Ms. Pam Williams, representing herself
Ms. Billie Woods, representing herself and Neighbors for Neighbors

Hondo

Ms. Luana Buckner, Medina County Groundwater District
Ms. Anne B. Dale, Lake Medina Conservation Society
Mr. Greg Ellis, Edwards Aquifer Authority
Mr. Robert T. Fitzgerald, representing himself and Medina County Environmental Action Association
Mr. Jim Hannah, Lake Medina Conservation Society
Mr. Mike Mahoney, Evergreen Underground Water Conservation District
Mr. Steve Marceau, representing himself
Mr. Kirk Patterson, representing himself
Mr. A. Maurice Rimkus, representing himself and Uvalde County Underground Water Conservation District

San Antonio

Mr. Thomas M. Culbertson, representing himself and Regional Clean Air and Water Association
Mr. Norman Dugas, San Antonio Water System
Mr. Greg Ellis, representing himself and Edwards Aquifer Authority
Ms. Mary Fenstermaker, representing herself
Mr. John Kight, representing himself
Ms. Patsy Light, representing himself and San Antonio River Basin Alliance
Mr. Jay Millikin, representing himself and Comal County Commissioners Court
Mr. Steve Musick, Texas Natural Resource Conservation Commission
Mr. Leonard Olson, Texas Water Development Board
Ms. Susan Peace, representing herself and Grey Forest City Council
Mayor Howard Peak, representing himself and City of San Antonio
Mr. Jack Rogers, Greater San Antonio Chamber of Commerce
Mr. Ed Scharf, representing himself and Bexar County Trinity Aquifer Conservation Coalition
Ms. Jill Sondeen, Southeast Trinity Groundwater Conservation District
Mr. Michael Thuss, San Antonio Water System and City of San Antonio

Brownwood

Mr. Harvey Everheart, Mesa Underground Water Conservation District
Mr. Anton Haner, representing himself and Texas Farm Bureau
Mr. Regan Kirk, representing himself and Texas Farm Bureau
Mr. C.E.Williams, Texas Water Conservation Association

RECOMMENDATIONS

FINDING #1: Groundwater comprises approximately 57 percent of the total water used statewide, and adequate groundwater supplies are crucial to the state's future and economic growth. In order to manage this resource for future citizens, the state faces many challenges, the most significant of which is the balance between private property rights provided under the rule of capture and the rights of surrounding property owners. For example, if individual landowners are allowed to pump all the groundwater they can "capture" under their land and use or sell that water, they could potentially not only pump themselves dry but their neighbors as well. In this scenario, the "law of the biggest pump" prevails.

Senate Bill 1 (SB 1), Acts of the 75th Legislature, 1997, recognized the importance of this water supply to individual citizens, cities and counties, agriculture, and industry. The bill also recognized that an appropriate balance between private property rights and the rights of surrounding landowners could be achieved through groundwater conservation districts. In light of this, the legislation clearly stated that the state's preferred method of groundwater management was through groundwater conservation districts. These districts are controlled by a local board of directors and allow management of this resource on a local level through well permitting and spacing requirements.

RECOMMENDATION #1: The Legislature should support the creation of groundwater conservation districts as the appropriate mechanism for groundwater management in Texas.

FINDING #2: As the preferred method of groundwater management in Texas, groundwater conservation districts are charged with managing groundwater by providing for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater resources within their jurisdiction. Groundwater conservation districts are authorized with powers and duties that enable them to accomplish this goal. Specifically, some groundwater conservation district powers include the following: permitting water wells, regulating the spacing and production of water wells, developing comprehensive management plans, and adopting the necessary rules to implement these management plans.

In addition, groundwater conservation districts conduct groundwater quality monitoring, collect data, and carry out research projects. Further, these districts may 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.

Further, groundwater conservation districts may levy ad valorem taxes and assess fees for administrative services. Groundwater districts may also receive grants and/or donations from local, state, or federal agencies, private individuals, companies, or corporations for specific projects or research and issue and sell bonds for capital improvements.

RECOMMENDATION #2: The Legislature should provide groundwater conservation districts with all the powers and authority necessary to enable them to adequately manage groundwater resources.

FINDING #3: Texas contains many large, diverse aquifers that stretch beneath entire regions of the state. For example, the Ogallala Aquifer in the Panhandle covers all or portions of 46 counties. However, groundwater conservation districts are local in nature and are often created to cover only one or two counties over an aquifer.

These issues raise concerns about whether a district can effectively manage a groundwater resource when the boundaries of the district only overlie a portion of the aquifer. Further, when two neighboring groundwater districts exist over the same aquifer, they may have conflicting rules and regulations for the same resource. Also, varying degrees of pumpage directly outside the boundaries of a district can influence aquifer levels within the district but leave the district with no means of management. Finally, since districts are primarily supported by a tax, counties support the creation of districts that will use funds to support management within their tax base, as opposed, for example, to subsidizing a neighboring county with a smaller tax base.

RECOMMENDATION #3: The Legislature should consider streamlining the process for creating districts through the landowner petition process and the priority groundwater management process at the TNRCC. This includes encouraging, where feasible, the creation of districts along designated management boundaries as opposed to political boundaries.

In addition, the Legislature should consider strengthening statutes that encourage joint management by districts that share the same aquifer, including the development of consistent management plans, joint education projects, aquifer-modeling and studies.

FINDING #4: Section 36.117 of the Texas Water Code sets forth a number of exemptions and exceptions from the permitting requirements of groundwater conservation districts. Groundwater district managers report that exempting some classes of groundwater users from groundwater district permitting requirements makes management of the resource impossible and completely unfair to the regulated sector. Further, local landowners and users contend that their conservation efforts are less effective when exempt users are allowed to pump without regulation. In addition, local landowners and users further assert that the exemptions may be contributing to over-pumping and larger declines than is deemed appropriate for their managed area.

Specifically, in some districts, single-family residential wells are completed in area subdivisions by the hundreds. This can potentially have dramatic short and long-term effects on groundwater resources in the area, and, due to an exemption, groundwater conservation districts have virtually no authority over these types of wells. Further, Section 36.117 provides exceptions and limitations on wells incapable of producing 25,000 gallons per day. A number of aquifers within the state are not capable of producing this volume of water, and this restriction often prevents the protective measures that local districts have been created to address.

RECOMMENDATION #4: In order to create a more equitable structure for groundwater district permitting and management, the Legislature should consider examining Section 36.117, Texas Water Code, with particular focus on the exemption for wells incapable of producing more than 25,000

gallons of water per day.

In addition, the Legislature should specify that exemptions granted under Section 36.117, Texas Water Code, no longer apply when the well is not being used for its exempted purpose.

FINDING #5: In 1997, in response to concerns about groundwater export, SB 1 added Sec. 36.122 to the Water Code, authorizing regulation of groundwater exports within a groundwater conservation district's jurisdiction. This section allows a district to promulgate rules requiring a person to obtain a permit to increase, on or after March 2, 1997, the amount of groundwater to be transferred out of the district under existing contracts, or to transfer water out of the district, on or after March 2, 1997, under a new contract. Further, the district must consider certain criteria in determining whether or not to issue a permit. Finally, Sec. 36.122 also allows a district to limit a permit issued under this authority and provides that a district may not prohibit the export of groundwater if the purchase was in effect on or before June 1, 1997.

Continued resistance to efforts to market groundwater has raised concerns about what will happen as more districts develop exportation rules and reject or severely curtail permit applications under Sec. 36.122. Questions remain about court challenges to this regulation and about the validity of a property owner's claim that the district has taken his or her property without just compensation. While no challenges have arisen yet, these and other issues related to statutory limits on groundwater exports are likely to be an issue in the upcoming legislative session.

RECOMMENDATION #5: The Legislature should continue to consider the effect of export limitations and fees on private property rights and on the authority of groundwater conservation districts.

FINDING #6: Groundwater Availability Modeling (GAM) will develop state-of-the-art, publicly available numerical groundwater flow models that will provide reliable information on groundwater availability to the citizens of Texas. This data will help citizens ensure the adequacy of groundwater supplies and/or recognize the inadequacy of groundwater supplies throughout a 50-year planning horizon.

GAM will assist both groundwater conservation districts and regional water planning groups in managing groundwater resources and planning for future water supplies. Further, GAM will result in a greatly improved understanding of groundwater resources in the state.

RECOMMENDATION #6: The Legislature should continue to support all aspects of the Texas Water Development Board's Groundwater Availability Modeling efforts.

ABANDONED WATER WELLS

ABANDONED WATER WELLS

INTRODUCTION

In December 1999, the Honorable James E. "Pete" Laney, Speaker of the Texas House of Representatives, charged the House Committee on Natural Resources with assessing the condition of abandoned or deteriorated water wells and the need for state and local involvement to address potential problems. Representative David Counts, Chairman of the committee, appointed a subcommittee to address the charge. The Subcommittee on Abandoned Water Wells ("the subcommittee") was comprised of the following members: Representatives Tracy O. King (Co-Chair), Robert R. Puente (Co-Chair), Frank Corte, David Counts, and Gary L. Walker.

BACKGROUND[19]

Over the years, many water wells around homes, farms, industrial sites, and urban areas have been abandoned without being properly plugged. Not only are these wells potential avenues for groundwater contamination, many are a safety hazard to children and animals. It is conservatively estimated that 150,000 of the water wells drilled since 1965 are abandoned and or deteriorated.

According to Texas Water Code, Chapter 32, a well is considered to be abandoned if the well is not in use. A well is considered to be in use in the following cases: a nondeteriorated well which contains the casing, pump, and pump column in good condition; a nondeteriorated well which has been capped; the water from the well has been put to an authorized beneficial use; the well is used in the normal scope and with intensity and frequency of other similar users in the general community; or the owner is participating in the Conservation Reserve Program or any other similar governmental program.[20]

Conversely, a deteriorated well is defined by the code as a well that due to its condition will cause, or is likely to cause, pollution of any water in this state, including groundwater. Further, an abandoned well is a well that has not been used for six consecutive months.[21]

These abandoned and or deteriorated wells pose a threat to groundwater resources in the state. Abandoned water wells range in size from shallow, large-diameter dug wells to deep, drilled wells tapping aquifers under artesian pressure. Numerous state and local programs have identified abandoned water wells as having a significant, or potentially significant, impact on the quality of groundwater in the state.

An abandoned water well is a direct conduit from the surface to the aquifer below. Contaminants that enter the well are introduced directly into the aquifer with no opportunity for natural filtration by soils or geologic materials. This puts other wells in the aquifer at risk, particularly those wells on the same property or those that are close to the abandoned well.

A water well open to more than one aquifer can allow water to migrate out of a zone with higher

pressure head and enter a zone with lower pressure head. In many areas of Texas, deep aquifers are under high pressures and are extremely salty. When the casing from a high pressure well deteriorates and the well is abandoned without proper plugging, continual upward flow of salty water from the deeper aquifer can cause contamination of the shallow, fresh aquifer. Also, any pollutants that occur in one zone can migrate to another zone along the outside of the well casing or through the well.

Acts of the 70th Legislature in 1987, strengthened the state's authority to require the plugging of abandoned or deteriorated water wells. State law requires landowners or other persons who possess an abandoned or deteriorated well to have the well plugged or capped under the standards and procedures adopted by the Texas Department of Licensing and Regulation (TDLR). However, there is little incentive for owners of abandoned wells to voluntarily comply with the plugging or capping provisions.

While landowners are concerned about the costs of closure, many are unaware of the environmental risks and liability of abandoned water wells, and the range of options available to address well closure. Closure techniques can range from backhoe filling to large-scale drilling rig pressure cementing.

ABANDONED WELL NOTIFICATION PROGRAM

The Abandoned Well Notification Program, administered by TDLR, utilizes the Water Well Driller/Pump Installer Program investigators who compile, identify, and work abandoned water well notification and enforcement cases. When an abandoned water well complaint is received, it is assigned a department enforcement number. An initial letter is sent to the landowner notifying them of the abandoned well, statutory requirements, and time frame for compliance. If there is no response within the 180-day statutory time requirement, a final notice is then sent to the landowner. If there is still no response, then a Notice of Violation is sent with the option of an administrative hearing, which includes administrative penalties and compliance requirements.[22]

This program developed and initiated a State of Texas Plugging Report Database in September of fiscal year 2000. In this year, 32 abandoned well enforcement cases were closed, 939 water wells were plugged and reported, and 21,803 well reports were received. Since 1965, 558,365 water well reports have been received by the Texas Water Development Board (TWDB).[23]

WATER WELL DATABASE

Of the approximate one million water wells drilled in Texas in this century approximately 120,000 are registered in the TWDB groundwater database. State well numbers have been assigned to this based on their location within numbered 7 one-half minute quadrangles formed by lines of latitude and longitude. To obtain well information, including location, elevation, depth, well type, owner, driller, construction and completion data, aquifer, water-level and water-quality data, query language is used to search the database for information on any number of wells, ranging from one to several thousand, whether located in a small community or throughout the entire extent of a major aquifer or minor aquifer.

This database represents many years of collection effort and contains information for more than 123,500 sites in Texas including data on water wells, springs, oil/gas tests, water levels, and water quality. The purpose of the TWDB's data collection effort over the years has been to gain representative information about aquifers in the state in order to do water planning. It is very important, however, to realize that the wells in the database represent only a small percentage of the wells that actually exist in Texas. A registered water well driller is required by law to send in a report to the State for every well that is drilled. This requirement began in 1965, and we estimate that approximately 500,000 wells have been drilled in Texas since then.

GROUNDWATER PROTECTION COMMITTEE

The Texas Groundwater Protection Committee was created by the 71st Texas Legislature in 1989 as a means to bridge the gap between existing state groundwater programs and to optimize water quality protection by improving coordination among agencies involved in groundwater activities. House Bill 1458 (codified as Sections 26.401 through 26.407 of the Texas Water Code) established the committee and outlined the powers, duties, and responsibilities of the committee.

A state groundwater protection policy was also adopted by the Legislature as part of the bill that created the committee. The policy sets out nondegradation of the state's groundwater resources as the goal for all state programs. The committee actively seeks to implement this policy by identifying opportunities to improve existing groundwater quality programs and promote coordination between agencies. The committee also strives to improve or identify areas where new or existing programs could be enhanced to provide additional protection.

The committee's membership is composed of the following individuals or their designated representative: the executive director of the TNRCC; the executive administrator of the TWDB; a representative selected by the Railroad Commission of Texas; the commissioner of health of the Texas Department of Health; the deputy commissioner of the Department of Agriculture; the executive director of the Texas State Soil and Water Conservation Board; a representative selected by the Texas Alliance of Groundwater Districts; the director of the Texas Agriculture Experiment Station; and the director of the Bureau of Economic Geology, University of Texas at Austin.

Recognizing the dangers that abandoned water wells pose to human health and groundwater quality, the committee developed an educational outreach plan to promote the low-cost, landowner-initiated closure for capping or plugging of abandoned wells. The plan generally calls for the committee to develop educational materials to support and complement educational outreach activities to rural citizens conducted by the Texas Agricultural Extension Service (TAEX).[24]

This effort has been a joint endeavor of the TNRCC, TAEX, TDLR, the Texas State Soil and Water Conservation Board, the TWDB, the U.S. Department of Agriculture Natural Resource Conservation Service, the Texas Alliance of Groundwater Districts, and the Texas Rural Water Association. Funding for the materials has been provided by the TNRCC through federal grants and state appropriations,

and the cooperating agencies have provided staff.[25]

To date, the committee has developed and published a technical guidance document entitled *Landowner's Guide to Plugging Abandoned Water Wells*. (See Appendix B) The committee with the cooperation of TAEX has also produced a well closure videocassette and public service announcement.

Further, the committee's educational outreach plan calls for additional efforts. Plans for the 2001 fiscal year include additional brochures on the dangers of abandoned water wells, identification of possible sources of match-money for closing abandoned wells, development of educational curriculum materials, and closure demonstrations.

REGIONAL DIFFERENCES

Texas aquifers vary dramatically in size and scope across the state. In some regions, there is only one aquifer available for consumption, while in other areas, several aquifers used as drinking water sources can be found layered beneath the surface. Further, drilling requirements, depth of the well, and plugging requirements can vary greatly from aquifer to aquifer. Consequently, plugging a well in one region of the state can cost significantly more or less than plugging a well in another region. For example, plugging a well over the Ogallala Aquifer in West Texas where only one aquifer exists could be significantly cheaper than plugging a well in Central Texas or South Texas where aquifers often exist in overlapping layers.

FUNDING SOURCES

Two potential funding sources have been identified for plugging abandoned water wells by the Groundwater Protection Committee. The Environmental Protection Agency (EPA) provides monies to address nonpoint sources of pollution under the Clean Water Act, Section 319 program. Under this program, the plugging of abandoned water wells has been identified under the State Management Plan as an approved best management practice and therefore eligible for funding in some instances. This program is limited in that the circumstances with which the program can apply must be when a surface/groundwater connection is evident. The program provides 60 percent federal dollars to be matched by 40 percent non-federal dollars.

Also, at the request of the Groundwater Protection Committee, the plugging of abandoned wells has also been identified as an activity eligible under the TNRCC's Supplemental Environmental Project program.

FUNDING OPTIONS

In order to address the financial problems associated with plugging abandoned or deteriorated water wells, the Legislature should consider establishing a state fund to address the problem.
Several options exist for the creation of this fund including: the assessment of an abandoned well

plugging fee to be paid by a landowner or other person having any new water well drilled, as a percentage of these wells will eventually become abandoned or deteriorated; an annual fee to be collected from groundwater conservation districts or other political subdivisions with a well plugging program; a combination of both of these fees; or any other feasible funding option available to address the problem.

Further, by matching funding sources such as these through general revenue, the Legislature could create a meaningful funding source for addressing abandoned or deteriorated water wells across the state. Further, a one-time appropriation to address this issue could significantly address the problem since TDLR reports that the plugging of most newly discovered abandoned and deteriorated wells is currently being addressed. The significant problem, they report, is with a backlog of old abandoned or deteriorated wells for which no financial resources are available.

These funds could be disbursed through grants by application to political subdivisions, including groundwater conservation districts, that have abandoned water well programs. Grants could be prioritized according to such factors as: the threat to public health, the vulnerability of the aquifer, and the consideration of the return of monies to areas of the state that contribute significantly to the fund through assessed fees.

In assessing any fee, however, landowners should be assured that the fee will be reasonable and not overly burdensome. Further, the Legislature should be cautious in implementing any regulatory programs that will act as a deterrent to plugging wells as opposed to an incentive.

PUBLIC HEARING

The subcommittee conducted a public hearing on September 18, 2000, in Austin, Texas. The following persons testified before the subcommittee (listed alphabetically):

Ms. Mary Ambrose, Texas Groundwater Protection Committee
Mr. Scott Halty, San Antonio Water System
Mr. William H. Kuntz, Texas Department of Licensing and Regulation
Mr. Mike Mahoney, Evergreen Underground Water Conservation District and Texas Alliance of Groundwater Districts
Mr. Joe Mayorga, Texas Railroad Commission
Mr. Ken Petersen, Texas Rural Water Association
Mr. Brian Sledge, representing himself
Mr. Ed Small, Texas & Southwestern Cattle Raisers Association
Mr. Comer Tuck Jr. High Plains Underground Water Conservation District #1
Mr. Steve Wiley, Texas Department of Licensing and Regulation

RECOMMENDATIONS

FINDING: Abandoned water wells are not only potential avenues for groundwater contamination, but

also many are a safety hazard to children and animals. It is conservatively estimated that 150,000 of the water wells drilled in Texas since 1965 are abandoned and or deteriorated. These wells have been identified as a significant source of groundwater quality degradation by the Texas Alliance of Groundwater Conservation Districts, the Texas Groundwater Protection Committee, the Texas Rural Water Association, the Bureau of Economic Geology, the Texas Water Development Board and the Texas Natural Resource Conservation Commission.

Current state law requires landowners to plug or cap abandoned or deteriorated water wells, and the Texas Department of Licensing and Regulation has the authority to assess penalties when landowners do not comply. However, in many cases involving insolvent or absentee landowners, monies to plug or cap an abandoned or deteriorated well may not be available. Therefore, lack of financial resources often results in the failure to properly plug or cap abandoned wells.

RECOMMENDATION: The Legislature should consider supporting the creation of a state fund for plugging abandoned or deteriorated water wells in situations involving absentee or insolvent landowners where funds are not available to properly plug such water wells.

Further, the Legislature should also consider expanding the authority to attach a lien to the land where an abandoned or deteriorated well is located that is currently granted to groundwater conservation districts, in Texas Water Code 36.118, to include political subdivisions with well plugging programs and the state. Monies collected from these liens should be deposited into the state well plugging fund.

WETLANDS MITIGATION

WETLANDS MITIGATION

INTRODUCTION

In December 1999, the Honorable James E. "Pete" Laney, Speaker of the Texas House of Representatives, charged the House Committee on Natural Resources with studying the state's criteria and regulations for determining potential sites for wetlands mitigation efforts. Representative David Counts, Chairman of the committee, appointed a subcommittee to address the charge. The Subcommittee on Wetlands Mitigation ("the subcommittee") was comprised of the following members: Representatives Robert L. "Robby" Cook (Chair), David Counts, Peggy Hamric, Ron E. Lewis, and John Shields.

BACKGROUND

Federal statute defines wetlands as those areas that are saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Generally, this includes areas such as swamps, marshes, and bogs. In addition, in the early 1980s, federal agencies and the courts expanded the definition of wetlands to include areas such as bottomland hardwood forests that are dominated by wetland-tolerant plant species. Under this definition, wetlands are not limited to traditional swamps and marshes, but they also encompass areas with plant species that people do not ordinarily associate with "wetlands." Further, regulatory definitions of wetlands can also include artificial or man-made wetlands, and, in specific cases, the definition can be expanded to include not only wetlands that border or are adjacent to a stream, lake, or other water, but also isolated wetlands that affect interstate commerce.[26]

Attention and better recognition of the economic benefits of wetlands has drawn support for their protection due to their ability to provide flood control and water quality enhancements. Some of the important benefits include: flood conveyance, barriers to waves and erosion, flood storage, fish and shellfish, sediment control, recreation, habitat for waterfowl, endangered/threatened species and other wildlife, water supply, food production, water quality, education, research and open space, and aesthetic values.[27]

Because wetlands provide a home for countless wildlife species, wetlands preservation is essential to maintaining healthy wildlife populations. Some major benefits of wetlands include providing habitat for millions of waterfowl and water birds and habitat for one-third of the nation's endangered and threatened species. In addition, wetlands support a 2.5 billion dollar a year nursery and spawning habitat business for 90 percent of the recreational and commercially important marine fish species in Texas. Further, wetlands provide opportunities for economically beneficial fishing, hunting, birdwatching and other ecotourism, the value of which increasingly rivals the value of agricultural production from the land.[28]

Throughout the United States, coastal and inland wetlands provide permanent homes as well as

stopover, feeding and resting areas for migratory birds. Texas is the most important waterfowl wintering area in the Central Flyway. It provides habitat for 3 million to 5 million birds each year. In the Panhandle, shallow depressions called playa lakes provide resting and feeding areas for birds in route to other areas to nest or winter. These playas are also important to pheasants, mourning doves, and red-winged blackbirds, to name a few.[29]

Hardwood bottomlands, which have diminished to approximately 6 million acres in Texas, are particularly important to waterfowl. Two species that are specifically dependent upon bottomlands are the mallard and wood duck. Steady decline in numbers of mallards in Texas seems to correlate with the loss of bottomlands. Wood ducks are particularly dependent upon bottomland habitat because this species nests in cavities of large hardwood trees. Because bottomlands provide a diversity of floral species and an abundance of food resources, animal groups are more diverse in this habitat type. A listing of wildlife species found in bottomlands included: 273 species of birds, 45 mammals, 54 reptiles, 31 amphibians, and 116 fish species.[30]

Both inland and coastal wetlands are essential to fish and shellfish species. Estuarine wetlands in Texas are important producers of shrimp, crabs, oysters and other species of shellfish. Approximately two-thirds of U.S. commercial species depend on estuaries or salt marshes for nursery and spawning habitat. Those important wetland dependent marine fish species include: speckled sea trout, atlantic croaker, southern flounder and both red and black drum.[31]

Endangered and/or threatened species are particularly dependent upon wetlands. According to a report of the National Wetlands Policy Forum published by the Conservation Foundation nearly one-third of the nations endangered and threatened species use or live in wetlands. In Texas, numerous species of plants and animals on state or federal lists require a certain type of wetland habitat.[32]

TEXAS WETLANDS[33]

Texas has lost significant quantities of wetland that can best be illustrated by considering the status of hardwood bottomlands. It has been reported that approximately 16 million acres were once found in Texas as hardwood bottomland and riparian corridors. According to estimates, only 5.9 million acres remain. This represents a 63 percent loss in Texas bottoms. Because these areas are prime areas for reservoir construction, losses will continue as new reservoirs are considered as part of the Senate Bill 1 (SB 1) planning process. If currently identified potential reservoirs are constructed, as much as an additional 200,000 acres would be lost in East Texas.

Losses of coastal marshes in Texas have also been significant. Of the estimated 937,400 acres that existed in 1956, only 611,700 acres were estimated to remain in 1980. Today it is estimated that only 50 percent of coastal wetlands in Texas remain.

A recent study by the National Wetlands Inventory evaluated wetland losses since the mid-1950s for the entire Texas coastal plain. The results showed a 29 percent decrease (235,000 acres) in freshwater marshes, and an 11 percent decrease (96,000 acres) in forested wetlands. Estuarine non-vegetated

tidal mud/sand flats decreased by 13 percent (30,000 acres) and salt marshes decreased by 8 percent (31,000 acres).[34]

Submerged aquatic vegetation (SAV) is another important wetland habitat. Coastal seagrass communities, primarily along the southern coast, are the predominant form of SAV. Texas has some 235,000 acres (1994 estimate) of this valuable habitat. Almost 79 percent occur in the Laguna Madre; 19 percent in the coastal bend (Arkansas/Corpus Christi/San Antonio Bay systems); and, the remainder, less than 2 percent, occurs north of Matagorda Bay. Practically all seagrass is gone from the Galveston Bay system (95 percent loss) and grass is decreasing in the Laguna Madre, due in part to water quality issues like brown tide and nutrient over-enrichment. In all others, seagrass extent fluctuates with environmental conditions or is relatively stable. Localized impacts due to development, discharge, etc., have affected seagrass as well.[35]

FEDERAL ROLE

In essence, state and federal policy states that there should be no net loss of wetlands. The primary statutes providing the authority for state and federal management of this resource are the Federal Rivers and Harbors Act and the Clean Water Act. Specifically, authority for regulation of development in wetlands is found in Section 404 of the Clean Water Act, which has evolved into a permitting process administered by the U.S. Army Corp of Engineers. Ultimately, however, the issuance of these permits involves various agencies on both the state and federal level.

U.S. Army Corp of Engineers and the 404 Permitting Process

In 1972, the United States Congress passed the Clean Water Act which established a permit program requiring federal authorization for discharges of fill material into waters of the United States, including wetlands. It requires that both public and private individuals and public agencies obtain authorization for such work. Section 404 of the act directed the U.S. Army Corps of Engineers (the Corps) to administer the permit program. Congress gave the responsibility of program oversight to the **U.S. Environmental Protection Agency**, including the authority to override or veto permits issued by the Corps. Under the authority of Section 404, the Corps has been evaluating the impacts of discharge of dredged and fill material into waters of the United States since 1972. Waters of the United States include lakes, rivers, streams, swamps, tidal marches, the territorial seas, wetlands, and similar habitats. Department of the Army authorization is normally required for discharges associated with activities that disturb the ground, such as filling, grading, excavation, backfilling, road fills and mechanized land clearing when they occur in waters of the United States.[36]

In addition, under Section 10 of the Rivers and Harbors Act of 1899, the Corps also regulates the construction of structures that are in or may affect federally determined navigable waters of the United States. These differ from the navigable waters designated by the State of Texas.[37]

In reviewing permit applications, the Corps evaluates the impacts of a project on the human environment and determines if issuance of a permit is in the public interest. During this evaluation, the

Corps follows its implementing regulations, which require compliance with the National Environmental Policy Act, the Section 404 guidelines, the Endangered Species Act, the National Marine Mammals Protection Act, the National Historic Preservation Act, the Coastal Zone Management Act and other laws. Part of the permit application process includes issuance of a public notice and review of comments received on the project from state and federal agencies, adjacent landowners, and the general public including the **Environmental Protection Agency, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service**.[38]

In addition, the **Natural Resource Conservation Service** (NRCS) has been designated as the lead federal agency for wetlands delineations on agricultural land. Agricultural lands are defined as including cropland, hayland, pastureland, orchards and vineyards, but do not include rangelands, silvicultural land, or uncultivated meadows or prairies where native vegetation has not been removed. A wetlands delineation on agricultural land made by the NRCS will be effective for developments, reshaping existing drainage ditches, recreational facilities, stormwater management facilities, and aggregate and hard rock mining activities.[39]

STATE ROLE

In Texas, several issues arise in issuing permits and forming state policy to protect and preserve our wetlands. As the population of the state grows, wetlands compete with land needed for development in urban areas, as well as land needed for development of new water supplies like lakes and reservoirs. For example, water development activities that involve impoundment and diversion of Texas rivers and streams can also affect riverbank and floodplain environments, including the six million acres of bottomland hardwoods and other forested wetlands that remain in Texas and are of particular concern. In fact, construction of lakes and reservoirs in Texas so far this century have replaced over 600,000 acres of forested wetlands, and, if many of the currently proposed reservoirs are built, this number will continue to increase.

In addition, real estate developers argue that regulations protecting wetlands are overly restrictive and onerous, and that, in some instances, the only objective is to slow development. Further, they state several aspects of the regulatory process such as the lack of a uniform definition and minimum size determination of a wetland make the permitting process overly burdensome. Finally, many homeowners do not consider wetlands to be valuable resources but, instead, to be nuisances in need of reclamation by draining or filling.[40] Consequently, circumstances such as these represent the difficult policy decisions that must be made in relation to wetlands.

Legislation passed by the 72nd Texas Legislature (S.B. 1054; H.B. 1622) establishes a goal of no net loss of wetlands on state owned lands. This initiative is overseen by the **Texas Parks and Wildlife Department (TPWD)** and **General Land Office (GLO)** due to their responsibility to protect the states resources, specifically on state lands. An important aspect of that legislation was the formation of a Coastal Coordination Council, one member of which is the Chairman of the Parks and Wildlife Commission. The Council has a key role in the Texas Coastal Zone Management Program.

The TPWD is active in wetland protection and is a key player on federal, state or private projects. Comments and testimony are provided to the U.S. Army Corps of Engineers on 404 dredge and fill permits and comments are provided to other federal and state agencies with authority or responsibility concerning wetlands. Agency staff assists project sponsors by providing guidance and recommendations. When loss of a wetland does result from development, mitigation for wetland losses is requested.

In Texas, the water regulatory agency is the **Texas Natural Resource Conservation Commission (TNRCC)**. While the agency does not regulate "wetlands" specifically, it does require permits for water withdrawal, discharges, and impoundment. Mitigation considerations are also required.

The TNRCC's primary responsibility in relation to wetlands is the 401 certification program under Section 404 of the Clean Water Act. While the federal government provides the initial authorization for a wetlands permit, the TNRCC does a water quality certification process for the applicant. Basically, the applicant picks a site for development and the TNRCC evaluates only the water quality aspects of the permit. Many times, the agency does not deny the application in full but provides a point-by-point correction of the permit. However, the agency does have the authority to deny a permit based on water quality impacts, and a denied TNRCC permit equals a denied overall permit.

FEDERAL AND STATE COOPERATION

A Memorandum of Agreement was signed this fall between the TNRCC and the Southwestern Division of the U.S. Army Corps of Engineers to implement a process for interagency cooperation and TNRCC review of individual Section 404 permit applications under Section 401 of the Clean Water Act. This process is intended to result in maintenance of state water quality standards in Section 404 projects and to maximize the effective use of resources at both agencies.

MITIGATION

Section 404 of the federal Clean Water Act requires that a permit be obtained before discharging dredged or fill material into waters of the United States, which includes lakes, streams, bays, and wetlands. Such discharges can destroy or degrade the wetlands and other aquatic areas, and state and federal policy requires no net loss of wetlands. In order to accomplish this, state and federal policy does allow for mitigation of environmental losses through the permitting process. Mitigation is the process by which impacts from the original project proposal are reduced by one means or another. This involves avoiding impacts, minimizing impacts, and compensating for impacts. This concept is adopted in the 404 Guidelines and the Memorandum of Agreement between the Corps and the EPA, regarding mitigation.[41]

Specifically, when the Corps reviews projects for authorization under Section 404 of the Clean Water Act, the evaluation process typically includes a determination of whether the applicant has taken sufficient measures to mitigate the project's likely adverse impacts to the aquatic ecosystem. Mitigation for impacts to waters of the United States, including wetlands, is required for both the public and

private sectors. Federal law does not give preference to public agencies regarding mitigation requirements.[42]

Basically, mitigation is a three-step sequential process involving avoidance, minimization, and compensation.

> **Avoidance:** The applicant must first take all appropriate and practicable measures to avoid adverse impacts to an aquatic ecosystem that are not absolutely necessary to complete the project.
>
> **Minimization:** The applicant must also take all appropriate and practicable measures to minimize adverse impacts to the aquatic ecosystem that cannot reasonably be avoided by construction of the project.
>
> **Compensation:** The applicants must implement appropriate and practicable measures to compensate for adverse project impacts to the aquatic ecosystem that cannot reasonably be avoided or minimized. This is known as compensatory mitigation.[43]

The purpose of compensatory mitigation is to replace those aquatic ecosystem functions that would be lost or impaired through an authorized activity. The amount and type of compensatory mitigation required for a particular activity is commensurate with the nature and extent of the activity's adverse impact on aquatic functions. It varies depending on the quality of the aquatic resources being impacted and the type and location of the proposed mitigation.[44]

Aquatic functions can be simply defined as "the things that aquatic systems, including wetlands, do." These functions include sediment trapping and nutrient removal; flood storage and conveyance; erosion control; providing habitat for fish and wildlife, including endangered species; groundwater recharge; water supply; production of food, fiber, and timber; and recreation. The number and extent of these and other aquatic functions vary widely among the myriad of aquatic habitats found across the State of Texas.[45]

While this sequential mitigation process is normally applied only during the review of applications for individual permits, most nationwide and regional general permits also require avoidance and minimization of discharges of dredged and fill material into waters of the United States to the maximum extent practicable. In lieu of avoidance and minimization, the Corps District Engineer may approve a compensation plan that is more beneficial to the environment. The District Engineer normally requires all practicable and appropriate compensation as a condition of the Department of Army authorization.[46]

If unavoidable impacts still exist after this sequential process, ways to further rectify or compensate for these impacts are addressed. For instance, temporary impacts may be restored on-site. Permanent impacts need to be replaced either on-site or off-site. This process can take several forms, including restoration, enhancement, creation, and preservation.

Restoration: The re-establishment of functions and characteristics that have either ceased to exist or exist in a substantially degraded state, such as farmed or cleared areas where the soil hydrology may be disturbed or degraded but can be restored.

Enhancement: This includes activities conducted on or adjacent to existing wetlands and other aquatic resources that are intended to enhance one or more aquatic functions such as conversion to a less destructive land use or improvement of the existing plant community. For example, this can include planting more desirable trees, improving hydrology, and removing livestock.

Creation: This is the establishment of a wetland or other aquatic resource where one did not formerly exist. This option is expensive and usually less desirable.

Preservation: This involves the protection of existing, ecologically important wetlands and other aquatic resources in perpetuity by implementing certain legal and physical mechanisms. Preservation is normally appropriate only in exceptional cases, such as when a high value aquatic resource would be lost due to lawful activities were it not protected by preservation. An example where preservation might be acceptable is when a seasonally flooded, old growth bottomland hardwood forest with exceptional wildlife habitat value is threatened by logging. Because most logging practices are not regulated by Section 404, preservation of this valuable resource might be acceptable mitigation option for the project.[47]

Restoration and enhancement of existing wetlands are preferred to creation because they are normally less expensive, reestablish wetland functions quickly, and are less likely to adversely affect existing upland and open water habitats. A compensatory mitigation project that involves ground disturbing activities in waters if the United States may itself require authorization.[48]

Determining Mitigation Sites

Mitigation can involve changes in the location or operation of a water project, but, many times, mitigation takes the form of "in-kind" compensatory land acquisition or the replacement of each acre lost with a similar purchase elsewhere. The purpose of this type of mitigation is to replace the impacted aquatic functions to the extent that they would be lost or impaired by the proposed activity. Therefore, compensatory mitigation is generally located in an ecosystem similar to the impacted area, and it is not acceptable to mitigate losses in a tidally-influenced aquatic system with mitigation in a fresh water system.[49]

Compensatory mitigation is generally provided as close to the site of the adverse impacts as practicable to minimize losses to the local aquatic system. However, off-site compensation may be more appropriate when the compensation cannot reasonably be conducted at the impact site or where it is more beneficial to the aquatic ecosystem if implemented at another location. In some cases, it is acceptable to provide partial compensation at multiple locations. For example, it may be necessary to compensate for flood storage impacts on-site while compensating for wildlife habitat at another

location.[50]

For federally sponsored water projects, the mitigation lands are usually dedicated as preserves or refuges and administered by the U.S. Fish and Wildlife Service. In addition, this agency is also conducting an ambitious Bottomland Hardwoods Acquisition Program with a reported goal of acquiring over 250,000 acres of land in Texas. For state and locally sponsored water projects, the mitigation lands are usually dedicated as state parks or wildlife management areas to be administered by the TPWD. In general, the development of state parks in combination with new lakes and reservoirs provides greater appreciation of natural resources and better public access than do other types of compensatory land acquisition. However, parks are not necessarily managed to compensate for fish and wildlife losses as are specific wildlife mitigation management areas.[51]

Establishment of small, isolate parcels of mitigation lands are often known to have little ecological values. An alternative to this approach is the development of regional mitigation banks that contain large, consolidated tracts of land with fully functional ecosystems that can be managed more efficiently and effectively to return long-term environmental benefits. Currently, problems develop with water resources and efforts on acquisitions that are too small to provide ecosystem-level benefits.[52]

Methods of Accomplishing Mitigation

There are two general approaches to implementing compensatory mitigation. These include project-specific and third-party compensation projects.

> **Project-Specific**: This compensation project is conducted to compensate for the adverse impacts of a single activity that requires Department of Army authorization. A project-specific compensation project is typically designed and implemented by the permittee in conjunction with the authorized activity and is often located on-site or near the authorized activity. The permittee is also responsible for monitoring and assuring the success of the mitigation project.
>
> **Third-Party**: This approach consolidates compensation for multiple projects requiring Department of the Army authorization in one or more off-site mitigation projects. This approach is distinguished from project-specific compensation in that a third party typically accepts the responsibility of designing, implementing, and assuring the success of compensatory mitigation for the permittee. This approach involves such activities as mitigation banking, combined or joint mitigation projects, and in-lieu fee or fee-based trusts.[53]

Combined or Joint-Project Mitigation is a system that simultaneously provides compensatory mitigation for more than one permitted project that adversely impacts the aquatic ecosystem. Unlike a mitigation bank, a joint project typically does not provide compensation in advance of project impacts. Each use of a joint mitigation project typically requires Corps approval.[54]

In-lieu fee and fee-based mitigation systems provide a Department of the Army permittee an opportunity to pay a fee in lieu of conducting project-specific compensation activities. Fees are used to

fund projects designed to restore, enhance, create, or, in some cases, preserve aquatic ecosystem functions. Typically, in-lieu systems pertain to unspecified future mitigation projects, while fee-based systems involve specific, identified mitigation projects, that are either complete or under development, as fees are collected.[55]

Mitigation Banks

Mitigation banks are mitigation systems that provide consolidated off-site compensation for numerous authorized activities in advance of adverse project impacts. A mitigation bank is developed and operated under the terms of a mitigation banking instrument among the bank owner, the Corps, and other natural resource agencies. In most cases, authorization is required to develop the bank.[56]

Mitigation banks can often involve a high degree of bureaucracy and cost. The regulatory requirements are strict, and this can make the project cost prohibitive.

Mitigation Plans

Department of the Army permittees are responsible for developing a mitigation plan and submitting it to the Corps. An appropriate real estate instrument, such as a deed restriction, will normally be required to achieve long-term success of a mitigation plan or to provide sufficient compensation for adverse project impacts. A mitigation plan should generally include:

1. A description of the efforts to avoid and minimize impacts to the aquatic ecosystem.

2. A description of the compensatory mitigation area.

3. A delineation of the waters and wetlands present on the site. The 1987 Corps of Engineers Wetlands Delineation Manual should be used.

4. A detailed description of all activities that involve disturbance of the ground and structures associated with the mitigation project.

5. If aquatic resources that are not part of the permit site are modified or created, a detailed description of the activities must be provided. If planting of vegetation will take place, the plan will include a description of the types of plants, the method of planting, and the survival rate.

6. A description of impacts to federally listed threatened and endangered species and how these impacts will be mitigated.

7. A description of impacts to cultural resources and how these impacts will be mitigated.

8. A monitoring plan for the mitigation proposed.[57]

Corps District Regulatory Program staff, in consultation with other federal and state natural resources agencies, evaluates mitigation proposals. These agencies include the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Natural Resources Conservation Service, the Texas Natural Resource Conservation Commission, the Texas Railroad Commission, the Texas Parks and Wildlife Department, and the General Land Office.[58]

BROAD-BASED PLANNING[59]

The key to providing wetland conservation and restoration is not only having adequate federal and state laws and regulations, but also fostering local and private support. Because funds are never adequate to provide sufficient monitoring and enforcement, it is important to inform the public about wetland protection and look for opportunities to involve private support for programs to protect wetlands.

Texas has led the way in developing conservation plans to focus those efforts. *The Texas Wetlands Conservation Plan* and the companion *Wetlands Assistance Guide for Landowners*, is a non-regulatory and incentive-based approach that has been held up as a national model. Implementation is well underway. Additionally, *The Seagrass Conservation Plan for Texas* was published in 1999 and endorsed by all three Texas natural resource agencies (TPWD, TNRCC, and GLO). All phases of the plan are at some stage of implementation. The plan itself is being used as model by the EPA's Gulf of Mexico Program for conservation of seagrass on a gulfwide basis.

The Texas Parks and Wildlife Department also is involved in the acquisition of wetland properties. During the periods between 1985 - 1990, the department spent eight million dollars on wetlands for waterfowl and other wildlife. This includes 14 different properties and more than 24,000 acres. Acquisition of wetlands, both in fee and easement, from 1992 to the present, totaled 10,166 acres.

The following are some examples of broad-based planning and cooperative efforts in Texas:

Coastal Mitigation Programs

Establishment of a Coastal Preserve Program was a joint effort of the GLO and the TPWD. The purpose of this program is to identify unique coastal areas and to develop management plans to ensure their continued conservation. Currently, TPWD has four areas that have been leased from the GLO: South Bay, at the extreme southern end of the Laguna Madre; Welder Flats, in San Antonio Bay, used by whooping cranes; and Christmas Bay and Armand Bayou, which are part of the Galveston Bay System.

Wetlands Reserve Program

The Wetlands Reserve Program (WRP) is a voluntary program to restore and protect wetlands on private property. It is an opportunity for landowners to receive financial incentives to enhance wetlands in exchange for retiring marginal agricultural lands. Congress authorized WRP under the Food Security Act of 1985, as amended by the 1990 and 1996 Farm Bills. Funding for WRP comes from the

Commodity Credit Corporation (CCC). The Natural Resources Conservation Service (NRCS) assumed control of WRP in Texas in July of 1995. The Farm Services Agency (FSA) administered WRP up until that point. Landowners who choose to participate in WRP may sell a conservation easement or enter into a cost-share restoration agreement with USDA to restore and protect wetlands. United States Department of Agriculture may purchase the "agricultural value" of the property, therefore limiting future use of the land while the land remains in private ownership.

Dow Advanced Mitigation Project

Over a five-year time span, Texas Parks and Wildlife Department (TPWD) and Dow Corporation developed and permitted a significant wetland conservation project. Dow has a major industrial complex near Lake Jackson, Texas, and anticipates its expansion over the next several decades with new component industrial processes of Dow and related corporations. The most efficient and least environmentally damaging approach is to contain the units in a compact array, minimizing the sprawl of infrastructure, such as roads, levees, pipelines and transmission lines. This also avoids the retention of isolated wetland patches within the complex, which could endanger either the wildlife using them or operations of the complex. Dow proposed to delineate the wetlands within the site, and to compensate for their loss by transferring appropriate lands, and endowing wetland creation, enhancement and management as mitigation.

Mitigation tracts selected were two blocks adjacent to TPWD's Peach Point Wildlife Management Area (WMA). These areas could be incorporated into the overall operations of the WMA most efficiently and produce the maximum wetland functions of the type to be lost by industrial expansion. A little over 3,100 acres were included in the two tracts, and nine "projects" were designed, including water control and delivery structures and vegetation management. This facilitated the permitting of over 400 acres of wetland fill at the Dow complex under the Clean Water Act, Section 404 regulatory program and added significantly to the conservation of wildlife and fishery habitat under TPWD responsibility.

Texas Department of Transportation Mitigation Banks

The construction and replacement of highways and bridges requires frequent crossing of streams and wetlands, particularly in the eastern half of the state. The Texas Department of Transportation (TxDOT) is required to obtain permits from the Corps of Engineers for filling of "waters of the U.S." which includes such projects. Replacing the wildlife habitat functions of such areas is difficult and mitigation off-site would require TxDOT to manage a myriad of such sites. To address this issue TxDOT and TPWD have cooperated to develop regional "mitigation banks" under Corps guidelines, which compensate for many road projects in a single, large-scale management area, a "bank."

The first such project was created in 1994, adjacent to the Sabine River in Smith County. Over 2,000 acres were obtained by TxDOT, and placed under TPWD management, and, at the same time, another 2,000 acres of the "Anderson Tract" were purchased by the Parks and Wildlife Foundation and turned over. The 4,000-acre wildlife management area is now known as "Old Sabine

Bottoms," and it comprises some of the best old-growth hardwood bottomland in East Texas. The mitigation credits will facilitate permitting of highway projects in three TxDOT districts for the next 25 years or more.

A second, similar project was accomplished at Blue Elbow Swamp, just north of Interstate 10, just inside the state line. Over 3,000 acres of cypress-tupelo swamp was set aside under TPWD management as mitigation for TxDOT projects in three TxDOT districts in that region. As was the case with the Anderson Tract, Blue Elbow Swamp had been a significant conservation funding objective for decades, but monies for its preservation had never been available before this effort, or owners had not been interested in selling. Such old-growth forests, in large contiguous blocks, are extremely valuable wildlife habitats. Also, their scale in the landscape has important watershed-protecting attributes in controlling floods, assimilating pollutants, facilitating absorption of floodwaters and associated functions, in addition to their wildlife value.

In the past year, a four-year effort to use mitigation banking to further state transportation goals and cooperatively achieve important conservation objectives as well resulted in the approval of the Coastal Bottomlands Mitigation Bank in Brazoria County. Also serving three TxDOT districts south of Houston, this 4,000-acre wildlife management area is of tremendous importance to migratory birds as they "fall out" to rest and feed after crossing the Gulf of Mexico on their northward migration in the spring. It is anticipated that this area will compensate for roadway projects for at least 20 years in the area.

PUBLIC HEARING

The subcommittee conducted a public hearing on May 17, 2000, in Austin, Texas. The following persons testified before the subcommittee (listed alphabetically):

Brigadier General Edwin Arnold, U.S. Army Corps of Engineers
Ms. Glenda Callaway, Representing herself and the Galveston Bay Foundation
Mr. Tom Calnan, General Land Office
Dr. Larry McKinney, Texas Parks and Wildlife Department
Mr. Daniel W. Moulton, Texas Parks and Wildlife Department
Mr. Jeff Saitas, Texas Natural Resource Conservation Commission
Mr. Norman Sears, Environmental Protection Agency, Region 6
Mr. Frederick T. Werner, U.S. Fish and Wildlife Service

RECOMMENDATIONS

FINDING: For many years, the regulatory process surrounding permitting in a wetlands area has been confusing and overly burdensome. The involvement of both state and federal agencies had created serious duplication in permitting efforts and a waste of both the applicant and the state's time and monies.

Due to recent developments and cooperation efforts, today's regulatory processes in Texas are more streamlined, and the coordinated actions of state resource agencies in working with the U.S. Army Corps of Engineers provide evidence of that effort. Although some permit applicants still experience delays or frustrations with the process, this most often occurs when project proposals are incomplete or unnecessarily destructive of wetlands. Many permit applicants do not experience such delays.

The greatest failure of the existing system is the initiation and enforcement of permit conditions to mitigate for wetland impacts, including the determination of appropriate mitigation sites. This area of regulation has suffered greatly as resources at the federal level have diminished. It is also frustrating for both an applicant and a resource agency when expensive mitigation efforts are never initiated, or they fail due to inefficient planning or inadequate science.

RECOMMENDATION: The Legislature should continue to encourage permit streamlining efforts and cooperation between state and federal agencies; should continue to study the criteria and regulations used for determining wetlands mitigation sites; and should strongly support mitigation efforts that encourage broad-based planning and restoration.

OVERSIGHT

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In December 1999, the Honorable James E. "Pete" Laney, Speaker of the Texas House of Representatives, charged the House Committee on Natural Resources ("the committee") with conducting active oversight of agencies under the committee's jurisdiction. The charge was undertaken by the committee as a whole.

In addition to frequent, informal briefings by agencies under the committee's jurisdiction on matters of interest to the committee, the committee also received formal updates at public hearings on oversight issues. Primarily, the committee was briefed by the Texas Water Development Board (TWDB) on the implementation of Senate Bill 1 (SB 1), Acts of the 75th Legislature, Regular Session, 1997, and the progress of the Regional Water Planning Groups (RWPGs) in preparing their regional water plans. The final regional water plans, adopted by each RWPG, are due to the TWDB by January 5, 2001. The initially prepared plans (draft plans) were due to TWDB by October 1, 2000 for agency review and comment. The implementation of SB 1 has involved numerous state agencies including the Texas Natural Resource Conservation Commission (TNRCC), TWDB, and the Texas Parks and Wildlife Department (TPWD).

Further, at the committee's public hearing in Hondo, Texas, Greg Ellis, General Manager of the Edwards Aquifer Authority, provided an update on the proposed permit rules and future plans of the authority. Public testimony was also taken on this issue.

Throughout this interim, several state natural resource agencies under the committee's jurisdiction were also under review by the Texas Sunset Advisory Commission. Natural resource agencies that were reviewed include the: TNRCC, TWDB, TPWD, State Soil and Water Conservation Board, Railroad Commission of Texas, Coastal Coordination Council, and the Texas Energy Coordination Council. The commission has currently issued reports and decisions on several of these agencies, including the TNRCC, and more reports are anticipated before the next legislative session.

Although it has no specific recommendations at the time of this report, the committee will continue to monitor the agencies' activities with regard to SB 1 implementation, the Edwards Aquifer Authority, the sunset review process, and other issues of state and local concern. Many of these issues may warrant deliberation and action by the 77th Texas Legislature.

ENDNOTES

1. The Interim Committee on Water Resources Development and Management, "Interim Report to the 76th Legislature: Implementation of Senate Bill 1" (Austin: 76th Texas Legislature, January, 1999, 100.)

2. The Interim Committee on Water Resources Development and Management, "Interim Report to the 76th Legislature: Implementation of Senate Bill 1" (Austin: 76th Texas Legislature, January, 1999, 102.)

3. The Interim Committee on Water Resources Development and Management, "Interim Report to the 76th Legislature: Implementation of Senate Bill 1" (Austin: 76th Texas Legislature, January, 1999, 103.)

4. The Interim Committee on Water Resources Development and Management, "Interim Report to the 76th Legislature: Implementation of Senate Bill 1" (Austin: 76th Texas Legislature, January, 1999, 103.)

5. Texas Groundwater Protection Committee, *Joint Groundwater Monitoring and Contamination Report - 1998* (Austin: TNRCC, October 1999, 5.)

6. Groundwater Law Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 2,5.)

7. Groundwater Law Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 2,5.)

8. Groundwater in Other States Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 10-11.)

9. The Interim Committee on Water Resources Development and Management, "Interim Report to the 76th Legislature: Implementation of Senate Bill 1" (Austin: 76th Texas Legislature, January, 1999, 105.)

10. The Interim Committee on Water Resources Development and Management, "Interim Report to the 76th Legislature: Implementation of Senate Bill 1" (Austin: 76th Texas Legislature, January, 1999, 110.)

11. Alwin, Lawrence F., CPA, "An Audit Report on Groundwater Conservation Districts: Phase One," Office of the State Auditor (Austin: August 2000, introduction.)

12. Groundwater Boundaries Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 9.)

13. SB 1911 Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 9.)

14. Groundwater Boundaries Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 10-12.)

15. Texas Natural Resource Conservation Commission, *Groundwater Conservation Districts Report to the 75th Legislature* (Austin: TNRCC Water Planning and Assessment Division, February 1997, 52-53.)

16. Texas Natural Resource Conservation Commission, *Groundwater Conservation Districts Report to the 75th Legislature* (Austin: TNRCC Water Planning and Assessment Division, February 1997, 52-53.)

17. Texas Natural Resource Conservation Commission, *Groundwater Conservation Districts Report to the 75th Legislature* (Austin: TNRCC Water Planning and Assessment Division, February 1997, 52-53.)

18. Groundwater Exports Section from: Wells, Hope E. "Managing Groundwater For Texas Future Growth," House Research Organization Focus Report (Austin: March 23, 2000, 15-17.)

19. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided by Mary Ambrose, Texas Groundwater Protection Committee) (Tape copy available from House Audio/ Video Services)

20. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided by Steve Wiley, Texas Department of Licensing and Regulation, Water Well Driller/Pump Installer Program) (Tape copy available from House Audio/ Video Services)

21. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided by Steve Wiley, Texas Department of Licensing and Regulation, Water Well Driller/Pump Installer Program) (Tape copy available from House Audio/ Video Services)

22. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided by Steve Wiley, Texas Department of Licensing and Regulation, Water Well Driller/Pump Installer Program) (Tape copy available from House Audio/ Video Services)

23. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided

by Steve Wiley, Texas Department of Licensing and Regulation, Water Well Driller/Pump Installer Program) (Tape copy available from House Audio/ Video Services)

24. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided by Mary Ambrose, Texas Groundwater Protection Committee) (Tape copy available from House Audio/Video Services)

25. Texas House of Representatives Committee on Natural Resources Subcommittee on Abandoned Water Wells, public hearing, Austin (September 18, 2000) (Testimony provided by Mary Ambrose, Texas Groundwater Protection Committee) (Tape copy available from House Audio/Video Services)

26. Mattox, Sharon M., "Wetlands--An Overview," Paper presented to the 10th Annual Texas Wetlands Conference (Houston: February 3-4, 2000.)

27. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/ Video Services)

28. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/ Video Services)

29. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/ Video Services)

30. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/ Video Services)

31. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/ Video Services)

32. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Natural Resources Committee)

33. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Natural Resources Committee)

34. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/Video Services)

35. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/Video Services)

36. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

37. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

38. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

39. Mattox, Sharon M., "Wetlands--An Overview," Paper presented to the 10th Annual Texas Wetlands Conference (Houston: February 3-4, 2000.)

40. Pettot, J.W. "Jess", "Wetlands from the Developer's Prospective," Paper presented to the 10th Annual Texas Wetlands Conference (Houston: February 3-4, 2000.)

41. Testimony of , Environmental Protection Agency, Texas House of Representatives Subcommittee on Wetlands Mitigation, May 17, 2000.

42. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

43. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

44. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video

Services)

45. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

46. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

47. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

48. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

49. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

50. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

51. Texas Water Development Board, *Water for Texas: A Consensus-Based Update to the State Water Plan* (Austin: August 1997, 3-20, 3-21.)

52. Texas Water Development Board, *Water for Texas: A Consensus-Based Update to the State Water Plan* (Austin: August 1997, 3-20, 3-21.)

53. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

54. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J.

Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

55. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

56. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

57. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

58. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of Brigadier General Edwin J. Arnold, U.S. Army Corps of Engineers) (Tape copy available from House Audio/Video Services)

59. Texas House of Representatives Committee on Natural Resources Subcommittee on Wetlands Mitigation, public hearing, Austin (May 17, 2000) (Testimony of McKinney, Larry, Texas Parks and Wildlife Department) (Tape copy available from House Audio/Video Services)