TEXAS CENTER
FOR POLICY STUDIES

ENVIRONMENTAL FLOWS IN THE REGIONAL PLANNING PROCESS

INTEGRATING THE GOALS OF SENATE BILLS 1, 2 AND 3

November 2013

EXECUTIVE SUMMARY

Since 1997, the Senate Bill 1 water planning process has required protection of natural resources as the state determines how to meet needs for water for the future. For example, the basic directive of the legislature in Senate Bill 1 is:

> The state water plan **shall** provide for the **orderly development, management and conservation of water resources** and preparation for and response to drought conditions, in order that sufficient water will be available at a reasonable cost **to ensure** public health, safety and welfare, **further economic development and protection of agricultural and natural resources** of the entire state." (Texas Water Code, Section. 16.051, emphasis added.)

One of the "Guiding Principles" as adopted by the Texas Water Development Board (TWBD) for the 2017 State Water Plan is:

> (23) Consideration of **environmental water needs, including instream flows and bay and estuary inflows,** including adjustments by the [Regional Water Planning Groups] to water management strategies to provide for environmental water needs including instream flows and bay and estuary needs.…(TWDB rule at 31 Texas Admin. Code Section 358.3.)

This guiding principle makes sense not only because of the language in Senate Bill 1, but also because the legislature has enacted two other laws that focus on protecting environmental water needs: Senate Bill 2 in 2001 and Senate Bill 3 in 2007. These laws recognized the important role that water left in rivers and available to flow to bays and estuaries plays in conserving fish and wildlife habitat, protecting healthy timber and agricultural lands, providing recreational opportunities and sustaining economic and cultural values. Even the value of private property along a river and associated riparian rights can vary significantly with the flow conditions in the river.

Yet, to date, the results of work done under Senate Bills 2 and 3 have played a very limited role in determining how Texas will use its water resources over the next 50 years. The work of these bills has not been fully integrated into the Senate Bill 1 water planning process. This next round of regional planning provides an important opportunity to help provide for environmental water needs.

For those regions that want to do more to protect environmental water needs the question is how to use the water planning process. The most straightforward approach would be to treat environmental water needs like other water needs. Healthy river and bay systems need flows that mimic natural conditions, but not necessarily all the water that has historically flowed in them. Once the healthy flow needs are identified, the regional planning groups could develop suggested strategies to meet those needs over time. In many cases, strategies to meet environmental flow needs can work in combination with strategies to provide water for municipal, agricultural or industrial needs

Current TWDB rules and guidance do not treat environmental water needs in the same fashion as other needs, however. Instead, the rules and guidance focus on evaluating the water supply

strategies for other needs and then identifying the effects of the strategies on environmental water needs. The rules and guidance suggest that regional water plans and the state water plan need only adjust their strategies for obtaining new water supplies with considerations of existing environmental flows. Thus, if we have already created unhealthy rivers and bays, there is no process to try to reverse that situation over the next 50 years or more.

Thus, the current state approach gives environmental water needs a very limited role in the regional planning process. TWDB rules and guidance do not promote the idea that regional planning groups should find strategies to ensure healthy rivers and bays and, thus, actually develop comprehensive plans that "protect natural resources."

Second, while TWDB encourages the use of TCEQ "environmental flow standards" under SB 3, TWDB fails to acknowledge that such standards are very limited. They do not reflect the types of flows that scientists and stakeholders in the SB 2 and SB 3 processes determined are needed to sustain a sound ecological environment in our rivers and bays. TCEQ's standards apply only to surface water rights permit applications that seek new appropriations of state water. That is a very different process from one that is seeking to develop strategies to fill water needs for the future.

TWDB rules do, however, allow regional water planning groups to use a different process to develop strategies for meeting environmental water needs in the future. Regional groups wanting to do so simply have to develop their own approach.

There are a number of options for regional planning groups that want to protect and enhance environmental water needs while not limiting the growth of cities, industries or agriculture.

For example, the Brazos River Authority (BRA) sends large amounts of water from Possum Kingdom Lake downstream to Lake Granbury for transfer to Squaw Creek Lake and use there by Luminant as cooling water for the Comanche Peak Nuclear Power Plant. That water could be delivered in different ways from Possum Kingdom Lake. It could be released in one large pulse once a day or once a week, leaving the river mostly dry the rest of the time. It could be released at a constant low flow. Or BRA could send the water down in a fashion that meets some, possibly all, of the SB 3 recommendations for environmental water needs in the segment of the river between the two lakes.

Thus, the Region G planning group could, with the assistance of BRA and Luminant, develop strategies for meeting all or some of the recommendations of scientists and stakeholders who worked to develop an environmental flow regime for that segment of the river under Senate Bill 3. Water needed for existing and new uses could be released in a fashion that also helps meet the environmental flow needs identified in the SB 3 process.

As discussed in detail in the white paper, while such an approach is not encouraged by the TWDB rules and guidelines, it is not prohibited. It will, unfortunately, be up to the regional planning groups to take the initiative in the 2016 round of planning with little assistance from TWDB.

Legal Framework for Regional Planning and Environmental Water Needs

Texas law and TWDB's Guiding Principle 23 provide ample legal authority for regional water planning groups to focus some of their work on "environmental water needs." While the Guiding Principle makes clear that the term environmental water needs includes "instream flows and bays and estuaries inflows," TWDB planning rules and guidance do not otherwise define the term.

Elsewhere, TWDB defines "environmental flows" as the flow of water (both quantity and timing of flow) needed to maintain ecologically healthy streams and rivers, as well as the bays and estuaries that they feed. http://www.twdb.state.tx.us/surfacewater/flows/

In Senate Bill 3, the term "environmental flows" is used in the definition of several key terms:

> (15) "Environmental flow analysis" means the application of a scientifically derived process for predicting the response of an ecosystem to changes in instream flows or freshwater inflow [to bays and estuaries].
>
> (16) "Environmental flow regime" means a schedule of flow quantities that reflects seasonal and yearly fluctuations that typically would vary geographically, by specific location in a watershed, and that are shown to be adequate to support a sound ecological environment and to maintain the productivity, extent, and persistence of key aquatic habitats in and along the affected water bodies. Section 11.002, Tex. Water Code.

In addition, TWDB has provided excellent guidance on the value and role of environmental flow on its website: http://www.twdb.state.tx.us/surfacewater/flows/faqs/index.asp.

TWDB rules for the 2016 regional plans do not, however, require regional planning groups to determine environmental water needs in the step-wise process that applies to projecting water needs for municipal, agricultural, industrial, steam-electric, mining and livestock uses. The rules do not include environmental water needs in the process for developing new supply strategies over the 50-year planning horizon. 31 Tex. Admin. Code 357.33 & 34.

Given Texas law and TWDB rules, however, regional planning groups have a range of ways to bring environmental water needs into the regional water planning process. That can be done outside of the process for other water needs.

Identifying Environmental Water Needs

Environmental water needs have some characteristics that make them different from other water needs evaluated by the regional planning groups. The major unique feature, as the Brazos River example above indicates, is that some environmental water needs can be satisfied with water that is filling or can fill other needs.

Most of the needs addressed in the regional plans and state water plan are for "consumptive uses," that is, water diverted from a river, stream or lake and used for drinking water, irrigation and manufacturing. Some of that water may be returned to the river. Most is not. It is consumed or used

up. It might, for example, be taken up by crops or lawns. It might end up in soft drinks or beer. It might be evaporated in cooling for power plants.

In contrast, most environmental water needs are non-consumptive, such as flows in the river to provide for fish and wildlife. Some environmental flows, like those needed for bays and estuaries to support commercial fisheries, are more like the consumptive needs. They cannot be used for other fresh water supplies once they are in the bays or estuaries. Of course, the inflows to bays and estuaries may be made up, in part, of return flows from other upstream uses.

To do more than the minimum that TWDB requires, a regional planning group will first have to identify the environmental flow needs. TWDB does not now provide this information to the planning groups as part of the other data needed for water planning.

Fortunately, scientists and stakeholders have worked under the Senate Bill 3 process to develop a good first cut at what those needs are for most river basin and bay systems. In a few basins, studies under Senate Bill 2 are providing an even better basis for identifying some environmental flow needs.

Moreover, some environmental water needs were identified well before the passage of Senate Bills 2 and 3. For example, some state and federal permits for new dams required releases for downstream fish and wildlife, public health and other instream benefits. In most cases, these earlier requirements were set in terms of constant releases from dams, rather than the more complex release patterns that are now recognized as better protecting the health of the river, stream, lake or bay.

For purposes of illustration, assume a constant release of 20 cubic feet per second (cfs) was set as the requirement for a release from a dam. That is reflected in Figure 1 as the blue line.

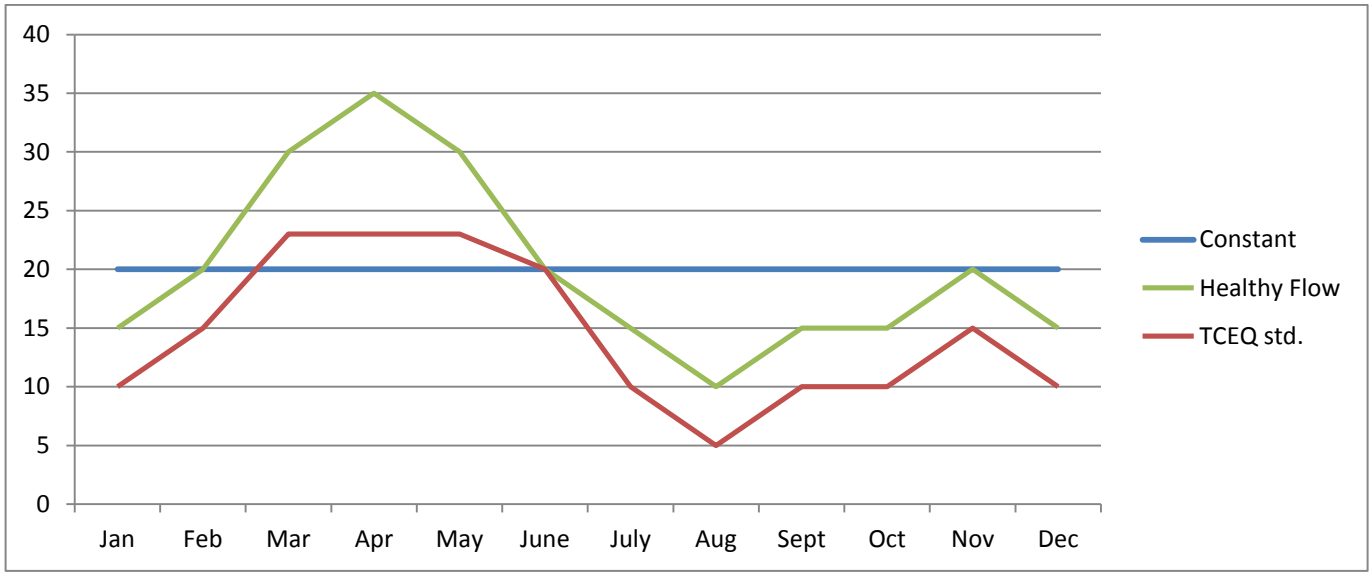

Figure 1. Different types of environmental flows

More recently, such constant flows have not been favored. Instead, as indicated in Senate Bills 2 and 3, environmental flows are defined as "flow regimes" that mimic historic flow conditions. Thus, like

historic flows, environmental flows usually vary from month to month and year to year. Senate Bill 3 requires such environmental flow regimes be set with the goal of assuring a "sound ecological environment."

Thus, for purposes of comparison with the type of constant release discussed above, a flow regime that mimics historic flows is represented as the green line on Figure 1.

In this hypothetical case, the constant release pattern – the blue line – satisfies this SB 3 type environmental flow recommendation at times, but it also provides more water at times and less at times. Thus, if this were the case in a river segment downstream of a dam, the operator of the dam might be able to use the same amount of water to provide the green line flows as it did for the blue line and do so in a way that meets the type of healthy environmental flows needed to provide for a "sound ecological environment." Such an approach would, of course, be voluntary and may require permit amendments, but there is nothing that prohibits exploration of or even recommendations for such strategies through the regional planning process.

There is a third type of environmental flow, reflected in the red line on Figure 1. Under Senate Bill 3, TCEQ is required to adopt "environmental flow **standards**" based on the environmental flow regimes recommended by the scientists and stakeholders participating in the process. Again, that type of recommended flow regime is represented by the green line.

The TCEQ flow standard is, however, more limited in most cases. TCEQ's standard can only include those aspects of the recommended flow regime that can be obtained with the available water. That means the flow standard is limited to the unappropriated water at the time the standard is set. The standard cannot include water already in a water right, whether it is being used or not. Thus, in rivers that are fully appropriated, there may be no water for an environmental standard during many months. In other river segments, the appropriated water in water rights may limit the standard to a fraction of the recommendation flow regimes.[1]

Thus, the TCEQ standard does not reflect the recommended flow regime or the environmental water needs as defined by scientist and stakeholders. It reflects what is possible given that much, if not all, of the water in a river has already been allocated in water right permits.

In those basins with green line type recommendations from the SB 3 process, SB 2 studies or other scientifically credible sources, the regional planning groups have what they need to identify much of the environmental water needs.

While TWDB planning rules do require protection of the red line water needs the rules and TWDB guidance or assistance do not provide for or encourage better protection of environmental water needs over the next 50 years. Nevertheless, regional groups do not have to limit their plan to the red line approach. They can develop ways to achieve the green line goal for healthy flows through

[1] The red line approach was created in Senate Bill 3 for use in TCEQ in issuing permits, not for regional planning. It limits TCEQ from issuing any new water right permit that would result in flows below the red line, once that line is established. The permitting process is not intended to help create environmental flows where they do not meet the green line approach. It will take the water planning process to help meet the green line approach in most basins.

strategies that the groups recommend in the regional water plans. The plan can provide for such strategies over the 50 year planning period.

Options for Integrating Environmental Water Needs into the Water Planning Process

A basic requirement of the planning process authorized by Senate Bill 1 is to "ensure protection of … natural resources." That requirement, however, has not been a priority to date for water or other natural resources. For example, TWDB's decision to approve the 2011 Region C plan was reversed by Texas courts because TWDB did not treat the protection of natural resources as an equal responsibility with the development of water strategies.[2]

There are, however, a number of options that would allow a regional planning group to develop proposals that ensure that water resources, including environmental water needs, are protected, while also providing strategies for other water needs over the entire planning horizon.

In most Texas river basins the red-line approach - the environmental flows standard - is well below what the scientists and stakeholders have recommended as the environmental water need. Thus, regional planning groups would have to do more to develop a plan to assure the type of "sound ecological environment" that Senate Bill 3 seeks for all rivers, streams, and bays.

In the 2011 regional process, only one region made efforts to look at environmental water needs beyond the limited approach that TWDB proposed at that time and now proposes for the 2016 planning process.[3] In its 2011 plan, the Region D group explicitly indicated that it was looking to protect the green line type water needs for several basins. Excerpts from the 2011 Region D regional water plan are provided in **Appendix A**.

One of the region's priorities was environmental water needs for Caddo Lake and a segment of Big Cypress Bayou above the Lake. Lake O' the Pines was constructed in 1960 on Big Cypress 35 miles by river upstream of Caddo Lake. Over the past 7 years, environmental studies have been completed to help define environmental flow needs for Caddo Lake and the segment of Big Cypress below Lake O' the Pines. The work was done under the Sustainable Rivers Project, a national joint effort by the Nature Conservancy and the U.S. Army Corps of Engineers.

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[2] TWDB found no conflict between the Region C and Region D plans even though a reservoir proposed in the Region C plan was identified in the Region D plan as a conflict with that region's goal of protecting certain natural resources at the site of the proposed reservoir. *TWDB v Ward Timber*, et al. No. 11–12–00030–CV., (Tex. App.— Eastland May 23, 2013, no pet.)

[3] Several regions made significant efforts to analyze the effects of potential water supply strategies on environmental water needs, but even these regions did not consider the environmental water needs in a fashion comparable to other needs. Region L, for example, had two special studies prepared, but both were designed to help with the basic evaluations TWDB requires for proposed water supply strategies.
http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0704830697_RegionL/2011%20Region%20L%20Study%204%20Report%20(Final), and
http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0704830697_RegionL/2011%20Region%20L%20Study%205%20Report%20(Final).pdf

One of the reasons it was done is that the federal permit for Lake O' the Pines requires only a blue line or minimum constant release type requirement set at a constant 5 cfs from the lake. Greater releases, generally 25 cfs, have generally been made, but neither the 5 cfs release nor the higher releases were tied to any scientific analysis or set of stakeholder goals for an environmental flow regime.

Over the past few years, a voluntary approach by scientists and stakeholders has developed such a recommendation.[4] Recently, both the Corps of Engineers and the Northeast Texas Municipal Water District agreed to help provide releases from Lake O' the Pines to meet some aspects of the recommended environmental flow regimes. Thus, in this region, not only has a healthy environmental water need been identified, but also at least one strategy for meeting that need has been developed. It is currently being tested.

Thus, the Region D planning group can add environmental water needs in the Cypress basin, as well as at least one strategy to meet those needs to the regional plan. Like all other projected needs and strategies (for municipal, irrigation etc.), those needs and strategies for environmental flows will be subject to periodic revision. If new information or analysis shows that changes should be made, they can be. Water planning in Texas is a continuing process that allows for improvements every 5 years, and even more often if an amendment to a plan is justified.

Other regional planning groups could take similar steps based on Senate Bill 3 recommendations of scientists and stakeholders. They may not be able to identify strategies for all the environmental water needs that are not satisfied with available water, but they could and should begin the process.

One obvious place to start would be any stream segment recommended as an "ecologically unique stream segment" in a regional plan. For these segments, historic flows and other factors could be evaluated to determine the environmental water needs and the planning groups could develop recommended strategies for meeting those needs, if they are not now met. If such needs are not well defined now or the strategies for meeting them are not obvious, the regional planning group could request TWDB funds for a special study.

There are also studies that can assist regional planning groups in identifying strategies to restore or protect environmental water needs. The Science Advisory Commission, which was first created by statute[5] in 2003, published a report in 2004 with a discussion of a number of options for protecting

[4] Senate Bill 3 provided a schedule for all river basins except, the Cypress, Sulphur, Red and Canadian basins. The legislature provided schedules for the other basin, and required that TCEQ adopt environmental standards for all by 2014. State funds were used to pay for the development of the recommendations for environmental flow regimes by scientist and stakeholders, which were then used by TCEQ to develop the flow standards. In the basins without a schedule, the law provided that a "voluntary consensus-building process" could be used. See, Section . 11.02362(e), Tex. Water Code. This voluntary approach has been used in the Cypress basin to develop the recommended environmental flow regimes.

[5] This commission, as well as the Study Commission on Water for Environmental Flows, was created by Senate Bill 1639 in 2003. That law, like Senate Bill 2 in 2001 and Senate Bill 3 in 2007, found, "Maintaining the biological soundness of the state's rivers, lakes, bays, and estuaries is of great importance to the public's economic health and general well-being." It directed, "In evaluating the options for providing adequate environmental flows, the study commission shall take notice of the strong public policy imperative that exists in this state, recognizing that environmental flows are important to the biological health of our parks, game preserves, and bay and estuary systems."

and restoring environmental flows.[6] The relevant text of that report is provided as the **Appendix B** to this report.

Conclusion

Texas has been developing and refining state water plans since the 1960s. In 1997, the Texas Legislature added a role for sixteen region planning groups through Senate Bill 1. The goal was to ensure that the diverse interests from all parts of Texas were reflected in the state planning process.

Then in 2001 and 2007, the Legislature passed Senate Bills 2 and 3 as the next big steps in water planning. Those laws began a process of identifying and protecting environmental water needs. Those laws have not, however, been effectively integrated into the Senate Bill 1 water planning process.

TWDB's current rules do require some protection for environmental water needs. TWDB has not, however, developed a process or provided the basic information needed by regional planning groups to identify, protect and enhance environmental water needs. These environmental water needs are not treated the same as other water needs, such as needs for drinking water, irrigation, or cooling water for power plants.

If any regional planning group wants to integrate environmental water needs into the regional planning process such that it can enhance and protect th environmental water needs, there is, in most river basins, sufficient information to do so for the 2016 regional plans.

Full integration of Senate Bills 2 and 3 can and should be a priority for the Senate Bill 1 planning process.

[6] Currently there is a Scientific Advisory Commission, but this one was established in 2007 by Senate Bill 3. It has worked with scientists and stakeholders across the state to set the green line type of environmental flow regimes. It could also be called by regional planning groups for advice and assistance on flow recommendations and possibly additional strategies that the SAC may have identified.

Appendix A

Excerpts from 2011 Region D Regional Water Plan

1.5 DESCRIPTION OF WATER DEMAND IN THE REGION

1.5(a) **Historical and Current Water Use**

Historical and current uses in the North East Texas Region include municipal, manufacturing, recreation, irrigation, mining, power generation and livestock. . . .

In addition to these uses, which are mostly consumptive uses, **there are non-consumptive uses such as flows in rivers, streams, and lakes that have been relied upon to maintain healthy ecological conditions, navigation, recreation and other conditions or activities that bring benefit to the Region.** These historic non-consumptive uses and future needs have not yet been the subject of detailed consideration in the State's Senate Bill 3 planning process, but are discussed in *Section 2.3.7 Regional Environmental Flow Demand Projections* and will be addressed in more detail in Round 4 of the planning process. . . .

1.5(e) **Environmental Water Demands**

Environmental water demands in the Region include the need for water and associated releases necessary to support migratory water fowl, threatened and endangered species, and populations of sport and commercial fish. Flows must remain sufficient to assimilate wastewater discharges or there will be higher costs associated with wastewater treatment and nonpoint discharge regulations. Periodic "flushing" events should be allowed for channel maintenance, and low flow conditions must consider drought periods as well as average periods. In recognition of the importance that the ecological soundness of our riverine, bay, and estuary systems and riparian lands has on the economy, health, and well-being of our state, the 80th Texas Legislature created the Environmental Flows Advisory Group. . . .

Another ongoing study is the Cypress Basin Flows Project, initiated in 2004, which is a voluntary effort by the non-profit Caddo Lake Institute and The Nature Conservancy in partnership with the U.S. Army Corps of Engineers and others. This project is studying the environmental flow needs of the Cypress Basin as they impact Caddo Lake and its surrounding wetlands. . . .

2.3.7 Regional Environmental Flow Demand Projections

An additional demand for water in the Region is that water needed for "environmental flows," as that term is defined in Senate Bill 3 of the 2007 Regular Session (S.B. 3). While no volumes or rates have been projected in this plan, NETRWPG anticipates a significant amount of water will be needed in the Region's rivers, streams, and lakes to fill the need.

As discussed in *Section 3.5 Impact of Environmental Flow Policies on Water Rights, Water Availability, and Water Planning,* S.B. 3 establishes a process to determine the environmental flow needs for each river basin. The Texas Water Development Board is anticipated to seek funds for the process for basins in the North East Texas Region. Moreover, a voluntary process authorized by S.B. 3 is ongoing for the Cypress Basin. Thus, the NETRWPG recognizes that environmental flow needs will likely be defined during Round 4 of the planning process and can then be incorporated more specifically in that regional plan. . . .

8.8 CYPRESS CREEK BASIN

It is the position of the North East Texas Water Planning Group that there will be unavoidable negative impacts to the integrity of the ecological environment of the water bodies of the Cypress River Basin and especially Caddo Lake, should there be development of new reservoirs in the Cypress River Basin or transfer of water out of the basin, unless such new reservoirs or transfers do not conflict with the environmental flow needs for the water in the North East Texas Region. Those flow needs are defined as the low, pulse and flood flows needed for a sound ecological environment in Senate Bill 3, 2007 Regular Session of the Texas Legislature (SB-3).

Those flow needs have been identified initially by the process of obtaining recommendations from scientists and stakeholders for the flow regimes for the Cypress Basin through a process initiated in 2004 and summarized in the draft Report on Environmental Flows for the Cypress Basin, updated May 2010 and provided as Appendix to the May 31, 2010 Comments of the Caddo Groups to the Region D IPP and referred to as the *Cypress Basin Flow Project Report*. . . .

The Cypress Basin lies entirely in the North East Texas Region (Region D). The amount of needs in the Cypress Basin for environmental flows is not fully or finally determined. Once the State has set aside water for such needs, the State will have made its determination on such needs. There is, however, sufficient unappropriated water in the Cypress Basin to meet the environmental flow needs and unused or unsold water from Lake O' the Pines is one potential source for the additional needs, should appropriate strategies be developed to protect the interests of the NETMWD member cities and others in the Basin that will need such water.

Proposals for new reservoirs or interbasin transfers can be made consistent with the environmental flow needs in the Cypress Basin only after final decisions have been made to determine those needs and sources to fill them. Until then, however, no water should be proposed for a new reservoir or for uses in other regions unless the proposals in other regional plans explicitly recognize the environmental flow needs for Region D and that the amount, timing, diversion rate and other characteristics must be consistent with the needs. . . .

8.11 SULPHUR RIVER BASIN

. . . It is the position of the North East Texas Regional Water Planning Group that there be no development of new reservoirs in the Sulphur River Basin within Region D nor transfer of water out of the basin for that part that is within Region D until the flow needs for a sound ecological environment are defined for the Sulphur River Basin through the process established in Senate Bill 3, 2007 Regular Session of the Texas Legislature. Those flow needs are defined as the low, pulse, and flood flows.

The flow needs assessment for the Sulphur River has not yet begun. No development should take place until the State has identified the flow needs for the Sulphur River and established a demand for the environmental flows for the basin. . . .

Development of new reservoirs prior to determination of the water demands required for environmental flows in the Sulphur River Basin would be premature. Once the State has set aside water for such needs, the State will have made its determinations on such needs. Proposals for new reservoirs or interbasin transfers can then be made consistent with the environmental flow needs in the basin.

Appendix B

Excerpts from

F I N A L R E P O R T

SCIENCE ADVISORY COMMITTEE REPORT

ON WATER FOR ENVIRONMENTAL FLOWS

Senate Bill 1639
78th Legislature

October 26, 2004

prepared for

STUDY COMMISSION
ON WATER FOR ENVIRONMENTAL FLOWS

7. IMPLEMENTATION STRATEGIES FOR ENVIRONMENTAL FLOWS

7.1 Available Environmental Flow Implementation Strategies

Turning from the previous section's discussion of the various tools available to assess the environmental water needs of rivers, streams, bays, and estuaries, this section discusses the possible implementation strategies that could be used to achieve the desired flows, once the target amounts and allocation pattern have been established.

Implementation strategies for achieving desired levels of environmental flows can be generally grouped into two categories: regulatory and market-based. An overview of these two categories and the types of strategies that fall within them are described in the following sections. These strategies are drawn from the literature and from what is being practiced in Texas today. They are intended to provide a relatively broad representation of available options rather than serve as recommendations.

It is important to observe at the outset that the starting point can matter a great deal in shaping the implementation strategy or strategies for providing for environmental flows. Broadly stated, two starting points are possible, depending on whether or not sufficient unappropriated water is available to meet environmental flow targets. If insufficient unappropriated water exists, one of the main objectives of the implementation strategy is to "recover" water for environmental flows from existing permits (water rights). In this case, many of the regulatory approaches described below may prove to be politically difficult to implement, and could raise the possibility of legal challenges. Market-based strategies, by which existing water right holders voluntarily enter into transactions by which their rights are converted or modified to provide for environmental flows, are likely to offer the best means to recover the necessary water to satisfy environmental flow requirements. In the case where sufficient unappropriated water exists, regulatory approaches that allocate the water to fulfill environmental flow needs may prove to be efficacious strategies, with market-based strategies serving as a mechanism for adapting to the natural dynamics and inherent uncertainties associated with environmental flows. In general, it certainly is more difficult/costly to recover the water to meet environmental flow needs from existing permits than it is to allocate or reserve water for environmental flows directly, if that option is available.

7.1.1 Regulatory Environmental Flow Strategies

Regulatory strategies are those that would utilize the legal and regulatory authority of the state to directly allocate water for environmental purposes, stipulating that specified quantities of water be passed downstream before any water can be diverted or impounded, thereby reserving the bypassed flows for environmental purposes, for a specified stretch of a river or stream. A broad spectrum of strategies exists. Some of the most common approaches are described briefly in the following sections.

This section draws from a variety of sources that include Seibert et al. (2000), National Wildlife Federation (unpublished), and Instream Flow Council (2002).

7.1.1.1 Environmental Flow Reserves

An authorized state entity would reserve or "set aside" surface water flows solely to meet the target environmental flow requirements for a particular watershed or stream reach. No permits for consumptive use (diversions or impoundments) could be issued by the state that would reduce these reserved flows. In Texas, the state currently does not have such authority.

Pros – The state entity could act directly on behalf of the public, in the interest of the public good. With proper authority, the implementation process is relatively simple.

Cons – The use of the reserved water would have a priority date that is "junior" to existing water rights permits, thus potentially limiting its availability during low-flow periods when supplies are diminished. To be effective, there must be sufficient unappropriated water available to provide for the reserved flows.

7.1.1.2 Environmental Flow Permits

A permit (water right) for a given quantity of environmental flows would be issued to a governmental or non-governmental entity or private individual through the water rights permitting application process. The total amount available for environmental flows permits in a particular watershed or stream reach would be set at the target level for that particular watershed or stream reach, and permits for environmental flows would not be issued in excess of that amount.

Pros – An enforceable water right for environmental flows would be created, with all of the authority and protection afforded other water rights.

Cons – Any new permit authorizing a certain level of environmental flows would have a priority date that is "junior" to existing water rights permits, thus potentially limiting the availability of water to sustain the environmental flows during low-flow periods when supplies are diminished. To be effective, there must be sufficient unappropriated water available to allocate to the environmental flow permit. Acquisition of an environmental flow permit also would require an applicant willing to shepherd the permit through the permitting process and pay the associated costs.

7.1.1.3 Environmental Flow Conditions Attached to New Water Rights Permits

New water rights permits for non-environmental uses would include conditions to protect environmental flows, stipulating that specified quantities of streamflow be passed downstream before any water can be diverted or impounded, thereby reserving the bypassed flows for environmental purposes, for a specified stretch of river or stream. The nature and scope of these conditions would be established by a state entity using all available information regarding environmental flow targets for the subject watershed or stream reach. Also, the conditions would be subject to scrutiny and review by affected parties, and possibly to revision, through the permitting process. This is basically the strategy that has been used for providing for environmental flows in Texas. (See detailed description in Section 7.3)

Pros – The state entity can act directly, in the interest of the public good. It is relatively easy to implement (and in the case of Texas, is already in place). This approach has been done and accepted, the mechanism for implementing this approach is in place within the State, and it is an established practice that can assure adequate environmental flows for limited segments of rivers and streams and for the bays and estuaries.

Cons – Without proper state coordination and direction, adding environmental flow conditions to new permits can result in an ad hoc approach that makes it difficult to sufficiently and comprehensively achieve environmental flow targets. This strategy cannot address existing water rights that do not have environmental flow conditions, and there must be sufficient unappropriated water available to ensure that the environmental flow targets can be satisfied during low-flow periods when supplies are diminished. Unless conditions explicitly incorporate mechanisms for later modification, adjusting the quantity of environmental flows provided for in the condition could be difficult, if not impossible.

7.1.1.4 Water Taxes

A portion of the water involved in market transfers would be returned to the environment in the form of environmental flows. Such water taxes for environmental flows could be a fixed percentage of the transfer amount or a sliding-scale fixed amount as a function of the transfer amount. The resulting environmental flow

amount would then be converted to either an environmental flow reserve or an environmental flow permit subject to administration by the state.

Pros – This strategy could be effectively implemented, provided that the necessary authority was provided to the administering state agency. The resulting quantities of water available for environmental flows would be authorized and protected to the same extent as the originating water rights.

Cons – This strategy could discourage beneficial and necessary water transfers; it would provide and protect environmental flows within a watershed or stream segment only in the immediate vicinity of the originating water rights and downstream only as far as the next senior water right; and its implementation would likely be controversial among stakeholders.

7.1.1.5 Reservation of Return Flows

Instead of allowing full reuse of all historically discharged municipal return flows when wastewater reuse applications are being considered, the state would reserve a specified percentage, e.g., 10% to 30%, of the return flows for environmental purposes. The resulting environmental flow amount would then be converted to either an environmental flow reserve or an environmental flow permit subject to administration by the state.

Pros – This strategy would be relatively simple to administer, provided the necessary authority was provided to the administering state agency. If applied to both direct (flange-to-flange) and indirect (bed and banks) reuse projects, there would be trade-off between less water available for direct reuse projects and reduced permitting complexities for indirect reuse projects. The resulting quantities of return flows available for environmental flows could be authorized and protected to the same extent as the originating water rights.

Cons – Return flows originating from groundwater or interbasin transfers would require special consideration; benefits of any environmental flows resulting from return flows would be realized and protected only in the immediate vicinity of the reuse project and downstream only as far as the next senior water right; and implementation of this strategy could be controversial among stakeholders. The use of return flows to create environmental flows (either as a permit or reserve) could have a priority date that is "junior" to existing water rights permits, thus potentially limiting its availability during low-flow periods when supplies are diminished.

7.1.1.6 Superceding Public Interest

Based on the public trust doctrine and the "usufructary" nature of water rights permits in Texas, the state could assert superceding interest on existing permits (water rights) for the purpose of providing environmental flows for the greater public good. Possible applications of this approach range from the cancellation of unused rights and their conversion into environmental flow reserves or permits (possible under existing water code); placing environmental flow conditions (reservations) on existing water rights; or, in the most extreme case, "condemning" existing water rights permits for public use as environmental flows.

Pros – This strategy can address sharing of the burden of providing for environmental flows among all existing water rights, even senior water rights that currently have no duty to pass or reserve flows for environmental purposes, and it can provide for environmental flows in over-appropriated basins where the issuance of new permits is not likely.

Cons – This strategy would be politically unpopular to implement and extremely controversial among stakeholders, and it is likely to be perceived as interfering with property rights (i.e., unconstitutional), with very high potential for extended litigation.

7.1.2 Market-Based Environmental Flow Strategies

Like most other western states, surface water supplies in much of Texas are fully appropriated. As noted above, when starting from a position of over-appropriation, achieving target environmental flows will likely require reallocation of existing supplies. Market-based approaches have become important mechanisms that can create unique and important opportunities for voluntary water reallocation, helping to balance competing water demands, including environmental flows.

7.1.2.1 Water Markets

The term "water market" refers to the exchanges of water rights (permits) by willing sellers and willing buyers in a given region, or for a particular water body. It is important to recognize that the geographic extent of markets for surface water is dependent on the size of the watershed (excepting interbasin transfers). States that contain multiple watersheds would consequently require multiple water markets that allow for exchange of permits within those watersheds. Water markets can take a number of forms, and exchanges can be made for both water rights themselves (permanent), and leases of agreed-upon quantities of water but not the rights (temporary). In the specific case of environmental flows, exchanges may also take the form of a donation, if water regulation makes that option available. Water markets exist in nearly every state in the western United States, and are being considered in eastern states such as Florida, North Carolina, and New York.
As with any water management tool, water markets face a number of potential problems and complications. Restrictions on certain types of trades are common, particularly in the case of irrigation organizations, such as cooperatives or irrigation districts. Restrictions may include those on trades that involve changes of use, transfers of ownership outside of the organization, and trades to locations outside the river basin (Wilkinson 1986). In addition, water markets are particularly prone to third-party effects. Transfers of water rights may alter the spatial and temporal pattern of diversions and return flows, affecting large numbers of right holders not directly involved in the transaction (i.e. third parties). In some irrigation organizations, trades may be blocked by the protest of a third party who would be adversely affected (Colby 1990b). Other problems that may impair the performance of water markets include few buyers and sellers (i.e. thin markets), high transaction costs, imperfect information, and the public good aspects of instream uses for water (Brajer and Martin 1990; Colby 1990a, b, and 1989a; Randall 1983). Bauer (1998, 2004) analyzes the experiences of Chile, where the government has been among the most active in the world in establishing water markets, and finds that virtually all of these problems have affected Chilean water markets.

Nonetheless, participation in water markets can be an effective approach for acquiring water rights to meet environmental flows needs. For markets to be used to provide water for environmental flows, environmental flows—or more generally, non-consumptive uses—must be recognized as legitimate and legal. Such "instream flow" rights are recognized in some form in nearly every western state**.** However, individual participation in water markets for the purpose of acquiring rights for environmental flows is rare, and may be precluded under existing water regulation. Instead, transactions to acquire environmental flows typically involve either state entities or, if the water code permits, private, non-profit organizations (see the following discussion of water trusts) established to represent the demand for environmental flows in the market. Environmental and instream flow demands are a growing part of nearly every western state water market. With the exception of Wyoming, environmental water sales have occurred in every western state. This market sector has increased steadily since 1990, when less than $500,000 was spent on water purchases. In comparison, more than $11 million dollars was expended from 1990 to 1997 on purchases of water to improve habitat conditions for fish and wildlife (Landry, 1998). Expenditures for environmental water acquisitions throughout the western United States are currently estimated at $20 million per year (Landry 2003).

Pros – This approach provides a voluntary mechanism by which existing water rights for human uses can be reallocated for use as environmental flows. Because it is an "ownership rights" based approach, it avoids many of the potential problems associated with regulatory approaches previously described. It also provides the opportunity to acquire senior water rights for use as environmental flows.

Cons – The water-market approach requires that entities seeking to acquire water rights for environmental flows have the financial resources to participate in the market sufficiently to obtain the target level of environmental flows. If left to decentralized efforts and financing from multiple participants, it is unlikely that sufficient water rights will be acquired to meet environmental flows targets. Decentralized efforts may also lead to high "transaction costs," which include costs associated with locating trading partners, developing contracts, and working out trading procedures. Because widespread use of water markets in Texas would be a new approach, potential participants may have limited experience with banking and may not fully understand how the bank functions. Potential participants may hold back during the initial trading periods to observe and gain market information and then enter once the market is more established. Water trusts (see following section) represent a way to address many of these issues.

7.1.2.2 Water Trusts

For the purposes of this report, an environmental flows "water trust" is a formally organized and recognized entity that has been established to hold and manage water rights specifically to provide environmental flows. A water trust can exist as either an entity of the state or as a private non-profit organization. Oregon and Washington have statutes that specifically allow private entities to acquire water rights for instream use. The new instream water rights are held in trust with the state. However, the organizations maintain a fiduciary responsibility to instream rights. As a result, private entities have legal authority to monitor and enforce the instream rights. Though it may be too early to tell, it appears that states such as Oregon, Washington, and Montana that allow for some form of private ownership or holdership have tended to see environmental flows evolve more quickly. Table 7-1 provides a summary of private conservation organizations active in water throughout the western United States. Assuming that sufficient funding is available to them, water trusts can participate in water markets to acquire rights to be used for environmental flows. Importantly, water trusts can also acquire water rights through donation. It is important note that, although Texas has established a state entity called the "Texas Water Trust," it serves a slightly different function as simply the holder of water rights that can be placed in the Water Trust—either for a limited period of time or permanently—for use in meeting environmental flow needs (see more detailed discussion of the Texas Water Trust that follows).

TABLE 7-1 PRIVATE NON PROFIT ENVIRONMENTAL

WATER MARKET ORGANIZATIONS Organization	State	Focus
Colorado Water Trust	Colorado	State-wide organization
Deschutes Water Exchange	Oregon	Deschutes Basin
Klamath Basin Rangeland Trust	Oregon	Klamath Basin
Great Basin Land & Water	Nevada	Truckee Carson Basin
Montana Water Trust	Montana	State-wide organization
Montana Trout Unlimited	Montana	State-wide organization
Oregon Water Trust	Oregon	State-wide organization
Washington Water Trust	Washington	State-wide organization
Walla Walla Watershed Alliance	Washington	Walla Walla Basin