Final Report

Drought Management in the Texas Regional and State Water Planning Process

Texas Water Development Board

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May 31, 2009

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Prepared for

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Drought Management in the Texas Regional and State Water Planning Process

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SECTION ES.
Executive Summary

In June 2008, the Texas Water Development Board retained a consulting team led by BBC Research & Consulting (BBC) to evaluate the role of drought management measures in the regional and statewide water planning process. This study examined the potential benefits and drawbacks of including drought management as a regional water management strategy.

Study Approach

The study team conducted a series of research tasks regarding the role of drought management measures in regional and state planning, including:

- Review of planning documents prepared for the 2007 State Water Plan;
- Review of planning processes used in other western states;
- Interviews with chairpersons of the 16 regional water planning groups;
- Interviews with 90 regional water planning group members and other stakeholders; and
- Analysis of a sample of more than 100 drought contingency plans from across Texas.

Key Results

The study team investigated four key questions during this study. Below is a brief discussion of study team findings for each of these questions. Section VI provides a more detailed discussion of the conclusions.

Question #1, part A— Is it possible to use drought management measures as water management strategies in the regional plans? There are substantial analytical challenges in evaluating drought management as a water management strategy. The main difficulties involve estimating water savings achieved through drought measures and comparing the "costs" of drought management measures with traditional water supplies. Additionally, the current modeling framework (calculating water needs by comparing supplies and demands during drought of record conditions) makes it difficult to fully assess effects from incorporating drought management as a strategy.

These issues could be resolved. Recent draft studies by Regions L and H provide a starting point for calculating the costs and savings of drought management and comparing drought management with other water management strategies. The regional planning approach to analyzing future needs could be modified to consider other climatological and hydrologic conditions. Water planning continues to become more sophisticated, and approaches such as probabilistic modeling of future supplies, demands and costs are being implemented by some providers.

Question #1, part B — Is it appropriate to use drought management measures as water management strategies in the regional plans? There are well reasoned arguments for and against including drought management measures as a water management strategy. The most common

reasons for opposing the use of drought management measures as a water management strategy were the removal of the safety factor provided by drought management plans, potential economic impacts and the unwillingness of water providers and the public to accept a planning approach that includes future shortages and demand reduction measures. Proponents, on the other hand, argue that during periods of drought most providers would implement drought measures, and not including effects from these measures in the planning process could lead to unnecessary water projects. Most proponents also noted that occasional reliance on drought management measures can be cost effective. Arguments on both sides suggest the need for refinements in the process for analyzing future needs in order to make the inherent safety factor provided by drought planning more explicit and determine which water management strategies might be used only during drought conditions.

Question #2 — Why haven't Regional Water Planning Groups (RWPGs) recommended drought management as a water management strategy? There are five major reasons why RWPGs have not recommended drought management measures as a water management strategy:

- The difficulty of quantifying the costs and yields of drought management measures;
- Lack of information on water supplies and demands under varied hydrologic conditions leads to uncertainty that promotes a cautious approach to water supply planning;
- In many regions, relatively affordable new supply alternatives remain;
- Concerns about regional competition for state assistance and inter-regional equity; and
- The makeup of the RWPGs likely favors the perspective of those opposed to including drought management as a water management strategy.

Question #3 — What are the ranges of savings, statewide, if drought management was included as a water management strategy? The study team estimates a reduction in demand of 15 to 20 percent if all municipal providers implemented measures identified in the drought of record stage of their drought plans. These measures would, in many cases, at least temporarily reduce customer quality of life and could adversely affect the local economy. Less onerous drought measures might reduce demand by 5 percent or less. It is important to note that there is considerable uncertainty in these estimates as the study team used projections reported by providers with drought plans and there are limited data on actual savings achieved using drought measures in Texas.

Question #4 — What would have to change for RWPGs to recommend drought management as a water management strategy? The study team identified four key changes required for RWPGs to recommend drought management as a water management strategy:

- Reliable estimates of water savings and costs for drought management measures;
- More sophisticated supply, demand and "need" analysis in the water planning process;
- Increases in the cost and difficulty of pursuing water supply alternatives; and
- More incentives for including drought management as a water management strategy.

Additional Findings

The study team identified a number of other insights and questions from this research. These issues are discussed in detail at the end of Section VI.

SECTION I.
Introduction

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Introduction

In June 2008, the Texas Water Development Board ("the TWDB") retained a consulting team led by BBC Research & Consulting ("BBC" or "study team") to evaluate the role of drought management measures in the regional and statewide water planning processes. Along with BBC, the study team included Morningside Research and Consulting (based in Austin) and G.E. Rothe Company, Inc. (from Hondo, Texas). This report presents the results of the study team's evaluation.

Background

Regional water planning continues to evolve in Texas and other states. Early efforts at regional cooperation focused primarily on collaborative efforts to develop new supplies and allocate and share supplies from existing sources. In recent years, water conservation has become an increasingly important part of water planning at the local, regional and statewide levels.

In some ways, incorporating consideration of drought management measures appears to be a logical continuation of this planning evolution. Like ongoing water conservation measures, drought contingency strategies can reduce the amount of supply that providers must maintain in order to meet future demands. Larger municipal providers in Texas (utilities with more than 3,300 connections) are already required to file drought contingency plans with the Texas Commission on Environmental Quality. Texas statute requires that Regional Water Planning Groups ("RWPGs") consider drought management measures as potential water management strategies in the planning process.[1]

Several factors complicate any effort to include drought management in regional and state water plans. Customers expect providers to meet their water needs under all but the most extreme conditions and most water providers traditionally seek to develop and maintain sufficient supplies to meet demands under a repeat of the historical drought of record. Drought restrictions and other drought contingency measures are often viewed as the strategy of last resort by municipal providers. How much customers will reduce their water use under varied drought management measures is uncertain, as is the durability of such savings. Triggers for implementation of drought management measures and the measures themselves vary from provider to provider, depending on local preferences and the nature and extent of their water supplies.

The BBC team was tasked with seeking the answers to four fundamental questions:

- Is it possible and appropriate to use drought management measures as water management strategies in regional water plans?
- Why haven't Regional Water Planning Groups recommended drought contingency planning as a water management strategy?

[1] Texas Water Code Section 16.053(e),(h).

- What are the ranges of potential statewide water savings if various drought management measures, already contained in existing drought contingency plans, were recommended in regional plans and implemented?

- What would need to change in order for Regional Water Planning Groups to recommend drought management measures as water management strategies in the regional water plans?

Since regions are now beginning the efforts leading up to the next round of regional plans in 2011, this is an appropriate time to evaluate the advantages and disadvantages of incorporating drought management measures as water management strategies in the regional and state water supply planning process.

Distinguishing Drought Management from Ongoing Water Conservation

Drought management can be defined as the use of temporary measures to reduce water demand during emergency conditions resulting from adverse climatological circumstances. Although some water providers may also be able to temporarily increase water supply by obtaining water from alternative sources or through water sharing arrangements with other water systems, this study focuses on demand management strategies to respond to droughts.

Figure I-1, on the following page, provides a conceptual illustration of the effects of drought management in the context of long-term water supplies and demands for a hypothetical water provider.

In simple terms, the transition from normal conditions to drought, and the subsequent implementation of drought management, can be considered to have four sequential effects:

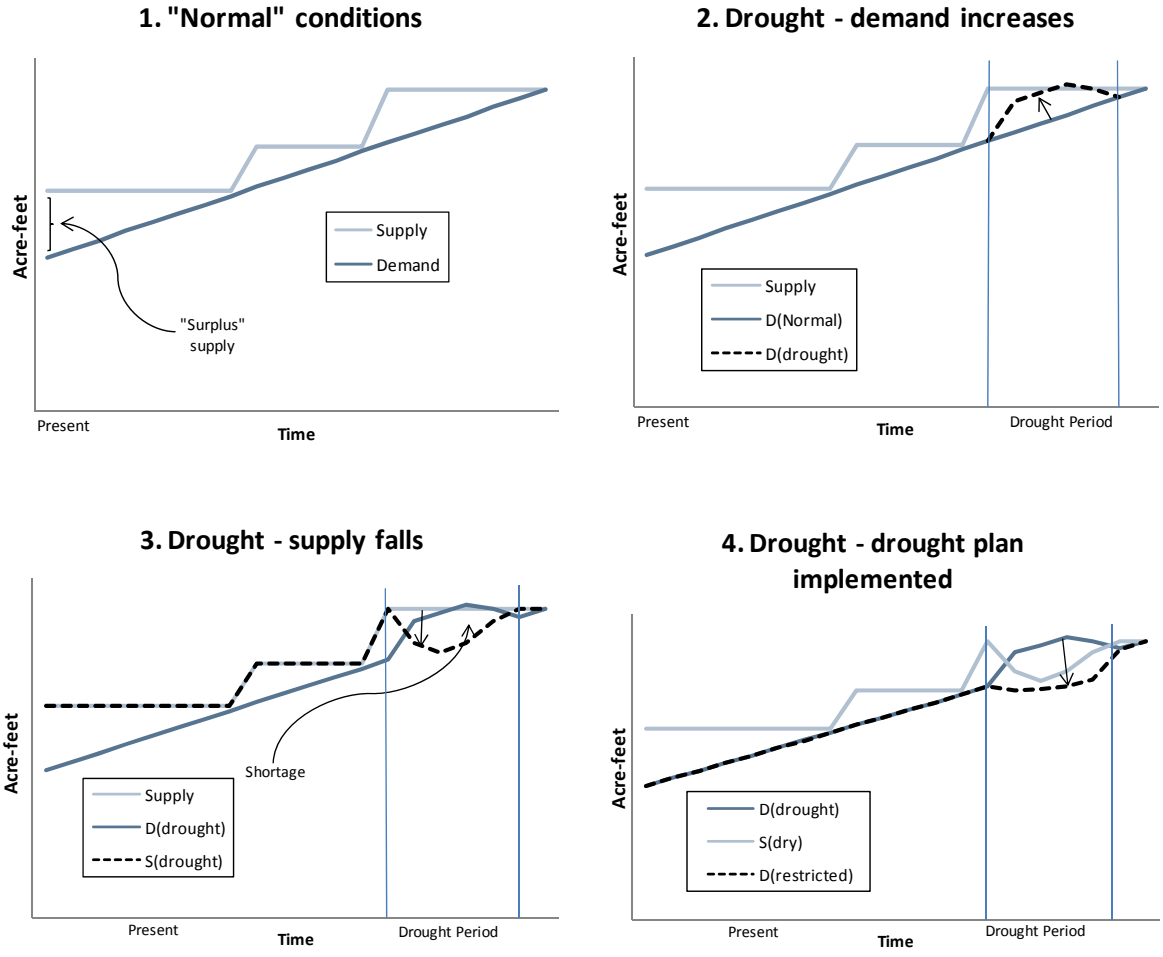
1. Under normal conditions, the provider adds supplies in incremental stages to insure that available supplies are greater than anticipated demands. This panel illustrates the growth in demands, and the development of two additional sources of supply, for the hypothetical provider over the 50+ year planning period used in Texas.

2. With the onset of a drought, demands (particularly for outdoor irrigation) typically increase as a result of hot and dry conditions. This panel depicts these effects from a drought occurring near the end of the planning period.

3. Due to the drought, supplies decrease (especially for providers reliant on surface water or highly variable aquifers like the Edwards Aquifer). As shown in panel #3, available supply for the hypothetical provider is anticipated to potentially fall below the increased demand level due to the drought — leading to a potential shortage.

4. Recognizing the situation, the provider implements its drought management plan to reduce demands to a level that can be sustained through the drought period. This final panel shows demands being reduced as a result of the drought management strategies invoked by the hypothetical provider.

Figure I-1.
Conceptual illustration of drought management in the context of long-term supplies and demands for a hypothetical water provider



In actual practice, drought management is not truly an approach of last resort to be implemented only under drought of record conditions or when "all else fails." Because drought management does not actually produce any new water, the purpose of drought management is to extend existing "wet water" supplies so that they will last throughout the drought period. At the onset of a drought, it is impossible to predict how long the drought will last or how severe it will be. Consequently, most providers have drought contingency plans with multiple stages — demand reduction efforts can then be gradually increased as conditions warrant. Some providers, such as the San Antonio Water System, have implemented their drought management plans several times in recent years, although the drought of record has not been repeated in the San Antonio area during this time frame.

Drought management is sometimes confused with ongoing water conservation programs. In part, this confusion may arise because some measures invoked by some providers for drought management purposes are used by other providers as part of their ongoing conservation efforts. For example, limitations on the frequency and/or time of day that customers may irrigate their landscapes are common early stage drought response strategies for many providers. Other providers, however, enact these types of restrictions on a regular, ongoing basis as part of their conservation plans. By definition, drought response measures for a particular provider must go beyond the water conservation measures that provider has already implemented as part of its ongoing conservation efforts. In general, and particularly for more severe drought conditions, drought response measures involve more aggressive efforts to limit demand — and potentially greater hardship for customers — than ongoing, routine conservation measures.

There is, however, a relationship between drought management and water conservation. One common concern among many water providers across the nation is that the increases in water use efficiency that result from ongoing water conservation efforts will absorb much of the "slack" in the system, reducing the effectiveness of drought management measures when needed. This phenomenon is typically referred to as "demand hardening."

Organization of the Study and this Report

The BBC team evaluated the relationship between drought management and regional and state water planning, and the potential benefits and drawbacks of incorporating drought management as a regional water management strategy, through the following research and analytical tasks:

- Review of regional and statewide planning documents from the last round of water planning in Texas and more recent studies conducted by two of the RWPGs (described in Section II of this report);
- Review of water planning and drought management in other western states (also described in Section II of this report);
- Interviews with the chairpersons of the 16 regional water planning groups (described in Section III of this report);
- Interviews with 90 regional water planning group participants and outside stakeholders (described in Section IV of this report); and
- Review and analysis of a systematic sample of more than 100 drought contingency plans filed by regional and wholesale providers (described in Section V of this report).

Section VI of this report summarizes the findings and conclusions resulting from this research.

SECTION II.
Water Planning and Drought Management in Texas and Other Western States

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As part of the research for this study, the BBC team reviewed regional and statewide Texas water planning documents completed in developing the 2007 Texas Water Plan. The study team also reviewed water planning processes and drought management requirements in other western states. Finally, the study team examined recent planning reports developed by two of the Regional Water Planning Groups that focus specifically on drought management-related issues.

Regional and State Planning for the 2007 Texas Water Plan

The regional plans adopted in 2006 and the statewide water plan adopted in 2007 address drought management in the context of long-term water planning with varying degrees of detail.

Legal framework. Drought contingency and water conservation planning are covered by Texas Water Code (sections 11.1272 and 11.1271, respectively) as well as Texas Commission on Environmental Quality (TCEQ) rules (30 TAC chapter 288 and 31 TAC chapters 357 & 358). These regulations establish the entities responsible for drafting plans as well as outline the minimum requirements for the plans. All wholesale public water suppliers, retail public water suppliers serving 3,300 connections or more, and irrigation districts were required to submit water conservation and drought contingency plans. All public retail water suppliers (regardless of the number of connections served) must have a drought contingency plan available for inspection upon request.

Regional Water Planning Groups (RWPGs) are required to consider drought management measures as a water management strategy.[1]

2006/07 Texas planning documents. All of the Regional Water Planning Group reports adopted in 2006 summarize drought contingency planning requirements and most identify the entities in each region required to submit a drought contingency plan. The regional reports vary considerably with respect to the level of detail they provide regarding drought contingency plans, triggers and strategies.

Level of detail. In most cases, the RWPG collected drought contingency plans from water user groups and then constructed a model plan or plans as a guideline for other user groups in the area. Some reports include a summary of plans received from entities within the region, by trigger and water source type. Summaries of the overall regional plans are contained in the 2007 Texas State Water Plan.

[1] Texas Water Code Section 16.053(e),(h).

Triggers. Drought contingency stage triggers are largely determined by source type and vulnerability, by user group and provider type, time of year, and by provider-specific administrative and legal constraints. The types of triggers can be divided into three categories: demand-type, supply-type, and other. Demand-type triggers are related to the entity's production capacity — treatment as a percentage of capacity, total daily demand as a percentage of pumping or storage capacity, hours pumped per day, or other production limitations. Demand-type triggers were the most common across all regions.

- Supply-type triggers are based on source volume indicators (e.g., reservoir levels or well levels). Several regions indicated potential problems with supply-type triggers, particularly when assessing groundwater levels.

- Other drought contingency plan triggers are either based on climatological conditions, administrative decision or time of year. Some water supply sources have existing legal restrictions that impact the drought contingency plan triggers. For example, some reservoirs fall under the jurisdiction of the U.S. Bureau of Reclamation (USBR), so drought triggers for those areas may be predetermined by the USBR.

- Some contingency plans used a hybrid of two or more trigger types, and/or used different types of triggers to determine different stages of drought response.

Strategies. The RWPG reports vary significantly in their identification of measures included in drought contingency plans. Many of the model plans, though they list potential actions for each trigger stage, give no indication of which measures are the most appropriate for each drought condition stage.

Most regional groups distinguish between water conservation and drought contingency planning, noting that conservation efforts are designed to protect water resources in such a way that a water supply is made available for future or alternative uses. Drought contingency planning is a way to have a structured response to a sudden shortage of water.[2]

Based on the regional water planning documents, no RWPG thoroughly considered drought management as a water management strategy. None of the regional plans shows an accounting of potential water savings, costs or implementation issues associated with drought management as a water management strategy or compares drought management to other water management strategies. None of the regions chose to pursue drought management as one of the means to meet future water needs. Among the regions that discussed why drought management was not recommended as a water management strategy, the most commonly cited reasons for dismissing drought management were that it was considered a temporary strategy and it was inappropriate for long-range needs. (Other reasons were identified during the interviews with regional chairs and other RWPG participants, discussed in later sections of this report.)

[2] "The drought contingency plan must include drought or emergency response stages providing for the implementation of measures in response to at least the following situations: (i) reduction in available water supply up to a repeat of the drought of record; (ii) water production or distribution system limitations; (iii) supply source contamination; or (iv) system outage due to failure or damage of major water system components (e.g., pumps)." (TAC rule § 288.20)

Water Planning and Drought Management in Other Western States

Other western states with arid or semi-arid climates and growing populations face the same challenges as Texas in preparing to meet future water needs and dealing with the risk of severe droughts. Each state, however, has adopted its own unique approaches to long-term water planning and drought contingency preparation. The study team reviewed water planning processes, and drought contingency planning requirements, in six other western states — Arizona, California, Colorado, New Mexico, Oklahoma and Wyoming.

Arizona. Modern state water planning in Arizona began with the passage of the Groundwater Management Code and creation of the Arizona Department of Water Resources (ADWR) in 1980. Water planning is primarily a top-down process, with the primary objective of controlling groundwater depletion and achieving "safe-yield" (a sustainable condition) in the state's most populous areas. The principal planning regions are the five Active Management Areas (AMAs): Prescott, Phoenix, Pinal, Tucson and Santa Cruz.[3]

Water supplies are planned and managed through individual management plans for each AMA. The state is currently operating under the Third Management Plan (in effect from 2001 to 2010). While regional stakeholders (e.g. water providers, local governments and other interests) participate in the development of each management plan through technical advisory committees, planning is led by ADWR. Projections of future demand and supplies focus on water use under average climatological conditions. Projections extend through 2025, the date when the Groundwater Code requires the AMAs to achieve safe yield.

Separate from the AMA planning and management effort, Arizona has prepared a state drought plan and also requires individual water systems to file water supply and drought management plans. The Arizona Drought Preparedness Plan (ADPP) was completed in October, 2004. The first part of the plan documents the historical impacts of drought conditions on water supplies in certain areas. The second part of the plan outlines the methods of identifying drought conditions and triggering mechanisms as well as operational responses to the various drought stages.

As of 2008, each community water system (CWS) is required to submit a system water plan, which must include a water supply plan, drought preparedness plan and water conservation plan. As part of the required water supply plans, each CWS must project water demands in its service area for the next 5, 10 and 20 years. These analyses are made at the CWS level under "average" conditions. The ADWR provides a template for the system water plans, which includes an interactive drought plan tool to assist a CWS in assessing drought vulnerability and management strategies.[4]

[3] The management goal for the Pinal AMA is to "preserve the (agricultural) economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses." For the other AMAs, the goal is to reach safe-yield by 2025.

[4] http://droughtplan.arid.arizona.edu

California. As in Arizona, water planning in California is primarily the responsibility of the state's water management agency, the California Department of Water Resources ("DWR"). The California Water Plan is updated every five years and the last statewide plan was completed in 2005. The 2005 plan considered future water needs through 2030 under three scenarios: current trends, less resource intensive and more resource intensive. While California water planning has been primarily a top down process in the past, one of the initiatives identified in the 2005 plan was to move toward implementing integrated regional water management. At this time, regional participation remains a voluntary element in California water planning.

One of the key elements of planning for California's future water needs is "urban water use efficiency." In February, 2008 California Governor Schwarzenegger called for a 20 percent reduction in statewide water use per capita by 2020. This element is focused on long-term water conservation savings programs, not drought management.

Urban water suppliers with 3,000 or more connections are required to submit Urban Water Management Plans (UWMP) to the DWR detailing responses to water supply reductions of up to 50 percent. The Urban Drought Guide, a publication produced by the DWR to assist water suppliers and local agencies in drought contingency planning, presents methods for modeling future water supply and demand at the local level. The guide suggests modeling under "average" seasonal conditions as well as under drought of record conditions to determine the magnitude of potential shortages during drought years.

Colorado. Water planning in Colorado is transitioning from a top-down process to a bottom-up approach somewhat akin to water planning in Texas. The most recent statewide water planning effort, the Statewide Water Supply Initiative (SWSI), was directed by the Colorado Water Conservation Board (CWCB) and completed in 2004. The SWSI report was developed by consultants, although there was considerable input from basin "roundtables" across the state.

The 2004 SWSI evaluation of future supplies and demands across Colorado focused on anticipated water needs in 2030. The study projected demands on an "average year" basis, though alternative scenarios of higher or lower demands (primarily related to varying assumptions about future water conservation) were considered. Supplies were primarily evaluated on a "firm yield" basis, meaning the maximum supply that could be anticipated on a reliable basis.

Since 2004, the basin roundtables have continued to function and to evaluate future water needs and water management strategies. The ongoing water planning process is now primarily occurring at these regional levels, with funding support from CWCB. The basin roundtables may lead to shared regional projects in some parts of Colorado.

The primary focus of the SWSI process was the question of how to meet growing municipal demands in various parts of Colorado. While water conservation was an important part of the strategy to meet future water needs in the 2004 SWSI report, drought management was not considered as a management strategy. In Colorado, municipal providers are encouraged, but not required, to file drought management plans with the CWCB.

New Mexico. Among the other states examined in this study, water planning in New Mexico most closely resembles the planning process in Texas. New Mexico updates its state water plan every five years. The most recent published plan is for 2003, though the 2008 plan should be available soon.

As in Texas, statewide water planning in New Mexico is a bottom up process. Also like Texas, the state is divided into a total of 16 regions for regional water planning purposes. The planning process includes regional supply and demand projections and is intended to lead to the prioritization of future water supply projects on a regional basis. Planning is primarily based on average supply and demand conditions, though a review of regional plans in New Mexico suggests there is more flexibility in how regions analyze and project supplies and demands than in the Texas process. Some New Mexico regions developed very simple supply and demand projections, while others developed elaborate scenario-based approaches.

Drought management has not been integrated into long-range planning in New Mexico. As in Colorado, water providers are encouraged, but not required, to file drought management plans with the state.

Oklahoma. Perhaps because the state has not experienced strong population growth relative to Texas and most of the other western states considered in this study, water planning in Oklahoma is comparatively simple. Oklahoma developed a statewide water plan in 1980 and in 1995 and is currently working on an updated plan expected to be completed in 2011. The Oklahoma Water Resources Board is tasked with developing the new statewide water plan.

Even though the water planning process is top-down in nature, the first component of the planning process has been to obtain local and regional input through a series of town hall-type meetings and other sources. The 1995 plan was formulated around eight planning regions across the state, while the current plan is gathering information across 11 different planning regions.

Oklahoma has a drought management plan, published in 1997. The plan, however, focuses on coordinating responses to drought by state and local agencies, not on mitigating drought impacts through demand management. Local water providers are not required to file drought management plans in Oklahoma.

Wyoming. Wyoming embarked on a new state water planning process in 1999. Wyoming water planning is based on integrating the results of regional water planning (like the process in Texas and New Mexico and the emerging process in Colorado). In Wyoming, the regional planning groups are termed "Basin Advisory Groups" and state water planning has proceeded basin by basin. The first basin plan was developed in about 2002 and the last of the seven basin plans was completed in 2006.

Identification of water needs and evaluation of water management strategies in Wyoming has been based around comparison of demand projections under average year conditions with available water supplies under average, wet and dry years. Compared with some of the other western states, management options in Wyoming focus more on new supply development and less on urban water conservation — likely due to the relatively small share that municipal uses contribute to Wyoming water demands. Drought management strategies have not been incorporated in the Wyoming water planning process.

Summary of water planning and drought management in other western states. A number of western states confront some of the same water planning challenges as Texas: arid or semi-arid climates that are prone to periodic droughts, rapid population growth, and diversity of water uses and supplies across the state. Like Texas, these states have developed water planning processes to identify and evaluate options for meeting future water needs. In some cases, other states also require providers to develop drought management plans and file them with a state agency.

The review of the water planning process in other western states highlights some of the strengths of the process used in Texas. Other states, such as California and Colorado, that have historically relied on a top-down, state-driven planning process are moving toward more of a regionally-based system. Figure II-1 summarizes elements of the water planning process in other western states and compares those elements to the Texas process.

Figure II-1.
Summary of water planning in other western states

Planning Elements	Texas	Arizona	California	Colorado	New Mexico	Oklahoma	Wyoming
"Bottom up" planning process?	Yes	No	No	Emerging	Yes	No	Yes
Regional demand projections?	Yes	Yes, AMAs only	No	Yes	Yes	Yes	Yes
Demand projection basis?	Dry year	Average year	NA	Average year	Average year, flexible	Average year	Average year
Regional project priorities?	Yes	Generally no	No	Developing?	Yes	Yes	Developing
Providers required to file drought plans?	Yes	Yes	Yes	Encouraged	Encouraged	No	No
Linkage between drought plans and demand projections?	No	No	NA	No	No	No	No

Source: BBC Research & Consulting.

As in Texas, drought management strategies in other western states have not been integrated into state and regional long-term water planning efforts. Long-term water planning is other western states is most often based on the approach of considering supplies in terms of firm-yield, while demands are typically evaluated in terms of average year conditions. In Texas, demands are evaluated on the basis of projected needs during dry years.

In California and Colorado, some local water planners are departing from the traditional approach of planning on the basis of firm yield supply estimates derived from droughts of record during the past century. Tree ring studies in Colorado suggest that the state has experienced much drier conditions in the past than have occurred since the advent of written record-keeping. Uncertainty about the severity of potential drought based on historic (and pre-historic) data is only compounded by questions regarding the future effects of possible global climate changes. In light of these uncertainties, some urban providers are adopting alternative planning paradigms, such as probabilistic analyses of future supplies and demands. These types of analyses consider a range of possible future demands and supplies (and potential shortages or needs), based on statistical analyses of historical variability in these variables.

One example is the City of Boulder, Colorado. Boulder has adopted reliability criteria for water resource planning based around the acceptable frequency and magnitude of water shortages — and established corresponding goals for water use reductions from various drought management stages. Boulder describes its reliability goals, and corresponding objectives for drought management measures, as follows:

> "Our reliability standards vary for the types of uses. For example, the city of Boulder provides sufficient water to meet all municipal water needs up to and through a drought severe enough to occur only once every 20 years on average. However, water for landscaping needs may be restricted for droughts of a severity that occurs less frequently than once every 20 years. Water for landscaping may be curtailed to the point that some landscaping die-back occurs for droughts that occur no more often than once every 100 years. As droughts increase in severity the amount of restrictions also increases to the point that outdoor water use is totally eliminated during droughts that occur once in 1,000 years."[5]

Recent Texas Studies Regarding Drought Management and Regional Planning

Recently, two Texas RWPGs, Region L and Region H, have undertaken studies to further explore issues associated with integrating drought management and regional water planning. More specifically, these studies have explored two of the issues often cited as reasons that RWPGs have not fully considered drought management as a water management strategy: the challenges in quantifying the "yield" or savings that can be achieved through drought management (Region H study) and the difficulties in estimating the costs associated with drought management as a water management strategy (Region L study). The study team reviewed the most recent drafts of these documents available at the time this report was written.

Region L study. Section 4.0 of the December 2008 draft of the Region L study 2011 Regional Water Plan — Study 3, Enhanced Water Conservation, Drought Management, and Land Stewardship provides the first effort by a RWPG to quantify the costs associated with using drought management as a water management strategy and compare then with the costs of other management strategies such as new supply development or enhanced water conservation. The Region L study estimate costs of drought management as a water management strategy by considering costs to be equivalent to projected economic impacts. The study also takes an initial step toward a probabilistic analysis of the likelihood and magnitude of water shortages by analyzing historic variability in water use per capita among municipal water providers in the region. The study reaches the conclusions that drought management may potentially be economically viable for some water user groups in Region L relative to other water management strategies. This is particularly true if the drought management plans are able to reduce the economic impacts of shortages by primarily cutting back on discretionary (e.g. landscaping) uses.

One of the findings from the Region L analysis of historic variability in per-capita water demands is that year 2000 demands — which provide the foundation for future water demand projections in Texas under dry year conditions — are not the highest per-capita demands that the region has experienced over the past four decades. These differences may be due to a number of factors, including variability in demand due to weather conditions, as well as the effects of conservation programs and occasional implementation of drought management measures.

[5] City of Boulder Colorado Drought Plan. Volume 1 Drought Response Plan. February 20, 2003.

During the time period analyzed in the Region L study (1964-2004), per-capita demands exceeded the year 2000 average about 25 percent of the time. It must be taken into consideration that the year 2000 per-capita average is lower due to cumulative conservation efforts undertaken by the region's providers. It is also possible that some of the municipal providers in Region L implemented drought management measures in year 2000, which would have reduced per-capita demands during that year.

The largest per-capita demands appear to be about 7 percent greater than year 2000 demands. This analysis suggests that if a provider (or a region) developed future water management strategies to just exactly meet future dry year demands (based on year 2000 GPCD), it would have to rely on drought management to reduce demands during some future years, though this conclusion is uncertain without further analysis to disentangle the cumulative effects of conservation programs from annual demand variability due to weather conditions and other factors. This analysis also highlights the possibility that the year 2000 GPCD numbers may already incorporate some drought management water savings (for providers that enacted their drought plans during that year).

The BBC team believes this type of analysis can be further developed in several ways. First, additional analysis could be conducted to remove the effects of conservation (and the occasional implementation of drought management measures) on historical per-capita demands and more conclusively isolate the annual variability in demands due primarily to weather variation. Also, the analysis could be further developed by examining the probabilistic distribution surrounding available supplies, as well as per-capita demands. Finally, certain aspects of the economic impact (cost) estimates can be improved.

Most municipal providers' drought contingency plans are intended to minimize economic impacts by reducing discretionary water uses first and attempting to maintain more essential uses of water. (The Region L study presents a scenario that recognizes this approach for the San Antonio Water System, but does not include this refinement in the overall impact/cost analysis). We also do not believe that foregone utility revenues should be counted as an economic impact to the region. Although this is a financial loss for water (and potentially wastewater) providers, it is offset by corresponding cost savings for utility customers – so it is a financial transfer, not an economic impact.

Nonetheless, Region L's development of an initial approach for comparing drought management with other water management strategies and the probabilistic analysis of demand variability in the region are both valuable contributions to the discussion about integrating drought management and regional planning in Texas.

Region H study. The *Region H Planning Group Drought Management Study Draft Report* was issued on November 4, 2008. The study reviewed historical data from the region and other locations (including providers in other states) in an effort to analyze the efficacy of drought management — how much water drought management can save. The study identified providers that have implemented drought contingency plans and gathered and analyzed water use data before and after the plans were implemented.

Although some providers appear to have experienced reductions in demand after implementing their drought management plans, there is "very little good empirical research to quantify the effectiveness of drought response measures," according to the Region H study. It is difficult to separate the effects of drought management plans from other factors, such as varying climate conditions and ongoing conservation efforts. Nonetheless, the study concluded that "implementation of drought management plans will have effects on annual water demands when implemented during drought conditions."

The study developed some rules of thumb for projecting potential savings from various stages of drought response that were then used to estimate impacts on regional reservoir levels.

A key finding from the Region H study was that, based upon surveys of Region H providers that had implemented portions of their drought contingency plans in recent years, "'real' water supply shortages are not a common occurrence during droughts…Accordingly, the most common objective of municipal drought contingency plans is to "shave" peak water demands in order to reduce stress on infrastructure and thereby avoid or minimize impacts on water service …" Further, "it's important to note that the degree of demand reductions needed to address a peaking problem may be much less than what would be needed in an actual water shortage situation. For example, in a true water shortage situation limiting lawn water to one or two days per week, or an outright ban, may be required to achieve the desired reduction in water use while an alternate day (e.g. odd-even) watering schedule may be sufficient to reduce peak water demand to safe levels." [6]

The Region H finding that drought management plans were most often invoked in response to infrastructure limitations in not surprising, particularly in a region that is located in the eastern portion of Texas (which receives more rainfall than central and western Texas) and wherein most water providers rely on groundwater supplies (which are generally not as immediately correlated with climate conditions as surface water supplies). This finding is also consistent with insights gained during our study from conversations with TCEQ staff that administer the drought contingency plan program and may hold for other parts of Texas as well as Region H. The observation that programs designed to "shave peak use" through scheduled watering days may require smaller reductions in water use than a "real" water supply shortage is also consistent with the experience of other regions of the country. In the 1970s, for example, Denver Water, placed its customers on a once every three days watering schedule to reduce demands on its treatment plants. While that program achieved its desired objectives, Denver Water staff recall that it did not substantially reduce overall seasonal or annual water demands.[7] As discussed in Section V, most drought contingency plans of municipal providers in Texas contain numerous stages with the intent that they can be responsive to either infrastructure limitations or "real" water supply shortages.

The Region H study reached the conclusion that drought management alone would not replace or modify any recommended long-term water management strategies in the region. The study argued that drought management only reduces water demand during drought and that these savings would not be significant in the context of long-term water supply planning.

The Region H conclusion regarding the relationship between drought management and long-term water strategies appears logical in terms of water supply projects needed to meet demands under normal or average year conditions. However, the current regional and statewide water planning approach in Texas is based around meeting demands under drought of record conditions. In this context, some of the water management strategies selected by Region H (or other regions) may only be needed to fill the gap between future supply and demand projections in the case of severe drought. Under such circumstances, comparison of drought management as a water management strategy to these particular water management strategies may be appropriate and useful.

[6] Drought Management Study. Region H Water Planning Group. November 2009. Page 2-4.

[7] Study team conversations with Denver Water planning staff during previous studies.

SECTION III.
Interviews with Regional Chairpersons from the 2006 Regional Planning Process

SECTION III.
Interviews with Regional Chairpersons from the 2006 Regional Planning Process

In order to better understand local perspectives on drought management in relation to the regional water planning process, the study team interviewed the regional chairs and co-chairs across the 16 planning regions in Texas. The BBC team was able to interview 16 regional chairs and co-chairs, covering 15 of the 16 regions. This section describes the interview process and gives a summary of overall insights from those interviews.

Interview Guide and Process

The TWDB staff provided a list of the chairs and co-chairs for all 16 regions during the planning process that culminated with the 2006 regional water plans. The TWDB also mailed a letter giving a brief description of this research project to all regional water planning group chairs and co-chairs prior to contact by the study team.

The study team developed an interview guide (reviewed by the TWDB staff) for the regional chair interviews. The interview guide discussed a wide range of topics including:

- Recollection of discussions of drought management measures as a water management strategy in the last planning process;
- Perceived advantages and disadvantages to including drought management measures as a water management strategy;
- Recent responses to drought and the adequacy of drought contingency plan;
- Obstacles to including drought management measures as a water management strategy in future planning processes; and
- Regional discussions about drought management since the end of the last planning process.

Appendix A presents the full interview guide and the introductory letter sent out by the TWDB.

Study team members contacted each regional planning chair to schedule an interview. Interviews were 20 to 30 minutes on average. A list of regional chairs the study team interviewed is included in Appendix A; however, results reported here are aggregated to preserve anonymity.

Interview Results

Interviewees provided insight on the consideration of drought management measures in the last planning process, arguments for and against including drought management measures as a water management strategy, and other issues related to drought management measures and the water planning process.

Extent of discussions regarding drought management during and since last planning process. Most interviewees reported there was relatively little discussion about drought contingency measures during the last planning process, and there has not been much discussion about them since the last plan was completed. There were a few exceptions to this rule:

- One region explored the idea of trying to standardize drought response within the region during the last planning process — but determined there would be too much effort involved for relatively little benefit;

- One region did specifically discuss the suitability of drought contingency measures for use as water management strategies — though the region determined not to incorporate them as management strategies in their plan; and

- Two regions have initiated studies related to drought management and regional planning (these studies were discussed in Section II).

Reasons for including drought management as a water management strategy. Three regions suggested that drought contingency measures should be considered in analyzing the adequacy of supplies during drought of record conditions. Two of these regions also called for more aggressive municipal conservation measures to help reduce the amount of water being transferred from agricultural to municipal use.

Reasons against including drought management as water management strategy. Regional chairs and co-chairs provided a variety of reasons for not including drought measures as a water management strategy. These reasons fell into four major categories:

Economic impact. Four regions identified economic impact as a key reason for not relying on drought contingency measures as a water management strategy.

Lack of data an unpredictability. Five regions cited concerns about lack of data and difficulty in predicting results of drought contingency measures as reasons they should not be included as water management strategies. Some of these regions noted that "every drought is different" or that the wide variety of different circumstances and drought plans among municipal providers made it particularly difficult to anticipate and quantify results.

Little municipal use. Two regions indicated that most of their water use was for agricultural irrigation and that municipal drought contingency measures would have little effect on their future water demands or needs.

Inconsistency with long-term planning purposes. Two regions stated that the fundamental purpose of drought contingency measures is different from water management strategies such as conservation or new supplies, and that it should not be incorporated into long-term planning. They stated that the purpose of drought contingency measures is to ration supplies when necessary and cope with shortage — and noted that drought contingency should be a short-term, emergency response.

Other obstacles to including drought management as a water management strategy. Many of the regional chairs and co-chairs provided additional reasons why it would be difficult to include drought management measures as a water management strategy in future water planning processes. BBC categorized the responses into five categories: the need for flexibility in responding to emergencies, adverse customer impacts, lack of legal or statutory authority to enforce drought restrictions, challenges presented by the drought plans, and other issues.

Flexibility and local control. Providers were concerned about losing flexibility by including drought management measures as a water management strategy:

- "[We] need flexibility to respond to unanticipated circumstances (e.g. drought worse than DOR, system failure)."
- "If drought plans are incorporated as water management strategies, [providers] will lose flexibility and the ability to modify the drought plans to suit changing circumstances."
- "Every drought is different."
- "[This decision] should not be legislated from the 'top down.' [It] may make sense for some entities to make this choice at their discretion."

Customer impacts. Some regional chairs indicated that providers were hesitant to implement drought management measures as a water management strategy because of perceived impacts on customers. Specific concerns included:

- Public perception/reaction to the choice to rely on cutbacks rather than adding supplies;
- Rate impacts and the public's perception of being asked to sacrifice … and then pay more; and
- Impacts to quality of life, as well as the economy.

Lack of authority. Another reason presented by interviewees for not including drought management measures as a water management strategy in the regional plan was the lack of authority to enforce drought measures from the regional level. In particular, interviewees raised concerns about the lack of legal authority to tell water providers how to use supplies that they legally own and the lack of enforcement authority or enforcement commitment in some of the drought plans themselves.

Issues with drought plans. A few chairs relayed concerns from planning group members about the reliability of savings projected in drought plans and whether the region could plan using these estimates:

- Plans are mostly voluntary, cannot be relied on for savings; and
- Lack of uniformity among municipal plans.
- **Miscellaneous.** Other stated reasons for not including drought management measures as a water management strategy in future regional planning processes included:
  - Water is too cheap to successfully force reductions during drought;
  - Variation among providers (nature of customers, ownership of water supplies, region);
  - The State provides the demand projections and the regions "have no say," regions have no ownership of demand side numbers; and
  - "Not really applicable to us," not a priority for our region.

Drought management measures and long-term water conservation measures. Many regional chairs relayed some confusion among the regional planning group members regarding the difference between drought management measures and long-term water conservation. Figure III-1 summarizes the responses from the regional chairs when prompted for their own characterizations of the difference between the water conservation and drought management.

Figure III-1. Interviewee perceptions of difference between drought management and water conservation

Source:
BBC Research & Consulting, 2008.

Category	Drought management	Water conservation
Timing	Temporary Short-term Emergency	Ongoing Long-term Every-day Permanent
Measures	Potentially severe	Voluntary Educational
Trigger	Response to a lack of supply Climatological	No trigger – a strategic process to reduce demand
Customer impacts	Curtail some uses Impacts quality of life Some sacrifice required	Increased efficiency Minimal or no impact on quality of life
Goals	Protect essential uses Prioritize uses Ration shortages	Long-term reduction in GPCD

One regional chair stated that measures currently thought of as emergency drought measures may eventually become permanent conservation measures.

Estimating savings from drought management measures. The majority of regional chairs expressed skepticism about the ability to accurately project savings from drought management measures, a required step for using drought management measures as a water management strategy. Comments from interviewees about the challenges of projecting savings included:

- Estimates can be made, "but I wouldn't have much trust in them."
- "[It would be] difficult … hard even to estimate savings from conservation measures."
- "[Providers] don't have historical data or analytical basis to quantify results.
- "Data and data gathering processes not in place today."
- "Municipal measures are not aggressive, lack certainty of achieving target savings."

A few respondents thought reasonable estimates of savings could be developed, saying:

- "All of water planning relies on estimates, this would be no different."
- "Yes, our region has a good sense of what we can save."

On respondent said that larger cities in general have more reliable drought plans and would be better equipped to provide credible estimates than smaller cities. Another regional chair worried that asking about projecting potential savings was, "The wrong question. The question should be will the measures protect essential uses?"

Summary

Most regional chairs are supportive of including drought management as part of the regional planning process — but with a focus on making sure plans are workable, will protect essential uses and provide for appropriate rationing of available supplies when necessary. They see a role for the TWDB in providing technical assistance to meet these objectives.

Most regional chairs do not see drought management as a water management strategy. In their view, drought contingency plans are a tool to deal with emergency circumstances and provide flexibility to deal with the unexpected. Drought emergencies, and individual systems, are too variable to reliably anticipate and calculate savings from management measures.

There are a minority of regional chairs, however, that believe that not anticipating the reductions in demand that would occur under drought of record conditions leads to an over-allocation of water supplies to municipal uses and promotes transfers of supply from agricultural users. Others also noted that acquiring and developing extra supplies that may not be needed is an added cost for water systems and their customers.

Several chairs expressed concerns about a "top-down" mandate that drought contingency measures be included as water management strategies. They saw this as a step backward from the bottom-up approach Texas has traditionally followed in the state and regional planning process.

SECTION IV.
Interviews with RWPG Members and Other Stakeholders

SECTION IV.
Interviews with RWPG Members and Other Stakeholders

After completing the interviews with the Regional Water Planning Group (RWPG) chairpersons described in the previous section, BBC interviewed a selected sample of other RWPG members, consultants that have assisted the RWPGs in preparing their regional plans, and representatives of various interest groups. This section describes the interview process and the results from these interviews.

Sample Selection, Interview Topics and Response Rate

The BBC team began the stakeholder interview process by identifying the target sample of RWPG participants and other stakeholders for interviews.

RWPG participant sample. The following describes the process for identifying RWPG participants for participation in this study.

1. The TWDB provided a database including member names and contact information, region and interest category. The database included 318 members, excluding the chairs of each region.

2. The TWDB categorizes RWPG members into 19 different interest categories. BBC grouped the various interest group categories into six overall groups:

    a. Agriculture — which included agriculture interests only;

    b. Local Governments — which included municipal and county representatives;

    c. Water — which included representatives from water districts, water utilities, river authorities and conservation districts;

    d. Industry — which included electric utilities, industry and small business representatives;

    e. Environmental and recreation — which included representatives from both of these interests; and

    f. Other — which included all other categories.

3. The groups were of differing sizes, ranging from 70 representatives in the water category to 29 representatives in the environmental and recreation category. Given that the purpose of the stakeholder interviews was to better understand the full variety of views concerning the role of drought management in the planning process, BBC chose to sample an equal number of representatives from each group rather than a standard proportion of each group.

4. Given the initial goal of 90 completed interviews with RWPG members, the target sample size for each of the six groups was 15 complete interviews. Recognizing that we would likely be unable to contact some members, and some might refuse to participate, BBC randomly selected a primary sample of 15 members in each interest category and a replacement sample of 8 additional members for each category.

5. The BBC team made multiple attempts to contact and interview each individual in the primary sample. If the individual refused to participate, or could not be reached and scheduled for an interview after three attempts, he or she was replaced with an individual from the same interest category (and same region, if possible) from the replacement sample.

Outside stakeholder sample. BBC also included other stakeholders in the interview process. Based on consultation with the TWDB, the study team identified a number of engineering firms (and specific project managers) that have helped the RWPGs prepare regional plans, and several outside interest groups that have demonstrated an interest in the regional and state water planning processes. Outside stakeholder organizations (including consulting firms) BBC interviewed or attempted to contact are shown in Figure IV-1.

Figure IV-1.
Outside stakeholders included in interview process

Outside interest groups	Regional planning consultants
Completed interviews	
Coastal Conservation Association	Biggs & Mathews
Environmental Defense Fund	Freese & Nichols
National Wildlife Federation	HDR Engineering
Sierra Club	LBG-Guyton
Texas Municipal League	NRS Consulting Engineers
Texas Nursery and Landscape Association	Turner, Collie & Braden (now AECOM)
Other attempted contacts	
Association of Water Board Directors	Bucher, Willis & Ratliff
Texas Chemical Council	Schaumburg & Polk, Inc.
Texas Rural Water Association	
Texas Water Conservation Association	
Texas Wildlife Association	

The TWDB mailed a letter giving a brief description of the project and the TWDB contact information to all individuals in the primary sample. A copy of the letter is included in Appendix B.

Interview topics. The study team developed an interview guide (reviewed by the TWDB staff) for the stakeholder interviews. The interview guide was more specific than the guide used for the interviews with the regional chairs and incorporated refinements based on the experience from those earlier interviews. The interview guide covered the following topics:

- Strengths and weaknesses of the overall water planning process in Texas;
- Recollection of discussions of drought management measures as a water management strategy in the last planning process;
- Drawbacks, if any, to the current approach to identifying future "needs" in the regional water planning process;
- Whether or not reductions in water use from drought management should be included in assessing regional needs under drought of record conditions;
- Implications (if any) of not reflecting those reductions;
- Perception of fairness, or unfairness, if some regions were to include drought management as a water management strategy and others did not;
- Opinions on who should be responsible for estimating "savings" from drought management if it were to be included as a water management strategy;
- Familiarity with, and opinions regarding, drought contingency plans developed by municipal water providers; and
- Barriers or disincentives to including drought management measures as a water management strategy in future planning processes.

The full interview guide along with the introductory letter sent out by the TWDB is provided in Appendix B.

Response rate. The study team attempted to interview a total of 120 RWPG members (including 90 from the primary sample and 30 members drawn from the replacement pool), 8 consulting firms and 11 outside interest groups. Ninety interviews were successfully completed, reflecting an overall response rate of 65 percent. As shown in Exhibits IV-2 and IV-3, on the following page, each region and interest type was well represented among the respondents.

Figure IV-2 shows the number of respondents, by interest category and by voting region. Consultants and outside interest groups are coded as "NA" in terms of voting region and shown in the far right columns of the table.

Figure IV-2.
Completed interviews by voting region and interest category

Region	Interest category								Grand total
	Agric	Env/rec	Industry	Local gov	Other	Water	Stakeholder	Consultant	
A	1	1	1	1	1	1			6
B	1	2	1			1			5
C	1			1		1			3
D	2	1		1	1				5
E		1	1	3	1				6
F	0	1	1	1	2	1			6
G	0	1	1	1		1			4
H			2			1			3
I	1		1	2	2	2			8
J	1			0	1	1			3
K	1	3		1					5
L	2	2	0		1	2			7
M	1	1	0			1			3
N	2		2	1	2				7
O	1	1	1		1				4
P		0	2	1					3
NA							6	6	12
Total	**14**	**14**	**13**	**13**	**12**	**12**	**6**	**6**	**90**

Figure IV-3 shows the response rate (number of completed interviews divided by number of individuals that we attempted to interview) by interest category and by voting region.

Figure IV-3.
Response rate by voting region and interest category

Region	Interest category								Grand total
	Agric	Env/rec	Industry	Local gov	Other	Water	Stakeholder	Consultant	
A	100%	50%	100%	100%	50%	100%	NA	NA	75%
B	100%	100%	50%	NA	NA	100%	NA	NA	83%
C	100%	NA	NA	100%	NA	33%	NA	NA	60%
D	67%	100%	NA	33%	50%	NA	NA	NA	56%
E	NA	50%	100%	75%	14%	NA	NA	NA	43%
F	0%	50%	50%	100%	100%	100%	NA	NA	67%
G	0%	100%	100%	50%	NA	50%	NA	NA	57%
H	NA	NA	100%	NA	NA	25%	NA	NA	50%
I	100%	NA	100%	100%	50%	100%	NA	NA	80%
J	100%	NA	NA	0%	50%	100%	NA	NA	60%
K	100%	75%	NA	100%	NA	NA	NA	NA	83%
L	100%	100%	0%	NA	100%	67%	NA	NA	70%
M	100%	100%	0%	NA	NA	100%	NA	NA	75%
N	67%	NA	67%	100%	100%	NA	NA	NA	78%
O	33%	100%	33%	NA	100%	NA	NA	NA	50%
P	NA	0%	100%	100%	NA	NA	NA	NA	75%
NA	NA	NA	NA	NA	NA	NA	55%	75%	63%
Overall	**70%**	**74%**	**62%**	**72%**	**52%**	**63%**	**55%**	**75%**	**65%**

Note: Env/rec = environmental and recreation interests.
Industry = EGUs, small business and industry representatives
Local gov = municipal and county representatives
Water = water districts, water utilities, river authorities and conservation districts
Other = all RWPG interests not included in the other five RWPG interest categories
Stakeholder = state and national interest groups, primarily environmental
Consultant = consulting firms working with RWPGs.

Interview Findings

Interview results are summarized below according to the key areas of questions.

Views of overall planning process. The initial questions in the stakeholder interviews were designed to engage the respondents and focused on perceived benefits and shortcomings of the overall planning process. Respondents across all regions and interest categories identified the opportunity to obtain local input and gather diverse perspectives as primary benefits of the regional and state water planning processes. Promoting advance planning was also seen as an important benefit by some respondents, particularly consultants and water interests.

The primary drawbacks mentioned by respondents were the effort and cost involved in the process (particularly the need for frequent meetings), perceived competition between the various regions of the state for state attention and funding, and some issues with the state's role. The latter concerns included changes in the TWDB staff persons assigned to some of the regions and efforts by the state to promote consistency between regions. Some regional respondents felt that this effort to promote common approaches and methods did not always recognize the unique circumstances faced by their regions.

Perceived drawbacks to the current approach for identifying "needs"? The next area of inquiry, more directly relevant to the focus of this particular study, was to identify whether respondents felt there were drawbacks to the current approach to quantifying future shortages and identifying needs. The following introduction was read to each respondent and repeated if necessary:

> "In the last regional planning process, the "need" for new municipal supplies to avoid future shortages was determined by comparing the water supplies available under drought of record conditions to projections of future water demand. The demand projections were based on water use per capita during dry year conditions (year 2000 in most cases). The demand projections did not include additional reductions in municipal use during drought of record conditions that might result from watering restrictions or other drought contingency measures."

Many respondents felt there were drawbacks to the current approach used to quantify future shortages and identify needs, though their concerns were not always related to the fact that reductions in municipal water use due to drought management are not included in the calculation. In general, environmental and recreation interests and outside interest group representatives were the most likely to respond that there are drawbacks to the current approach. Consultants who have worked with the various regions were the most supportive of the current approach.

The answer to this question, and several subsequent questions, was likely determined in part by the interviewee's grasp of the details of the approach currently used in Texas water planning to quantify future water supplies, demands and resulting shortages or "needs." These are not simple concepts, particularly for RWPG representatives (and others) who do not have extensive experience in water modeling. Based upon the follow-up question regarding how the drawbacks noted by the respondent could be addressed and the related questions 8 and 9 later in the interview (see Appendix B), the study team assessed the interviewee's grasp of the modeling approach. In our view, about 40 of the 90 respondents understood the approach well, while others had varying degrees of understanding.

In Figure IV-4, and several of the following exhibits, we report the responses of the overall sample as a whole, but we also report (in bold) the responses of the 40 interviewees who best understood the modeling approach currently used in Texas. We report the response for each group separately, and do not aggregate responses across the various interest categories, because aggregate proportions would imply that the representation of each of the groups among the overall sample was somehow representative of the public or planning process as a whole — which is not necessarily the case.

Figure IV-4.
Are there drawbacks to the current approach to quantifying shortages and identifying "needs" in the water planning process?

Agriculture	#	#
Yes	5	**1**
No	7	**1**
Unclear	2	**1**

Environmental/ Recreation	#	#
Yes	8	**4**
No	4	**2**
Unclear	2	**1**

Local Government	#	#
Yes	4	**3**
No	6	**4**
Unclear	3	**1**

Stakeholder	#	#
Yes	3	**3**
No	0	**0**
Unclear	3	**0**

Water	#	#
Yes	4	**3**
No	5	**1**
Unclear	3	**2**

Industry	#	#
Yes	5	**0**
No	5	**1**
Unclear	3	**2**

Other	#	#
Yes	8	**3**
No	1	**0**
Unclear	3	**1**

Consultant	#	#
Yes	1	**1**
No	5	**5**
Unclear	0	**0**

Note: The right hand column in each box (shown in bold) reflects the responses of the interviewees that appeared to best understand the approach used in Texas to project and model future water supply, demand and "need."

Should drought management savings be counted in estimating shortages and "needs"? Interviewees were then asked whether reductions in municipal water use under drought of record conditions due to the implementation of drought contingency plans should be counted in estimating future shortages and determining water "needs." Most interviewees, across all interest categories, responded that drought management savings should be considered in estimating needs. While most respondents indicated that counting these savings would produce a more accurate view of actual supplies and demands under drought of record conditions, some interviewees noted perceived benefits to not include these savings in identifying needs and planning future projects. These respondents felt the current approach creates an implicit "safety factor" or provides a more conservative outlook (as discussed later).

Figure IV-5, on the following page, depicts the responses to this question for each interest category.

Figure IV-5.
Should drought management savings be counted in estimating shortages and determining needs under drought of record conditions?

Agriculture		
	#	#
Yes	10	**2**
No	2	**1**
Unclear	2	**0**

Environmental/ Recreation		
	#	#
Yes	11	**6**
No	0	**0**
Unclear	3	**1**

Local Government		
	#	#
Yes	7	**4**
No	1	**1**
Unclear	5	**3**

Stakeholder		
	#	#
Yes	3	**3**
No	1	**0**
Unclear	1	**0**

Water		
	#	#
Yes	8	**3**
No	2	**2**
Unclear	2	**1**

Industry		
	#	#
Yes	10	**3**
No	1	**0**
Unclear	2	**0**

Other		
	#	#
Yes	10	**2**
No	1	**1**
Unclear	1	**1**

Consultant		
	#	#
Yes	2	**2**
No	3	**3**
Unclear	1	**1**

Note: The right hand column in each box (shown in bold) reflects the responses of the interviewees that appeared to best understand the approach used in Texas to project and model future water supply, demand and "need"..

Interviewees were then asked a related, follow-up question: What are the implications if the demand reductions from drought contingency plans are not included in estimating future shortages and determining regional needs for new water supplies?

Among the 40 respondents who best understood the approach currently used to analyze future supplies, demands and "needs," interviewees stated that not including savings from drought management measures in assessing needs under drought of record conditions:

- Could lead to excess supply development (20 responses);
- Provides a safety factor to help ensure that demands can be met (7 responses); and
- Leads to unrealistic analysis (5 responses).

The remaining eight respondents in this group of best-informed interviewees noted a variety of implications, including concerns that:

- Data limitations will leave the region and state unprepared for a repeat of the drought of record;
- Not reflecting drought management under drought of record conditions reduces the credibility of the process; and
- The current approach leads the analysis to err on the side of caution (in terms of meeting future needs).

Would it be fair or unfair if some regions or providers rely on drought management while others do not? The following line of inquiry was intended to determine whether interviewees would be concerned about equity issues if some regions chose to rely on drought management savings as part of their approach to meeting needs under drought of record conditions while other regions did not.

Almost universally across all interest categories, respondents indicated that they prefer consistency and a "level playing field" across the various planning regions.
Figure IV-6 summarizes responses to this question.

Figure IV-6.
Would it be fair, or unfair, if some regions/providers rely on drought management while others do not?

Agriculture	#	#
Fair	2	**1**
Unfair	9	**2**
No opinion	2	**0**

Environmental/ Recreation	#	#
Fair	1	**0**
Unfair	11	**6**
No opinion	2	**1**

Local Government	#	#
Fair	1	**0**
Unfair	10	**7**
No opinion	1	**1**

Stakeholder	#	#
Fair	0	**0**
Unfair	3	**3**
No opinion	2	**0**

Water	#	#
Fair	1	**1**
Unfair	9	**4**
No opinion	2	**1**

Industry	#	#
Fair	2	**0**
Unfair	10	**3**
No opinion	1	**0**

Other	#	#
Fair	3	**2**
Unfair	9	**2**
No opinion	0	**0**

Consultant	#	#
Fair	2	**2**
Unfair	1	**1**
No opinion	2	**2**

Note: The right hand column in each box (shown in bold) reflects the responses of the interviewees that appeared to best understand the approach used in Texas to project and model future water supply, demand and "need."

Who should estimate drought management savings? If drought management were to be included as a water management strategy, the water use reductions from drought management measures would need to be estimated. Interviewees were asked who they thought should be responsible for estimating the savings from drought management measures, and why.

Most respondents indicated a preference that those savings be estimated on the local level, due to the perception that individual providers (or regions) would have better information on how much water savings can be obtained through their drought management efforts. Some respondents indicated a desire for a standardized approach and standardized assumptions (administered by the TWDB or third party consultants) or a desire for the TWDB to review estimates developed at the local level.

The following is a summary of responses to (across all interest categories) as to the desired group for estimated savings

- Municipal water providers (28 responses);
- Regions (21 responses);
- the TWDB (14 responses); and
- A combination of the above (17 responses).

Perceptions of existing drought contingency plans. The study team asked stakeholders about their views of the drought contingency plans that municipal providers develop and file with TCEQ. These plans would be the vehicle for reducing municipal water use under drought conditions and the savings estimates included in these plans could provide the basis for quantifying anticipated water use reductions if drought management were included as a water management strategy. Respondents were first asked whether they were familiar with any provider's drought contingency plan. They were then asked whether they thought that existing drought contingency plans were "realistic and enforceable."

Most respondents across the various interest categories indicated they did believe that drought plans are generally realistic and enforceable. In Figure IV-7, the right hand column for each interest group shows the responses of the subset of interviewees within that interest category who indicated specific familiarity with at least one provider's drought management plan.

Figure IV-7.
Are existing drought contingency plans realistic and enforceable?

Agriculture		
	#	#
Yes	1	**1**
No	0	**0**
Unclear	3	**1**

Environmental/ Recreation		
	#	#
Yes	5	**4**
No	2	**2**
Unclear	3	**3**

Local Government		
	#	#
Yes	7	**6**
No	0	**0**
Unclear	1	**0**

Stakeholder		
	#	#
Yes	1	**0**
No	1	**1**
Unclear	1	**0**

Water		
	#	#
Yes	9	**8**
No	0	**0**
Unclear	0	**0**

Industry		
	#	#
Yes	3	**2**
No	0	**0**
Unclear	1	**1**

Other		
	#	#
Yes	7	**6**
No	1	**1**
Unclear	2	**1**

Consultant		
	#	#
Yes	3	**2**
No	2	**0**
Unclear	1	**1**

Note: The right hand column in each box (shown in bold) reflects the responses of the interviewees that appeared to best understand the approach used in Texas to project and model future water supply, demand and "need."

Barriers or disincentives to including drought management as a water management strategy. The final key question posed to interviewees was: *Are there barriers or disincentives to including water use reductions from drought contingency measures as a water management strategy in the regional and state planning process?* This open-ended question elicited a wide range of responses. Individual responses, coded only by respondent interest category, are provided in Appendix B. Overall, responses can be loosely categorized into six groups, as shown below.

Identified barriers or disincentives to including drought management included:

- Lack of data or data quality concerns — 13 responses;
- Concerns that relying on drought management savings is too risky — 8 responses;
- Perceived resistance among those involved in planning, water users and/or the general public — 8 responses;
- Fiscal concerns (e.g. water providers want the income from water sales) or economic concerns (reliance on drought management measures could hurt economic development or general economic conditions) — 6 responses;
- Lack of funding for the analyses that would be required to do so — 5 responses;
- Lack of understanding among planning participants and/or the public and the need for further education — 4 responses; and
- Unique other responses — 10 responses.

Twenty-four respondents indicated they could think of no particular barriers or disincentives to including drought management as a water management strategy, or that they did not know if there were barriers or disincentives.

Summary

Most respondents agreed that recognizing the water use reductions that would occur if municipalities implemented their drought contingency plans would provide a more realistic view of water demands (and corresponding needs) under drought of record conditions. However, some respondents noted concerns about the risk of relying on drought management savings to get through drought periods, concerns about public perceptions of this approach and issues concerning the availability and quality of the data and analyses needed to incorporate drought management savings. The majority of respondents felt it would be unfair if some regions relied on drought management as a water management strategy, while other regions chose not to do so.

SECTION V.
Drought Contingency Plan Review and Estimated Savings

SECTION V.
Drought Contingency Plan Review and Estimated Savings

In order to further examine the feasibility of using drought management measures as a water management strategy, the study team reviewed a sample of drought plans from water user groups (WUGs) throughout Texas. This section provides an overview of these drought plans in addition to an analysis of potential water savings from drought management under drought of record conditions.

Sample Selection and Data Collection

State of Texas administrative code requires all wholesale water providers and retail water providers serving at least 3,300 connections to submit a drought contingency plan to the Texas Commission on Environmental Quality (TCEQ).[1] Providers with fewer than 3,300 connections are required to prepare and adopt drought contingency plans, but are not required to submit them to TCEQ. Drought contingency plans (DCPs) in Texas are prepared according to minimum requirements set forth in Texas administrative code.[2] Required elements include:

- Coordination with regional water planning groups to ensure consistency;
- Triggers for initiating and terminating drought management measures;
- Measures to be enacted during drought conditions;
- Goals for water use reduction during drought conditions;
- Policies for establishing variances from drought measures; and
- Procedures for notifying the public of drought conditions and measures.

The BBC team sought to gather and analyze at least 100 drought contingency plans across a wide range of Texas water providers. The study team performed the following steps to select the sample of drought contingency plans (DCPs) for analysis.

1. Based on results of interviews with regional chairs and input from the TWDB, BBC determined that potentially critical strata were a) system size, b) climate and c) source of supply.
2. Obtained database identifying all municipal water user groups (WUGs) from the TWDB.
3. Filtered database to eliminate WUGs that were collections of "county-other" residents.

[1] Title 30 Part 1 Chapter 288 Subchapter C rule §288.30.

[2] Title 30 Part 1 Chapter 288 Subchapter B rules §288.20 - §288.22.

4. Eliminated WUGs with fewer than 9,000 residents (the TWDB projected 2010 population) because most did not meet the 3,300 connection threshold.

5. Analyzed the WUGS remaining after the preceding step and determined to sample 30 large systems, 30 medium systems and 75 small systems. BBC oversampled the WUGs in view of the goal of analyzing at least 100 plans and in recognition that not all would have DCPs (especially among smaller systems).

6. Compared random sample derived from step 5 with TCEQ list of systems with DCPs. Twenty-nine systems in the target sample did not have DCPs according to the list provided by TCEQ[3]. Remaining sample of 106 was reasonably representative based on system size, climate and water supply sources.

The study team collected copies of the 106 targeted DCPs from TCEQ and entered information from these plans into a database for further analysis. Data entered for each drought plan included the triggers, goals and measures for each drought stage. The study team also identified the apparent drought of record stage for all providers. In a few cases, the plans specifically identified the drought of record stage. For water providers where there was no clear indication of the drought of record stage, the study team chose the most severe drought-related stage as the drought of record stage.[4]

Some drought contingency plans referred specifically to triggers, measures or goals required by their wholesale water provider. In these cases, the study team also analyzed the wholesale provider's plan and included this information in the database along with other information from the wholesale customer's plan.

[3] The 29 providers without DCPs listed by TCEQ may not have 3,300 connections. Lacking a comprehensive statewide database providing the number of connections for each municipal water provider, providers in the sample were chosen based on having a projected 2010 population of at least 9,000 residents. The study team anticipated that this level of population would approximate the connection threshold requiring a provider to file a drought plan with TCEQ.).

[4] Many DCPs include a most severe stage that is designated for a major system failure, not for drought-related conditions.

Overview of Sampled Drought Plans

The study team analyzed the number of stages, triggers, measures and goals for the 106 sampled retail provider drought plans.

Number of stages. The majority of drought plans had either four or five stages. As shown in Figure V-1, there was no distinct correlation between local climate and the number of stages in a provider's drought plan.

Figure V-1.
Number of drought stages in sample plans by climate

Climate	Three stages	Four stages	Five stages	Six stages
Dry	0	4	5	0
Mixed	8	35	21	5
Wet	9	4	14	1
Total	**17**	**43**	**40**	**6**

Note: n=106.
Source: BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.

Triggers. Drought contingency plans contain triggers that providers use to determine when a particular drought stage has been reached. Most drought stages in most plans have more than one trigger. The study team categorized triggers into the following categories:

- **Demand capacity.** The drought stage is triggered by an absolute demand amount usually expressed in millions of gallons per day (MGD) or demand expressed as a percentage of total system capacity.
- **Supply (aquifer, river or reservoir level).** The drought stage is triggered when the level of an aquifer, river or reservoir falls below a specified elevation or flow.
- **Distribution capacity.** The water provider declares a drought stage due to a supply related event such as storage tanks falling below certain levels, reduced system capacity due to mechanical failures, wells operating at a reduced capacity, or a system pressure reduction.
- **Wholesale trigger.** A wholesale provider declares a drought stage for all of it retail provider customers.
- **Other.** The drought stage is triggered by an event that does not fall into the above categories such as major system failure, source contamination, or a specified time of year.

The most common triggers used across all drought stages analyzed were demand capacity triggers and triggers in the "other" category. Figure V-2 shows the distribution of triggers for the drought of record stages for the 106 drought contingency plans in the sample.

Figure V-2.
Trigger types in drought of record stages

Note:
n=106.

Source:
BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.

Trigger type	Number of occurrences
Demand capacity	101
Supply (aquifer, reservoir or river level)	45
Wholesale trigger	31
Distribution capacity	32
Other (primarily system failure or contamination)	102

Measures. The study team also recorded the measures used to achieve reductions in water use for all of the drought contingency plans in the sample. As a part of this process, the study team developed categories of measures and identified whether those measures were voluntary, mandatory or a prohibition of a certain activity. The team classified measures according to the following categories.

- **Utility and government measures.** Measures enforced on the utility itself or other government agencies including:
  - Street sweeping reductions;
  - Increased leak detection;
  - Reduced flushing of mains; and
  - Public education and press releases.

- **Minimal impact.** Voluntary and other measures with minimal impact including:
  - Voluntary irrigation restrictions;
  - Prohibition of wasting water;
  - Voluntary vehicle washing restrictions; and
  - Mandatory sidewalk washing and dust control measures.

- **Moderate impact.** Measures with a greater impact on customers' daily lives were placed in this category. This category included the following measures:
  - Filling pools, operating fountains, and watering parks prohibited or restricted;
  - Mandatory restrictions on golf course watering;
  - Vehicle washing restricted;
  - Private landscape watering restrictions;
  - Hydrant, dust control, sidewalk washing prohibited;
  - Restaurants required to serve water only upon request;
  - Voluntary restrictions for industrial and commercial uses; and
  - Reductions in system pressure.

- **Onerous customer impacts.** Measures classified as onerous for the customer included:
  - Prohibitions of landscape irrigation[5];
  - Prohibition of vehicle washing[6]; and
  - Prohibition of foundation watering.

- **Substantial economic impact.** The following drought management measures were classified as having a substantial economic impact:
  - No new connections;
  - Water rationing and surcharges[7];
  - Industrial, commercial and construction restrictions and prohibitions;
  - Interruptible and wholesale customer restrictions and prohibitions;
  - Restrictions for power production; and
  - Golf course watering prohibited.

Figure V-3 shows the types of measures imposed during the drought of record stages for each of the 106 providers in the study sample. For example, 84 percent of all drought of record stages had at least one measure considered to have a substantial economic impact and on average the drought of record stages contained 2.2 measures considered to have a substantial economic impact.

Figure V-3. Measures implemented during drought of record conditions

Note:
n=106.

Source:
BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.

Measure classification	Percentage of plans with at least one measure in impact class	Average number of measures in impact class
Substantial economic impact	84 %	2.2
Onerous customer impact	81 %	2.1
Moderate impact	98 %	6.0
Minimal impact	71 %	1.0
Utility/government	88 %	2.1

[5] This category includes mandatory restrictions on drip or bucket watering, lawn watering of any type or watering of new landscapes.

[6] This category includes prohibition of private vehicle washing or prohibition of vehicle washing at a commercial vehicle washing business.

[7] Surcharges were included in drought management plans as temporary increases in water rates usually based on consumption. For example, under "Severe Drought Conditions" the Harris County MUD No. 55 a surcharge of 200 percent is applied to all water used in excess of 10,000 gallons/month including commercial customers.

Goals. State administrative code requires water providers to state explicit goals for reduction in water use for each drought stage. The study team recorded and classified the goals for the sampled drought plans in one of three categories:

- **Percentage reduction.** Providers specify a percentage reduction in total daily demand;
- **Total use reduction.** Providers specify an amount of water, usually in millions of gallons per day (MGD).
- **Unspecified reduction.** Providers look for a voluntary reduction in water use or set a goal based on the circumstances.
- **Other or no clearly stated goal.** Providers do not specify a goal or have a goal of "public awareness."

The majority of plans studied had only one goal per stage and approximately two-thirds of all goals listed were either percentage reductions or total use reductions. Where possible, BBC recalculated total use reduction goals as percentage goals in order to provide a consistent comparison across all plans in the sample.

Variation in water savings goals. The study team found that water use reduction goals stated for water providers varied substantially even when similar measures were implemented. To illustrate this point, Figure V-4 shows goals and measures for four different providers in the sample. The cities of Richmond and DeSoto have similar or fewer measures than the cities of North Richland Hills and Weslaco but project much higher savings from their drought plans.

Figure V-4.
Measures and reported goals for selected drought stages

Source:

BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.

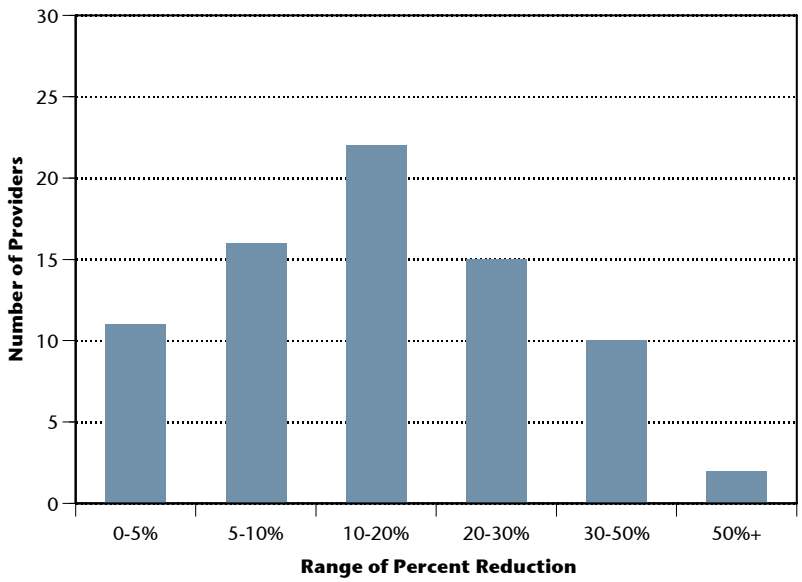
Drought plan characteristics	North Richland Hills	Weslaco	Richmond	De Soto
Stage	3	3	3	4
Number of stages in plan	4	3	5	5
Goal	5 %	4 %	50 %	80 %
Measures:				
Public landscape watering restrictions	■	■		
Private landscape watering restrictions	■	■	■	■
Golf course watering restrictions		■		■
Establishing new landscapes prohibited	■	■		
Private car-washing restrictions	■	■	■	■
Commercial car-washing restrictions		■		■
Commercial nursery restrictions	■	■		
Restrictions on filling pools and fountains	■	■		■
Industrial and commercial restrictions	■	■	■	

Drought of record goals. Figure V-5 shows how many providers had percentage goals for the drought of record stage (for those water providers with percentage goals). Many providers had goals in the range of 10 to 20 percent reductions. The average percentage reduction across all providers was about 20 percent.

Figure V-5.
Distribution of goals for drought of record stages

Note:
n=76.

Source:
BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.

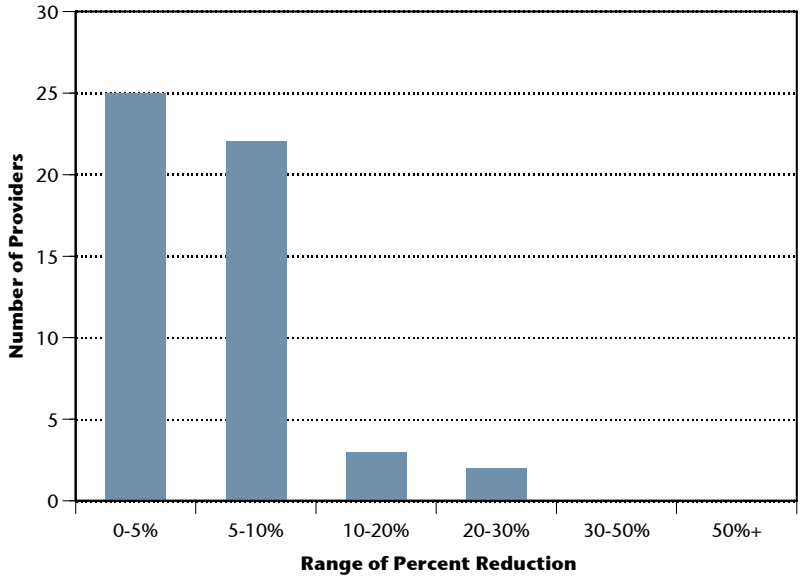


Goals for less onerous stages. For each provider, the study team identified the most severe drought stage that did not require any measures considered to have a "substantial economic impact" or "onerous customer impact." Of the 76 providers with quantifiable goals, 52 providers included a drought management stage without any measures in either of the two categories with the greatest impact on customers. Figure V-6 examines the water savings goals for these 52 providers. The average of the water use reduction goals for these stages was between 5 and 10 percent.

Figure V-6.
Distribution of water savings goals for stages without onerous measures

Note:
n=52.

Source:
BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.



Potential Statewide Savings from Drought Management Measures

The study team estimated potential savings from implementation of drought management measures for the drought of record stage as well as the most severe drought stage with no substantial economic impacts or onerous customer impacts.

Methodology. For each provider size category, the study team estimated the demand-weighted percentage savings for the sampled plans and used the percentage to estimate the savings for all Texas providers in that size category.

A number of providers were estimated to have fewer than 3,300 connections and thus were not included in the sample because they are not required to file drought plans with TCEQ. For these very small providers, the study team developed three alternative estimates of potential drought management savings during the drought of record based on the approaches described below:

- Approach 1 — The estimated savings for the smallest provider category in the sample was used for these providers;
- Approach 2 — The statewide average savings of all larger providers were applied to these providers; and
- Approach 3 — These providers were assumed to have no savings.

The study team used a similar methodology to create a range of state-wide estimates of the savings that would result from implementing the most severe drought stage with no substantial economic impacts or onerous customer impacts. For the 24 providers where all stages in their drought plan include either a measure with substantial economic impact or onerous customer impacts, the study team assumed no savings could be achieved without these types of impacts.

Results. Figure V-7 presents the results of our water savings estimates for both drought of record conditions and for the most severe drought stage without measures that have a substantial economic impact or onerous impact on the customer.

Figure V-7.
Potential statewide savings from implementation of drought measures

	Estimation method for smallest providers		
Drought stage	Average of smallest providers in sample	Statewide average	No savings
Drought of record	19.3 %	18.5 %	15.9 %
Most severe stage without onerous impacts	4.1 %	3.5 %	3.0 %

Note: n=76.

Source: BBC Research & Consulting, 2008 from drought contingency plans on file with the Texas Commission on Environmental Quality.

Based on this analysis of the water use goals in the sampled drought contingency plans, the study team estimates potential statewide savings in average daily water use during drought of record conditions of between 15 and 20 percent, but only if drought contingency plans were adopted and enforced simultaneously and consistently throughout the state. Potential savings for the most severe stage with no substantial economic or onerous customer effects could be below 5 percent.

Caveats and limitations. It is important to note several limitations to the estimates presented above:

- Some of the goals listed in drought contingency plans may be unrealistic, most are untested;
- According to Texas administrative code, goals in drought plans must be stated but are not legally binding;
- There are limited or no data available regarding actual savings during drought conditions for most providers; and
- Goals are applied to average daily demand only for days where the drought of record measures are in effect.

Potential drought management water savings based on other information sources. The potential savings estimates provided in Figure V-7 are based on the goals contained in drought contingency plans of municipal providers across Texas. Although not many rigorous statistical analyses of the effects of drought management programs have been conducted, a few studies from other locations provide some further insight into the potential reductions in demand that can be achieved during drought emergencies.

In one of the first efforts to examine the effects of drought management programs, the Rand Corporation studied the effects of drought management efforts enacted during the California drought of the late 1980s and early 1990s. Rand surveyed 85 California urban water agencies regarding drought management efforts and changes in water use between 1986 and 1991. Rand concluded that urban water use per-capita was fairly stable during the early years of the drought, but dropped about 14 percent in 1991. The largest changes in water use by class between 1990 and 1991 were in single-family residential use (19 percent decline) and public authority/institutional water use (23 percent decline). Rand noted that their analysis did not fully disentangle the effects of drought management from other factors, but the declines in water use corresponded to the timing of implementation of drought management efforts.[8]

During the peak of the drought in Colorado in 2003-2004, Denver Water reduced its customers' demands by about 25 percent through a combination of a sizeable public information campaign, mandatory drought restrictions and drought surcharges. This estimate is based on Denver Water's demand model, which attempts to isolate the effects of drought management programs from other factors such as weather conditions and long-term conservation efforts.[9] Aurora, Colorado, the largest

[8] Drought Management Policies and Economic Effects in Urban Areas of California, 1987-1992. Dixon et al. RAND, 1996.

[9] Unpublished analysis for Denver Water. BBC Research & Consulting. November 15, 2006.

Denver suburban community, reduced its water demands by about 26 percent in 2003 through similar measures.[10]

Drought management has also been studied outside of the western states. In 2002, Virginia experienced an unusually severe drought leading many water providers to implement drought management efforts similar to those found in western drought plans. A detailed econometric study by researchers from Virginia Tech sought to isolate the effects of various drought management measures in reducing demands. The study concluded that reductions in water use from voluntary measures ranged between 0 and 7 percent among the providers studied, while mandatory restrictions reduced use by between 0 and 22 percent for various providers.[11]

As noted in the recent Drought Management Study conducted for the Region H Planning Group (discussed in Section II of this report), it is difficult to generalize the effectiveness of drought management measures from one community to another because of variations in climate, socioeconomic characteristics, customer makeup and other factors. The studies just described seem to imply that a general range of about 15 to 25 percent reductions in annual water use may be a reasonable expectation for short-term reductions during actual drought conditions for most municipal water providers — though these studies also point out the wide variation in reductions achieved even within the same state. In general, larger reductions can be achieved in summer water use than in winter use, and areas in which irrigation accounts for a large portion of annual demands may have more potential to reduce water use than areas with relatively little irrigation demand. The longer-term effectiveness of using drought management programs over an extended period has not been systematically studied, though some providers believe it may be difficult to sustain drought management reductions over a long period due to customer concerns about lasting damage to their landscapes.

[10] Residential Water Demand Management: Lessons from Aurora, Colorado. Kenney et al. Journal of the American Water Resources Association. February 2008.

[11] The Effectiveness of Drought Management Programs in Reducing Residential Water-Use in Virginia. Halich and Stephenson. Virginia Water Resources Research Center. April, 2006.

Summary and Implications

The study team analyzed 106 drought contingency plans from a variety of providers across Texas. All of the plans included triggers, measures and goals for various stages of drought conditions. The study team analyzed the drought of record stage as well as the most severe stage with no onerous economic or customer impacts. The majority of providers provided an estimated goal for reducing average daily use for the drought of record stage and many provided an estimated goal for the less severe stage included in the analysis. The study team estimates daily savings of between 15 and 20 percent for the drought of record stage and below 5 percent for the less severe stage, based just on the information in the drought plans.

Exactly how inclusion of drought management as a water management strategy would affect the need for other water management strategies is complicated by several factors. This analysis has several implications concerning the potential use of drought management measures as a water management strategy in the regional water planning process.

- While this analysis has shown the feasibility of estimating water savings from drought stage goals, there are uncertainties regarding the potential savings estimates. Some of the limitations could be overcome with additional data collection and analysis; however, this analysis might prove difficult or costly and could require a shift in the modeling approach used to estimate supply and demand in the regional planning process.

- It is unclear to what degree savings are at least partially offset by increases in demand under drought of record conditions due to customer response to hot and dry meteorological conditions (see the discussion of the Region L study in Section II).

- The current water planning process does not identify what, if any, supplies are used by regions or providers only to meet needs during the drought of record. As a result, the extent to which drought management could substitute for other strategies identified in the regional planning process is not clear.

SECTION VI.
Findings and Conclusions

SECTION VI.
Findings and Conclusions

This study examined the role of drought management in regional and state water planning, and the potential benefits and drawbacks of incorporating drought management as a regional water management strategy. Research tasks included:

- Review of regional and statewide planning documents from the last round of water planning in Texas and more recent studies conducted by two of the RWPGs (described in Section II of this report);
- Review of water planning and drought management in other western states (also described in Section II of this report);
- Interviews with the chairpersons of the 16 regional water planning groups (described in Section III of this report);
- Interviews with 90 regional water planning group participants and outside stakeholders (described in Section IV of this report); and
- Review and analysis of a systematic sample of more than 100 drought contingency plans filed by regional and wholesale providers (described in Section V of this report).

The study was designed to investigate four principal questions. Study team conclusions address each of these questions.

Question #1, part A — Is it possible and appropriate to use drought management measures as water management strategies in the regional plans?

To consider drought management as a water management strategy in the regional planning process — and compare the costs and benefits of drought management with other supply and conservation options — relies on the ability to answer two key questions.

- What is the yield (or savings) that would result from drought management, and how does that yield compare with other strategies?
- What are the costs of drought management and how do those costs compare with other water management strategies?

At this time, there are significant analytical, data and modeling issues that would confront any region seeking to incorporate, or seriously evaluate, drought management as a water management strategy. The key issues are outlined below:

- The study team's review of more than 100 drought contingency plans for a wide range of Texas providers found that the drought plans were of varied quality and enforceability. Some plans do not have quantified water savings goals and there is a wide range of savings expectations associated with seemingly similar drought management measures. While the study team believes the aggregated estimates of statewide average water use reductions from drought management measures appear reasonable, the reliability of the estimates in individual plans (or even on a regional basis) is uncertain.

- Methods for quantifying the "costs" of drought management as a water management strategy are not yet well developed or agreed upon. The recent study conducted by Region L has taken some important steps toward developing a methodology for estimating the "costs" of drought management and putting them on an even footing with the cost estimates for other water management strategies. As discussed in Section II, we believe this approach needs further refinement.

- The existing approach used in the regional planning process for projecting and comparing water supplies and demands — and thus identifying needs — may not provide an adequate framework for considering drought management relative to other water management strategies. The existing approach compares supplies and demands only under drought of record conditions. It does not recognize the variability in supplies and demands from year to year, or explicitly examine "needs" under conditions other than the drought of record. Further, as demonstrated in the recent Region L study, demands under drought of record conditions may well be greater than the dry year demand (based on year 2000) used for forecasting in the regional planning process. If that is the case, some reliance on drought management may already be implicit in the planning process.

All of these issues could eventually be overcome. More consistent and reliable estimates of drought management savings might be developed by encouraging providers and regions to share information and conducting additional research into actual drought management experiences. The Water Conservation Task Force established by the Texas Legislature in 2003 to refine the statewide understanding of conservation measures could provide a useful model for a similar approach focused on drought management. The recent studies by Region L and Region H provide a starting point for developing methods to quantify the costs and savings associated with drought management and comparing drought management with other water management strategies. The regional planning approach to analyzing future supplies, demands and needs could be modified to also consider other climatological and hydrologic conditions (beyond just the drought of record). Water planning continues to become more sophisticated, and approaches such as probabilistic modeling of future supplies, demands and costs are being implemented by some water providers (as discussed in Section II).

Question #1, part B — Is it possible and appropriate to use drought management measures as water management strategies in the regional plans?

The interviews conducted with the regional water planning group chairs and a wide range of RWPG members, consultants and outside stakeholders produced extensive feedback on the perceived advantages and disadvantages of using drought management as a water management strategy. Those who oppose including drought management as a water management strategy and those who favor its inclusion can produce reasonable arguments in support of their views. There is not a clear right or wrong answer to this question.

The essence of the argument from those who oppose drought management as a water management strategy is as follows:

- Drought contingency plans provide a critical safety factor for unanticipated events such as a drought worse than the drought of record or a system failure;

- There would be potentially significant economic impacts, at least for some water systems, from relying on drought plans to reduce water use rather than developing additional supplies; and

- The public, and water providers themselves, are not yet ready to accept the notion of planning to be short of supply under drought of record conditions.

While these arguments are reasonable, they beg some further questions. How large a safety factor is appropriate, and should the safety factor be an explicit part of the planning process? Can some level of drought management that does not impose significant hardship be part of the strategy for meeting needs under drought of record conditions? (The analysis in Section V suggests that most drought plans include stages that produce moderate savings without substantial impacts on customers.) And how much are water-using customers willing to pay for different degrees of water supply reliability?

The essence of the argument from those who support drought management as a water management strategy is provided in the following bullets:

- Under drought of record conditions, many municipal providers would implement their drought contingency plans. In fact, many providers in Texas have implemented their drought contingency plans in recent years (albeit not necessarily to the drought of record stage) to deal with either drought conditions or, more frequently, system capacity problems. Ignoring the water use reductions that result from drought contingency plans leads to unrealistic projections of future drought of record demands and inflated estimates of future needs.

- The issue noted above may lead to unnecessary projects being built — with State funding assistance — primarily to maintain discretionary water uses through infrequent drought conditions.

- Occasional reliance on drought management can be a cost effective (and environmentally preferable) alternative to adding supplies that will seldom be needed.

These arguments are also reasonable. Once again, they suggest the need for refinements to the methods used in evaluating future supplies, demands and needs in the regional planning process. At present, it is not possible to determine which water management strategies may only be needed under extreme drought conditions, or what the actual cost of those strategies per acre-foot may be for water using customers.[1]

Question #2 — Why haven't RWPG's recommended drought management as a water management strategy?

Based on the interviews conducted with regional chairs and others involved with regional water planning in Texas, we believe there are five principal reasons RWPGs have not recommended drought management as one of the water management strategies for meeting future needs under drought of record conditions:

- It is difficult to reliably quantify the costs and yields of drought management in a way that is comparable to other water management strategies.

- Lack of information on supplies and demands under varied hydrologic conditions, and the frequency that those conditions can be expected to occur, leads to uncertainty that promotes a cautious approach to water supply planning.

- In many regions, relatively affordable new supply alternatives remain. For many of the participants in the regional water planning process, implementing drought management is seen as a less attractive option as long as other feasible alternatives are available.

- There are concerns about regional competition for state assistance and inter-regional equity. Most of the individuals interviewed by the study team felt it would be "unfair" if some regions rely on drought management to help meet future needs and others choose not to do so. Interviewees indicated a strong preference for a "level playing field."

- The constituent makeup of the RWPGs themselves likely favors the perspective of those opposed to including drought management as a water management strategy. Although the interviews described in Section IV of this report indicate a variety of perspectives within each of the various interest categories represented on the RWPGs, those most inclined to favor drought management as a water management strategy make up a relatively small portion of overall RWPG membership.

[1] In the regional planning process, annual costs per acre-foot for water management strategies reflect the assumption that the supply project is utilized at full capacity. A project that existed only to provide supplies under extreme drought conditions would likely have a greater cost per acre-foot actually delivered than implied by this costing approach, in part because the capital costs associated with the project would be spread over a much smaller volume of delivered water.

Question #3 — What are the ranges of savings, statewide, if drought management was included as a water management strategy?

The study team estimates that concurrent implementation of the drought of record stage of drought contingency plans by all municipal providers across the state of Texas would reduce daily water demands by between 15 and 20 percent, based on just the information in the drought plans. The measures required to achieve this level of savings would, in many cases, have some onerous effects on customers and would affect customers' quality of life and local economic conditions. Lesser drought management stages, with the potential to reduce demands by 5 percent or less, could be enacted with minimal adverse impacts on customers and local economies.

There is considerable uncertainty surrounding these estimates and the potential savings from drought management measures vary from provider to provider (and likely from region to region). As discussed in more detail in the recent study by Region H, there are very limited data on the actual reductions achieved by Texas water providers that have implemented stages of their drought contingency plans — and the data, in general, are not sufficient to fully isolate the effects of drought management activities from other factors.

Given the limitations of the current approach to projecting and analyzing future supplies, demands and needs in the regional planning process, it is also difficult to determine the extent to which these potential savings would eliminate the need for other water management strategies. To answer that question, further analysis would be needed to project and analyze supplies, demands and needs under a variety of future hydrologic conditions.

Question #4 — What would have to change for RWPGs to recommend drought management as a water management strategy?

Although some of the individuals interviewed for this study raised concerns about whether regional water planning groups have the authority to recommend drought management as a water management strategy, the study team believes those types of concerns also applied to using ongoing water conservation as a water management strategy — yet most regions have endorsed water conservation as part of their future water management efforts. Instead, we think there are four primary changes needed to facilitate the inclusion of drought management as a water management strategy.

- **Increased confidence in the water savings, reliability and estimated "costs" (or impacts) from drought management.** As noted earlier, studies by Region H and Region L provide some initial groundwork for developing methods to analyze drought management in a manner comparable to other water management strategies, but these approaches need further refinement. At least one interviewee suggested the notion that the TWDB (or others) should routinely audit a sample of the drought plans filed with TCEQ — not to punish providers that have filed deficient plans, but as part of an effort to educate providers on how to make plans better. A statewide effort analogous to the Water Conservation Task Force established by the Texas Legislature in 2003 could be another valuable step in improving the statewide understanding of drought management in general and help identify and better quantify the measures that providers with drought management experience have found to be most effective.

- **More sophisticated supply, demand and "need" analysis in the regional planning process.** Though we understand that the current approach of focusing entirely on the drought of record is embodied in the statutes that define regional and state water planning in Texas, more information is needed to fully examine benefits and costs of drought management as a water management strategy. At a minimum, regional water planning groups would need information on future supplies and demands (and corresponding needs) under other hydrologic conditions. Ideally, this information would be examined in a risk-based (probabilistic) approach that considers annual variability in supply and demand and frequencies of differing hydrologic conditions.

- **Increases in the cost and difficulty of pursuing new water supply alternatives.** As long as reasonably affordable (and otherwise feasible) supply options are available, most water providers will prefer to pursue those options and minimize reliance on drought management. We believe this primarily reflects water utilities' fundamental purpose of providing water service to their customers and customers' preference for receiving water rather than restrictions. The financial issues posed by reducing water sales may also be a consideration in some cases. As new supply options become more expensive or more difficult to pursue for other reasons, drought management will become an increasingly attractive alternative.

- **Additional state incentives or requirements to promote more serious consideration of drought management as a water management strategy.** Texas administrative code already requires regional water planning groups to consider drought management as a water management strategy. In the last round of regional planning in 2006, however, all of the regional planning groups interpreted this requirement to stop short of making a full comparison of the costs and benefits of drought management to other water management strategies. Potentially, the TWDB could provide more guidance on how to analyze drought management and more explicit expectations of what "consideration" of drought management as a water management strategy entails. Alternatively, the TWDB might be able to provide incentives to regions or individual water providers to promote more serious consideration of drought management as a water management strategy.

As noted earlier in this section, part of the reason that drought management has not received more consideration as a water management strategy may also be due to the makeup of the regional water planning groups. Although Texas has done more than most states to encourage diverse perspectives in the planning process, the types of interests that are more likely to favor drought management comprise a small portion of the membership of the regional water planning groups. Additional representation from environmental and recreation interests, in particular, would likely promote more consideration of drought management as a water management strategy.

Additional Insights and Questions Resulting from this Research

During the course of the research for this study, the BBC team identified a number of other analytical and policy-related questions relevant to consideration of how drought management interacts with regional and state water planning in Texas.

- **To what degree are water use reductions from drought management offset by increases in demands under drought conditions that are not captured in the year 2000-based demand projections?** As discussed in Section II, the Regional L analysis suggests that per-capita demands in that region may be up to 7 percent greater than in year 2000 — partly offsetting the potential water use reductions from drought management. This type of analysis in other regions could offer useful information for planning purposes.

- **How much of a "safety factor" is appropriate for droughts worse than the drought of record or other unanticipated conditions?** One of the reasons frequently cited for not including drought management as a water management strategy is the need for a buffer to accommodate unexpected events. Though this question is difficult to answer, an explicit approach to more specifically identifying and quantifying this need may be worthy of consideration.

- **Does the current approach for estimating the costs of water management strategies significantly understate actual delivered costs for supplies that are primarily used for "drought protection?"** As indicated earlier in this section, we believe this may be the case but do not have the data to provide a definitive answer.

- **How do municipal water customers value water supply reliability relative to water affordability?** Fully understanding the public's willingness to accept drought management as a water management strategy would require further research into this tradeoff. These types of studies have been undertaken in various locales.

This research also raises a number of additional questions for consideration.

- **Is a more accurate and more informative, but also more complex, approach to modeling future supplies, demands, "needs" and costs feasible and appropriate?** As suggested earlier in this section, we believe accurate consideration of drought management as a water management strategy requires more information than is currently developed during the regional water planning process. However, this study has also found that many RWPG members have a limited understanding even of the comparatively simplified approach currently used to quantify future needs. Developing more sophisticated analyses is also potentially costly. As noted earlier in this study, some larger municipal providers are now evaluating future supplies and demands in a probabilistic fashion, but we are unaware of any state that incorporates this type of analysis for regional or statewide planning.

- **Who should choose how much "drought protection" (or how large a safety factor) is appropriate?** Is this a choice that should be left to individual providers or to individual regions or should it be made by state agencies?

- **Should the TWDB and the RWPGs focus on trying to improve the quality and reliability of drought plans and helping to develop regional approaches to responding to drought and protecting essential uses?** While the questions of whether (and perhaps how) drought management should be reflected in the regional water planning process have implications for how resources are developed and allocated, more than one of the people interviewed for this study pointed out that the most important question is how to minimize impacts when the next drought of record actually occurs. When very severe drought strikes Texas again, the critical question will be how to minimize the adverse effects on public health and welfare and overall economic conditions.

The study team encourages the TWDB to consider these analytical and policy issues as the agency evaluates the next steps to more fully integrate drought management measures with regional and state water planning.

APPENDIX A.
Materials Related to Interviews with Regional Chairs

Appendix A.
Materials Related to Interviews with Regional Chairs

This appendix contains a copy of the introductory letter sent to all regional chairs and the interview guide used for these discussions. It also contains a list of the persons interviewed during this task.

July 12, 2008

Name
Position
Organization
Address

Re: Interviews regarding drought contingency measures and regional planning

Dear _____:

The Texas Water Development Board (TWDB) is sponsoring a study to examine advantages, disadvantages and issues associated with incorporating drought contingency measures as water management strategies in the regional and state water planning processes. TWDB has retained the consulting team of BBC Research & Consulting (BBC), Morningside Research and G.E. Rothe, Inc. to conduct this study.

During the next month, the BBC team will be conducting telephone interviews with the chairperson of each of the Regional Planning Work Groups (RWPGs). After completing the interviews with the chairpersons, the BBC team will also conduct a telephone survey of 100 members of the RWPGs and other stakeholders.

We request that you assist us by participating in the telephone interviews and by encouraging other members of your RWPG to participate in the subsequent telephone survey if they are chosen as part of the sample. While specific comments from the interviews and surveys will not be attributed to particular individuals, overall draft results from the study will be published for public comment – likely in early 2009. The Scope of Work for this research is available through a link under *'What's New'* at: http://www.twdb.state.tx.us/wrpi/index.htm

Please contact Matt Nelson in the TWDB Planning Section (512-936-3550) if you have any questions or concerns regarding this study.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator

BBC Research & Consulting
3773 Cherry Creek North Drive
Suite 850
Denver, Colorado 80209-3868
303.321.2547 fax 303.399.0448
www.bbcresearch.com bbc@bbcresearch.com

MEMORANDUM

To:	Matt Nelson, TWDB
From:	Doug Jeavons
Re:	Draft interview guide for RWPG chairs
Date:	July 7, 2008

Introduce ourselves. Our consulting team has been hired by the Texas Water Development Board to examine the potential role of drought management measures as water management strategies in the regional and state water planning processes. As part of that study, we are interviewing the chairperson in each region to get their perspective on these issues. You may have received a letter from TWDB discussing this study and asking for your help in completing this research.

Later this year, we will also conduct a broader survey of regional planning participants. All specific responses to both these interviews and the surveys we conduct later will be kept confidential. We anticipate that a draft of the study results will be available in late 2008 for public review and comment.

1. Basic information: Name, organization, position

2. Personal history of involvement with regional water planning process (when did they get involved? Role in previous regional and state planning processes)

3. (if applicable) Do you recall any discussions about drought management measures/contingency plans during the last regional planning process from 2002 through 2006?

    - (if applicable) Please describe those discussions.

4. Was there discussion about including drought management measures as a recommended water management strategy for the region?

   - Which participants/individuals were most active in those discussions?
   - What were their points of view?
   - What was the consensus of the regional group as a whole?
   - Was there general agreement or were there distinctly different viewpoints?
   - What did the group decide to do about drought measures/contingency plans for the last planning process?
   - If your region did not recommend inclusion of drought management measures as water management strategies in the regional water plan, why not?

5. Has there been any discussion about the role of drought management measures/contingency plans as a water management strategy among group members since the last regional plan was completed?

   - Who has raised this topic?
   - What has been discussed?

6. Has their region experienced a significant drought within the past decade?

   - (if applicable) Did municipal providers within the region enact their drought contingency plans?
   - (if applicable) What results did you hear of regarding drought contingency implementation? (I.e. did you hear reports of difficulties, specific demand reductions or efficacy of various measures?)

7. What are the advantages and disadvantages of including drought management measures as a water management strategy (and incorporating the anticipated water use reductions from those measures) in planning for future water supply needs at the regional and state levels?

8. What concerns, if any, do you have about including drought management measures as a water management strategy in the regional and state water planning process?

9. What concerns, if any, do you have about not including drought management measures as a water management strategy in the regional and state water planning process?

10. Are there any specific obstacles to including drought management measures as one of the mechanisms for meeting future demands under drought of record type conditions? (Prompt with: “for example legal, political or other institutional constraints?”)

11. How would regional planning change if quantified estimates of reductions in water use from drought management measures were incorporated as a water management strategy?

12. How do you think drought management, and drought management measures, should be defined?

13. How would you distinguish drought management (or drought contingency) measures from long-term water conservation measures?

14. Do you believe that most of the municipal providers in their region have realistic drought contingency plans that have been thoroughly considered and evaluated by their decision makers?

15. Do you believe it would be feasible to realistically estimate water use reductions from drought management measures based on the drought contingency plans of providers in their region?

Note: If interviewee seems familiar with specific drought management strategies and triggers probe about variations in provider plans including triggers, specificity of drought measures and delineation between long-term conservation measures and drought measures.

List of Regional Chairs Interviewed

Region	Name		Position	Organization	Location	
A	C.E.	Williams		Panhandle Groundwater Conservation District	White Deer	Texas
B	Curtis	Campbell	General Manager	Red River Authority of Texas	Wichita Falls	Texas
C	James (Jim)	Parks	Chairman	North Texas Municipal Water District	Wylie	Texas
D	Jim	Thompson		Region D	Atlanta	Texas
E	Tom	Beard	Executive Committee Chairman	Attorney At Law	Alpine	Texas
F	John	Grant	Chair & General Manager	Colorado River MWD	Big Spring	Texas
H	Jeff	Taylor, P.E.	Deputy Director	City of Houston Dept. of Public Works and Engineering	Houston	Texas
I	Kelley	Holcomb		Angelina and Neches River Authority	Lufkin	Texas
J	Jonathan	Letz	Commissioner	Kerr County	Kerrville	Texas
K	John	Burke	General Manager	Aqua Water Supply Corporation	Bastrop	Texas
L	Con	Mims		Nueces River Authority	Uvalde	Texas
M	Glenn	Jarvis	Attorney	Law Offices of Glenn Jarvis, InterNational Bank	McAllen	Texas
N	Scott	Bledsoe, III	President	Live Oak Underground Water Conservation District	Oakville	Texas
N	Carola	Serrato		South Texas Water Authority	Kingsville	Texas
O	Harold P. "Bo"	Brown		Texas Cattle Feeders	Lubbock	Texas
P	Harrison	Stafford, II	Judge	Jackson County	Edna	Texas

APPENDIX B.
Materials Related to Interviews with Regional Planning Group Members, Consultants and Outside Stakeholders

Appendix B.
Materials Related to Interviews with Regional Planning Group Members, Consultants and Outside Stakeholders

This appendix contains copies of the introductory letter sent to regional planning group members and other stakeholders and the interview guide used for these discussions. It also contains a list of the persons interviewed during this task and the specific responses to the question of perceived barriers and disincentives to including drought management as a water management strategy.

September 17, 2008

Re: Interviews regarding drought contingency measures and regional water planning

Dear RWPG members and other stakeholders:

The Texas Water Development Board (TWDB) is sponsoring a study to examine advantages, disadvantages and issues associated with incorporating drought contingency measures as water management strategies in the regional and state water planning processes. TWDB has retained the consulting team of BBC Research & Consulting (BBC), Morningside Research and G.E. Rothe, Inc. to conduct this study.

During the next month, the BBC team will be conducting telephone interviews with a random sample of Regional Water Planning Group members and other stakeholders. You are receiving this letter because you have been selected to be a participant in this process. You will be receiving a call from either BBC Research & Consulting or Morningside Research to schedule an interview. We anticipate each interview may require about 30 minutes. We request that you assist us by participating in the telephone interviews and providing your perspective on these issues.

While specific comments from the interviews and surveys will not be attributed to particular individuals, overall draft results from the study will be published for public comment – likely in early 2009. The Scope of Work for this research is available through a link under *'What's New'* at: http://www.twdb.state.tx.us/wrpi/index.htm

Please contact Matt Nelson in the TWDB Regional Water Planning Section (512-936-3550) if you have any questions or concerns regarding this study.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator,
Water Resources Planning and Information

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MEMORANDUM

To:	Matt Nelson, TWDB
From:	Doug Jeavons and Kevin Williams
Re:	Revised Interview Guide for Regional Planning Stakeholder Interviews
Date	September 2, 2008

Introduce ourselves. Our consulting team has been hired by the Texas Water Development Board to examine the potential role of drought management measures as water management strategies in the regional and state water planning processes. As part of that study, we are interviewing regional planning participants and other stakeholders to get their perspective on these issues. All specific responses to these interviews will be kept confidential. We anticipate that a draft of the study results will be available in late 2008 for public review and comment.

1. Basic information: Name, organization, position

2. Were you involved in the last regional planning process (2002-2006)? If so, what was your role?

3. Many states don't have a regional water planning process. What do you feel is the main benefit of having this process in Texas?

4. Do you see any major problems with the current regional planning process? If so, what are those problems?

In the last regional planning process, the "need" for new municipal supplies to avoid future shortages was determined by comparing the water supplies available under drought of record conditions to projections of future water demand. The demand projections were based on water use per capita during dry year conditions (year 2000 in most cases). The demand projections did not include additional reductions in municipal use during drought of record conditions that might result from watering restrictions or other drought contingency measures.

5. Are there any drawbacks to this approach to quantifying shortages and estimating future water needs for municipal water providers?

6. If so, how could these be addressed?

7. Was there discussion about using drought management measures as a water management strategy during the 2002 through 2006 regional planning process? If so, what do you recall about those discussions?

8. In the event of a recurrence of the drought of record, many municipal providers would implement their drought contingency plans. Should this be reflected in the process for estimating future shortages and determining regional needs for new water supplies?

9. What are the implications if the demand reductions from drought contingency plans are not included in estimating future shortages and determining regional needs for new water supplies?

10. If some water providers and/or regions include savings from drought contingency plans in estimating future shortages and determining regional needs for new water supplies and others do not, would that be fair or unfair? Why?

11. If drought management measures are to be included in future regional plans as a water management strategy, the reduction in water use from these measures will have to be estimated. Please tell me who you think should be responsible for estimating the savings from drought management measures, and why.

    a. TWDB—based on analysis of drought contingency plans filed with TCEQ.

    b. Each individual region.

    c. Each municipal provider within each region.

12. Do you have any experience with, or knowledge of, the drought contingency plans for any municipal provider? If so:

    a. Which provider(s) plans are you familiar with?

    b. Do you believe those plans are realistic and enforceable? Why or why not?

    c. Has the plan been successfully implemented in the past?

13. Are there barriers or disincentives to including water use reductions from drought contingency measures as a water management strategy in the regional and state planning process? If so, what are they?

14. Is there anything further you would like to add regarding the advantages or disadvantages of including drought management measures as water management strategies in the regional planning process?

List of RWPG Members, Consultants and Outside Stakeholders Interviewed (Page 1 of 2)

VotingRegion	Interest Category	LastName	FirstName	Title	Entity	City	State
E	LocalGov	Archuleta	Ed	General Manager	El Paso Water Utilities - PSB	El Paso	Texas
NA	Consultant	Ashworth	John		LBG-Guyton		
L	EnvRec	Balin	Donna	Geologist		San Antonio	Texas
K	EnvRec	Barho	Jim		Protect Lake Inks- Buchanan Assoc.	Burnet	Texas
L	Other	Bonavita	Evelyn		League of Women Voters	San Antonio	Texas
D	LocalGov	Bonds	Keith			Longview	Texas
D	Agric	Bradley	Adam		Bradley Timberlands	Jefferson	Texas
P	Industry	Brandenberg	Tommy			Hallettsville	Texas
I	LocalGov	Branick	Jeff		Jefferson County	Beaumont	Texas
E	LocalGov	Brewster	Rebecca L.	City Manager	Town of Van Horn	Van Horn	Texas
B	EnvRec	Brite	J.K. Rooter		Rancher	Bowie	Texas
I	LocalGov	Brock	David	Director, Water Utilities	City of Jacksonville	Jacksonville	Texas
N	Agric	Burdette	Ray			Raymondville	Texas
N	Agric	Burns	Chuck		Willacy Co.		Texas
M	EnvRec	Campbell	Mary Lou	Secretary	Rio Grande Region Water Planning Group	Mercedes	Texas
I	Other	Campbell	George P.		Nacogdoches County	Nacogdoches	Texas
C	Water	Chapman	Jerry W.	Member	Greater Texoma Utility Authority	Denison	Texas
A	EnvRec	Clark	Nolan		USDA-ARS	Bushland	Texas
A	LocalGov	Cook	Vernon	Judge	Roberts County	Miami	Texas
A	Water	Cooke	Charles		Texas Country Water Supply	Borger	Texas
NA	Stakeholder	Crawford	Lauren		Texas Municipal League		
J	Agric	Davis	Zach		Davis Hardware	Brackettville	Texas
N	LocalGov	Dick	Billy		City of Rockport	Rockport	Texas
N	Other	Durham	Lavoyger		Brooks Co		Texas
NA	Stakeholder	Edmondson	E. D. (Eddie)		Texas Nursery & Landscape Association		
F	LocalGov	Egan	Marilyn	Judge	Runnels County	Ballinger	Texas
H	Water	Eichelberger,	Reed	General Manager	San Jacinto River Authority	Conroe	Texas
O	Agric	Ethridge	Don		TTU College of Agricultural Sciences and Na	Lubbock	Texas
G	LocalGov	Fambrough	Tim	Judge	Nolan County	Sweetwater	Texas
D	Other	Frost	George			Maud	Texas
M	Agric	Fulbright	Robert E.		Jim Hogg County	Hebbronville	Texas
F	Water	Gist	Richard		Zephyr WSC	Brownwood	Texas
E	Industry	Goldberg	Howard		Supreme Laundry & Cleaners	El Paso	Texas
NA	Consultant	Gooch	Tom		Freese & Nichols		
G	Industry	Grace	Horace R.		AMG Enterprises, Inc.	Killeen	Texas
A	Other	Guthrie	Janet	General Manager	Hemphill County UWCD	Canadian	Texas
O	Industry	Harbin	Bill		Golden Spread Electric Coop.	Floydada	Texas
I	Industry	Harbordt	C. Michael			Lufkin	Texas
A	Industry	Henslee	Gale		Southwest Public Service	Amarillo	Texas
NA	Stakeholder	Hess	Myron		National Wildlife Federation		
I	Other	Heugal	William		Sabine County	Hemphill	Texas
M	Water	Hinojosa	Sonny	General Manager	Hidalgo Co. Irrigation Dist No. 2	San Juan	Texas
H	Industry	Howard	John		Howard Farms	Bellville	Texas
N	Industry	Hubert	Pancho		Tejas Veterinary Hospital	Kingsville	Texas

List of RWPG Members, Consultants and Outside Stakeholders Interviewed (Page 2 of 2)

VotingRegion	Interest Category	LastName	FirstName	Title	Entity	City	State
B	Agric	Hughes	Dale		W.T. Waggoner Estate	Vernon	Texas
L	Water	Illgner	Rick	General Manager	Edwards Aquifer Authority	San Antonio	Texas
B	Industry	Johnson, Jr.	Joe		Stephens Engineering	Wichita Falls	Texas
L	Agric	Jones	Bill		D.M. O'Connor Ranches	Victoria	Texas
NA	Stakeholder	Kelly	Mary		Environmental Defense Fund		
N	Industry	Knolle	Pearson		Sandia Agricultural Enterprises, Inc.	Sandia	Texas
NA	Stakeholder	Kramer	Ken		Sierra Club		
L	Agric	Langford	David		Texas Wildlife Association	Comfort	Texas
D	EnvRec	LeTourneau	Richard			Longview	Texas
E	EnvRec	Lieb	Carl	Associate Professor & Ass	Dept. of Biological Sciences, University of Te	El Paso	Texas
H	Industry	Long	Ted		NRG Texas Power LLC	Houston	Texas
K	EnvRec	Marbury	Laura	Water Analyst	Environmental Defense	Austin	Texas
NA	Consultant	Maroney	Kerry		Biggs & Mathews		
C	LocalGov	Mendez	Mark	Member	Tarrant County	Fort Worth	Texas
K	Agric	Miller	William M. (B		Rancher	Llano	Texas
B	Water	Miller	Kyle		Wichita County WCID No. 2	Wichita Falls	Texas
F	Other	Moody	Wendell			Eden	Texas
D	Agric	Nabors	Sharron			Paris	Texas
L	Water	Naumann	Ron		Spring Hill WSC	Seguin	Texas
NA	Consultant	Norris	Joseph W. (Bill)		NRS Consulting Engineers		
P	Industry	Ottis	Richard		Ricebelt Industries	El Campo	Texas
NA	Consultant	Parkhill	David		Turner Collie & Braden		
L	EnvRec	Pena	Illiana		Mitchell Lake Audubon Center (MLAC)	San Antonio	Texas
O	Other	Rainwater	Ken	Dr.	Texas Tech Water Resources Center	Lubbock	Texas
I	Agric	Reed, Jr.	Hermon E.			Carthage	Texas
F	EnvRec	Runge	Caroline		Menard County UWD	Menard	Texas
I	Water	Shank	Monty		Upper Neches River Muncipal Water Authorit	Palestine	Texas
E	Other	Shapleigh	Eliot	Communications Director	Office of Senator Eliot Shapleigh	Austin	Texas
F	Industry	Sipes	Buddy			Midland	Texas
G	EnvRec	Stark	Stephen L.	PhD, Professor, Graduate	Texas A&M University	College Station	Texas
E	LocalGov	Stegall	Charles		Terrell County Comissioners Court	Sanderson	Texas
O	EnvRec	Steiert	Jim		Quality Hunts	Hereford	Texas
B	EnvRec	Stephens	Pamela	Professor	Department of Geosciences, Midwestern Sta	Wichita Falls	Texas
N	Other	Stockton	William		Bee County		Texas
I	Water	Stroder	Robert		Lower Neches Valley Authority	Beaumont	Texas
K	LocalGov	Sultemeier	James	Commissioner	Blanco County, Pct. 2	Johnson City	Texas
NA	Consultant	Vaugh	Sam		HDR Engineering		
NA	Stakeholder	Vaughan III	Ben		Coastal Conservation Association		
P	LocalGov	Wagner	David	Commissioner	Lavaca County	Shiner	Texas
K	EnvRec	Walker	Jennifer		Lone Star Chapter, Sierra Club	Austin	Texas
G	Water	Webster	Kathleen		Retired	Abilene	Texas
A	Agric	Weinheimer	Ben		Texas Cattle Feeders Assoc.	Amarillo	Texas
J	Water	Wiedenfeld	Charlie		Wiedenfeld Water Works	Center Point	Texas
F	Other	Wilson	Len			Andrews	Texas
J	Other	Wilson	William Feath		Strata Geological Services	Bandera	Texas
C	Agric	Woodward	Tom	Dr.		Decatur	Texas

Responses to Question 13: Are there barriers or disincentives to including water use reductions from drought contingency measures as a water management strategy in the regional and state planning process? If so, what are they?

Respondent Interest Category	Response
Agric	Thinks it's a back door attempt to force conservation
Agric	They have lots of water, so not a real issue for them…very concerned about other regions stealing their water
Agric	Resource illiteracy among public
Agric	Process influenced by water development interests/people in the business of selling water
Agric	None
Agric	None
Agric	None
Agric	Lack of authority to tell water users what to do
Agric	Doesn't know.
Agric	Funding for analysis
Agric	Don't want to face issue
Agric	Don't know of any that have come up
Agric	Desire to make sure you have enough water and concern re lack of enforceability for drought plans
Agric	Accuracy of data from small communities due to the lack of resources
Consultant	Unfunded mandate
Consultant	Too risky
Consultant	Temporary supply
Consultant	Safety factor, impact, should be used rarely
Consultant	It removes a margin of error in the planning process
Consultant	
env_rec	Should reward providers that plan using conservation and restrictions; complicated to incorporate costs of DM
env_rec	Resistance on part of big cities to DMMs due to need for continued economic development. Also resistance from agriculture
env_rec	Need for accurate data
env_rec	Reduces the buffer…if people don't end up cutting back there will be a problem
env_rec	None
env_rec	None
env_rec	Lack of good information and data. Funding
env_rec	If people don't see the process as fair there will be resistance
env_rec	Get approval at the groundwater district level
env_rec	Doesn't think WSCs take planning seriously
env_rec	None
env_rec	Change in attitude by policy makers
env_rec	1. Reluctance from water providers. Hostility towards this type of measures. 2. Difficult to quantify potential savings. 3. The cost savings and economic impacts are calculated in an inappropriate basis (pro-rata). Obviously non-essential uses would be curtailed first.
env_rec	

Responses to Question 13: Are there barriers or disincentives to including water use reductions from drought contingency measures as a water management strategy in the regional and state planning process? If so, what are they?

Respondent Interest Category	Response
Industry	Who and how they are estimated
Industry	There may be a negative response from the general public
Industry	People in Texas don't like big government telling them what to do
Industry	None
Industry	None
Industry	None
Industry	Need to make sure there is enough supply for future needs
Industry	Hard to quantify; needs to be transparent
Industry	Economic disincentives for businesses and utilities to reduce demand projections
Industry	Don't punish irrigators on the Ogallala during drought because they need the water the most!
Industry	Doesn't know
Industry	
Industry	
LocalGov	Revenue disincentive - reduced projections are associated with lower revenues
LocalGov	Process may become more cumbersome and expensive. Responses may be disingenuous
LocalGov	Per capita estimates would be problematic because they have lots of variation in population during to tourism
LocalGov	None
LocalGov	None
LocalGov	None
LocalGov	Lack of common approach makes implementing broad changes difficult
LocalGov	It is hard to measure and expensive
LocalGov	Inefficiency of Texas legislature
LocalGov	Don't know
LocalGov	Distrustful of State
LocalGov	Adds another layer to an already complicated process; some municipalities may act strategically to get more water
LocalGov	

Responses to Question 13: Are there barriers or disincentives to including water use reductions from drought contingency measures as a water management strategy in the regional and state planning process? If so, what are they?
(Page 3 of 3)

Respondent Interest Category	Response
Stakeholder	Makeup of planning interests. Motivations of consultants and TWDB
Stakeholder	Landowners' water rights could be an issue
Stakeholder	Don’t why there would be - public has misconception of word 're-use'
Stakeholder	Being over-optimistic
Stakeholder	
Stakeholder	
Other	We need to change the attitude of "If we can afford we should use it." There are houses in Dallas that use more water than my entire town
Other	Taking water away will change the ecosystem
Other	Reducing water demand involves more than municipalities - this is not recognized by all
Other	Not aware of any
Other	Municipalities make money by selling water. Public education would be required to gain acceptance
Other	Lack of understanding about what drought measures are. Resistance on part of lead consultant
Other	It's not a conservative approach
Other	Funding mechanism encourages regional planners to overestimate supply needs
Other	Each provided is left on their own to determine and implement plan
Other	Doesn't see any (but responded about use of drought plans, not inclusion in modeling)
Other	Difficult to know the actual savings from drought measures
Other	
Water	Too many variables and too much uncertainty
Water	The prinicipal challenge is to calculate demand accurately
Water	Providers might not want to provide the information
Water	People don't have a good understanding of real demands
Water	Not at present
Water	None that he knows of
Water	None
Water	Need innovative thinking
Water	Doesn't know
Water	Difficulty in accurately measuring savings
Water	
Water	

APPENDIX C.
Drought Plans Analyzed

Appendix C.
Drought Plans Analyzed

This appendix contains a list of the providers included in the analysis of drought plans presented in Section V. Each provider is listed along with their region, size, climate and water source classification.

Figure C-1.
Providers included in drought plan analysis (part 1 of 3)

Provider	Region	Climate	Size	Water Source
Abilene	G	Mixed	Large	Surface Water
Acton MUD	G	Mixed	Small	Mixed
Alice	N	Mixed	Small	Surface Water
Allen	C	Mixed	Medium	Surface Water
Amarillo	A	Dry	Large	Mixed
Andrews	F	Dry	Small	Ground Water
Aransas Pass	N	Mixed	Small	Surface Water
Arlington	C	Mixed	Large	Surface Water
Athens	C	Mixed	Small	Mixed
Austin	K	Mixed	Large	Surface Water
Azle	C	Mixed	Small	Surface Water
Baytown	H	Wet	Medium	Mixed
Beaumont	I	Wet	Large	Mixed
Beeville	N	Mixed	Small	Surface Water
Benbrook	C	Mixed	Small	Mixed
Bethesda WSC	G	Mixed	Medium	Mixed
Big Spring	F	Dry	Medium	Mixed
Bolivar WSC	C	Mixed	Small	Ground Water
Borger	A	Dry	Small	Ground Water
Brenham	G	Mixed	Small	Surface Water
Brownsville	M	Mixed	Large	Mixed
Brownwood	F	Dry	Small	Surface Water
Brushy Creek MUD	G	Mixed	Small	Surface Water
Bryan	G	Mixed	Medium	Ground Water
Burkburnett	B	Mixed	Small	Mixed
Canyon	A	Dry	Small	Mixed
Carrollton	C	Mixed	Large	Mixed
Cash SUD	D	Wet	Small	Surface Water
Cedar Park	G	Mixed	Medium	Surface Water
Chisholm Trail SUD	G	Mixed	Small	Mixed
Conroe	H	Wet	Medium	Ground Water
Coppell	C	Mixed	Medium	Surface Water
De Soto	C	Mixed	Medium	Mixed
Denison	C	Mixed	Medium	Mixed
Denton	C	Mixed	Large	Surface Water
East Cedar Creek FWSD	C	Mixed	Small	Surface Water
El Campo	P	Mixed	Small	Ground Water
El Paso	E	Dry	Large	Mixed

Source: BBC Research & Consulting 2009.

Figure C-1 (continued).
Providers included in drought plan analysis (part 2 of 3)

Provider	Region	Climate	Size	Water Source
Euless	C	Mixed	Medium	Mixed
Forest Hill	C	Mixed	Small	Surface Water
Fort Bend County MUD #2	H	Wet	Small	Ground Water
Freeport	H	Wet	Small	Surface Water
Frisco	C	Mixed	Large	Mixed
Garland	C	Mixed	Large	Surface Water
Grand Prairie	C	Mixed	Large	Mixed
Greenville	D	Wet	Small	Surface Water
Groves	I	Wet	Small	Surface Water
Harris County MUD #200	H	Wet	Small	Ground Water
Harris County MUD #55	H	Wet	Small	Surface Water
Henderson	I	Wet	Small	Mixed
Houston	H	Wet	Large	Mixed
Irving	C	Mixed	Large	Surface Water
Johnson County Rural SUD	G	Mixed	Medium	Mixed
Katy	H	Wet	Small	Ground Water
Killeen	G	Mixed	Large	Surface Water
Kyle	L	Mixed	Small	Mixed
La Marque	H	Wet	Small	Mixed
La Porte	H	Wet	Medium	Mixed
Lakeway	K	Mixed	Small	Surface Water
Laredo	M	Mixed	Large	Mixed
League City	H	Wet	Medium	Mixed
Lewisville	C	Mixed	Large	Surface Water
Longview	D	Wet	Medium	Surface Water
Lubbock	O	Dry	Large	Mixed
Lufkin	I	Wet	Medium	Ground Water
Mansfield	C	Mixed	Medium	Surface Water
Mcallen	M	Mixed	Large	Surface Water
Mckinney	C	Mixed	Medium	Surface Water
Mesquite	C	Mixed	Large	Surface Water
Midland	F	Dry	Large	Surface Water
Military Highway WSC	M	Mixed	Small	Mixed
Mission	M	Mixed	Medium	Surface Water
Nederland	I	Wet	Small	Surface Water
North Alamo WSC	M	Mixed	Large	Mixed
North Richland Hills	C	Mixed	Medium	Mixed
Palestine	I	Wet	Small	Surface Water

Source: BBC Research & Consulting 2009.

Figure C-1 (continued).
Providers included in drought plan analysis (part 3 of 3)

Provider	Region	Climate	Size	Water Source
Pasadena	H	Wet	Large	Mixed
Plano	C	Mixed	Large	Surface Water
Port Arthur	I	Wet	Medium	Surface Water
Port Lavaca	L	Mixed	Small	Surface Water
Richardson	C	Mixed	Large	Surface Water
Richmond	H	Wet	Small	Ground Water
Rio Grande City	M	Mixed	Small	Surface Water
Rosenberg	H	Wet	Medium	Ground Water
Royse City	C	Mixed	Small	Surface Water
San Antonio	L	Mixed	Large	Mixed
Seabrook	H	Wet	Small	Mixed
Seguin	L	Mixed	Medium	Mixed
Sherman	C	Mixed	Medium	Mixed
South Houston	H	Wet	Small	Mixed
Southlake	C	Mixed	Medium	Surface Water
Stephenville	G	Mixed	Small	Mixed
Sugar Land	H	Wet	Medium	Mixed
Sweetwater	G	Mixed	Small	Ground Water
Tomball	H	Wet	Small	Ground Water
Travis County WCID #17	K	Mixed	Small	Surface Water
Universal City	L	Mixed	Small	Ground Water
Vernon	B	Mixed	Small	Ground Water
Victoria	L	Mixed	Medium	Mixed
Waco	G	Mixed	Large	Surface Water
Walnut Creek SUD	C	Mixed	Small	Surface Water
Watauga	C	Mixed	Small	Surface Water
Weatherford	C	Mixed	Medium	Mixed
Weslaco	M	Mixed	Medium	Surface Water
Wichita Falls	B	Mixed	Large	Surface Water
Windermere Utility Company	K	Mixed	Small	Surface Water

Source: BBC Research & Consulting 2009.