

Drought Preparedness Council



STATE DROUGHT PREPAREDNESS PLAN

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STATE OF TEXAS DROUGHT PREPAREDNESS PLAN

APPROVAL AND IMPLEMENTATION

This plan is hereby approved for implementation and supersedes all previous editions.

July 22, 2005

Date

Jack Colley

**State Drought Manager
Texas Drought Preparedness Council**

Explanation of Terms

A. Acronyms

| | |
|--------|--|
| AGD | Adjutant General's Department |
| CDBG | Community Development Block Grant |
| CEOS | Committee on Earth Observation Satellites |
| CER | Corporate Expansion and Recruitment |
| CMI | Crop Moisture Index |
| DPC | Drought Preparedness Council |
| DRIP | Drought Information Resource Packet |
| EO | Earth Observation |
| ESF | Emergency Support Function |
| FEMA | Federal Emergency Management Agency |
| FSA | Farm Service Agency |
| GDEM | Governor's Division of Emergency Management |
| GIS | Geographical Information System |
| GSC | General Services Commission |
| GUI | Graphical User Interface |
| HUD | Housing and Urban Development |
| IBWC | International Boundary and Water Commission |
| KBDI | Keetch-Byram Drought Index |
| NASS | National Agricultural Statistics Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRCS | National Resources Conservation Service |
| NWS | National Weather Service |
| ORCA | Office of Rural Community Affairs |
| OSC | Office of State Climatologist |
| PDD | Public Disaster Declaration |
| PDSI | Palmer Drought Severity Index |
| PET | Potential Evapotranspiration |
| PSA | Public Service Announcement |
| RD | Rural Development |
| RRC | Railroad Commission |
| SITREP | Situation Report |
| SPI | Standard Precipitation Index |
| TAEX | Texas Agricultural Extension Service |
| TAGD | Texas Alliance of Groundwater Districts |
| TASS | Texas Agricultural Statistics Service |
| TCCS | Texas Center for Climate Studies |
| TCDP | Texas Community Development Program |
| TCEQ | Texas Commission on Environmental Quality |
| TDA | Texas Department of Agriculture |
| TDED | Texas Department of Economic Development and Tourism |
| TDHCA | Texas Department of Housing and Community Affairs |
| TDSHS | Texas Department of State Health Services |
| TFS | Texas Forest Service |
| TNRIS | Texas Natural Resources Information System |
| TPWD | Texas Parks and Wildlife Department |
| TSSWCB | Texas State Soil and Water Conservation Board |
| TWDB | Texas Water Development Board |
| TWMC | Texas Water Monitoring Congress |
| TxDOT | Texas Department of Transportation |
| TxLEWS | Texas Livestock Early Warning System |
| USACE | United States Army Corps of Engineers |
| USBR | United States Bureau of Reclamation |
| USDA | United States Department of Agriculture |
| USFS | United States Forest Service |
| USFWS | United States Fish and Wildlife Service |

| | |
|-------|---|
| USGS | United States Geological Survey |
| USPHS | United States Public Health Service |
| VOAD | Voluntary Organizations Active in Disasters |
| VT | Vegetation and Temperature Condition Index |
| WAM | Water Availability Modeling |

B. Definitions

1. Meteorological Drought: This type of drought is often defined by a period of substantially diminished precipitation duration and/or intensity that persists long enough to produce a significant hydrologic imbalance. The commonly used definition of meteorological drought is an interval of time, generally of the order of months or years, during which the actual moisture supply at a given place consistently falls below the climatologically- appropriate moisture supply.
2. Agricultural Drought: Occurs when there is inadequate precipitation and/or soil moisture to sustain crop or forage production systems. The water deficit results in serious damage and economic loss to plant or animal agriculture. Agricultural drought usually begins after meteorological drought but before hydrological drought and can also affect livestock and other agricultural operations.
3. Hydrological Drought: Refers to deficiencies in surface and subsurface water supplies. It is measured as streamflow, and as lake, reservoir, and groundwater levels. There is usually a time lag between a lack of rain or snow and less measurable water in streams, lakes, and reservoirs, making hydrological measurements not the earliest indicators of drought.
4. Socioeconomic Drought: This drought occurs when physical water shortages start to affect the health, well being, and quality of life of the people, or when the drought starts to affect the supply and demand of an economic product.
5. Standard Precipitation Index (SPI): The SPI was designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources.
6. Palmer Drought Severity Index (PDSI): The PDSI is a "meteorological" drought index and responds to weather conditions that have been abnormally dry or abnormally wet. The Palmer Index provides decision-makers with a measurement of the abnormality of recent weather for a region, an opportunity to consider current conditions in a historical perspective, and a spatial and temporal representation of historical droughts.
7. Crop Moisture Index (CMI): The Crop Moisture Index (CMI) is an index that uses a meteorological approach to monitor week-to-week crop conditions. It was designed to evaluate short-term moisture conditions across major crop producing regions. It is based on the mean temperature and total precipitation for each week within a Climate Division, as well as the CMI value from the previous week-to-week crop conditions.
8. Keetch-Byram Drought Index (KBDI): The Keetch-Byram Drought Index is a drought index specifically used for fire potential assessment. The numeric value of the index, ranging from 0 to 800, is an estimate of the amount of precipitation (in 100ths of an inch) needed to bring the soil back to saturation. The KBDI is directly correlated to fire danger; as the index increases, the vegetation is subjected to increased moisture stress.
9. Vegetation and Temperature Condition Index (VT): The VT is a numerical index, being used for estimation of vegetation health and monitoring drought, changes from 0 to 100 characterizing change in vegetation conditions from extremely poor (0) to excellent (100).

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ANNEX

A – Emergency Drinking Water Contingency Annex

STATE OF TEXAS

DROUGHT PREPAREDNESS PLAN

I. AUTHORITY AND REFERENCES

A. AUTHORITY

The State Drought Preparedness Plan is prepared under the auspices of HB-2660, Section 2, Subchapter C, Chapter 16 of the Texas Water Code

B. REFERENCES

1. Public Law 84-99, Code 400 (Water Assistance) and Public Law 95-51
2. Government Code: TITLE 4 EXECUTIVE BRANCH, Subtitle B (Law Enforcement And Public Protection), Chapter 411 (Department of Public Safety of the State of Texas); Chapter 418 (Emergency Management); Subtitle F (Commerce And Industrial Development); Chapter 481 (Texas Department of Economic Development and Tourism Office)
3. Government Code: TITLE 10 GENERAL GOVERNMENT, Subtitle G (Economic Development Programs Involving Both State and Local Governments), Chapter 2306 (Texas Department of Housing and Community Affairs)
4. Education Code: Chapter 88 (Agencies and Services Of The Texas A & M University)
5. Health and Safety Code: TITLE 2 HEALTH and TITLE 9 SAFETY
6. Natural Resources Code: TITLE 8 ACQUISITION OF RESOURCES, Chapter 183 (Conservation Easements); TITLE 12 WETLANDS, Chapter 221 (Wetland Mitigation)
7. Parks and Wildlife Code: TITLE 2 PARKS AND WILDLIFE DEPARTMENT and TITLE 3 PARKS
8. Transportation Code: TITLE 6 ROADWAYS
9. Water Code: TITLE 1 GENERAL PROVISIONS; TITLE 2 WATER ADMINISTRATION, Subtitle A (Executive Agencies), Subtitle C (Water Development), and Subtitle E (Groundwater Management)
10. TAC Title 4 Agriculture: Part 1 (Texas Department Agriculture), Part 12 (Texas Forest Service)
11. TAC Title 10 Community Development: Part 1 (Texas Department of Housing and Community Affairs), Part 5 (Office of the Governor, Economic Development and Tourism Development), Part 6 (Office of Rural Community Affairs)
12. TAC Title 25 Health Services: Part 1 (Texas Department of State Health Services)
13. TAC Title 30 Environmental Quality: Part 1 (Texas Commission on Environmental Quality)
14. TAC Title 31 Natural Resources and Conservation: Part 2 (Texas Parks and Wildlife Department), Part 10 (Texas Water Development Board), Part 17 (Texas State Soil and Water Conservation Board)
15. TAC Title 37 Public Safety and Corrections: Part 1 (Texas Department of Public Safety)
16. TAC Title 43 Transportation: Part 1 (Texas Department of Transportation)

II. BACKGROUND

- A. Drought is a recurring event in Texas. Since it is frequently widespread and can cover several regional climatic areas, the State may incur inconsistent levels of drought intensity from one region to another on a statewide basis. Texas has suffered notable periods of drought since the 1930s with extended periods of drought having affected the State during 1933-1935, 1938-1940, 1950-1957, 1962-1967, 1988-1990, 1996, and 1998-2002.
- B. Drought conditions in 1996 affected Texas, causing greater economic losses to agriculture than any previously recorded one-year drought event. Two years later, the drought of 1998, which was relatively short in duration, caused agricultural impacts with total losses estimated to be just over \$6 billion, or slightly higher than those recorded in 1996. In June of 1999, drought conditions returned to the State and have continued into 2000 showing increasing evidence in many areas during June and July.
- C. To emphasize the need for Texas to have a proactive approach to drought planning, Governor George W. Bush, in May of 1999, signed legislation (HB 2660) that formed the Drought Preparedness Council (DPC). The member agencies were requested to support drought management efforts, emphasizing drought monitoring, assessment, preparedness, mitigation, and assistance. This law required that the State Drought Preparedness Council develop a comprehensive State Drought Preparedness Plan that provides for (1) systematic data collection, analysis, and dissemination of drought-related information; (2) an organizational structure that defines the duties and responsibilities and assures information flow among all levels of government; (3) an inventory of state and federal programs related to drought emergencies; (4) a mechanism to improve the timely and accurate assessment of drought impact; and (5) provision of accurate and timely information to the media.
- D. Numerous drought plans from various states were reviewed, and interviews were conducted with drought-related experts from both state and federal agencies. These interviews and analyses revealed that many previous drought plans provided "triggering" mechanisms or thresholds that were intended to initiate specific actions by various agencies, but when these thresholds were reached or exceeded, the prescribed response was rarely implemented in a timely or effective manner. By using an integrated approach to drought planning, the State Drought Preparedness Plan will serve as a viable and flexible approach to prepare for and mitigate the problems of drought in the State of Texas.

III. PURPOSE

- A. The purpose of this plan is to provide Texas with a framework for an integrated approach to minimize the impacts of drought on its people and resources. This plan outlines both long-term and short-term measures that are to be used to prepare for, respond to, and mitigate the effects of drought. To accomplish these goals, the State Drought Preparedness Plan:
 - 1. Identifies the local, state, federal and private sector entities that are involved with state drought management and defines their responsibilities.
 - 2. Defines a process to be followed in addressing drought-related activities, including monitoring, impact assessment, and response.
 - 3. Identifies long and short-term activities that can be implemented to prevent and mitigate drought impacts.
 - 4. Acts as a catalyst for creation and implementation of local drought planning and response efforts.
- B. The State Drought Preparedness Plan is intended to complement the State Water Plan and on-going water resource planning efforts identified in local and regional Water Conservation Plans and Drought Contingency Plans. The Texas Water Code and State Water Plan are important items of discussion in any water planning effort, and it is anticipated that measures and actions outlined in these documents will be incorporated into existing or future water and drought planning efforts.
- C. In designing the action items of the State Drought Preparedness Plan, every effort has been made to use existing partnerships and lines of communication as well as input of local Texas stakeholders in providing feedback as to the effectiveness of planned or implemented mitigation measures.

- D. The timely dissemination of drought-related information plays an important role in assuring the effectiveness of the State Drought Preparedness Plan. A targeted effort has been made to develop an information dissemination system using target customer lists for e-mail and fax communication systems. Existing agency informational brochures have been combined with Internet web sites to communicate drought information to the public. These efforts are designed to assure the timely delivery of needed data to both the state's decision-makers and to the general public.
- E. Because of the ever-changing staffs of state, federal, and local governments, and the need to periodically evaluate and revise the State Drought Preparedness Plan, two important decisions as to the Plan's format have been made to achieve these goals:
 - 1. To guarantee flexibility in the plan's content, a loose-leaf format has been chosen as opposed to a bound document. The loose-leaf format will allow for the modification of the original plan with the least amount of cost and delay.
 - 2. To allow access of the plan's content to the largest possible audience, without the need for massive document publication costs, the entire State Drought Preparedness Plan has been placed on the Drought Preparedness Council web site at: <http://www.txwin.net/dpc>. Timely updates on the status of drought in Texas are posted at the web site in hopes that this process will allow the greatest flexibility for the review, modification, and use of data in the plan.

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| IV. ASSUMPTIONS |
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- A. Drought is a complex physical and social process of widespread significance. Although drought sometimes affects the entire State, it frequently is a regional problem due to the vast geography and varying climatic conditions within the State. Despite the frequency and economic damage caused by drought, the term drought remains difficult to define, and there are no universally accepted parameters because:
 - 1. Drought, unlike floods, is not a distinct event in that it has no clearly defined beginning or end, thereby complicating attempts to define it.
 - 2. The definition of drought varies with its impact on individuals, thus influencing the perception of drought depending upon whom it affects and how they are affected.
- B. While the effects of drought on the environment cannot be avoided in many cases, the adverse effects of drought caused by human intervention in drought prone areas can be avoided.
- C. The most commonly used definitions of drought are based on meteorological, agricultural, hydrological, and socioeconomic effects.

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|---------------------------------|
| V. CONCEPT OF OPERATIONS |
|---------------------------------|

A. GENERAL

- 1. The potential impacts of drought on the State of Texas are many *of a varied nature* and can affect a wide range of economic, environmental, and social concerns. The relative vulnerability or risk exposure of these activities to the effects of drought usually depends on the types of water demands, how these demands are met, and the corresponding water supplies available to meet these demands.
- 2. Those human and natural resource activities which depend solely on rainfall and soil moisture, such as dryland farming, ranching, and some environmental water uses, are most at risk from drought. These activities can suffer discernible effects even with droughts of short duration.
- 3. Still at relatively high risk, but somewhat less exposed, are systems that depend upon stream flows such as run-of-the-river irrigation; aquatic, wetland, and riparian environmental communities; and recreational water uses.

4. Many urban and agricultural water users that rely upon surface water reservoir supplies or on aquifers not rapidly influenced by climatic or pumping conditions, are less likely to experience drought impacts.
5. The level of risk, which includes vulnerability and hazard, has been considered in the design of the structure of the State Drought Preparedness Plan and is integrated into the preparedness, response, recovery, and mitigation activities therein.

B. DROUGHT MONITORING AND DATA COLLECTION

1. Both drought monitoring and the ability to predict the current and future stages of drought development is key to the State Drought Preparedness Plan. To supply real-time climate, streamflow, aquifer, and reservoir information for water-planning professionals, a network of data-gathering sites, operated by various state and federal agencies, has been established. Taking a proactive approach to drought management requires continuous monitoring of factors indicating the onset and extent of drought conditions. This approach serves to lessen the element of surprise and allows time for planning and implementing drought mitigation strategies. Monitoring activities are increased as conditions warrant, and they continue as long as drought conditions persist. Monitoring provides continuous feedback to decision-makers and helps determine the short-term planning for assessment and response actions.
2. The National Weather Service (NWS) collects and analyzes data from numerous weather stations in Texas. These sites collect data on precipitation, temperature, and snowfall, and the results are integrated into various prediction indices. This data is also available in a real-time and long-term record format from the National Climatic Data Center at: <http://www.ncdc.noaa.gov/>.
3. The National Oceanic and Atmospheric Administration (NOAA) provides drought-related information through the Committee on Earth Observation Satellites (CEOS) Disaster Management Support Group which provides information that supports natural and technological disaster management by fostering improved use of existing and planned earth observation (EO) satellite data. A drought management web site is at: <http://disaster.ceos.org/newdrought.htm>.
4. The Office of the State Climatologist for Texas (OSC) is housed in the College of Geosciences at Texas A & M University and maintains close links with the National Climatic Data Center and the Southern Regional Climate Center. The OSC retains a large database covering Texas and southern states, and regularly publishes reports and monographs and undertakes research on historical climate, climate prediction, and other aspects of climatology. The Texas Climatic Bulletin and related weekly and monthly reports are available at: <http://www.met.tamu.edu/met/osc/osc.html>.
5. The U.S. Geological Survey (USGS) operates gauging stations at about 350 streamflow sites, about 150 major reservoirs, and about 50 wells in Texas. Current, recent, and historical data and analysis for these stations, and historical data for many other stations, are reported online at: <http://tx.usgs.gov/>.
6. The Texas Water Development Board (TWDB) monitors major water storage reservoirs, operated by various state, federal, and private entities and also aquifers in the State, and provides a monthly summary of the storage status of these reservoirs and aquifers at: <http://www.twdb.state.tx.us/publications/reports/waterconditions/watercon.htm>.
7. The Texas Commission of Environmental Quality (TCEQ) maintains a Water Systems Under Water Use Restriction Map at: <http://www.tceq.state.tx.us/permitting/waterperm/pdw/location.html>. This map reflects the Public Water Supply "Watch" list which is a database containing public water systems that are experiencing drought-related water supply problems and have mandated water restrictions using trigger points contained in their Drought Contingency Plans. This enables water systems to better manage supplies during periods of drought and prevent customer outages. Public water suppliers are required to notify the TCEQ when mandatory water restrictions are placed on customers. The "Watch" list is updated regularly to provide current information and contains the water supplier's name, county, phone number, water source, date of restriction notice, population, number of connections, priority, and water restriction stage. The priority classification system is (1) Emergency, (2) Priority, (3) Watch, or (4) Resolved. The list also contains information regarding the reason for the restrictions as well as short and long-term solutions.

8. The Texas Agricultural Statistics Service (TASS) operates under a cooperative agreement between the Texas Department of Agriculture (TDA) and the United States Department of Agriculture's National Agricultural Statistics Service (NASS). TASS publishes current and historical statistics on agricultural commodities and activities for the State of Texas on their Internet web site at: <http://www.io.com/~tass/>. Weekly reports on pasture, range, soil moisture and individual crop (sorghum, corn, cotton, wheat, rice, peanut) conditions are generated by [Texas Agricultural Extension Service](#) (TAEX) County Extension agents, summarized by districts, and reported by Texas Agricultural Statistics Service (TASS) and TAEX. The current system does not report individual county conditions. TASS and TAEX report the weekly summaries at the state level, and the report is incorporated into the National Agricultural Statistics summary. A goal of this plan is to make individual county information on drought impact by commodity available weekly at the county level.

C. DROUGHT ASSESSMENT OPERATIONS

The Drought Preparedness Council is directed by HB 2660 to collect, analyze, and disseminate drought information. The assessment process is as follows:

1. Applicable Council member agencies will develop/collect information using climatic regions in accordance with the NOAA climactic regional delineation. Texas has been divided into ten (10) separate NOAA climatic regions, each representing a particular area of the State that has relatively similar climatic conditions (see Attachment 1). Work is underway to develop smaller subgroups for these climatic regions.
2. The assessment will employ five "levels of concern" (i.e., from minimal concern to maximum threat (a range of numeric values for "level of concern" will be reported for a climate region when conditions vary significantly within that region):
 - a. Level 1 – Advisory
 - b. Level 2 – Watch
 - c. Level 3 – Warning
 - d. Level 4 – Emergency
 - e. Level 5 – Disaster
3. In addition, three "functional assessment indices" have been developed for three specific types of drought (i.e., *climatological drought*, *agricultural drought*, and *water availability drought*). Each "assessment index" consists of two to five sub-indices. (An explanation of these sub-indices can be found in Attachments 2-4.) The three functional assessment indices, coupled with their related sub-indices, are shown below. The agencies shown adjacent to the index name are the agencies responsible for obtaining and using the information on each index.
 - a. Climatological Assessment Index – Texas Water Development Board (TWDB)
 - (1) Standard Precipitation Index (SPI) – TWDB
 - (2) Keetch-Byram Drought Index (KBDI) – TFS
 - (3) Vegetation and Temperature Condition index (VT) – TWDB
 - (4) Crop Moisture Index (CMI) – TWDB
 - (5) Palmer Drought Severity index (PDSI) – TWDB
 - b. Agriculture Assessment Index – Texas Agricultural Extension Service (TAEX)
 - (1) Soil Moisture Index – TAEX

- (2) Crop Condition Index – TAEX
- (3) Pasture and Range Condition Index – TAEX
- (4) Livestock Sales Index – TDA
- (5) U.S. Department of Agriculture (USDA) Drought Declarations – TDA*

* While TDA maintains the updated information for this index, GDEM administratively processes the agricultural drought declaration request for approval by the Governor.

c. Water Availability Assessment Index – TWDB

- (1) Reservoir Levels – TWDB
- (2) Streamflow Data – TWDB

4. For each of the ten climatic regions in Texas, the three index managers will compile the information derived from their sub-indices and develop an overall “level of concern” for their particular assessment index (see Figure 1 where Region 3 is at a “Warning” stage for the Climatological Assessment Index, a “Disaster” stage for the Agriculture Assessment Index, and a “Watch” stage for the Water Availability Assessment Index).

Figure 1: Assessment Values

| | CLIMATOLOGICAL INDEX | AGRICULTURE INDEX | WATER AVAILABILITY INDEX |
|------------------|-------------------------|----------------------|-----------------------------|
| Region 1 | | | |
| Region 2 | | | |
| Region 3 | 3 | 5 | 2 |
| Region 4 | | | |
| Region 5 | | | |
| Region 6 | | | |
| Region 7 | | | |
| Region 8 | | | |
| Region 9 | | | |
| Region 10 | | | |

- 5. It should be noted that it is the opinion of the Drought Preparedness Council that the climatic regions in Texas are so large that drought indices developed across regions of this magnitude will routinely mask smaller, regional drought problems and emerging drought conditions. It is the goal of the Council to enhance drought monitoring by greatly reducing the scale upon which drought is reported. Lack of reliable, historical, and real-time weather data on a small scale currently limits the resolution to a smaller, more useful scale.
- 6. The “levels of concern” values, by major assessment index and climatic region, will be presented to the Council. The State Drought Manager, in concert with the Council member agency representatives, will then decide if any specific actions are necessary as a consequence of the drought assessment values portrayed. These “level of concern” values will be incorporated into the monthly Drought Situation Report (SITREP), which will be posted on the Drought Preparedness Council web site.
- 7. Some of the actions the Council might consider taking are:
 - a. Convening the Drought Preparedness Council meetings on a more frequent basis.
 - b. Providing supplemental and special reports regarding significant drought effects.

- c. Initiating drought awareness and conservation campaigns.
- d. Reviewing each assessment value to make meaningful appraisals and projections of need.
- e. Communicating drought concerns to the Regional Water Planning Groups, state leaders, and federal representatives.
- f. Coordinating initial interagency recommendations and initiating necessary actions.
- g. Recommending implementing legislative actions and agency responsibilities to respond to specific drought-related effects.
- h. Coordinating media releases to coincide with specific actions each agency is taking to respond to the impacts of drought.
- i. Issuing special reports and disseminating appropriate guidance to affected climatic regions.
- j. Supporting a Gubernatorial declaration/proclamation for a drought emergency in a particular county(s) or climatic region.

D. ACTIONS BY PHASES FOR EMERGENCY MANAGEMENT

1. The role of drought assessment and response in Texas is designed to be proactive and to assist existing state, federal, and local agencies in carrying out their designated missions for assisting drought-affected customer groups. For any hazard, be it natural or manmade, Texas uses an emergency management process or cycle to cope with the situation. This cycle consists of four parts:
 - a. Mitigation: This includes an assessment of the risk of drought in a particular area or region, and activities and programs that attempt (both on a short-term or long-term basis) to either eliminate or reduce the causes and effects of drought, especially on water-dependent systems.
 - b. Preparedness: These activities include all aspects of documentation, planning, training, exercising, researching, and monitoring that lead to preparing for a period of drought and developing actions on how best to respond to the drought when it occurs.
 - c. Response: Prompt, concerted, and coordinated actions required when drought conditions occur which are of such significance that they adversely affect the health and safety of individuals and/or the viability and vitality of state agricultural and other economic interests.
 - d. Recovery: Activities and programs that support immediate remedial measures to return drought-impacted systems from minimal capabilities to normal conditions.
2. For the purposes of this plan, the emergency management steps of “mitigation” and “preparedness” will be combined since many of the aspects of “preparedness,” such as education and training, are also found in the “mitigation” techniques used by various Drought Preparedness Council member agencies.

a. MITIGATION AND PREPAREDNESS

- (1) The entire strategic effort is initiated by the evaluation mechanisms discussed in Section VI.D. (“Drought Assessment Operations”) of this plan and is coordinated with the various levels of drought stages. These actions include items that are to be accomplished as a result of on-going drought and actions that are to be taken before a drought event to promote a more proactive atmosphere between affected parties. It is felt that this proactive approach will produce a more effective means of mitigating the effects of drought on the population and natural and economic resources of Texas.
- (2) The proposed actions be carried out by the respective state, federal, and local agencies emphasize the acceleration or targeting of agency resources to affected parties and encourage

existing agencies to develop strong partnerships between these agencies, their customers, and the general population of Texas. These efforts may challenge the management of many agencies to look beyond their current service or regulatory role and identify new partnerships and opportunities that will be of the greatest benefit to the State of Texas in minimizing the effects of drought.

(3) Governor's Division of Emergency Management (GDEM)

- (a) Provides training and educational programs focusing on the preparation of Emergency Management Coordinators to respond to natural and human-caused disasters.
- (b) Maintains a "Potential Drought Assistance Programs" directory of federal agencies and their programs that may be available to assist communities during drought and other natural disasters declared and undeclared.
- (c) Maintains a "Drought Assistance Reference Guide for State Agencies" to facilitate identified state agencies' drought assistance policies.
- (d) Through the "State Hazard Analysis" document, provides a systematic analysis of the hazards facing communities or jurisdictions to include historical information on droughts and dust storms.
- (e) Maintains and updates this plan as a comprehensive document providing information to assist the Drought Preparedness Council member agencies in mitigating the effects of drought.
- (f) Coordinates actions to eliminate or reduce long-term risk to life and property from natural or man-made disasters through the Emergency Management Council and emergency support function (ESF) representatives for Hazard Mitigation (i.e., the State Hazard Mitigation Team as identified in the State of Texas Emergency Management Plan.
- (g) Develops the State Hazard Mitigation Plan along with an annex that addresses possible mitigation activities and funding following a Public Disaster Declaration (PDD) for drought.

(4) The Texas Agricultural Extension Service (TAEX)

- (a) Provides educational efforts and services related to agricultural crop production systems, range management, risk management, and urban landscape and urban water use. These educational programs are designed to make field crops, forage, landscapes, and urban homes more efficient in utilizing water or less prone to drought and heat stress. Educational programming utilizes a variety of formats including one-on-one contact, public meetings, demonstrations, web sites (<http://agnews.tamu.edu/drought>), radio, television, electronic, and printed news releases.
- (b) In cooperation with the Texas Agricultural Experiment Station (TAES), develops the Crop Yield Estimator, a computer model under development for estimating the yield potential of crops based on stored soil moisture and rainfall projections. This model will aid the producer in the decision of what inputs are needed to maximize the return or minimize the loss on investment in the event of dry weather.
- (c) Manages the Potential Evapotranspiration (PET) Networks to provide a method to estimate the water use by field crops and turf grass. These networks provide irrigators with a method to precisely determine the quantity of water needed to meet the water requirements of a crop or turf. Drought damage to crops begins when reserves of water held in the soil are depleted, and evaporative demand exceeds the ability of limited soil reserves to supply water. In periods of high evaporative demand (high temperatures, high winds, low humidity), water requirements increase, and crop damage can and does occur at higher levels of available soil moisture. Using PET estimates, irrigation managers utilize local water use and rainfall data to set their irrigation frequency and rates. PET values are estimated for different environments in Texas and are posted electronically by TAEX.

- (d) In cooperation with TAES, develops the Texas Livestock Early Warning System (TxLEWS) as a model for predicting range conditions through the analysis of plant materials eaten by livestock. This method provides an understanding of the type, quality, and quantity of forage available for livestock. As the drought progresses, livestock will eat less desirable plants. Presence of these plant materials in their diet indicates the onset of a drought, allowing ranchers to minimize the pricing risk in destocking the range as well as minimizing long-term damage to native range species. This indicator can be more accurate than other remote monitoring techniques.
- (e) Provides educational materials, posted on the web site: <http://texaserc.tamu.edu/>, to assist urban clientele and agricultural producers affected by a drought.
- (f) Provides TAEX specialists, located on Campus and in regional centers across the State, to provide technical assistance and information to agents and their clientele on resource management approaches for mitigation.
- (g) Through the Texas A&M College of Agriculture, the Drought Strategies Task Force develops information and strategies for use by the public to mitigate drought.
- (h) Provides educational and demonstration programs, such as Water MEDIC, to teach urban residents to efficiently irrigate landscape and turf around their homes through water auditing and efficient irrigation techniques.
- (i) Operates irrigation schools to train agricultural and urban irrigators to use the latest irrigation technologies to more efficiently manage water resources.
- (j) Provides educational programs on water use in the home to teach urban residents to more efficiently use water resources.
- (k) Conducts programs such as the 4-H Water Camp and school programs to make youth aware of water and drought-related issues.
- (l) Produces educational programs in weed and brush control to reduce the impact of drought and increase water yield from rainfall.
- (m) In cooperation with TAES, conducts research in biotechnology and molecular biology with a goal to develop more drought and heat-tolerant species, varieties, and hybrids of crops and forage.
- (n) In cooperation with TAES, utilizes breeding programs in crops and forages that have a long history of developing more heat and drought-tolerant cultivars.
- (o) Conducts educational programs and field demonstrations to keep farmers up-to-date on crop and forage varieties tolerant to drought.
- (p) Researches and demonstrates no-till and conservation tillage which, when coupled with new transgenic crop hybrids, are reducing water requirements in crop production.
- (q) Educates on the selection of drought-tolerant landscape plants for reducing water demand outdoors while having good consumer acceptance.
- (r) Conducts research and educates farmers and ranchers in good fertilizer management and soil fertility techniques that reduce the profound impact drought has on crop and forage systems.
- (s) Provides educational programs on crop insurance and risk management to prepare farmers and ranchers for the economic risk associated with drought.

(5) The Texas Alliance of Groundwater Districts (TAGD)

- (a) Was created as a group of conservation districts as provided for by Chapter 36 of the Texas Water Code. Groundwater Conservation Districts are the state's preferred method of groundwater management planning.
- (b) Partners with the State Drought Preparedness Council to share ideas to develop groundwater management plans for mitigating the effects of drought.

(6) The Texas Department of Agriculture (TDA)

- (a) Identifies a TDA Drought Coordinator and corresponding staff to field inquiries from farmers, ranchers, agribusinesses, county/state officials, the general public and media on drought and resources availability.
- (b) Contacts agriculture commissioners in other states to establish procedures for acquiring hay from other areas, as necessary.
- (c) Raises the public awareness as to the effect drought is or can have on agriculture.
- (d) Provides, through the Texas-Israeli Exchange Grant Program, research knowledge on drought-tolerant plants and animals and on water use, information that can be used to help Texas producers in surviving times of drought.
- (e) Provides for the gathering of agricultural drought-related information from the Texas Agricultural Statistics Service, the TDA Market News, the Texas Cooperative Extension Service, the U.S. Department of Agriculture (USDA), and the USDA Farm Service Agency (FSA), and disseminates this information through press releases and radio stories to local, state, and regional media, farm press, and agricultural organizations. Information is also distributed through TDA's Internet web site at: <http://www.agr.state.tx.us/>.
- (f) Makes the necessary contacts with state and federal offices and officials to ensure Texas farmers and ranchers are kept at the forefront of drought planning and assistance.
- (g) As an ex officio member of all 16 Regional Water Planning Groups, provides agricultural representation in statewide water planning and management.
- (h) Provides assistance to state and federal drought planning efforts, especially in regards to how to properly prepare and respond to drought as it relates to the Texas agriculture industry.
- (i) Keeps the agricultural industry and public informed of the latest drought information and the assistance available through press releases, [radio stories](#), the TDA web site, the Drought Information Resource Packet (DRIP), and drought tours and workshops.
- (j) Maintains updated drought information on its Internet web site to assist farmers, ranchers, and agribusinesses in making informed decisions in regards to the drought.
- (k) Assists rural communities in economic development efforts to retain current business and, if possible, expand the local economy for continued growth and success to reduce the economic impact of drought.
- (l) Works with irrigation and water districts, TWDB, and other groups to secure funding for water infrastructure upgrades and rural economic development.

(7) The Texas Department of Economic Development and Tourism (TDED)

- (a) Maintains the Economic Development Clearinghouse providing information about drought-related issues <http://www.edinfo.state.tx.us/>.

- (b) Through the Office of Rural **Community** Affairs (**ORCA**), disseminates information on federal, state, and local issues affecting the rural communities in Texas.
 - (c) By employing the Corporate Expansion and Recruitment (CER) program, serves businesses that want to expand existing Texas operations as well as out-of-state businesses interested in relocating or expanding in Texas.
 - (d) Increasing statewide awareness that TDED is the lead economic development agency in the State and serves as the conduit for all inquiries for presentations regarding agency services and programs.
 - (e) Through the Texas Capital Fund Infrastructure Development Program, provides grant funds to non-entitlement communities for public infrastructure such as first-time construction of water/sewer, drainage channels, and ponds
 - (f) Through the Texas Capital Fund Main Street Improvements Program, fosters and stimulates the development of small businesses by providing financial assistance for non-entitlement cities (designated by the Texas Historical Commission as a Main Street City) for such purposes as acquiring land needed for water and wastewater facilities.
- (8) The Department of State Health and Human Services (DSHS)**
- (a) Develops plans and policies that support efforts to improve individual and community health.
 - (b) Conducts health and medical assessments/surveillance in communities affected by drought conditions.
 - (c) Evaluates the accessibility, quality, and effectiveness of personal and population-based health services such as hospitals and EMS systems.
 - (d) Provides technical medical information as required.
 - (e) Assists local governments in providing health and medical information to the public regarding the potential for disease and methods to combat the drought threat.
 - (f) Assists local governments and others in conducting inspections to ensure the safety of drinking water.
 - (g) Assists local governments in vector control, veterinary care, and the handling of stray animals, pets, and livestock that may be adversely affected by drought conditions.
- (9) Office of Rural Community Affairs (ORCA)**
- (a) Disseminates information about the Community Development Block Grant (CDBG) program under the heading of the Texas Community Development Program (TCDP) addressing drought-related activities.
 - (b) Monitors possible funding sources that may have application to drought-related activities.
 - (c) Awards Community Development Funds on a competitive basis to address housing and public facility needs such as water, sewage, or drainage needs (when a disaster coincides with the Community Development Fund application cycle).
 - (d) Awards Texas Small Town Environment Program grants to communities to purchase the materials needed to solve water and sewer problems by installing new transmission lines or replacing nonfunctional lines at reasonable engineering and management costs.
 - (e) Disseminates floodplain management and other materials at workshops where mitigation issues are discussed.

(10) **The Texas Forest Service (TFS)**

- (a) Develops Best Management Practice plans for landowners so as to promote proper land management, which includes maintaining Streamside Management Zones (SMZ) and tree-planting efforts.
- (b) Provides weather evaluation products to include short, medium, and long-range weather predictions; daily Keetch-Byram Drought Index (KBDI) forecasts; assessment updates; and fire-behavior forecasts.
- (c) Provides technical assistance, guidance, and training to TFS personnel, forest industry, and private owners in forest pest management.
- (d) Updates the Texas Wildfire Protection Plan focusing on disaster prevention activities related to a drought's impact upon the timber industry.
- (e) Uses media outlets (such as public service announcements (PSAs) on the radio, television interviews, and billboard advertisements) to keep the public informed of a current emergency situation and possible mitigation procedures.
- (f) Conducts applied research on major forest pests and transfers new pest management technology to the field.

(11) **The Texas Commission on Environmental Quality (TCEQ)**

- (a) Maintains drought information pages on the agency's web site, with links to other agencies' sites and other drought information resources.
- (b) Oversees the development and operation of community water systems including the processing of petitions to create new systems. Maintains a database of public water suppliers including water source, service area, population, system capacity, and water quantity and water quality measures.
- (c) Maintains a Watch List of community water systems that have implemented voluntary or mandatory water use restrictions.
- (d) Maintains and distributes the Drought Reference Manual for public water systems and water suppliers.
- (e) Assists community water systems' preparation of required drought contingency plans.
- (f) Assists major surface water users' preparation of required water conservation plans.
- (g) Permits new surface water diversions and impoundments, and administers water rights in accordance with the prior appropriation doctrine. Provides pre-application project planning and coordination for surface-water use projects, ensuring that the client knows all technical and administrative requirements.
- (h) Mails out, to areas not governed by the Commission's Watermaster Program, forms for utilities to report the amount of surface water used (or "diverted" from the source of supply) for each month of the previous year.
- (i) **Uses the** newly developed Texas Water Availability Modeling (WAM) System to protect existing water rights and the environmental needs of a river basin as well as to provide information for developing water supply alternatives. WAM consists of a database of water rights, water uses, and streamflows; geographic information system (GIS) tools for streamflow analysis; the water-availability model; and a graphical user interface (GUI). The models are

based on stakeholder input and other expertise to facilitate the water-planning efforts of planners in better accounting for all needs and uses in a river basin.

- (j) Develops and distributes the TCEQ Drought Activities Report, summarizing input from the Agency's regional offices and water programs.
- (k) Analyzes trends in groundwater fields and usage to communicate future problems of public water systems.
- (l) Follows-up the completion and implementation of Drought Contingency Plans.

(12) The Texas Parks and Wildlife Department (TPWD)

- (a) Based on biologists' assessments, predicts what changes in wildlife populations might be expected at specific seasons of the year based upon effects of previous droughts and the timing and severity of a current drought.
- (b) Through the Resource Protection Division, maintains data collection devices in several coastal estuaries and a database of fish-kill events.
- (c) Communicates mass media activities to stimulate media coverage of drought and water-related issues.
- (d) Develops and maintains the Texas Outdoor Recreation Plan (TORP) which applies strategic planning principles in the conduct of research, with emphasis on support of the Texas State Park System, and encourages appropriate use of resources for outdoor recreation in concert with the protection of cultural and natural resources and private property rights.
- (e) Provides information to land managers to provide for and mitigate the effects of drought on wildlife by installing wildlife watering systems, managing for habitat essential to wildlife, keeping deer and livestock numbers within the carrying capacity of the land, and reducing livestock numbers quickly during a drought so that the native habitat will continue to support wildlife.

(13) The Texas State Soil and Water Conservation Board (TSSWCB)

- (a) Works with landowners, farmers, and ranchers to develop resource management plans that include water conservation and drought mitigation practices.
- (b) Implements practices to increase irrigation efficiency through its water quality and conservation programs.
- (c) Administers the Texas Brush Control Program, through local soil and conservation districts, which includes a strategy for managing brush in critical areas and the designation of areas of critical need in the State where brush is contributing to a substantial water conservation problem.

(14) The Texas Water Development Board (TWDB)

- (a) Performs as the lead agency for coordinating the regional water planning process and incorporating the regional water plans into the comprehensive State Water Plan. This plan describes current and prospective water uses; identifies water supplies; matches these supplies to water uses; identifies needed water-related management measures, facility needs, and costs; addresses environmental concerns; and offers program and policy recommendations to better manage the State's water resources.
- (b) Serves as the State of Texas' water resource planning and financing agency to plan for ways to provide water for future Texans even during the drought of record. This effort includes a comprehensive projection of future water demands and needs, quantification of existing and

new developable sources, and identification of areas that may not be able to meet projected needs over the next 50 years.

- (c) Maintains a comprehensive drought-monitoring database that includes monitoring of climatic and hydrological conditions. This includes real-time monitoring of lake levels and critical groundwater levels, as well as collecting National Weather Service and National Drought Mitigation Center indices and materials.
- (d) Through its Conservation staff, works closely with all water interests and utilities in Texas to present and distribute information regarding water conservation and drought management. This includes conducting water conservation and drought management workshops and presentations for water utility managers and other interest groups, and also distributing water-conservation publications.
- (e) Maintains an active web page for both the Agency and the Drought Preparedness Council.
- (f) Through the Texas Natural Resources Information System (TNRIS), acts as the State's clearinghouse for natural resources data. Digital data available through TNRIS pertains to water resources, geology, the Census, and other natural resources spatial data.
- (g) Facilitates the operation of the Texas Water Monitoring Congress (TWMC), which provides a forum for agencies with water data-collection responsibilities. The TWMC works to identify issues of concern, develops recommendations to resolve or improve these concerns, and promotes the awareness of the need for good water resource information.
- (h) Through the State Water Plan, addresses strategic courses of action for obtaining viable economical water management results.
- (i) Provides financial assistance, through grants for regional planning, for the purchase of water conservation-related equipment for local irrigation and underground water conservation districts in order to promote agricultural conservation through the installation of water-efficient irrigation equipment.
- (j) Provides financial assistance to plan, provide and conserve water resources through grants and loans for regional planning, for water supply projects, and for agricultural water conservation programs.

(15) The Texas Department of Transportation (TxDOT)

- (a) Sponsors research to improve the safety and efficiency of the transportation system, which often results in the conservation of natural resources when planning projects.
- (b) Conducts environmental impact analysis for highway projects.
- (c) Researches products for vegetation management, and develops integrated vegetation management plans.
- (d) Conducts erosion control activities for roadways and special projects.
- (e) Conducts landscaping activities that promote indigenous plant growth.
- (f) Implements design activities that minimize effects on groundwater usage or obstruction.
- (g) Focuses on preventing erosion and protecting high quality wetland habitats.

(16) The Office of the State Climatologist for Texas (OSC)

- (a) Provides climate information and assessments to requesting state agencies.

- (b) Maintains historical database records for Texas climate.
- (c) Produces weekly and monthly Texas Climate Bulletins.
- (d) Conducts research on drought and drought prediction.
- (e) Provides information to the public on drought, drought prediction, and climate variability.

b. RESPONSE

- (1) The responses to particular drought effects in a geographical area are determined and initiated by agency representatives in each committee. These response actions have either been planned well in advance of a drought situation, or in the case of unforeseen situations, will be the result of intense analysis of available problem data by each respective agency. Additional or emergency assistance needs that cannot be met by Council member agency resources are passed to the Governor's Division of Emergency Management through the State Drought Manager for further action.
- (2) **Governor's Division of Emergency Management (GDEM)**
 - (a) Coordinates short-term, immediate responses to water shortages through Emergency Management Council agency representatives of the various emergency support functions such as the ESF for Food and Water, the ESF for Resource Management, the ESF for Military Support, etc. as identified in the State of Texas Emergency Management Plan.
 - (b) Coordinates emergency drinking water response actions in locating alternative sources of water and financing of response activities as outlined in Annex A to this plan (i.e., the "Emergency Drinking Water Contingency Annex").
- (3) **The Texas Agricultural Extension Service (TAEX)**
 - (a) Produces a weekly newsletter for news media outlets and for posting to the Internet web site at: <http://agnews.tamu.edu/drought>.
 - (b) Using agricultural communication specialists, subject matter specialists, and county agents, prepares printed communications for mass distribution of news stories, audiotapes for radio stations, and video for television news releases to communicate drought-related information.
 - (c) Using subject matter specialists and county extension agents, provides interviews with print and broadcast media to keep the public informed on drought-related information.
 - (d) Keeps the public informed of the drought impact on agriculture through weekly reports of county agents on crop and livestock conditions.
 - (e) Prepares periodic economic drought impact assessments of drought-affected areas to inform the public about the estimated amount of economic damage from drought.
 - (f) Gives users information on various water uses to reduce the impact of drought on livestock.
 - (g) Tests water samples and forage and feed samples for drought-related toxins.
 - (h) Conducts educational programs and produces printed materials to assist ranchers in identifying toxic weeds and in developing grazing management strategies to lessen the impact of these species in the times of drought.
 - (i) Distributes hay, through a collaboration between county extension agents and TDA; also informs ranchers on alternate feed sources and coordinates transportation to haul hay to feed herds during periods of drought.

- (j) Educates farmers and ranchers on provisions of crop insurance programs and government relief programs available to sustain their operations during drought.
- (k) Plans to give precise estimates of areas affected by drought through programs under development such as global positioning, Advanced Very High Resolution Radiometry (AVHRR) from satellite images and Next Generation Weather Radar (NEXRAD) data to give precise estimates of areas affected by drought
- (l) Is developing a web site to give weekly updates at the county level of crop, livestock, and soil moisture conditions.
- (m) Presents educational programs on alternative feed sources for ranchers during drought.
- (n) Through the Texas A&M "Aggie" Horticulture Network, maintains a "Plant Answers Drought Information Hotline" web site containing suggestions for the homeowner/gardener regarding the wise use of water during a drought situation. The site is at: <http://aggie-horticulture.tamu.edu/plantanswers/drought/drought.html>.

(4) The Texas Alliance of Groundwater Districts (TAGD)

Each of the water suppliers in a groundwater district is responsible for its response to drought in accordance with its drought contingency plan.

(5) The Texas Department of Agriculture (TDA)

- (a) Provides regular updates to the citizens of Texas on current drought conditions, drought assistance, and the condition of Texas agriculture through press releases to media, radio spots, the Agency web site, and media interviews.
- (b) Provides the agricultural industry, Texas counties, the State, and federal entities information on available assistance through other agencies and groups using the Drought Resource Information Packet (DRIP).
- (c) Assists livestock producers in locating available hay and pasture supplies and transportation resources/capabilities (both within and outside the State) through the Hay and Grazing Hotline at: (877) 429-1998.
- (d) Contacts and coordinates with the heads of agriculture departments in other states to assist Texas producers in times of crisis, such as the need for hay and pasture supplies.
- (e) Supports legislation and efforts (research, loan opportunities, and infrastructure improvements) to enhance the ability of agriculture to obtain adequate water supplies, especially in time of drought.
- (f) Provides testimony on the economic impact of drought to Texas agriculture, and recommends methods to assist the State's agriculture producers in responding to drought such as enhanced brush control and other technical aid.
- (g) Assists in finding aboveground sources of water (see Emergency Drinking Water Contingency Annex).
- (h) Requests the Texas Department of Transportation's approval on mowing and baling highway rights-of-way.
- (i) Requests USDA to expedite approval on Texas counties pending Secretarial approval for drought declarations and/or USDA-FSA programs, such as the Livestock Assistance Program and/or emergency grazing and haying on Conservation Reserve Program acreage.

(6) **The Texas Department of Economic Development and Tourism (TDED)**

Maintains a listing of state agency toll free numbers that could be used to assist those in need of drought-related disaster information.

(7) **The Department of State Health and Human Services (DSHS)**

- (a) Investigates and identifies community health hazards and potential problems.
- (b) Links individuals with a need for health services to appropriate providers.
- (c) Determines the scope of need during drinking water emergencies (see Emergency Drinking Water Contingency Annex).
- (d) Assists TCEQ in testing the quality of water.

(8) **Office of Rural Community Affairs (ORCA)**

- (a) Coordinates through appropriate channels when a water utility district or locality requests monetary assistance to address a problem water system.
- (b) Administers Texas Community Development Program (TCDP) funds that focus on finding new water sources (e.g., drilling a new well, connecting to another water source by means of supply lines, etc.).

(9) **The Texas Forest Service (TFS)**

- (a) Advises the public of the potential fire danger, mitigates the possibility of fire when possible, and actively suppresses fires if they exceed the control of local fire response organizations.
- (b) Provides support in the form of implementing the infrastructure to the Incident Command System (ICS) during situations that do not directly involve fire.
- (c) Organizes and supervises forest pest suppression projects on non-federal lands.

(10) **The Texas Commission on Environmental Quality (TCEQ)**

- (a) Administers an expedited review of proposed system upgrades and alternative water supplies for drought-impacted community water systems.
- (b) Provides the public water systems database to assist in the identification of water supply alternatives and potential system interconnections.
- (c) Assists community water systems in exploring alternative sources of water for non-potable uses (reuse).
- (d) Administers an expedited review of drought-related water right applications.
- (e) Responds to consumer calls regarding water outages and drought-related problems.
- (f) Explores alternative means of water delivery during outages.
- (g) Assesses the duration of emergency water delivery requirements (see Emergency Drinking Water Contingency Annex).
- (h) Supervises and conducts water quality analysis for potability (see Emergency Drinking Water Contingency Annex).

- (i) Determines alternative water supply venues, and conducts environmental impact analysis of supply (Emergency Drinking Water Contingency Annex).

(11) The Texas Parks and Wildlife Department (TPWD)

- (a) Provides recommendations to the Texas Water Control Board (TWDB) for scheduling of instream flows and freshwater inflows to Texas estuaries for the management of fish and wildlife resources.
- (b) Communicates information relative to water resource issues both within the Agency and to other state agencies such as TWDB and the TCEQ.

(12) The Texas State Soil and Water Conservation Board (TSSWCB)

Provides technical and financial assistance to landowners, farmers, and ranchers through its regional offices and soil and water conservation districts for developing and implementing conservation plans and practices.

(13) The Texas Water Development Board (TWDB)

- (a) Provides technical assistance to water utilities and water authorities regarding the implementation of drought plans, the location of alternate sources of water, and the provision of emergency loans associated with drought response measures.
- (b) Administers the Texas Water Bank that facilitates the transfer, sale, or lease of water and water rights throughout the State.
- (c) Administers the Texas Water Trust where water rights are held for environmental flow maintenance purposes.
- (d) Assists in identifying alternative sources, transportation, and distribution of water; diversion of water from current sources; and bridging of existing water systems including needs assessment, determining appropriate methods for financing emergency drinking water operations, and researching and evaluating the employment of desalinization systems (see Emergency Drinking Water Contingency Annex).

(14) The Texas Department of Transportation (TxDOT)

- (a) Repairs state highways that are damaged by drought conditions.
- (b) Administers the mowing and baling of hay on the right-of-way to support agriculture during drought conditions.
- (c) Issues permits for overweight vehicles, which could include vehicles delivering water or responding to other drought-related emergency situations.
- (d) Assists in finding methods for transporting and distributing water during periods of emergency (see Emergency Drinking Water Contingency Annex).

c. RECOVERY

- (1) The primary objective of recovery is to maintain, as far as possible, the resources affected by drought, and to assist in the return and restoration of those resources after drought, taking into consideration resource maintenance and long-term sustainability.
- (2) Particular short and long-term restorative or relief actions, funding, and guidance will be available depending upon the extent and type of need and will be addressed by specific agencies represented on the Council.

(3) Governor's Division of Emergency Management (GDEM)

- (a) May administer the funding of federal long-term drought relief and associated drought disaster consequences under the authority of a Presidential Disaster Declaration and in accordance with the Stafford Act.
- (b) Processes a request from a county judge for a federal (USDA) Agricultural Disaster Declaration.

(4) The Texas Agricultural Extension Service (TAEX)

- (a) Provides programs to reduce family stress from financial concerns resulting from drought.
- (b) Provides education on range, pasture, and crop management for ranchers and farmers in lands affected by drought.
- (c) Provides risk management programs to assess the financial condition of individual agricultural enterprises and give alternatives for operators to evaluate in drought recovery.

(5) The Texas Alliance of Groundwater Districts (TAGD)

Each of the underground water conservation districts is responsible and will assist landowners and groundwater right owners for acquiring additional water resources during a time of drought.

(6) The Texas Department of Agriculture (TDA)

- (a) Updates and distributes a Drought Resource Information Packet (DRIP) for county judges, agricultural producers, and agri-businesses that provides a comprehensive overview of the impacts of drought, available drought assistance programs, and who to contact for assistance.
- (b) Sends letters to the Texas Banking Commissioner and the Federal Deposit Insurance Corporation (FDIC) Regional Director asking that bank regulators be flexible when working with agricultural lending institutions when Texas agricultural producers are in a disaster situation.
- (c) Plays an active role when changes are being considered in Texas Agriculture Finance Authority's (TAFAs) disaster loan programs, such as the Linked Deposit Program, which assists producers in drought-declared counties who have suffered agricultural losses in refinancing existing debt and by providing assistance for the financing of water conservation equipment and projects.
- (d) Provides the resources and staff to answer inquiries on drought and drought assistance, and refers inquiries to proper sources for programs and technical assistance.

(7) The Texas Department of Economic Development and Tourism (TDED)

Coordinates the use of Texas Community Development Program (TCDP) funds after their release by the Texas Department of Housing and Community Affairs.

(8) The Department of State Health and Human Services (DSHS)

Mobilizes state and local stakeholders to solve remaining community health issues and develop health and medical-related mitigation strategies.

(9) **Office of Rural Community Affairs (ORCA)**

- (a) Identifies up to \$350,000 in available grant funds for eligible cities or counties specifically to obtain a permanent source of water after the Governor has issued a drought declaration for a particular county(s).
- (b) Administers Disaster Relief / Urgent Need Funds to assist communities in recovering from natural disasters and water and sewer urgent needs or recent origin.
- (c) Administers Colonia Funds to assist colonia areas recover from natural disasters and water and sewer urgent needs (if the disaster coincides with the Colonia Fund application cycle).
- (d) Assists in identifying and financing the long-term solution to a locality's water needs (see Emergency Drinking Water Contingency Annex).

(10) **The Texas Forest Service (TFS)**

Reviews actions taken during an emergency situation and the results of those actions to determine if the steps taken were sufficient to achieve desired goals within desired limits (e.g., costs, time, property saved, property lost, etc.).

(11) **The Texas Commission on Environmental Quality (TCEQ)**

- (a) Follows-up with drought-impacted community water systems to restore operations and ensure that drought-driven system improvements and modifications are in compliance with applicable rules and standards.
- (b) Maintains increased surveillance and monitoring of community water systems that experienced drought-related problems.

(12) **The Texas Parks and Wildlife Department (TPWD)**

- (a) Lends technical assistance with fisheries management issues.
- (b) Provides expertise with the management of nuisance aquatic vegetation.

(13) **The Texas State Soil and Water Conservation Board (TSSWCB)**

Manages program and practices for abating agricultural and silvicultural non-point source pollution [and conserving water](#).

(14) **The Texas Water Development Board (TWDB)**

- (a) Provides loans to local governments for water supply projects, water quality projects including wastewater treatment, flood control projects, agricultural water conservation projects, and groundwater districts.
- (b) Provides quick funding through the Small Community Emergency Loan Program to address the unforeseen circumstances that threaten the viability of a community's utility system.
- (c) Determines long-term status of water supplies and capacities.

(15) **The Texas Department of Transportation (TxDOT)**

Provides support to maintain recovery activities for drought-related emergencies.

VI. ORGANIZATION AND ASSIGNMENT OF RESPONSIBILITIES

A. DROUGHT PREPAREDNESS COUNCIL (DPC)

1. In an effort to coordinate the preparedness and response to drought throughout Texas, the Texas Legislature in SB-1, and later by revision in HB-2660, created the Texas Drought Preparedness Council. This organization (see Attachment 1) is the coordinating group that advises the State Drought Manager and member agencies on implementation of drought-related activities in the State of Texas. The Council consists of designated lead state drought response agencies as follows:
 - a. Department of State Health and Human Services (DSHS)
 - b. International Boundary and Water Commission (IBWC)
 - c. Office of Rural Community Affairs (ORCA)
 - d. Office of the State Climatologist of Texas (OCS)
 - e. Texas Agricultural Extension Service (TAEX)
 - f. Texas Commission of Environmental Quality (TCEQ)
 - g. Texas Department of Agriculture (TDA)
 - h. Texas Department of Economic Development and Tourism (TDED)
 - i. Texas Department of Public Safety (DPS) (through GDEM)
 - j. Texas Department of Transportation (TxDOT)
 - k. Texas Forest Service (TFS)
 - l. Texas Parks and Wildlife Department (TPWD),
 - m. Texas State Soil and Water Conservation Board (TSSWCB)
 - n. Texas Water Development Board (TWDB)
 - o. Texas Department of Housing and Community Affairs (TDHCA)
 - p. Texas Alliance of Groundwater Districts (TAGD)

2. The State Drought Preparedness Council also assumes the lead role in intergovernmental drought response coordination and media information releases, and acts as a liaison between various groups involved with drought planning to include participating federal agencies which are:
 - a. Farm Service Agency (FSA)
 - b. Federal Emergency Management Agency (FEMA)
 - c. Housing and Urban Development (HUD)
 - d. National Weather Service (NWS)
 - e. Natural Resources Conservation Service (NRCS)
 - f. Rural Development (RD)
 - g. United States Army Corps of Engineers (USACE)
 - h. United States Bureau of Reclamation (USBR)
 - i. United States Fish and Wildlife Service (USFWS)
 - j. United States Forest Service (USFS)
 - k. United States Geological Survey (USGS)
 - l. United States Public Health Service (USPHS)

3. The State Drought Preparedness Council consists of four committees and a special task force for reviewing and implementing drought-related assessments and operations. These entities are:
 - a. Drought Planning and Coordinating Committee
 - (1) The Drought Planning and Coordinating Committee conducts drought response planning and is responsible for developing and modifying the State Drought Preparedness Plan. This committee, through its member agencies, recommends specific revisions for a defined state response to a drought-related disaster. Throughout the planning and revisions, this committee ensures effective coordination among local, state, and federal agencies.

- (2) The Drought Planning and Coordinating Committee consists of experts from all of the represented state agencies on the Drought Preparedness Council (listed above) as well as from the following federal agencies: FEMA, HUD, NRCS, USACE, USBR, USFS, and USGS.
- b. Drought Monitoring and Water Supply Committee
- (1) The Drought Monitoring and Water Supply Committee is responsible for monitoring all available climatologically data, soil moisture readings, reservoir storage levels, selected aquifer levels, and other pertinent information necessary to analyze the current status level of drought conditions in the State of Texas. This group of professionals assesses climatologically, meteorological, and hydrological information to provide evaluations as to the current and future status of drought in the State; advises Council members as to the current status level of drought in the State; and, as necessary, employs needed "triggers" to implement further actions as identified in this plan.
 - (2) The Monitoring and Water Supply Committee consists of experts from GDEM, IBWC, NWS, OSC, RD, TAEX, TCEQ, TDA, TFS, TPWD, TWDB, USACE, USFS, USGS, and USPHS.
- c. Drought Technical Assistance and Technology Committee
- (1) The Technical Assistance and Technology Committee coordinates with regional water planning groups on drought-related issues in their regional water plans. This committee maintains a database of water suppliers and provides a means of communicating and disseminating vital information during possible emergency conditions. Also, the Committee coordinates technical and financial assistance and outreach for drought contingency planning for drought-impacted communities.
 - (2) The Technical Assistance and Technology Committee consists of experts from FSA, GDEM, HUD, NRCS, ORCA, TAEX, TCEQ, TDA, TFS, TPWD, TSSWCB, TWDB, TxDOT, USACE, USBR, USFS, and USPHS.
- d. Drought Impact Assessment Committee
- (1) The Impact Assessment Committee is comprised of professionals who focus on public reporting of drought monitoring and water supply conditions in Texas. They assess and report potential impacts of water shortages on the public's health, safety, and welfare. Additionally, they monitor and assess the current and potential impacts of impending or ongoing drought upon the state's economy, agricultural, and natural resources.
 - (2) The Impact Assessment Committee consists of experts from DSHS, GDEM, NRCS, NWS, TAEX, TAGD, TCEQ, TDA, TDED, TFS, TPWD, TWDB, USACE, USFS, USFWS, USGS, and USPHS.
- e. Drinking Water Task Force
- (1) The Drinking Water Task Force is activated by the Council to coordinate the actions of its members and other organizations to respond to an immediate and temporary need of providing emergency drinking water to a community once it becomes evident that community has, or soon will have, exhausted its supply of or access to potable drinking water. The activities of this entity are described in the attached Emergency Drinking Water Contingency Annex (see Annex A).
 - (2) The Drinking Water Task Force consists of experts from TCEQ, DSHS, TDA, DPS/GDEM, TWDB, TxDOT, ORCA, the Texas National Guard/Adjutant General's Department (AGD), the Texas General Services Commission (GSC), Health and Human Services Commission (HHSC), the Texas Railroad Commission (RRC), the Texas Voluntary Organizations Active in Disaster (TxVOAD), and the United States Army Corps of Engineers (USACE).

B. ASSIGNMENT OF RESPONSIBILITIES

1. Each of the agencies and organizations assigned to the Drought Preparedness Council works together to find better methods of identifying and monitoring drought situations; advising the public and economic entities on various methods for best coping with drought; and determining appropriate actions necessary to respond to a major, widespread drought when it occurs.
2. Specific actions of the Drought Preparedness Council member agencies can be found in "Section VI, Concept of Operations," under the applicable paragraphs (E.2.a - E.2.c) related to the emergency management cycle functions of mitigation, preparedness, response, and recovery.
3. If a drought situation degrades to the point where a community suddenly needs potable drinking water on an emergency basis, the State Drought Preparedness Council can immediately turn to the State Emergency Management Council for support under the Emergency Support Function (ESF) for Food and Water to determine how best to solve the problem. Since the State Drought Manager is also appointed as the State Coordinator for Emergency Management, this transfer can be easily affected.
4. Should the drinking water situation be one with some lead-time, the Emergency Drinking Water Contingency Annex of this plan can then be implemented.

| |
|-----------------------------------|
| VII. DIRECTION AND CONTROL |
|-----------------------------------|

- A. In periods of drought, the effectiveness of the State Drought Preparedness Plan hinges on the timely dissemination of clear and precise information to the public.
- B. To accomplish this objective, the following communications guidelines have been established.
 1. Official release of drought response or recovery information will generally originate from the Office of the Governor via Governor's Division of Emergency Management, with technical oversight being provided by member agencies of the Drought Preparedness Council.
 2. Drought press releases from the Office of the Governor will use appropriate distribution lists to target media outlets, legislative delegates, and Emergency Management Council and Drought Preparedness Council agency contacts.
 3. Other state agencies and organizations that are not members of one of the above Councils are encouraged to redirect drought-related information obtained from the Office of the Governor to their respective client bases.
 4. Drought status and response information, developed by the Drought Preparedness Council, will be posted to the Council's web site, and links to that web site shall be established from all applicable member agencies on the Council.
 5. The Drought Preparedness Council will be responsible for the review and dissemination of existing drought-related public service announcements for use by the press, radio, and television media in drought-affected areas.
 6. A comprehensive annual or biennial report will be prepared to summarize the period's drought activities undertaken by the Drought Preparedness Council. This report will include the drought activity summaries submitted by each participating state agency, assessment and response activities taken by that agency over the preceding months, a list of drought management objectives for the upcoming year, actions taken to mitigate drought impacts, a summary of the successes realized by each agency during the reporting period, and future endeavors.

VIII. ADMINISTRATION AND SUPPORT

A. RECORDS

1. The State Drought Preparedness Council is provided administrative support through GDEM under the direction of the State Emergency Management Coordinator who is also designated as the State Drought Manager.
2. Records will be maintained of all Drought Preparedness Council meetings, and the minutes from each meeting will be posted on the State Drought Preparedness Council web site at: <http://www.txwin.net/dpc/>.

B. REPORTS

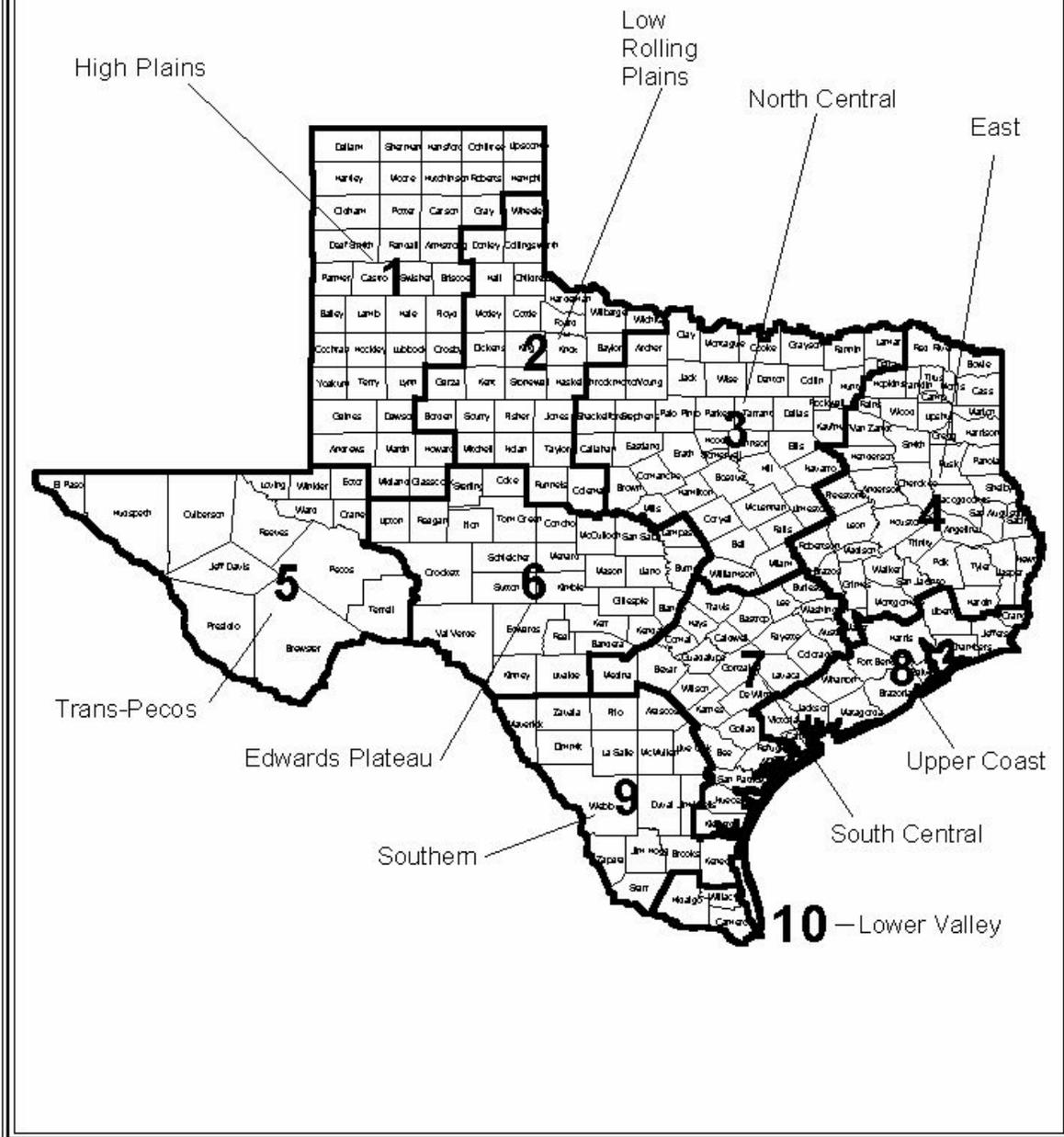
1. A monthly Drought Situation Report (SITREP) will be prepared and disseminated each month on the Drought Preparedness Council web site. This report will provide information on and assess drought and water supply conditions in the State; will advise the regional water planning groups on drought-related issues; and will recommend, as appropriate, provisions for a defined state response to a major drought-related emergency.
2. A Drought End-of-Year Report (or in some cases a Drought Biennium Report) will be prepared for the Legislature and will provide details concerning drought-related issues, education, prevention, responses, and other accomplishments or setbacks during the reporting period.
3. Three additional pamphlets/documents are published and revised on an a periodic basis as follows:
 - a. "Drought Assistance Reference Guide for State Agencies" - This document provides information on the drought-related mission of each State of Texas agency, lists drought emergency response resources maintained by each agency, and provides points of contact for drought assistance from each agency--- providing of course that established procedures outlined in the State of Texas Emergency Management Plan are followed.
 - b. "Potential Drought Relief Programs" – This pamphlet provides basic information about federal programs that Texans may find beneficial in relieving the effects of drought. This document describes each program in general, outlines specific eligibility requirements for the program, and provides a contact agency from which to obtain more specific details and learn the application procedures.
 - c. "Drought Assistance Directory for Public Officials and Drinking Water Utilities" – This directory, which is prepared in coordination with the Texas Commission of Environmental Quality (TCEQ), the Texas Water Development Board (TWDB), and the Governor’s Division of Emergency Management (GDEM), is developed to assist local government efforts in preventing, mitigating, and responding to drought-related public water supply problems and emergencies in a particular community.
4. When appropriate, GDEM, in conjunction with TCEQ, will send letters to all drinking water suppliers as well as all county judges and mayors throughout Texas regarding the need to conserve water in drought situations and to educate the public on water conservation techniques and procedures.

IX. PLAN DEVELOPMENT AND MAINTENANCE

- A. Drought Preparedness Council member agencies and organizations will be responsible for reviewing this plan and providing revisions as appropriate. Recommended changes to the plan should be forwarded to the Governor’s Division of Emergency Management (GDEM), which will, in turn, prepare the revised document and coordinate the revisions with the assembled Council for approval.
- B. This plan will be reviewed, at a minimum, on an annual basis and revised if appropriate.
- C. Agencies and organizations assigned responsibilities in this plan are responsible for developing and maintaining standard operating procedures, as applicable, covering those responsibilities.

Attachment 1

CLIMATIC REGIONS



This picture is not for distribution.

Attachment 2

**Organizational Chart
DROUGHT PREPAREDNESS COUNCIL**

Chair: State Drought Manager, Texas Department of Public Safety – Governor’s Division of Emergency Management (GDEM)

- Advises the Governor on significant drought conditions
- Reports to the Legislature regarding significant drought conditions in the State
- Liaison with federal agencies

Council Member Agencies: Texas Agricultural Extension Service (TAEX), Texas Department of Agriculture (TDA), Texas Department of Economic Development (TDED), Department of State Health and Human Services (DSHS), Texas Department of Housing and Community Affairs (TDHCA), Texas Forest Service (TFS), Texas Commission on Environment Quality (TCEQ), Texas Parks and Wildlife Department (TPWD), Texas State Soil and Water Conservation Board (TSSWCB), Texas Water Development Board (TWDB), Texas Department of Transportation (TxDOT), Texas Alliance of Groundwater Districts (TAGD), Office of Rural Community Affairs (ORCA), Office of the State Climatologist Office (OSC)

Federal Agency Participants: United States Army Corps of Engineers (USACE), Federal Emergency Management Agency (FEMA), Housing and Urban Development (HUD), National Weather Service (NWS), United States Bureau of Reclamation (USBR), United States Forest Service (USFS), United States Geological Survey (USGS), United States Public Health Service (USPHS), International Boundary and Water Commission (IBWC), Natural Resources Conservation Service (NRCS), Rural Development (RD), Farm Service Agency (FSA), United States Fish and Wildlife Service (USFWS)

| Drought Planning and Coordinating Committee | Drought Monitoring and Water Supply Committee | Drought Technical Assistance and Technology Committee | Drought Impact Assessment Committee |
|--|---|--|---|
| *GDEM TPWD TWDB TDED TCEQ DSHS TSSWCB TDA TDHCA TFS TAEX TxDOT FEMA USFS HUD USACE USGS USBR NRCS TAGD ORCA OSC | *TWDB TDA TCEQ TAEX TPWD TFS GDEM NWS USFS USGS USPHS USACE IBWC TAGD RD OSC | *TWDB TAEX TCEQ TxDOT TSSWCB TDA TPWD ORCA GDEM USACE USBR USFS USPHS HUD NRCS FSA | *TCEQ TAEX DSHS TFS TDA TDED TPWD TWDB GDEM USFS USPHS NWS USACE USGS TAGD USFWS NRCS |
| <ul style="list-style-type: none"> • Conduct drought response planning and prepare State Drought Preparedness Plan • Recommend specific revisions for a defined state response to drought-related disasters • Ensure effective coordination among state, local, and federal agencies in drought-response planning | <ul style="list-style-type: none"> • Assess and report on meteorological conditions and forecasts • Assess and report on hydrological conditions and forecasts • Assess and report water supply conditions and forecasts • Make recommendations concerning when to activate State Drought Response Plan | <ul style="list-style-type: none"> • Advise regional water planning groups on drought-related issues in the regional water plans • Maintain database of water suppliers and provide a means for communicating possible emergency conditions • Coordinate technical and financial assistance and outreach for drought contingency planning to drought impacted communities | <ul style="list-style-type: none"> • Public reporting of drought monitoring and water supply conditions • Assess and report potential impacts of water shortages on the public's health, safety, and welfare • Assess and report potential impacts of water shortages on economic development • Assess and report the potential impacts of water shortage on agricultural and natural resources |

* Denotes Chair Agency

Attachment 3

Climatological Assessment Values

A. Standardized Precipitation Index (SPI)

1. The Standardized Precipitation Index (SPI) is used for quantifying the precipitation departure from "normal" over multiple time scales. These time scales reflect the impact of drought on the availability of the various water resources. A drought event is defined as any time the SPI is continuously negative and reaches an intensity where the SPI is -1.0 or lower. The drought event ends when the SPI becomes positive. Each drought event therefore has a duration defined by its beginning and end, and an intensity for each month that the event continues, as shown in the table below.

| SPI Values for Drought | | |
|------------------------|------------------|--------------------|
| SPI Values | Drought Category | % Time in Category |
| 0.0 to -0.99 | Mild Drought | 34.1% |
| -1.0 to -1.49 | Moderate Drought | 9.2% |
| -1.5 to -1.99 | Severe Drought | 4.4% |
| -2.00 or less | Extreme Drought | 2.3% |

2. Also, this table shows the percent of time that the SPI is in each of the drought categories based on an analysis of available station data. Because the SPI is standardized, these percentages are usually expected from a "normal distribution" of the SPI. The 2.3% of SPI values within the *Extreme Drought* category is a percentage that is typically expected for an *extreme* event. In contrast, the Palmer Index reaches its *extreme* category more than 10% of the time across section of the Great Plains. This standardization allows the SPI to determine the rarity of a current drought as well as the probability of the precipitation necessary to end the current drought.

B. Keetch-Byram Drought Index (KBDI)

1. A soil/duff drought index that ranges from 0 (no drought) to 800 (extreme drought) and is based on a soil capacity of 8 inches of water. Factors in the index are maximum daily temperature, daily precipitation, antecedent precipitation, and annual precipitation.

| | |
|-----------------------------------|--|
| 0 – 200 Low Fire Danger | Soil and fuel moisture is high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches. |
| 200 – 400 Moderate Fire Danger | Fires more readily burn and will carry across an area with no "gaps". Heavier fuels will still not readily ignite and burn. Also, expect smoldering and resulting smoke to carry into and possibly through the night. |
| 400 - 600 High Fire Danger | Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems. |
| 600 – 800 Extreme Fire Danger | Surface litter and most of organic layer is consumed. 1000-hour fuels contribute to intensity. Stumps will burn to the end of roots underground. Any dead snag will ignite. Spotting from snags is a major problem if close to line. Expect dead limbs on trees to ignite from sparks. Expect extreme intensity on all fires making control efforts difficult. With winds above 10 miles per hour, spotting is the rule. Expect increased need for resources for fire suppression. Direct initial attack is almost impossible. Only rapid response time to wildfire with complete mop-up and patrol will prevent a major fire situation from developing. |

2. Should any part of the state of Texas experience extended periods of fair, windy weather, the implementation of countywide bans on outdoor burning may be advised as a wildfire prevention tool in that area. The TFS recommends that local governments consider a KBDI of 500 and above for imposition of burn bans.

C. Satellite Vegetation Health Index

This is a numerical index or vegetation condition, which ranges from 0 (extremely poor) to 100 (excellent) based on a combination of chlorophyll and moisture content monitored by plant color and temperature. The satellite images are color-coded maps of vegetation condition (health) estimated by the Vegetation and Temperature Condition Index (VT). The VT is a numerical index, which changes from 0 to 100 characterizing change in vegetation conditions from extremely poor (0) to excellent (100). The VT reflects indirectly a combination of chlorophyll and moisture content in the vegetation and also changes in thermal conditions at the surface. This new approach combines the visible, near infrared, and thermal radiances in a numerical index characterizing vegetation health. This approach is extremely useful in detecting and monitoring such complex and difficult-to-identify phenomenon as drought. The VT values below 35 are used for identifying vegetation stress that is an indirect drought indicator. The VT is very useful for early drought detection, assessing drought area coverage, duration, and intensity, and for monitoring drought impacts on vegetation and agricultural crops.

D. Palmer Drought Severity Index (PDSI)

1. The Palmer Drought Severity Index (PDSI) is a "meteorological" drought index that responds to weather conditions that have been abnormally dry or abnormally wet. The PDSI is calculated based on precipitation, temperature, and Available Water Content (AWC) of the soil. The Palmer Index varies from +6.0 to -6.0 with a classification scale indicating relative meteorological and hydrological development cycles. Table 1 reflects the range and extent of the PDSI classification system:

| Table 1: PDSI Classification System | |
|--|----------------------------|
| 4.00 or more | Extremely wet |
| 3.00 to 3.99 | Very wet |
| 2.00 to 2.99 | Moderately wet |
| 1.00 to 1.99 | Slightly wet |
| 0.50 to 0.99 | Incipient wet spell |
| 0.49 to -0.49 | Near normal |
| -0.50 to -0.99 | Incipient dry spell |
| -1.00 to -1.99 | Mild drought |
| -2.00 to -2.99 | Moderate drought |
| -3.00 to -3.99 | Severe drought |
| -4.00 or lower | Extreme drought |

2. The preliminary PDSI is calculated nationwide on a weekly basis and this data can be found at <http://www.cpc.ncep.noaa.gov>. The data for Texas is extracted and maps showing the preliminary PDSI are created by TWDB staff and are posted on the Texas Water Information Network web site. Texas has 10 National Weather Service Climatic Divisions, with more than 25,000 square miles in each division. Current drought reporting is based on these NWS Climatic Divisions. It is the goal of this plan to develop reporting and information systems on smaller reporting regions so that a more realistic picture of drought as it develops, rather than reporting drought impact after it has inflicted large-scale damage.

E. Crop Moisture Index ("CMI")

1. Most crops are in the field only a fraction of the year, with this time ranging from about 90 days for sunflower to as much as 250 days for wheat. The potential for drought damage varies vastly with crop growth stage, which is governed by planting date and environmental conditions. As Texas has great differences in climate between the 10 climatic divisions, crop maturity and potential damage from drought on a given calendar date varies greatly with location, crop and seasonal conditions.

- A Palmer derivative, the CMI reflects moisture supply in the short term across major crop-producing regions and is not intended to assess long-term droughts. The Crop Moisture Index (CMI) uses a meteorological approach to monitor week-to-week crop conditions across major crop producing regions. It is based on the mean temperature and total precipitation for each week within a Climate Division, as well as the CMI value from the previous week. The CMI responds rapidly to changing conditions, and it is weighted by location and time so that maps, which commonly display the weekly CMI across the United States, can be used to compare moisture conditions at different locations.

Climatological and Hydrological Evaluation Table

| DROUGHT SEVERITY CLASSIFICATION | | RANGES | | | | | |
|---------------------------------|---------------------|--|---------------|---------|----------|---------------------|--------------|
| DPC STAGE | DESCRIPTION | POSSIBLE IMPACTS | SPI | KBDI | VT INDEX | CROP MOISTURE INDEX | PDSI |
| Advisory | Abnormally Dry | Going into drought: short-term dryness slowing planting and growing crops or pastures; fire risk above average. Coming out of drought: lingering water deficits; pastures or crops not fully recovered | 0 to -.99 | 300-399 | 36-45 | -1.0 to -1.9 | -1.0 to -1.9 |
| Watch | First-Stage Drought | Damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, water shortages developing or imminent, voluntary water use restrictions requested | -1.0 to -1.49 | 400-550 | 26-35 | -2.0 to -2.9 | -2.0 to -2.9 |
| Warning | Severe Drought | Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed | -1.5 to -1.99 | 551-650 | 16-25 | -3.0 to -3.9 | -3.0 to -3.9 |
| Emergency | Extreme Drought | Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions | -2.0 or less | 650-700 | 6-15 | -4.0 to -4.9 | -4.0 to -4.9 |
| Disaster | Exceptional Drought | Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies | -2.0 or less | >700 | 1-5 | -5.0 or less | -5.0 or less |

Source: TWDB Regional Climatic and Hydrologic Indicators (Modified from U.S. Drought Monitor, 2000)

- Each Index range shown here is a relative guide only, first order determination is the responsibility of the Drought Monitoring and Water Supply Subcommittee. This information along with the Water Supply Availability, Agricultural Indicators, and Water Utility Indicators will determine the drought stage. Because the ranges of the indicators do not correlate directly, the final drought category tends to be based on what the majority of the indicators shown. The SPI, KBDI, and VT are considered more accurate and are weighted heavily than the preliminary PDSI and CMI. This classification is to be used only as a guide for determining drought stages in each region. Further modification of this task of the Drought Evaluation Process will be modified when more precise, accurate, and localized drought monitoring products are available.
- Drought Indices Listing
 - SPI – Standardized Precipitation Index
 - KBDI – Keetch–Byram Drought Index
 - CMI – Crop Moisture Index
 - VT – Satellite Vegetation Health Index
 - PDSI – Preliminary Palmer Drought Severity Index
- Most preliminary drought indices are available weekly; however, the SPI is available monthly.

Attachment 4

Agricultural Assessment Values

- A. The overall Agricultural Index will reflect the impact of drought on the agricultural industry based upon observations of soil moisture, crop conditions, range and pasture conditions by Texas Agricultural Extension Service (TAEX) county agents and specialists. While livestock sales are independent of drought, much of the economic damage to this industry from drought comes from forced liquidations of stock associated with lack of forage and water. The Texas Department of Agriculture (TDA) will monitor livestock sales and note abnormal increases in sales volume during drought conditions to weight the Agriculture Index. Drought declarations by the U.S. Department of Agriculture (USDA) occur after significant economic damage has been done by drought. This indicator will enter into the later stages of agricultural drought.
- B. It is understood that this index is subjective and will require interpretation by the Drought Preparedness Council to arrive at an overall score of the current impact of drought on agriculture and its related industries. No one index can accurately reflect the impact of drought to such a large and diverse industry. The Agricultural Index is intended to provide timely, concise and useful information to the public and policy makers regarding the status of drought in the state.
- C. The Agricultural Index will be established by evaluation and a weighted summation of five variables. These include:
 - 1. Soil moisture conditions
 - 2. Crop conditions
 - 3. Pasture and range conditions
 - 4. Livestock sales
 - 5. USDA drought declarations
- D. The soil moisture conditions component of the Agricultural Index will be developed using data provided by TAEX county agents. County agents develop a weekly report, which is shared with the Texas Agricultural Statistics Service, and gives their professional estimate of soil moisture conditions within their county. Ratings are made as very poor, poor, fair, good, or excellent. Moisture conditions will be summarized across the reporting district and a composite score will be developed.
- E. Crop conditions are reported in much the same manner, with agents ranking each of the major crops produced in their counties as very poor, poor, fair, good or excellent condition. Pasture and range conditions are included on the same report, using the same qualitative scale. Conditions of each crop are summarized separately across the reporting district. From this, a composite "Crop Conditions" index will be developed. The pasture and range conditions index will reflect the results of a compilation of the district- wide summary.
- F. As part of the Agricultural Index, the Texas Department of Agriculture will be working in cooperation with the USDA-TDA Market News, the TAEX, and the USDA Farm Service Agency (FSA) to provide agricultural conditions as they relate to drought for evaluation.
- G. Livestock sales, reported weekly, at 26 Texas auction barns are publicized by USDA-TDA Market News. These reports show the weekly cattle sales compared with the previous week and previous year. They also provide information on age and size of cattle being sold. TDA and USDA-TDA Market News will be able to provide a summary of the number of livestock sales (number of receipts) showing an abnormal increase of younger and lighter cattle being sold. That can reflect an area's forage situation and the lack of feedstuffs. Some of the auction barns include sheep and goat sales.
- H. Another element that will be considered under the Agricultural Index will be the number of USDA Secretarial Disaster Designations due to drought within a climatic region. These disaster designations are based on a USDA Flash Situation Report completed on a county level and summarizing the type of disaster and estimates crop and livestock losses and other agricultural damages. The County Judge also sends a letter of request, along with the Flash Report, to the Governor asking for an agricultural disaster declaration. If warranted, the Governor will request USDA assistance from the U.S. Secretary of Agriculture. The county FSA office

prepares a Damage Assessment Report outlining the extent of agricultural losses and submits the report to USDA for determination. The declaration may be approved if, as a result of a natural disaster within a county, a request is made within 90 days of the incident, the incident is “weather-related,” and there is at least a 30 percent countywide production loss of crops. The U.S. Secretary of Agriculture decides whether the request for a declaration should be granted. Since drought does not recognize county lines, counties that are contiguous to the approved county (primary county) are also declared disaster counties, including counties across state lines.

- I. Based on the fact that agricultural drought losses have already occurred by the time the disaster designation is approved, this index will not be weighted as heavily during consideration as the preceding agricultural indexes.
- J. Agricultural Drought Declarations Map Index

| DPC STAGE | OBSERVATION |
|-----------|---|
| Advisory | 5 percent of all counties within a NOAA Climatic Region have been approved for a USDA Drought Declaration. |
| Watch | 20 percent of all counties within a NOAA Climatic Region have been approved for a USDA Drought Declaration. |
| Warning | 40 percent of all counties within a NOAA Climatic Region have been approved for a USDA Drought Declaration. |
| Emergency | 60 percent of all counties within a NOAA Climatic Region have been approved for a USDA Drought Declaration. |
| Disaster | 80 percent of all counties within a NOAA Climatic Region have been approved for a USDA Drought Declaration. |

- K. USDA-FSA Drought Flash Reports and county drought declarations are used to report a drought disaster at the federal level. These reports are not released until disaster conditions are at hand, and are thus not predictive of drought, nor do they report severe conditions less than those considered being disaster.
- L. The USDA-FSA state office and Governor’s Division of Emergency Management both retain official copies of county Flash Reports and disaster requests, if the need for additional county drought losses should arise for evaluation purposes.

Attachment 5

Water Availability Assessment Values

| DROUGHT SEVERITY CLASSIFICATION | | RANGES | | |
|---------------------------------|---------------------|---|--|---|
| DCP STAGE | DESCRIPTION | POSSIBLE IMPACTS | PERCENT OF RESERVOIR CONSERVATION STORAGE CAPACITY WITHIN REGION | STREAMFLOW PERCENT EXCEEDANCE WITHIN REGION |
| Advisory | Abnormally Dry | Going into drought: short-term dryness slowing planting and growing crops or pastures; fire risk above average. Coming out of drought: lingering water deficits; pastures or crops not fully recovered. | <70 | 70-79 |
| Watch | First-Stage Drought | Damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, water shortages developing or imminent, voluntary water use restrictions requested | <60 | 80-89 |
| Warning | Severe Drought | Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed | <40 | 90-94 |
| Emergency | Extreme Drought | Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions | <20 | 95-98 |
| Disaster | Exceptional Drought | Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies | <10 | 0-1 |

A. Percent of Reservoir Conservation Storage Capacity:

Conservation storage is the portion of water stored in a reservoir that can be later released for useful purposes such as municipal water supply, power, or irrigation. Conservation storage is defined by the TWDB, as is the volume of water between the conservation pool elevation and that of the lowest intake. Percent of Reservoir Conservation Storage Capacity is calculated by dividing the actual water volume storage by the total conservation storage capacity. This is calculated by NOAA climatic region.

B. Streamflow as Percent Exceedance:

1. To measure streamflow, the method used by the TWDB is Percent Exceedance, computed with 30-day mean flows. Percent Exceedance is the expected percent of time (or probability) that flows of a given magnitude will be exceeded, and it is based on statistical analysis of historical records. For example, a one percent exceedance at 100 cfs implies that one percent of the time the flows will be larger than 100 cfs, or that 99 percent of the time they will be smaller. There are 29 reporting index stations used to calculate this index. Percent Exceedance ranges in the Table above are modified from the U.S. Drought Monitor.

2. Percent Exceedance is classified by the TWDB as:

| <u>30-day mean flows</u> | <u>Percent Exceedance</u> |
|--------------------------|---------------------------|
| High | 5 percent – 30 percent |
| Near normal | 30 percent – 70 percent |
| Low | 70 percent – 95 percent |
| Very low | 95 percent – 100 percent |

3. Water Supply Availability Indicators are used to estimate the available water supplies within specific region. Water supplies in reservoir storage within a region might be made available to other regions, either by conveyance downstream or by interbasin transfer..

Attachment 6

Future Planning and Coordination Recommendations

The Drought Preparedness Council, as a relatively new coordinating body, has developed the following recommendations for future drought-related operations and activities:

A. Drought Monitoring

1. Modernize the statewide environmental monitoring and forecasting system by installing a geographically distributed automated network similar to the Texas MesoNet System.
2. Enhance methods of passing drought-related information to those who are vulnerable to drought.

B. Impact Assessment

1. Coordinate the efficient and timely assessment of impacts related to various water uses.
2. Develop timely economic impact assessment tools.
3. Enhance the coordinated statewide response to drought.

C. Research and Educational Programs

1. Encourage the continued use of educational programs for drought awareness.
2. Support ongoing research into methods for improving drought monitoring, assessment, and mitigation.
3. Enhance use of the media for informing the public about drought management options and activities.

D. Drought Mitigation Strategies

1. Increase the educational emphasis given to forest and range management practices for the minimizing of drought impacts.
2. Establish stronger economic and other incentives for private investments in water conservation.
3. Improve water conveyance infrastructure efficiencies in agricultural, municipal, and industrial uses.
4. Encourage water-efficient land use and development practices.
5. Encourage coordinated drought response activities, particularly water use restrictions, among neighboring water systems.

Attachment 7

Useful Drought-Related Web Sites

“Aggie” Horticulture: <http://aggie-horticulture.tamu.edu/tamuhort.html>

Climate Prediction National Centers for Environmental Prediction: <http://www.cpc.ncep.noaa.gov/>

Committee on Earth Observation Satellite Drought Management:
<http://www.ceos.org/pages/DMSG/index.html>

Economic Development Clearinghouse: <http://www.edinfo.state.tx.us/>

Federal Emergency Management Agency (FEMA): <http://www.fema.gov/>

Governor’s Division of Emergency Management (GDEM): <http://www.txdps.state.tx.us/GDEM>

International Boundary and Water Commission (IBWC): <http://www.ibwc.state.gov/>

National Climate Data Center (NCDC): <http://www.ncdc.noaa.gov/>

National Weather Service (NWS): <http://www.nws.noaa.gov/>

Natural Resources Conservation Service (NRCS): <http://www.nrcs.usda.gov/>

Office of Rural Community Affairs (ORCA): <http://www.orca.state.tx.us/>

Office of the State Climatologist: <http://www.met.tamu.edu/osc>

State of Texas Drought Preparedness Council: <http://www.txwin.net/dpc/>

Texas Agricultural Extension Service (TAEX): <http://agprogram.tamu.edu/>

TAEX Resource Center: <http://texaserc.tamu.edu/>

Texas Agricultural Statistics Service: <http://www.nass.usda.gov/tx/>

Texas Department of Agriculture (TDA): <http://www.agr.state.tx.us/>

Texas Department of Economic Development and Tourism (TDED): <http://www.tded.state.tx.us/>

Department of State Health and Human Services (DSHS): <http://www.dshs.state.tx.us/>

Texas Department of Housing and Community Affairs (TDHCA): <http://www.tdhca.state.tx.us/>

Texas Department of Transportation (TxDOT): <http://www.txdot.state.tx.us>

Texas Drought Links: <http://agnews.tamu.edu/drought/>

Texas Forest Service (TFS): <http://txforestservation.tamu.edu/>

Texas Commission of Environmental Quality (TCEQ): <http://www.tceq.state.tx.us/>

TCEQ Public Water Supply Systems Map: <http://www.tceq.state.tx.us/>

Texas Parks and Wildlife Department (TPWD): <http://www.tpwd.state.tx.us/>

Texas State Soil and Water Conservation Board (TSSWCB): <http://www.tsswcb.state.tx.us/>

Texas Water Development Board (TWDB): <http://www.twdb.state.tx.us/>

TWDB Reservoir Conservation Storage:
<http://www.twdb.state.tx.us/publications/reports/waterconditions/watercon.htm>

U. S. Army Corps of Engineers (USACE): <http://www.swf-wc.usace.army.mil/>

U. S. Bureau of Reclamation (USBR): <http://www.usbr.gov/main/index.html>

U. S. Department of Agriculture (USDA): <http://www.rurdev.usda.gov/tx/>

U. S. Forest Service (USFS): <http://www.fs.fed.us/r8/>

U. S. Geological Survey (USGS): <http://www.tx.usgs.gov/>