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ASSISTANCE IN DEVELOPING THE STATEWIDE WATER MANAGEMENT PLAN

VOLUME I - IDENTIFICATION AND USE ASSESSMENT OF LOUISIANA WATER RESOURCES

Prepared for the

Louisiana Ground Water Management Commission

Prepared by

C. H. Fenstermaker & Associates, Inc.

LBG-Guyton Associates

Hydro-Environmental Technology, Inc.

Onebane, Bernard, Torian, Diaz, McNamara & Abell

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DISCLAIMER

All of the numerical data contained within this report are previously published publicly available data from various sources, as cited. The collection or recordation of new field data is beyond the scope of this document. The project team of C. H. Fenstermaker & Associates, Inc, LBG-Guyton Associates, Hydro-Environmental Technology, Inc., and the Onebane Law Firm offer no certification of either the validity or timeliness of these data, but accepted same as accurate on face value.

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PREFACE

Purpose of this Report

During the 2001 Regular Legislative Session, the Louisiana State Legislature enacted Act 446 to create the Ground Water Management Commission. One of the duties of the Commission and its advisory groups is to develop and implement a comprehensive statewide water management plan. The objective of this report is to provide guidance for the Commission and the Legislature in the fulfillment of their duties with respect to the development of a water management plan. This document was not created to function as a water management plan itself. The information presented herein is intended, instead, to serve as a road map for developing and implementing water regulations for Louisiana.

The scope of this report was not to provide hydrogeologic or engineering studies or to reproduce studies performed previously by other private or public entities. The Project Consultants have not attempted to "re-invent the wheel" by collecting geologic, hydrogeologic, or hydrologic information in the field or by developing new models of the state's aquifer systems and drainage basins. However, an effort was made to locate, collate, interpret, and analyze the wealth of previously collected, but widely scattered, data so that all of the relevant data can be easily referenced and available during the planning process.

In the process of generating this report, the Project Consultants analyzed water management programs from a number of states in an effort to categorize their strengths and weaknesses and to assess their applicability to water planning in Louisiana. The consultants utilized their own experience with water planning in other states and their familiarity with water resource issues in this state. This document is intended to lay the foundation for water management planning in Louisiana.

Although the components and data of this plan are technical in nature, the plan is written in a format that a broad range of readers will be able to understand.

Regions of the State

This Assistance Document divides Louisiana into three regions to better describe the waters of the state. This organization is a departure from previous planning efforts that divided the state into management areas based on drainage basin boundaries or subdivisions of drainage basins. Being primarily a ground water management plan, emphasis is placed on understanding aquifer systems and the interaction of aquifers with overlying drainage basins. Each one of Louisiana's major aquifers lies beneath two or more drainage basins and many political subdivisions. The natural flow of ground water in each of these aquifers, however, is not governed by the configuration of drainage basins or by parish boundaries. Thus, the Project Consultants sought to develop an approach that would not lead to unnecessary and confusing divisions of the state's major aquifers. According to this approach, the aquifers that account for most of the ground water pumpage in Louisiana lie entirely within well-defined regional boundaries.

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ACRONYMS/GLOSSARY

Acre-Foot (acre-ft) - the volume of water required to cover 1 acre of land (43,560 square feet) to a depth of 1 foot. Equal to 325,851 gallons or 43,560 cubic feet.

Alluvium - A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited by a stream or other body of running water.

Alluvial - Having to do with alluvium; having the components of alluvium.

Alluvial Aquifer - An area of water-bearing sand and gravel typically found near lakes, streams and rivers.

Ambient Ground Water Monitoring - Ambient ground water monitoring programs measure background or existing water quality and are used to track long-term trends in contaminant concentrations.

Aquifer - A layer of underground sand, gravel, or permeable rock with sufficient saturated permeable material to yield economical quantities of water. Aquifers may lie close to the surface or at great depths. Aquifers can be hundreds of miles long and wide or narrow, shallow veins running through rock.

Aquaculture Water Use – Water used for fish, crawfish, and alligator farming. Water for aquaculture use comes both from public-supplied sources, such as a parish water department or district, and from self-supplied sources, such as local wells. Instream fish farming is not included in this category.

Aquifer, Confined - An aquifer that is overlain by a confining layer that has a significantly lower hydraulic conductivity than the aquifer.

Aquifer, Unconfined - An aquifer in which there are no confining layers between the zone of saturation and the surface. An unconfined aquifer has a water table.

Aquifer Test - A test of an aquifer made by pumping a well for a long period of time and observing the changes in the hydraulic head in the aquifer. Also known as a pumping test.

Aquitard - A layer of material with low permeability, which can store ground water and also transmit water slowly from one aquifer to another.

Artesian Well - A well in a confined aquifer with the water level in the well occurring above the ground surface.

Base of Freshwater - Top of the transition zone between freshwater and brackish water.

Basin - A geographic region which is drained by a network of rivers and/or streams.

Brackish Water - Slightly salty. A term applied to water that has a salt content intermediate between freshwater and seawater.

CFS - Cubic feet per second.

Chemical Characteristics - The chemical content and the physical properties of water.

Commercial Water Use - Water used for motels, hotels, restaurants, office buildings, other commercial facilities, and institutions. Water for commercial use comes both from public-supplied sources, such as a parish water department or district, and from self-supplied sources, such as local wells.

Cone of Depression - The depression, roughly conical in shape, produced in a potentiometric surface by pumping (or artesian flow).

Confining Layer – A geological formation or a single bed with permeability low enough to limit the vertical flow of water. Also known as a confining bed.

Class V Injection Wells - Shallow disposal systems that are used to place a variety of fluids below the land surface, into or above underground sources of drinking water (USDW).

Clean Water Act (CWA) - Enacted in 1972, the Clean Water Act is the primary federal law that protects our nation's waters, including lakes, rivers, aquifers, and coastal areas. Its primary objective is to restore and maintain the integrity of the nation's waters.

Contamination (Water) - The degradation of natural water quality as a result of human activities.

Critical Ground Water - ACT 446 defines critical ground water as "an area where sustainability of an aquifer is not being maintained under current or projected usage or under normal environmental conditions which are causing a serious adverse impact to an aquifer".

Depletion - The loss of water from surface water reservoirs or ground water aquifers at a rate greater than that of recharge.

Dip - The angle at which a stratum or any planar feature is inclined from the horizontal.

Discharge - The volume of water that passes a given location within a given period of time.

Domestic Water Use - Water used for household purposes, such as drinking, food preparation, bathing, washing clothes, dishes, dogs, flushing toilets, and watering lawns and gardens. About 85% of domestic water is delivered to homes by a public-supply facility, such as a parish water department or district. About 15% of the Nation's population supply their own water, mainly from wells.

Drainage - The removal of surface water from within a specific area.

Drought - A water supply shortage for a certain use; a quantity or amount less than what is demanded.

Drawdown - The lowering of the water table (unconfined aquifer) or the potentiometric surface (confined aquifer) due to pumping of ground water from wells.

Evaporation - The changing of liquid water from rivers, lakes, soil and vegetative surfaces into water vapor.

Evapotranspiration – The process of moving moisture into the atmosphere from evaporation from the soil and transpiration of water by plants.

Fault - A fracture or zone of fractures with displacement of the sides relative to one another parallel to the fracture.

Freshwater - Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses.

Freshwater-Saltwater Interface - The boundary surface between two fluids of different density. The boundary surface is the zone between freshwater and brackish water.

Ground Water - The subsurface water beneath the water table in soils and geologic formations that are fully saturated.

Head - The height above a datum plane of a column of water. In a ground water system it is composed of elevation head and pressure head.

Hydraulic Conductivity - The rate of flow through a permeable medium, typically measured in gallons per day per foot squared (gpd/ft^2).

Hydraulic Gradient - The rate of change of head over distance of flow in any given direction.

Hydrogeology - The study of the inter-relationships between geologic materials and processes with water, especially ground water.

Hydrologic Cycle - The constant process of water movement from the Earth to the atmosphere by evaporation and transpiration, and from the atmosphere to the Earth in various forms of precipitation. This cycle also includes movement of water on and beneath the Earth's surface (runoff and seepage) and surface and ground water storage.

Industrial Water Use - Water used for industrial purposes in such industries as, chemical, paper, and petroleum refining. Nationally, water for industrial uses comes mainly (80%) from self-supplied sources, such as local wells or withdrawal points in a river, but some water

comes from public-supplied sources, such as the parish/city water department.

Instream Use – The use of water without removal from its natural environment. Common instream uses include hydroelectric power generation, fishing, and navigation.

Irrigation – The withdrawal or diversion of water from a ground water or surface water source for application to vegetation. This includes application to field crops such as rice, corn, cotton, fruit crops, nurseries, and special applications, such as the watering of golf courses and sporting fields.

Irrigation Water Use - Water application on lands to assist in the growing of crops and pastures or to maintain vegetative growth in recreational lands, such as parks and golf courses. Water for irrigation use typically comes from self-supplied sources, such as local wells or from diversion of rivers and streams.

Land Subsidence - The loss of surface elevation due to removal of subsurface support. One cause of subsidence is over-pumping ground water.

Levee - Soil or other materials deposited to contain the flow of water.

Livestock Withdrawal – Water withdrawn or diverted from a ground water or surface water source for use in the production of cattle horses, sheep, swine, poultry, and other animals. The water can be used for livestock consumption, sanitation, and other farm needs.

Loess - A wind blown deposit of silty soil having little or no stratification.

Louisiana Geological Survey (LGS) - The Louisiana Geological Survey is Louisiana's primary geological research institution. One of its purposes is to take actions leading to the development of resources for the benefit of the economy of the state and to the protection of the state and its people from natural, geological, and environmental hazards.

Maximum Contaminant Levels (MCLs) - According to the Safe Drinking Water Act, the MCL is the greatest amount of a contaminant that can be present in drinking water without causing a risk to human health. MCLs are set by considering both health effects of the compound and technical feasibility of removing the compound from the water supply.

Monitoring Well - Wells used to monitor ground water conditions, such as water level, and to collect ground water samples for the purpose of physical, chemical, or biological analysis. They are generally installed where ground water contamination exists or have a potential to exist.

Nonpoint Source Pollution - Pollution discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff. Non-point source pollution is contamination that occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards. As this runoff moves across the land surface, it picks up solid particles and pollutants, such as nutrients and pesticides.

Once-through cooling – The one-time use of water for cooling and other industrial uses. Water used in this manner is usually returned to its source and little, if any, water is consumed.

Over-pumping - The reduction of ground water storage that occurs when withdrawals from an aquifer exceed recharge.

Percolation - The downward movement of water through layers of soil or rock.

Potentiometric surface - The imaginary surface of the total head of ground water. In a confined aquifer, it is measured as the level at which the water will rise in a well. In an unconfined aquifer, it is the level of the water table.

Power-Generation Water Use – Water used for thermoelectric purposes such as cooling, sanitation, washing, and steam generation. Water for power-generation use is typically withdrawn or diverted from a ground water or surface water source. Use of hydroelectric power-generation is considered instream and not a withdrawal.

Precipitation - The process by which water vapor condenses in the atmosphere or onto a land surface in the form of rain, hail, sleet, or snow.

Prior Appropriation Doctrine – The system for allocating surface water rights to landowners used by most western states. The doctrine of Prior Appropriation was in common use throughout the arid West as early settlers and miners began to develop the land. The prior appropriation doctrine is based on the concept of "First in Time, First in Right," that is, the first person to take a quantity of water and put it to beneficial use has a higher priority of right than a subsequent user. Prior Appropriation Rights can be lost through nonuse; they can also be sold or transferred apart from the land. Modified forms of the prior appropriation doctrine have been adopted by southeastern states such as Florida and Mississippi.

Public Supply Water Use - Water withdrawn or diverted from a ground water or surface water source and delivered to a group of users by public and private water suppliers. Typically, a public water supply is defined as one that serves at least 25 people with 15 connections year round. Public Supply water is used for a variety of purposes such as domestic, commercial and industrial water use.

Recharge - The replenishment of ground water by seepage (deep percolation) of precipitation and runoff. Also defined as the process of addition of water to the saturated zone.

Recharge Area - A part of an aquifer that receives water (recharge). The recharge area is generally where an aquifer is exposed at the earth's surface (outcrop area) and receives water from rainfall or surface streams. A recharge area may be in the subsurface where there are interconnections with aquifers of higher head.

Reservoir - An impoundment for water storage either above or below the ground.

Riparian Water Rights - The rights of an owner whose land abuts a body of surface water. The doctrine of riparian rights is an old one, having its origins in English common law. Specifically, persons who own land adjacent to a stream have the right to make reasonable use of the water. Riparian users of a stream share the stream flow among themselves, and the concept of priority of use (Prior Appropriation Doctrine) is not applicable. Riparian rights cannot be sold or transferred for use on non-riparian land.

Runoff - That portion of precipitation or irrigation water that moves across land as surface flow and enters streams or other surface receiving waters. Runoff occurs when the precipitation rate exceeds the infiltration rate.

Rural-domestic Withdrawal – Water withdrawn or diverted from a ground water or surface water source by a person or family for personal uses. These users are often in rural areas where public supplies are unavailable.

Safe Drinking Water Act (SDWA) - The law passed in 1974 that required the setting of standards to protect the public from exposure to contaminants in drinking water.

Saline Water - Water with a dissolved solids content between 1,000 and 35,000 mg/L.
Parameters for water salinity classifications:

- Fresh water - Less than 1,000 parts per million (ppm)
- Slightly saline water - From 1,000 ppm to 3,000 ppm
- Moderately saline water - From 3,000 ppm to 10,000 ppm
- Highly saline water - From 10,000 ppm to 35,000 ppm

Salt Water Intrusion or Encroachment - Displacement of fresh ground water by the advance of saltwater due to its greater density. This may occur anywhere that freshwater and saltwater are in hydraulic continuity. Encroachment occurs when the total head of saltwater exceeds that of adjacent freshwater.

Secondary Aquifer - Any aquifer that is not the main source of water to wells in a given area - includes shallow and perched aquifers.

Sinkhole - The cavities in bedrock that are open to the atmosphere. These usually result from the collapse of overlying soil or geologic material.

Sole Source Aquifer - An aquifer that is the sole or principal drinking water source for an area and which, if contaminated, would create a significant hazard to public health.

Static Water Level - The level of water in a well that is not effected by the withdrawal of ground water.

Stormwater - Rainwater and snowmelt that runs off the land and enters streams, rivers, and lakes.

Strike - The bearing of the outcrop of an inclined bed or structure on a level surface.

Surface Water - The water from all sources that occurs on the Earth's surface either as diffused water or as water in natural channels, artificial channels, or other surface water bodies.

Total Dissolved Solids (TDS) - The total amount in milligrams of solid material dissolved in one liter of water (mg/L).

Treatment - Remedial techniques or actions used to restore contaminated ground water.

Underground Injection Well - A well through which fluids are injected into the subsurface.

Underground Storage Tanks (USTs) - Any system having 10 percent of the total tank volume below ground.

United States Geological Survey (USGS) - The U.S. Geological Survey is the nation's largest earth-science agency and has the principal responsibility for appraising the earth resources of the Nation and for providing hydrologic or earth-science information. In Louisiana, the USGS engages in a wide range of earth-science data-collection and appraisal activities.

Vadose zone - The zone between the land surface and the water table (zone of saturation), also known as the unsaturated zone. Saturated bodies, such as perched ground water, may occur in the unsaturated zone.

Volatile Organic Compound (VOC) - An organic chemical that volatizes (evaporates) relatively easily when exposed to air.

Water Quality - The chemical, physical, biological, and radiological condition of a surface or ground water body.

Watershed - The land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large watersheds, like the Mississippi River basin contain thousands of smaller watersheds.

Water Rights – A legal entitlement to the usage of surface and/or ground water as defined by a state's doctrines regarding the access or use of water resources.

Water Table - The top of the subsurface zone that is saturated with ground water. That surface in an unconfined water body at which the pressure is atmospheric (water level below the top of the aquifer). It is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water.

Water Use – Water withdrawn or diverted from a ground water or surface water source and used for public supply, industry, power generation, rural domestic, livestock, irrigation, and aquaculture purposes.

Well (water) - An artificial excavation put down by any method for the purposes of withdrawing water from the underground aquifers. A bored, drilled, or driven shaft, or a dug hole whose depth is greater than the largest surface dimension and whose purpose is to reach underground water supplies.

Wellhead Protection Area - A designated surface and subsurface area surrounding a well or well field that supplies a public water supply and through which contaminants or pollutants are likely to pass and eventually reach the aquifer that supplies the well or well field. The purpose of designating the area is to provide protection from the potential of contamination of the water supply. These areas are designated in accordance with laws, regulations, and plans that protect public drinking water supplies.

Wetlands - A land area that is inundated or saturated by surface and/or ground water with a frequency and duration sufficient to support an abundance of water-loving plants or other aquatic life that require permanently saturated or seasonally saturated soil conditions for growth and reproduction. Examples include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflow areas, mud flats, and natural ponds.

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EXECUTIVE SUMMARY

Widespread concern about the sustainability of Louisiana's ground water resources led to the passage of Act 446 in the 2001 Regular Session of the Louisiana Legislature. Act 446 established the Ground Water Management Commission (Commission) in the Office of the Governor and assigned the Office of Conservation within the Louisiana Department of Natural Resources (DNR) to support the Commission. Act 446 also created a Ground Water Management Advisory Task Force to advise the Commission, provided for the adoption of rules and regulations for the delineation of critical ground water areas (CGWAs), authorized the Commission to limit the access to and the usage of ground water sources in CGWAs, and provided for response to emergency situations. In addition, Act 446 required the development of a plan to implement a statewide ground water management system. Through the Office of Conservation, the Commission contracted with C.H. Fenstermaker & Associates (CHFA) of Lafayette, Louisiana to develop a framework for the plan. CHFA and a team of three sub-consultants (LBG-Guyton Associates, the Onebane Law Firm, and Hydro-Environmental Technology) began work on the framework plan in December 2001. The final report was submitted to the Commission on December 4, 2002, and the Commission accepted the Project Consultant's report on December 13, 2002.

The project was divided into two parts. Part 1 consisted of the following tasks:

Task 1 – A general evaluation of Louisiana's water resources, water quality, historical use of ground water and surface water, and current and projected water demand.

Task 2 – A determination of data necessary to manage the state's water resources and sources of such data, including but not limited to water level, water quality, and water use.

Task 3 – Identification of the data necessary to determine the sustainability of each major aquifer and predict critical ground water areas, including but not limited to which aquifer's current and projected water use are greater than its recharge.

Task 4 – An evaluation of the state's surface water resources available for development and development of alternatives to ground water use, including identification of the surface water resources for use in critical or potentially critical ground water areas.

Part 2 consisted of seven tasks:

Task 1 – A general evaluation of the use of surface water and recycling of used or treated water and identification and development of surface water projects to meet current and future demands as obtained from existing publications.

Task 2 – Evaluate incentives and alternative technologies for conservation of water resources and development of an education and conservation program.

Task 3 – Development of an emergency use and contingency plan.

Task 4- Development of a program to provide mitigation for loss of ground water resources and incentives to transfer use from ground water resources to surface water sources or alternative sources where transfers will not harm the surface water sources.

Task 5 – Identification of areas where inter-jurisdictional relationships will be necessary.

Task 6 – Designation of the appropriate state entity structure to manage and protect the state's water resources, including the costs of administration and implementation.

Task 7 – Identify legal issues to be addressed.

The following sections of this Executive Summary present overviews of the main topics of the 13 chapters that comprise the Project Consultants' final report to the Commission.

Chapter 1 – Description of the State of Louisiana

Chapter 1 provides an overview of the physiography, climate (and occurrence of drought), population, economy, aquifers, and surface water resources of Louisiana. As such, Chapter 1 presents the basic information needed to establish a foundation for the development of a comprehensive management plan. A key element is the division of Louisiana into three regions (Regions I – III) to better describe the waters of the state (Section 1.1 and Figure 1-1). The delineation of the three regions in this report is a significant departure from previous planning reports that divided Louisiana into management areas on the basis of drainage basin boundaries or subdivisions of drainage basins. Because this is the framework for a ground water management plan, the emphasis is placed on understanding aquifer systems and the interaction of aquifers with overlying drainage basins. Ground water management programs that are based primarily on the boundaries of surface water systems have the disadvantage of fragmenting flow systems along physiographic features that have little or no relevance for effective management of aquifers.

Region I consists of the 26 parishes in the northern part of the state. These parishes cover an area 18,647 square miles (mi^2). The major cities of Region I are Shreveport, Ruston, Monroe, and Natchitoches. The Sparta and Mississippi River alluvial aquifers are the principal sources of ground water in Region I. The 16 parishes of Region II cover the 16,243 square mile (mi^2) area of southwestern and central Louisiana. The major cities of Region II are Lafayette, New Iberia, Alexandria, and Lake Charles. The Chicot aquifer is the principal aquifer of Region II. Region III is a 17,514-mi^2 area consisting of the 22 parishes east of the Atchafalaya River. The major cities of Region III are Baton Rouge, Baker, New Orleans, the rapidly growing cities of the Florida Parishes, and the Houma-Thibodeaux Metropolitan Statistical Area. The major source of ground water in Region III is the Southern Hills Aquifer.

Chapter 2 – Legal and Inter-Jurisdictional Issues

Chapter 2 is an examination of the legal and inter-jurisdictional issues that must be addressed and resolved by a comprehensive water management plan. These issues include the "rule of capture" doctrine, the potential established by Act 446 for the application of one or more water rights systems (e.g., correlative rights) that have been embraced by other states but not Louisiana, and a constitutional provision requiring the Legislature to pass laws designed to protect, conserve, and replenish insofar as possible the natural resources (including air and water) of the state.

Although the above-mentioned constitutional provision can be interpreted as an endorsement of passive advocacy for natural resource legislation in the public interest rather than as a substantive directive, modern jurisprudence invoking this provision as the basis for environmental law to protect Louisiana's ground water resources directs that all state agencies must act with utmost regard for the public interest, specifically where ground water rights are in play, but with due regard for economic and social factors. Thus, while the above constitutional provision does not appear to create enforceable rights of a constitutional dimension, particularly private rights, arguably these cases can be read to the conclusion that, in situations of possibly acute endangerment of private water supplies that could affect public health and safety, the rights asserted are constitutional in scope from a judicial perspective.

Within this constitutional framework, Act 446 is enabling legislation moderating civil law surface and water rights doctrines to establish a system of correlative rights among competitive water users in the public interest and welfare. Commentators pose that, without such legislative action, Louisiana's civil law and its interpreting case precedents do not recognize such a correlative rights doctrine. With such regulation, the rule of capture in the ground water context, and riparian rights in the surface water context, would continue to control water use within the state unless Louisiana courts afford relief by pure constitutional right. As one court recognized in a ground water rights dispute nearly forty years ago, case-by-case adjudication in this area likely would prove to be a less than adequate substitute for deliberative legislative action. Thus, the Legislature has promulgated Act 446 to that end.

Chapter 3 – Population and Water Use

Chapter 3 examines the growth of population and water usage over a 40-year period (1960 – 2000), as well as the distribution of population and patterns of water usage in the three regions delineated in Chapter 1. The salient points of Chapter 3 are:

Population

- Louisiana's population grew from 3.25 million in 1960 to 4.46 million in 2000. Most of the growth occurred between 1960 and 1980, when the state's population increased by more than 949,000. The rate of growth flattened out after 1980,

largely because of out-migration related to stagnant economic conditions in the state.
- Approximately 54 percent of the state's population resides in the Region III. Region II accounts for another 25 percent, and the remaining 21 percent is in Region I.
- The population of Louisiana is projected to grow from 4.45 million in 2000 to 5.21 million by the year 2020.

Total Water Use

- Total water use in Louisiana increased from 5,900 million gallons per day (Mgd) in 1960 to 13,500 Mgd in 1980, and then decreased to 9,600 Mgd by 1990. Between 1990 and 2000, total water use increased to 10,400 Mgd.
- Region III accounts for 72 percent of total water pumpage in Louisiana; Region II, 21 percent; and Region I, 7 percent.
- Surface water provides 93 percent of the state's total pumpage.
- In order of total usage, the major water user groups in Louisiana are: (1) electricity generators, ~55 percent; (2) industry and manufacturing, ~24 percent; (3), irrigators, ~13 percent; (4) public supply, ~7 percent; and (5) rural and livestock demand, ~1 percent.

Water Use – Region I

- In 2000, total water use in Region I was ~863 Mgd. Surface water provided 58 percent of the total supply of Region I.
- Electricity generators are the primary users of surface water, accounting for 35 to 50 percent of total usage during the 1990's.
- The Sparta and the Mississippi River alluvial aquifers are the principal sources of ground water in Region I (Figure 3-32).
- The Mississippi River alluvial aquifer is a major source of water to support irrigation in the easternmost parishes of Region I.
- All agricultural-related applications of ground water account for 60 to 70 percent of total use since 1990. Electricity generators account for less than 1 percent of total ground water use.
- The Sparta is the principal source of supply for public supply and industry. All other sources of demand on the Sparta account for less than 1 percent of total use.
- Other aquifers of Region I (e.g., the Carrizo-Wilcox, Cockfield, Catahoula, Upland Terrace and Red River aquifers) are considered to be minor sources of supply.

Water Use – Region II

- In 2000, total water use in Region II was ~2,105 Mgd. Surface water provided 56 percent (1,189 Mgd) of the total supply of Region II. Ground water provided the remaining 44 percent (916 Mgd).

- Between 1960 and 1985, rice farming accounted for 40 to 70 percent of total surface water use.
- Between 1990 and 2000, total surface water use by electric power generators and industry grew to 70 - 80 percent.
- Agriculture accounts for more than 70 percent of total ground water use in Region II.
- Outside of the agricultural sector, the largest users of ground water are public supply (~15 percent) and industry (~10 percent). All other groups account for less than 1 percent of total ground water use.
- The Chicot aquifer provides more than 80 percent of ground water usage in Region II. Minor aquifers in the region are the Evangeline, Jasper, and Mississippi River alluvial aquifers.

Water Use – Region III

- In 2000, total water use in Region III was ~7,384 Mgd. Surface water provided 95 percent (7,047 Mgd) of the total supply of Region III. Ground water provided the remaining 5 percent (337 Mgd).
- The largest users of surface water in Region III are: (1) electricity generators, ~65 percent; (2) industry, ~30 percent; and (4) public supply, ~5 percent.
- The largest sources of ground water demand in Region III are: (1) industry, ~46 percent; (2) public supply, ~42 percent; and (3) electric power generators, ~5 percent.
- The Southern Hills aquifer system is the principal source of ground water in Region III.

Chapter 4 – Ground Water and Surface Water Resources

Chapter 4 is an overview of the aquifers and surface water resources of Louisiana. The aquifers and surface water resources are discussed according their respective regions. Maps of the potentiometric surfaces and the recharge areas of the major aquifers and most of the minor aquifers are included, along with hydrographs showing changing in water levels over time for key wells in each aquifer. The discussion of each aquifer includes summary information on water quality from the Baseline Monitoring Project (BMP) managed by the Louisiana Department of Environmental Quality (LDEQ). The detailed water quality reports are included in Appendix VIII.

Maps of each of the state's river basins are included in Chapter 4, along with maps showing the locations of stage and discharge gages operated by the United States Geological Survey, and the New Orleans and Vicksburg Districts of the United States Army Corps of Engineers. The chapter includes tables showing water quality assessments (divided into Condition Indicators and Vulnerability Indicators) for all watersheds in Regions I – III.

Also included in Chapter 4 is a discussion of the data needed to assess the sustainability of aquifers. This information is included to provide guidance to the Commission and to staff

members of the Office of Conservation who must consider the different approaches to and limitations of assessing the sustainability of ground water resources in their efforts to develop a comprehensive management plan. Because this information is highly detailed, the reader is referred to Sections 4.2.7 – 4.2.7.2.2 and to Table 4.2.

Chapter 5 – Overview of Water Management Plans of Other States

Summaries of the approaches to water management adopted by the states of Arkansas, Mississippi, Texas, Alabama, Florida, Oklahoma, Utah, and New Mexico are found in Chapter 5. This information is included to provide the reader with a basic understanding of (1) the issues that have driven the need for water planning and management in the United States and (2) the strategies that states have developed to address their respective water management problems.

The management plans discussed in Chapter 5 represent substantial diversity with regard to geographic location, water resource needs and issues, approaches to water planning, the definition and administration of water rights, and the degree of regulation of water resources. Of the programs summarized in Chapter 5, those of Arkansas, Mississippi, and Texas are emphasized because these states share major and minor aquifers and surface-water systems with Louisiana and because a comprehensive water management plan for Louisiana will probably have to consider common issues of concern with neighboring states.

In compiling information on each state's water management program, the Project Consultants sought to answer the following questions:

- What are the issues driving the need for water planning and management?
- What is the basis for water planning and management? When was this authority enacted? What agencies are involved in implementing and reviewing the program?
- What are the requirements for a water plan? Who must submit plans? What triggers the requirements for planning? Does the planning and management program have provisions and procedures for delineating "critical" areas?
- How does the state define and administer water rights?
- What issues are required or recommended for consideration in the planning and management program? Is the plan required to analyze future water needs and emergency management? What specific conservation measures are included in the planning and management program?
- How is the planning and management program implemented? Are revisions and updates of the plan required? How are the plans enforced, and can penalties be imposed for noncompliance with management objectives?
- How much money is budgeted for implementation of the plan? How many staff members are dedicated to implementing planning activities?

As expected, the Project Consultants found that planning and management programs are driven by a wide range of water availability and water quality issues and the resources

made available to planning agents by political leaders, who must first agree on the need for and the extent of such programs. The approaches to planning and management range from loosely structured programs (Arkansas) to programs that vest significant regulatory control in well-funded stage agencies (Florida). Most lie somewhere in the spectrum between those in Arkansas on one end and Florida on the other. Until the passage of Act 446, Louisiana was the only state bordering the Gulf Coast that did not have a coherent approach to the management of ground and surface water resources. The neighboring states have all recognized that water resources are important components of long-term economic growth, and all have cited the need for sensible planning and management to ensure that adequate water resources will be available when and where they are needed.

Chapter 6 – Critical Ground Water

Chapter 6 begins with an overview of the rules governing the designation of critical ground water areas (CGWAs) in Louisiana, along with a summary of the critical area programs of Arkansas, Texas, Alabama, and Florida. The text lays out the bases and procedures for delineating critical areas in each of the above states. Also summarized are the definitions of and approaches to defining critical areas by the Sparta Ground Water Conservation Commission and the Capital Area Ground Water Conservation Commission.

The Project Consultants recommend that all critical area decisions in Louisiana be made on a case-by-case basis. It should not be assumed that data and models that support a decision in one case are sufficient to warrant a similar decision in another. Readers are referred to the discussion in Section 4.2.7 regarding the sustainability of aquifers for a conceptual basis and justification for the type of data that are needed to support a CGWA petition.

The data required to evaluate a CGWA application are determined by the nature of the problem and the area (e.g., the size) of the proposed CGWA. The amount of data required to address a specific issue may increase and the type of data become more complex as the scale of a problem becomes larger. A CGWA petition of regional extent may require the development of a properly constructed numerical flow model to test assumptions about the responsiveness of an aquifer to a range of different pumping scenarios and to make assessments of short-term or long-term availability of ground water. Where applicable, a numerical model should be coupled with a transport model if there is concern about the flow of contaminants or the encroachment of solutes into freshwater sections of an aquifer.

To provide greater clarity to discussions and deliberations regarding the delineation of critical ground water areas in Louisiana, the Project Consultants recommended in August 2002 that members of the Technical Committee of the Ground Water Advisory Task Force reconsider the definition of a critical ground water area in Act 446. Specifically, the Project Consultants suggested that the original definition was too vague to provide the type of guidance needed to delineate critical areas. The original definition is as follows:

- **Critical Ground Water Area** (CGWA) means an area where sustainability of an aquifer is not being maintained under current or projected usage or under normal environmental conditions, which are causing a serious adverse impact to an aquifer.

In October of 2002 the Technical Committee generated a new Critical Ground Water Area definition and recommended that this definition be incorporated into any future legislation. The new definition reads as follows:

- **Critical Ground Water Area** (CGWA) shall mean an area in which, under current usage and normal environmental conditions, sustainability of an aquifer is not being maintained due to either movement of a salt water front or water level decline, or both, resulting in unacceptable environmental, economic, social, or health impacts, or causing a serious adverse impact to an aquifer, considering the area and temporal extent of all such impacts.

The Project Consultants have reviewed the Technical Committee's definition from a both a legal and technical standpoint and have determined that it is consistent with Louisiana law and ties in with the Public Trust Doctrine. The Technical Committee recommended, and the Project Consultants concur, that the current definition of "sustainability" be retained.

To add a greater sense of clarity to future discussions, the Project Consultants also proposed to add three other definitions that should be used in the formulation of the final Statewide Water Management Plan. These definitions are as follows:

- **Potential Critical Ground Water Area** (PCGWA) shall mean an area in which, under projected usage and normal environmental conditions, sustainability of an aquifer will not be maintained due to either movement of a salt water front or water level decline, or both, resulting in unacceptable environmental, economic, social, or health impacts, or causing a serious adverse impact to an aquifer, considering the area and temporal extent of all such impacts.

- **Ground Water Stress Area** shall mean an area in which sustainability of an aquifer is being less than optimally maintained under current usage and normal environmental conditions, for which such non-coercive measures as use guidelines, voluntary conservation, and ground water monitoring, may be considered. Coercive regulatory controls shall not be imposed in designated Ground Water Stress Areas.

- **Ground Water Emergency** shall mean an unanticipated occurrence as a result of a natural force or a man-made act that causes a ground water source to become immediately unavailable for beneficial use for the foreseeable future.

The above definitions, and their applications are fully described in Volume II, Chapter 10 and in Volume III, Appendix XIV.

Chapter 7 – Water Management Strategies

Chapter 7 presents descriptions of 25 *efficiency strategies* designed to result in the more efficient use of water. Efficiency strategies are divided into *efficiency measures* and *efficiency incentives*. *Efficiency measures* are specific tools, devices, and practices that result in the more efficient use of water. *Efficiency incentives* are actions or policies that promote conservation and motivate the adoption of efficiency measures. The 25 water efficiency strategies are divided into 19 efficiency measures and 6 efficiency strategies.

The 19 *efficiency measures* are divided into 3 groups:

- New and/or alternative sources of water
  - Interbasin transfers
  - Utilize surface water
  - Multipurpose reservoirs
  - Desalination
  - Aquifer storage and recovery systems
  - Drill new wells
  - Rainwater collection systems for domestic use and irrigation of yards
- Water conservation technologies
  - Reuse treated wastewater
  - Recycling of water by industry
  - Residential use of graywater
  - Reduce irrigation water use through improved water management
  - Retrofit residences and offices with low-flow plumbing fixtures
- Management initiatives and regulation
  - Regional water management districts
  - Interstate ground water management agreements
  - Require permits for the use of ground water
  - Transferable water rights
  - Prohibit hazardous waste sites in recharge areas
  - Limit impervious land cover in recharge areas
  - Water-saving landscape/irrigation ordinances

The 6 efficiency incentives are divided into 2 groups:

- Information programs
  - Public education programs to promote conservation
  - Provide adequate technical, educational, and research assistance to agricultural users
  - Drought Management and Emergency Use & Contingency Plans
- Economic incentives
  - Tax incentives to encourage conservation and/or the use of alternative sources of water

- Charge fees to users of large volumes of ground water
- Develop pricing systems to manage public water demand (demand-management pricing)

Chapter 8 – Evaluation of Water Management Strategies

Chapter 8 describes the results of a survey methodology known as Preference-Feasibility Analysis (P-FA), which is used to identify efficiency measures and efficiency incentives to promote water conservation. The P-FA is designed to measure the degree to which stakeholders prefer a specific management strategy relative to others, and the extent to which the respondents assess the feasibility of implementing the strategy, based on an understanding of key technical, institutional, social, and economic facts that affect implementation.

The Project Consultants distributed a questionnaire listing the 25 efficiency strategies described in Chapter 7 to more than 400 potential respondents representing Agricultural, Industrial, Public Supply, and Other stakeholder groups. The recipients of the questionnaire were instructed to rank each strategy on a scale of 1 (low) to 5 (high) with respect to both preference and feasibility. Two hundred twenty-eight respondents returned questionnaires filled out as instructed.

The results of the Preference-Feasibility Analysis indicate support for an approach to water planning and management based primarily on public education and conservation. Tax incentives have widespread support, but the different stakeholder groups are split on the use of other "economic" incentives such as user fees and demand-management pricing (or conservation pricing). User fees and demand management pricing have low preference and feasibility scores from Agricultural and Industrial stakeholders but moderate scores from the Public Supply and Other stakeholder groups. Other options receiving a broad base of support in Louisiana are drought planning, utilization of surface water, and multipurpose reservoirs. Regional water management districts receive moderate levels of support from Agricultural, Public Supply, and Other stakeholders, and low preference and moderate feasibility rankings from the Industrial sector. The stakeholders are also split on the matter of requiring permits for water wells. The option ranks low with respect to preference and feasibility with Agricultural and Industrial water users, and moderate to high with the Other and Public Supply sectors, respectively.

All stakeholders give low preference and feasibility scores to the development of a system of transferable water rights in Louisiana. Other options receiving low or low-to-moderate scores are recommendations for alternative sources of water (such as retrofitting, graywater, rainwater collection systems, interbasin transfers, and desalination).

Chapter 9 – Water Conservation, Incentives, and Public Education Programs

Based on the Preference-Feasibility Analysis, the Project Consultants recommend that future legislation regarding the management of Louisiana's ground water and surface water resources emphasize:

- water conservation,
- incentives to conserve water,
- public education, and
- regional planning and management.

Accordingly, Chapter 9 presents guidelines for programs that emphasize conservation, incentives, and public education. The justification for and the detailed description of an agency, which should be charged with regional planning and management, are found in Chapter 11.

Conservation planning in Louisiana planning will be most effective if it is a cooperative effort by state and federal agencies, city and parish governments, and other organizations. Conservation planners should recommend realistic conservation goals for Louisiana and should work with local officials to frame plans designed to meet their respective needs in a cost-effective manner. A 10-step approach to conservation planning based on recommendations by the American Water Works Association is presented in Chapter 9. The 10-step approach establishes procedures for developing a written plan that explains the policies, facts, figures, expected results, and recommendations leading to the implementation of a conservation plan.

In Louisiana, state agencies and organizations with the resources needed to assist in the development of water conservation plans are:

- Louisiana Cooperative Extension Service
- Department of Agriculture and Forestry
- Louisiana Geological Survey
- Louisiana Farm Bureau Federation
- Louisiana Municipal Association
- League of Women Voters

Tax incentives were among the highest-ranking strategies among all stakeholder groups, both with respect to preference and feasibility. As such, this approach to water management should be considered in any future legislation concerned with water management. Tax incentives should target users of large volumes of water in areas where ground water resources are under stress. Any program based on the use of tax incentives, however, must be structured to ensure that participants will be able recover either a large percentage of their investments (or their entire investments) in water-saving technologies and practices within a reasonable period of time.

A **public education** program designed to promote water conservation should provide a targeted audience with information that will cultivate an ingrained ethic regarding the economic and environmental benefits of conservation. The goal should be to affect the behavior of water users permanently, rather than to achieve short-term reductions in the use of water.

Public education programs should be developed through the cooperative efforts of experts in the fields of water resources, economics, law, public health, engineering, agriculture, ecology, public policy, and public relations. The programs are coordinated most effectively by state agencies, which have the resources and the expertise needed to reach diverse groups of stakeholders. The Louisiana Cooperative Extension Service is the state agency best equipped to coordinate a public education program.

A public education program designed for Louisiana should present information in non-technical terms on the aquifers and surface water resources of the state. The information should include graphs of water use patterns over time and by user group, along with explanations of the problems and potential problems caused by over-development and contamination. The program should emphasize the value of ground water and surface water to Louisiana's economy and to the economies of other states, along with the economic and environmental benefits of water conservation and the economic and environmental problems caused by shortages and contamination. Louisianans will be more receptive to water conservation if a public education program provides the information needed to understand the economic benefits of conservation to an individual and to the state as a whole. The program should explain a number of conservation measures available to user groups, along with information needed to weigh the benefits against the costs of implementing them.

Chapter 10 – Legal and Inter-Jurisdictional Issues

Chapter 10 presents the constitutional basis for the Project Consultants' recommendation that the "correlative rights" doctrine be applied to determine the access to and use of ground water in areas where aquifers are determined to be either critical or under sufficient stress to warrant concern about sustainability. The Louisiana Civil Code gives a property owner absolute ownership of all things above and below the surface of his property. Case law, however, has tempered that right with respect to the use of ground water by the "rule of capture," holding that the owner has absolute ownership of ground water only once the water is produced and used for one or more beneficial purposes. Otherwise, the owner only has the right to develop ground water underlying his property by drilling wells to capture ground water as a publicly held natural resource. The same case law also holds that the right to take ground water under the rule of capture is unrestricted and unlimited, regardless if the water is drained from beneath a neighbor's property, subject only to liability for waste, pollution, or intentional damage to the resource. This case law also indicates that a party must be actively exercising a water right before the court will recognize his claim for interference with that exercise by another.

More recent decisions have held that the protection of ground water as a public resource is a constitutional mandate on all state agencies under the "Public Trust" doctrine imposed by the Louisiana Constitution. Also, "subterranean water" is delineated as a mineral and made subject to a correlative rights doctrine under the statutory provisions of the Louisiana Mineral Code, arguably supplanting the rule of capture in the context of ground water use. Act 446 is interposed within these legal authorities to modify the rule of capture to limit ground water use and consumption as a public resource in "critical ground water areas" in the state to fairly allocate rights to ground water among all stakeholders who depend on the resource. More specifically, Act 446 modifies the rule by incorporating elements of the reasonable use, prior appropriation, and correlative rights doctrines that govern ground water rights in other states.

As these doctrines have been held to be a constitutional exercise of a state's police power where they are utilized, there is arguably no constitutional impediment for the Legislature to utilize these same doctrines to reasonably regulate ground water use as a public resource for the common good. With the enactment of a successor statute to Act 446 in the 2003 Legislative Session, as contemplated in the Act, it is advisable that more specific statutory language be used to clearly set out the scope of the Commission's authority to utilize various management controls in CGWAs and to consider historic use as part of the CGWA process, particularly on the issue of correlative rights.

The regulation of ground water also has a number of inter-jurisdictional implications from state-local, state-state, and state-federal perspectives. There are many local governing bodies in Louisiana, such as parish water districts, which to some degree dictate use of ground water within a parish. The powers of these bodies are likely subordinate to those of the Commission under current Act 446. As to interstate concerns, aquifers are typically "trans-boundary" between and among states, such as the Sparta Aquifer, which is situated in southern Arkansas and northern Louisiana. Effective, long-term management of such trans-boundary ground water resources may require the formation of interstate compacts among the affected states as allowed by Congress, and consistent with applicable federal laws. The same compact structure now in place under the Sabine and Red River Compacts may restrict the use of surface water as an alternative source to ground water contemplated under Act 446.

Chapter 11 – Comprehensive Water Management in Louisiana

Chapter 11 presents the Project Consultants' recommendation for an agency that should be charged with the management of ground water resources in Louisiana. In parts of Louisiana, ground water is being used at a faster rate than it can be naturally replenished. As a result, current trends in ground water quality and use point to the need for a more coordinated ground water protection effort by the state. To date, most state and federal legislation and programs have been aimed, not at conservation, but at prevention of problems or remediation of existing or future ground water contamination. Relatively little

funding has been set aside for regulation or monitoring of ground water withdrawals or for ground water conservation programs.

Proposed Office of Water Resources and Louisiana Water Commission

The goals of the agency that ultimately administers the Statewide Comprehensive Water Management Plan (herein after referred to as the Plan) should be six fold:

- Recommend statewide policy and management objectives
- Recommend standards for data collection and monitoring activities
- Provide Critical Ground Water Area determinations and recommendations
- Set priorities
- Promote and enhance interagency cooperation
- Provide water education and conservation programs

The Project Consultants recommend that an **Office of Water Resources (OWR)** be established within DNR (Figure 11-1). The OWR should report to and act as the staff for a newly created **Louisiana Water Commission (LWC)**. The LWC should be comprised of nine permanent members. The Commissioner of the OWR should act as the chairman of the LWC. A quorum of six members would be required for decision, with the governor rendering the controlling decision in the event of a tie vote. The eight other members of the Commission should be representatives of the following:

- Office of the Governor
- Dept. of Agriculture & Forestry
- Dept. of Culture, Recreation & Tourism
- Dept. of Economic Development
- Dept. of Environmental Quality
- Dept. of Health & Hospitals
- Dept. of Transportation and Development
- Dept. of Wildlife & Fisheries

Adequate presentation of regional issues to the LWC will be afforded by the OWR staff and through representatives of the regional districts, which are also proposed in Chapter 11. The Louisiana Geological Survey should provide technical assistance and act in an advisory capacity to both the LWC and the OWR.

The proposed management structure described in Chapter 11 requires the transfer of all ground water related functions and staff of the Department of Transportation and Development (DOTD) to DNR. According to job descriptions, 13 existing positions at DOTD were determined to be necessary at OWR along with the 3 existing positions in DNR. As the OWR matures and its workload increases, it is projected that the OWR will require 4 additional staff members. This additional staff includes 3 technicians and a permit agent.

It is within DNR's statutory jurisdiction and its mission to preserve and enhance water, minerals, and all other natural resources, and to ensure that the state realizes appropriate economic benefit from its assets. Ground water is classified as a mineral for purposes of

the Louisiana Mineral Code, and the extraction of minerals is regulated by DNR. Additionally, the framework for regulation of water already exists within DNR's Office of Conservation, which has proven experience with regulating minerals under a similar correlative rights regime. The same general framework used to regulate oil and gas can serve as a guide for the creation of the OWR for the implementation of the Plan.

The OWR should generate policy and management objectives both statewide and regionally and recommend these policies and objectives to the LWC for adoption. The OWR should also be responsible for the uniform administration of water statutes and policy statewide.

One of the prime functions of the OWR should be to conduct hearings and to make recommendations on applications for the designation of CGWAs. A staff geologist or engineer assigned to a particular region should process applications for CGWA status, and present the background and application for CGWA status to the LWC. The Commissioners will conduct hearings on CGWA application, and then render their decision based on the technical merits of the applications, and the recommendations of OWR staff members.

Proposed Regional Ground Water Districts

Regional Water Resource Districts (Districts) are proposed to aid the OWR in the management and development of water resources in different geographic regions of the state (Section 11.8.2.4 and Figure 11-1). The Districts should be legislatively authorized boards with appointed members representing a cross-section of the stakeholders within that region. Subject to the OWR's approval, the Districts should be given taxing and/or fee levying authority, thereby allowing them to be self-funded. The Districts should be responsible for data collection and reporting and for the maintenance of data records. They should also be responsible for monitoring, compliance, and enforcement activities, subject to the OWR's overview. One of the main functions of the Districts should be to collect and compile data to support an application requesting CGWA status and to submit that application to the OWR through the state's regional staff. The Districts should be given water management and planning responsibility for their respective regions as long as their actions do not conflict with the state's water management policy and objectives. Allowing the Districts a certain degree of autonomy would permit the OWR to account for the diverse economic and hydrologic differences of the state. Each of the Districts should be able to address agriculture, industrial, and municipal interests within their jurisdictions as they relate to local circumstances and hydrologic conditions.

Permits

The water well construction process in the state should utilize a permit system to allow persons, companies, and corporations to utilize ground waters of the state. The use of a permit process instead of a registration process would allow better control over the installation of water wells and ensure the collection of data needed to monitor ground water conditions. Permit conditions (i.e. pumping capacity, data collection, final well closure, etc.) may be attached to and become a part of the permit to drill. Inherent to the permitting

process should be the ability to allow or deny permission to drill a well, along with enforcement powers in case regulations or conditions are not followed.

Well permitting should not be aimed at imposing coercive requirements or unreasonable time constraints on water well drilling, but rather to function primarily as a system to collect the necessary information for effective statewide management and planning for the use of water resources. Additionally, the information could be used to direct conservation and educational materials related to water use to the state's water users.

The permit system should be divided into three categories of permits: exception, general, and individual. Details on the specific permit types are found in Section 11.10.2 of the report. All water wells drilled after the effective date of the legislation would be required to obtain a permit from the OWR. Existing water wells would be grandfathered into the system.

The ultimate goal of permitting is to optimize management of and planning for effective use of the state's water resources and data collection without burdensome regulation or unreasonable time constraints on water users. The system described in Chapter 11 is designed to function administratively in a time-sensitive fashion (i.e., 15 days or less for most permits), with limited hearings (only where issues cannot be resolved prior to hearing and those issues are legitimately in dispute). In a majority of the applications, obtaining a permit should be no more time consuming or difficult than currently is required for registering a water well. All Permits by Exception and uncontested General Permits will be administratively granted by the OWR. In these cases, no hearings are required and no other delays are anticipated.

Chapter 12 – Emergency Use and Contingency Plan

Chapter 12 presents the details of a drought contingency plan [*Louisiana Drought Contingency Plan* (LDCP)] for Louisiana. The proposed LDCP is based on observations and recommendations by the U.S. Army Corps of Engineers and the American Water Works Association, as well as the Project Consultants' familiarity with the drought management programs of other states, specifically the *Oklahoma Drought Contingency Plan* (ODCP). The Project Consultants evaluated approaches to drought planning adopted by other states, but concluded that the approach described in the ODCP best meets the needs of Louisiana.

The Project Consultants recommend that the Governor authorize the establishment of the Louisiana Drought Management Team (LDMT), which would be comprised of a Drought Coordinator and three committees - the Water Availability and Outlook Committee (WAOC), the Impact Assessment and Response Committee (IARC), and the Interagency Coordinating Committee (ICC). The Drought Coordinator should be the Director of the Office of Emergency Preparedness. Through information and recommendations provided by the WAOC, the IARC, and the ICC, the Drought Coordinator should make the decision

to activate a specified drought state in one or more of the nine Palmer Drought Severity Index divisions of Louisiana (Figure 12-1).

The WAOC should be responsible for monitoring water availability and moisture and for providing estimates of near-future water supply for agricultural, municipal, and industrial users of water. The WAOC should be established as a permanent working group responsible for the continual development of a monitoring system to phase in and out the levels of response to drought conditions and public notification of drought conditions.

The IARC should be activated by the Governor upon the recommendation of the Drought Coordinator and members of the WAOC during the Warning phase of drought. The primary duty of the IARC should be to monitor and evaluate the current and potential impacts of impending or ongoing drought on the economy, the environment, and the natural resources of Louisiana.

The ICC should be activated by a "Drought Emergency Proclamation" issued by the Governor, upon the recommendation of the IARC at the onset of the Emergency phase of drought. The ICC should consist of the senior managers of state agencies with the capability of responding to drought. The primary responsibility of the ICC should be to determine which drought-related needs of the state are best met by the re-allocation of existing resources.

The procedures for initiating a drought plan are based on the use of indicators and indices to identify the onset of one stage or another of drought. Chapter 12 includes descriptions of recommended drought indicators and indices, as well as a table that outlines the steps to be taken by the committees of the LDMT during all phases of drought.

Chapter 13 – Mitigation for the Loss of Ground Water

The correlative rights doctrine establishes a basis for mitigating the loss or diminution of a ground water resource. As a renewable resource, ground water is not "lost" unless irreparable harm is done to an aquifer by saltwater encroachment, severe disruption of recharge by impervious cover in the recharge area, irreversible subsidence of the aquifer, or other severe and largely irreversible impacts to the aquifer's physical structure. The correlative rights doctrine implicitly regulates water rights between and among users by requiring a "just and equitable share" of withdrawal by each user of equivalent water volumes per surface acre. If total use causes a threat to the sustainability of an aquifer, then a stepped-up program of non-coercive conservation and education methods can be promoted in designating the area a "ground water stress area" in an effort to reverse the adverse effects on the aquifer and to return it to optimal sustainability as practical. If non-coercive methods prove ineffective, then a critical area designation with an array of regulatory controls can be considered to check the onset of severe impacts to the aquifer. If the impacts are related to abnormal environmental conditions such as drought rather than excessive withdrawal, then the area alternatively might also be considered for designation

as a "ground water emergency area." Controls such as pumping limits, well spacing and density requirements, and alternative water source use then may be appropriate.

In effect, the combination of correlative rights and critical area limits acts as a ratchet against increasing threats to sustainability. The inherent problem with the rule of capture doctrine is that it is legally reactive, inquiring after the fact whether a user's past conduct is legally actionable because he may have caused waste, pollution of, or intentional damage to the resource. In contrast, the application of correlative rights and appropriate stress area and critical area designations is a proactive method to mitigate what otherwise would be unrestricted use without regard for adverse impacts to the resource.