

ARKANSAS STATE WATER PLAN

BOEUF-TENSAS BASIN



Arkansas Soil and Water Conservation Commission

August, 1984

STATE OF ARKANSAS

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CHAPTER I
GENERAL DESCRIPTION

LOCATION AND SIZE

The Boeuf-Tensas Basin is a highly developed agricultural region located in the southeast corner of the State. The area encompasses about 1,350 square miles or about 864,000 acres [numbers in angle brackets refer to the reference numbers cited in the bibliography] and has an overall length of about 80 miles in a generally north-south direction and averages about 20 miles in width. <1> Major crops grown on the productive agricultural land are soybeans, cotton, and rice. There are portions of six counties in this basin. These counties and their total area in the basin are as follows: Ashley - 75,391 acres (12.63 percent); Chicot - 376,231 acres (85.94 percent); Desha - 295,046 acres (57.27 percent); Drew - 10,746 acres (2.01 percent); Jefferson - 8,128 acres (1.40 percent); and Lincoln - 98,138 acres (26.90 percent). <1>

This area lies wholly in the alluvial floodplain of the Mississippi River. <2> It is protected from floods of the Arkansas and Mississippi Rivers by a continuous levee beginning on the south bank of the Arkansas River near Pine Bluff and extending down the west bank of the Mississippi River. This levee forms its northern and eastern boundaries. On the south it is bordered by the Arkansas-Louisiana state line and on the west by the natural levee of Bayou Bartholomew, a tributary of the Ouachita River.

Interior drainage within the basin consists of an intricate interconnecting system of drainage ditches and meandering bayous which, under varying conditions, produce an interchange of flow between the waterways. Excess water is carried through this complex system to the Boeuf and Bayou Macon Rivers, which, in Louisiana, outlets into the Ouachita River. There are about twenty-one streams located in the basin. <3> The major ones include Boeuf River, Bayou Macon, Cypress Creek, Big Bayou, LaFourche Bayou, Oakwood Bayou, and their tributaries. In general, the streams are separated from the backswamps by natural levees which are higher in elevation than the adjacent land.

TOPOGRAPHY

The relief of the area ranges from level to undulating, with most of the area being level to nearly level. Elevations range from about 170 feet mean sea level in the northern portions to about 115 feet MSL on the southern boundary. <4> The major surface relief in the area occurs in Chicot County along Macon Ridge. This ridge rises from 10 to 40 feet above the adjacent areas and traverses the central portion of the basin between Eudora, Arkansas and Sicily Island, Louisiana.

CLIMATE

Climatic data was obtained from a 30-year weather bureau record at Dumas, a town located in the northwest portion of the basin. <10> The climate is humid with warm summers. Mean temperatures range from 43.7 degrees Fahrenheit in January to 82.3 degrees Fahrenheit in July. Temperature extremes vary from 112 degrees Fahrenheit to minus 6 degrees Fahrenheit. <10> The average growing season is 228 days from March 22 to November 5, although killing frost has occurred as late as April 16 and as early as October 10. See Figure 1-1 for the average monthly rainfall and temperature.

Average Rainfall. The average annual rainfall in the area is 50.44 inches. <10> <11> The maximum precipitation generally occurs from December through May and the minimum from June through November. See Figure 1-1. The type of weather stations and their locations are shown in Figure 1-2. The average monthly rainfall in inches is as follows:

<u>Month</u>	<u>Inches</u>	<u>Month (cont.)</u>	<u>Inches</u>
January	4.46	July	4.32
February	4.72	August	3.02
March	5.87	September	3.26
April	5.31	October	2.73
May	5.18	November	3.90
June	3.13	December	4.54

AVERAGE RAINFALL and TEMPERATURE
DUMAS GAGE

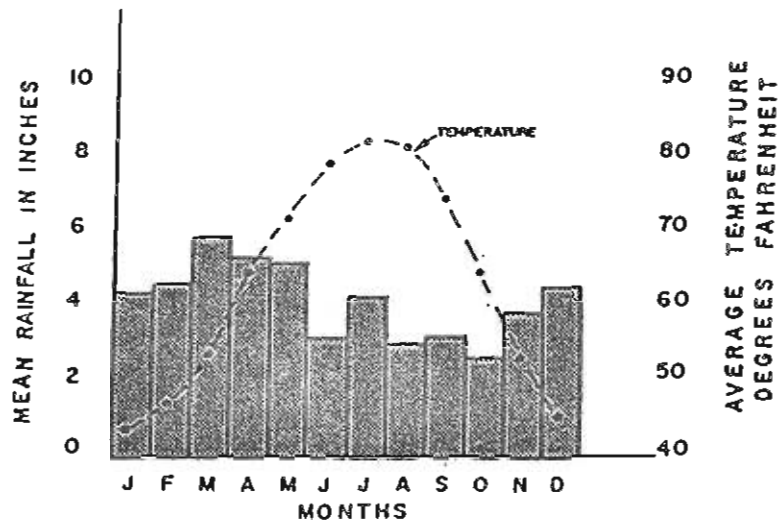
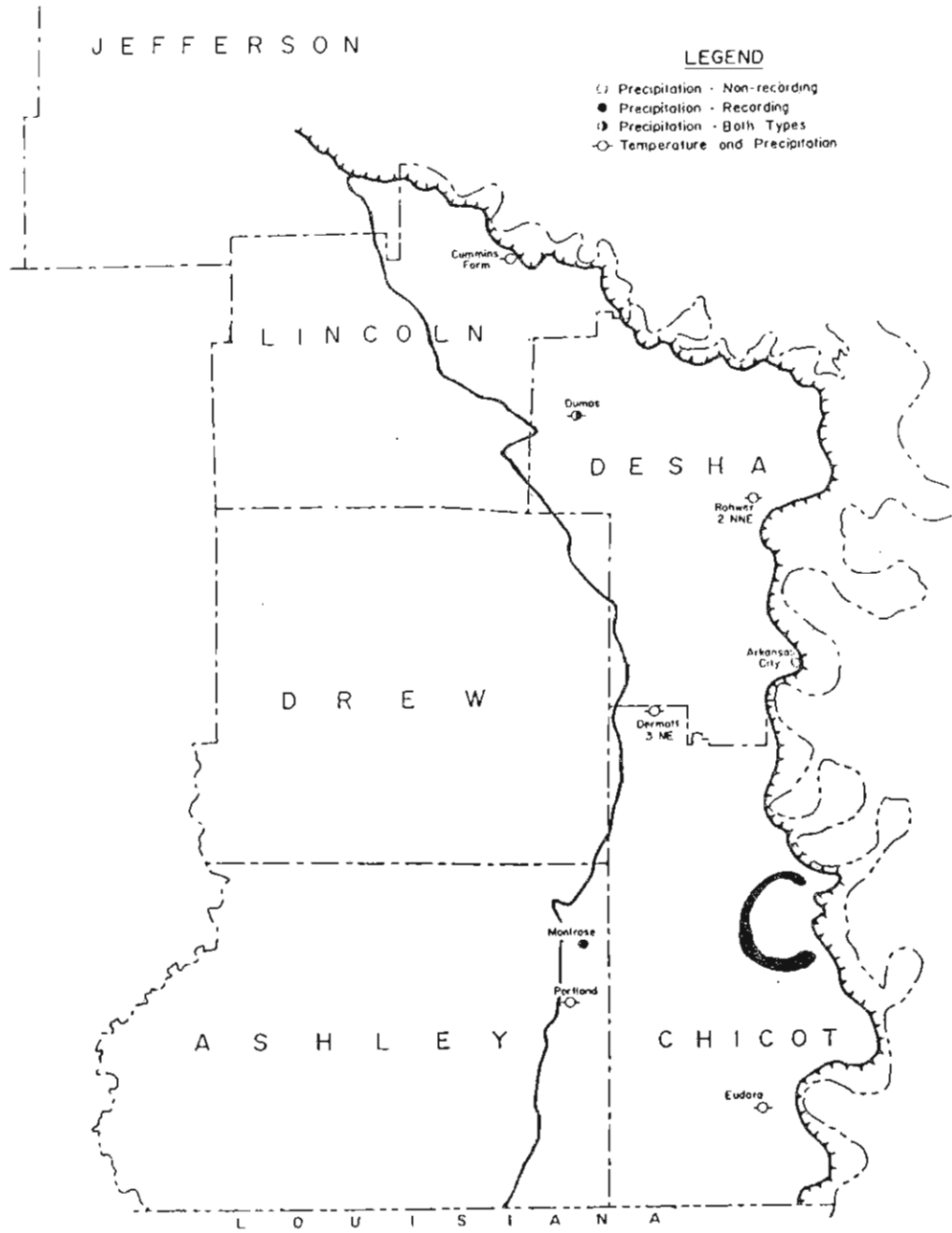


FIGURE 1-1

Average Runoff. Runoff is water that drains from the land by means of surface streams. These streams are supplied by surface runoff and from groundwater sources. Basically, runoff is the water remaining from precipitation after losses to interception, evapotranspiration, infiltration, percolation, depression and channel storage. Average discharge data for this basin is obtained from two stream gages located near the Arkansas-Louisiana state line. <12> One of these gages is located on the Boeuf River and the other is on Bayou Macon. The drainage area of these two gages represents about 95 percent of the drainage area of the basin. Published information from an eleven year period shows that the total average discharge (runoff) of these two gages is about 1,058,000 acre-feet per year. <12> (See Table 3-3).

WEATHER STATION LOCATIONS



Source: National Oceanic and Atmospheric Administration, Climatological Data, Arkansas.

FIGURE 1-2

In this basin runoff data is affected by the interconnecting system of bayous and drainage ditches which produces an interchange of flow under varying conditions. Also, during extreme floods, considerable flow bypasses some of the stream gage stations, resulting in poor to fair records.

POPULATION AND ECONOMY

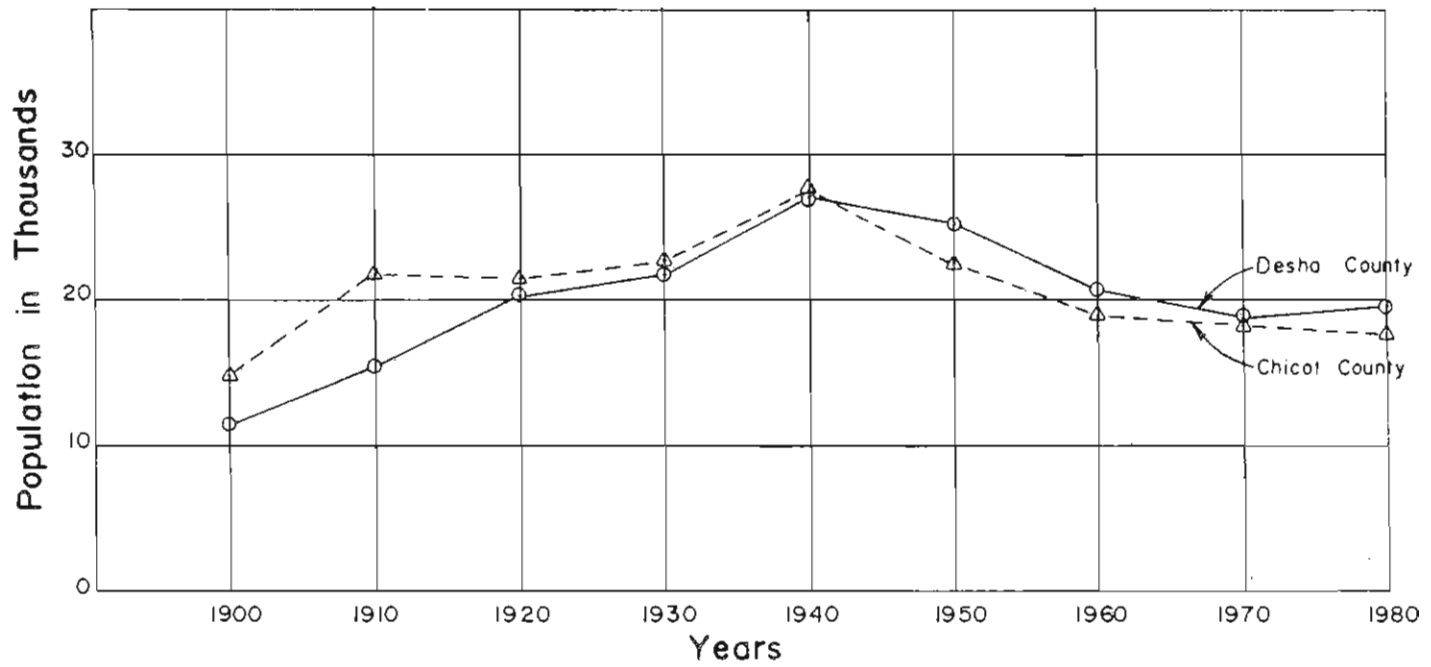
Only two counties (Chicot and Desha) were selected to make up the study area for portions of this report even though there are parts of six counties located within the boundary of the basin. The remaining four counties were omitted from the study area because of the relatively small area which they contribute to the basin and the fact that the 1980 census of population does not break population data down into hydrologic boundaries. Therefore, any trends, projections, or conclusions that would be made, based on the data for the entire six county region, would be erroneous and misleading.

The total 1980 population of these two counties is 37,553, of which Chicot County has 17,793 and Desha County has 19,760. These figures represent an increase from the 1970 census of about 1,000 people for Desha County and a decrease of about 370 people for Chicot County. <5> Figure 1-3 indicates the population for the study area has decreased since 1940. <6>

The economy of the area is dependent upon agriculture and agri-related industries. The area has the lowest per capita personal income of any of the study areas in the State. The 1979 per capita personal income for Desha County was \$5,995 and \$5,102 for Chicot County, as compared with \$6,756 for the State and \$8,637 nationally. (See Figure 1-4) <7> Other income and poverty characteristics and unemployment data are shown in Table 1-1 and Figure 1-5, respectively. <8> <9>

POPULATION TRENDS IN THE STUDY AREA

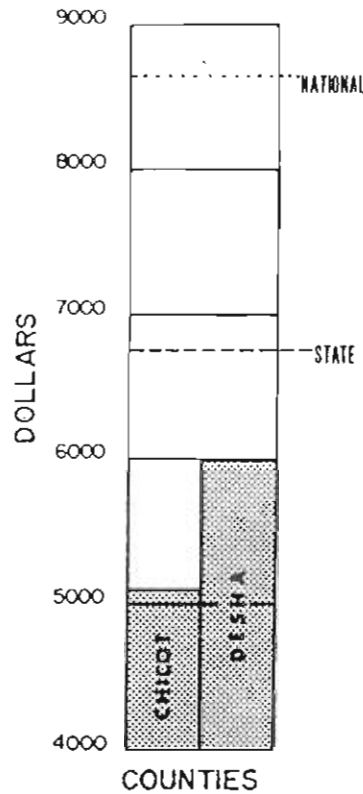
(by years)



Source: Industrial Research and Extension Service

FIGURE 1-3

PER CAPITA PERSONAL INCOME¹
in the
STUDY AREA



¹ STATE AND COUNTY ECONOMIC DATA FOR ARKANSAS, PUBLICATION L-2, JUNE 1981

FIGURE 1-4

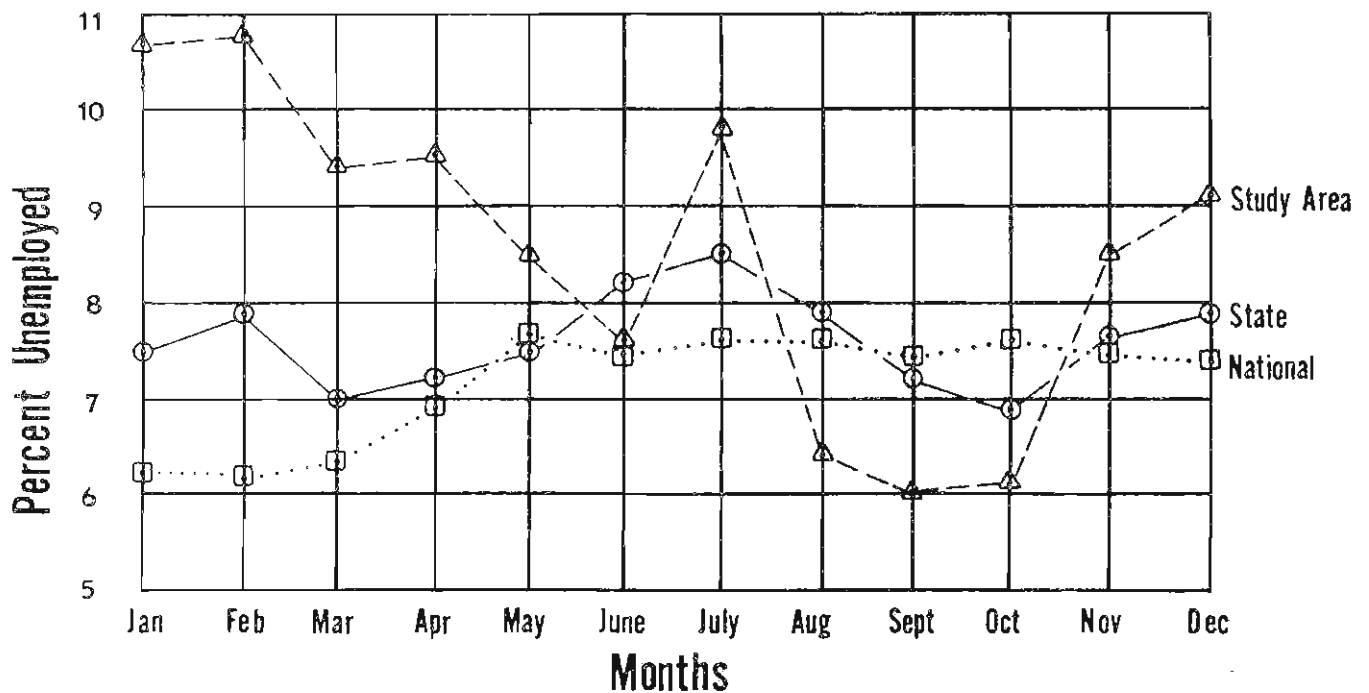
The graph plotting the percent of unemployment versus months (Figure 1-5) indicates that unemployment, except for a sharp peak in July of about 9.8 percent, is much higher during the winter season than at other seasons of the year. <9> This is understandable in a basically agricultural region because the planting, cultivating and harvesting seasons demand for labor is higher than during the winter season. The reason for the high unemployment rate in July is thought to be because of students entering the job market while school is not in session.

TABLE 1-1
 INCOME AND POVERTY CHARACTERISTICS ^{1/}
 IN THE STUDY AREA

	Above Poverty Level	Below Poverty Level	All Income Levels
Total Number of Persons	19,432	17,219	36,651
Percent of Persons	53.0%	47.0%	100.0%
Total Number of Families	6,044	5,079	11,123
Percent of Families	54.3%	45.7%	100.0%

^{1/} County Profile, Arkansas Dept. of Local Services, January, 1977

**Unemployment Rates ^{1/}
 in the
 Study Area—1980**



^{1/} Arkansas Employment Security Division

FIGURE 1-5

CHAPTER II
LAND RESOURCE INVENTORY

PRESENT LAND USE

Most of the land in this basin is composed of farms and is used for crop production. Of the total 863,680 acres in this basin, cropland accounts for 735,426 acres (85.2 percent), with about 63 percent in soybeans, 26 percent in cotton, 10 percent in rice, and the remaining one percent in a variety of other crops. <1> As can be seen in Figure 2-1 below, of the remaining lands in the basin, grasslands occupy 41,903 acres or 4.9 percent, and forestlands cover 64,068 acres (7.4 percent). Urban and built-up land accounts for 9,842 acres (1.1 percent) and water and other lands account for the remaining 12,441 acres (1.4 percent). <1> See Table 2-1 for the present land use by counties represented in the basin.

The 735,426 acres of cropland represent about 9.4 percent of the total cropland in the State. In 1980 this basin produced about 14 percent of the cotton, 9 percent of the soybeans, and 9 percent of the total rice grown in the State. <1> This, however, has not always been true. Figure 2-2 shows the 40-year trend of major crops harvested in the basin. <13> As can be seen from this figure, soybeans are the only crop which has had a dramatic upswing in the number of acres harvested, while the other crops generally remained the same.

PRESENT LAND USE

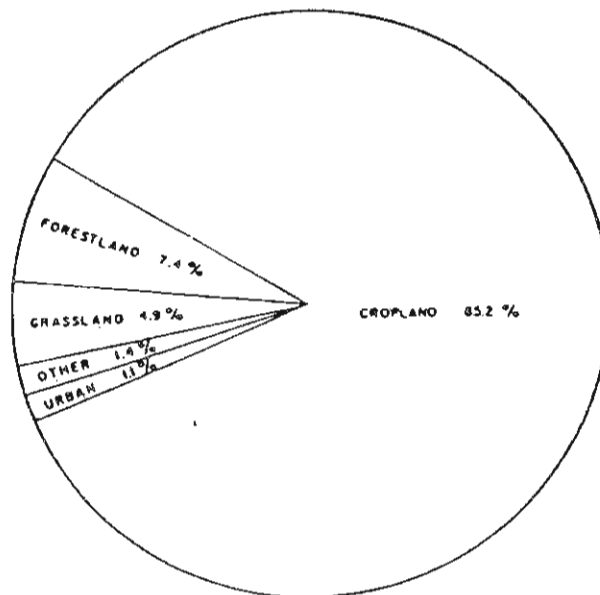


FIGURE 2-1

TABLE 2-1
 PRESENT LAND USE ^{1/}
 (By Counties)

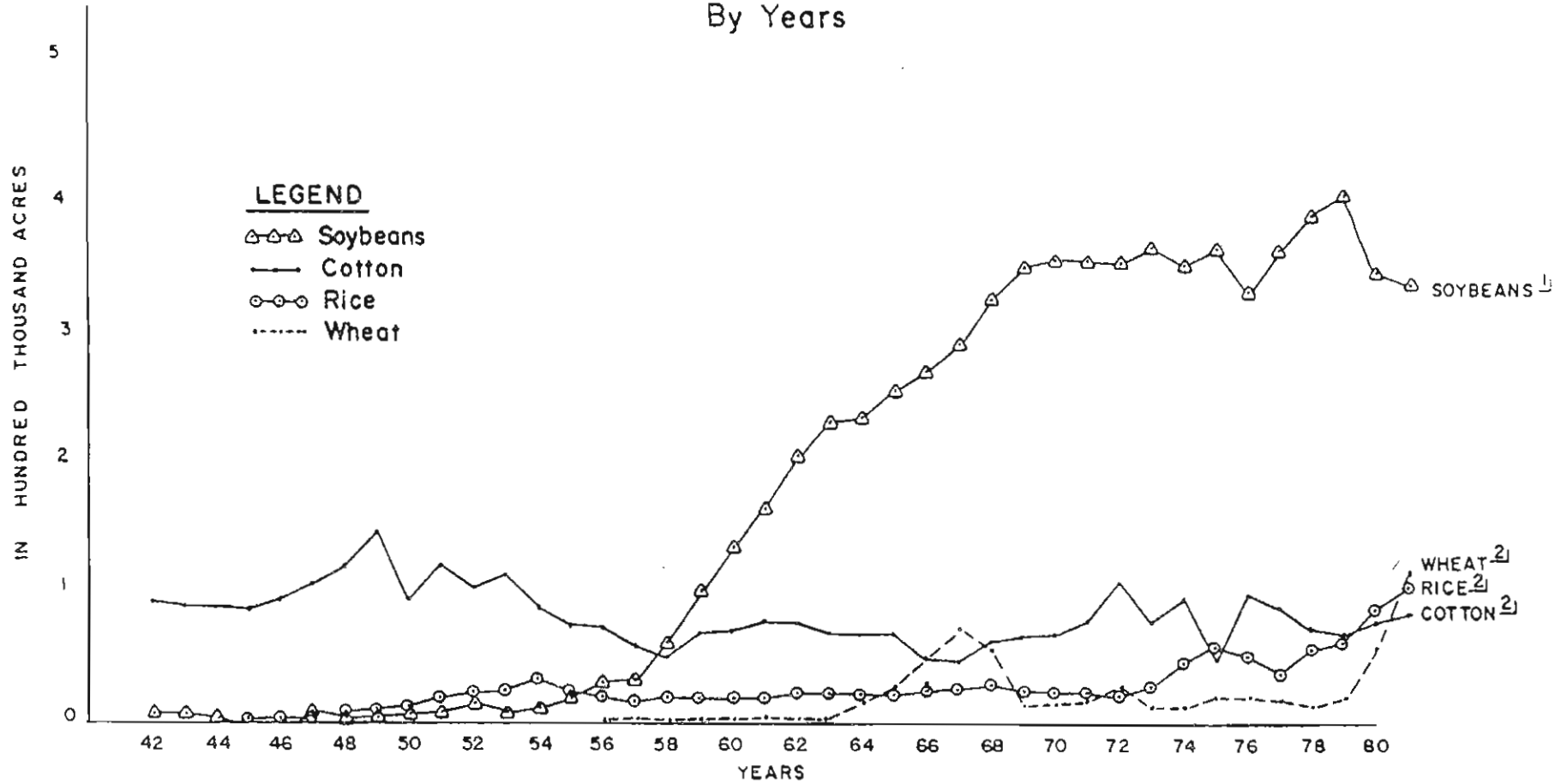
COUNTY	CROPLAND	GRASSLAND	FORESTLAND	URBAN & BUILTUP	OTHER	TOTAL ACRES IN BASIN	TOTAL ACRES IN COUNTY	PERCENT OF COUNTY IN BASIN
ASHLEY	64,141	4,352	6,898	-	-	75,391	597,031	12.6
CHICOT	326,926	18,985	19,998	2,864	7,458	376,231	437,760	85.9
DESHA	248,128	16,085	25,850	-	4,983	295,046	515,200	57.3
DREW	9,571	-	-	1,175	-	10,746	534,899	2.0
JEFFERSON	6,464	-	1,664	-	-	8,128	580,480	1.4
LINCOLN	80,196	2,481	9,658	5,803	-	98,138	364,800	26.9
TOTALS	735,426	41,903	64,068	9,842	12,441	863,680	-	-
PERCENT	85.2	4.9	7.4	1.1	1.4	100.0	-	-

^{1/} U.S.O.A.-S.C.S. River Basins (RIDS), 1977

ACRES OF MAJOR CROPS GROWN IN STUDY AREA ^{3/}

By Years

2-4



1/ Acres Harvested

2/ Acres Planted

3/ U.S. Dept. of Agriculture, Arkansas Crop & Livestock Reporting Service, published yearly

FIGURE 2-2

Forestland. Forestland represents only 7.4 percent or 64,068 acres of the present land use in the basin. Table 2-2 indicates that the forestland is mostly of the Oak-Gum-Cypress type. Almost 90 percent of the forestland is privately owned and is used primarily for commercial purposes. <1>

TABLE 2-2

FORESTLAND BY FOREST TYPE ^{1/}			
(Acres)			
FOREST TYPE	ACRES		PERCENT
Oak - Hickory	27,018		42.2
Oak - Gum - Cypress	37,050		57.8
TOTAL	64,068		100.0%
FORESTLAND BY OWNERSHIP ^{1/}			
(Acres)			
OWNERSHIP	ACRES		PERCENT
Federal	0		-
State	0		-
City	0		-
Forest Industry	7,880		12.3
Misc., Private	56,188		87.7
TOTAL	64,068		100.0%
COMMERCIAL AND NON-COMMERCIAL FORESTLAND ^{1/}			
ITEM	COMMERCIAL	NON-COMMERCIAL	TOTAL
Percent in Basin	87.8%	12.2%	100.0%
Acres	56,268	7,800	64,068 Acres

^{1/} U.S.D.A. - Soil Conservation Service, RIDS-1977.

Wetlands. The study area contains 5,154 acres of forested wetlands. Chicot County has 3,058 acres and Desha has 2,096 acres. <1>

PRIME FARMLAND

Prime farmland is land that is well suited to the production of food and fiber. This land has the quality needed to produce sustained yields of crops economically, if managed according to acceptable farm practices. The Prime Farmland Map, Figure 2-3, indicates that over 75 percent of the land in this basin is prime farmland. <14> A 1979 study conducted by the USDA - SCS showed that 70 acres of prime farmland were lost in a one-year period from 1978 to 1979 in the study area, mostly as a result of urban and built-up areas. (See Table 2-3).

TABLE 2-3
 AGRICULTURAL LAND CONVERSION ^{1/}
 (Acres)

Agriculture Land Use	Urban & Built-up	Other	Total Prime Farmland Lost
Cropland	16	10	26
Woodland	0	0	0
Pastureland	44	0	44
Total	60	10	70




^{1/} Total Agricultural Land Lost in Study Area from November, 1978, to November, 1979, U.S.D.A.-S.C.S., 1979.

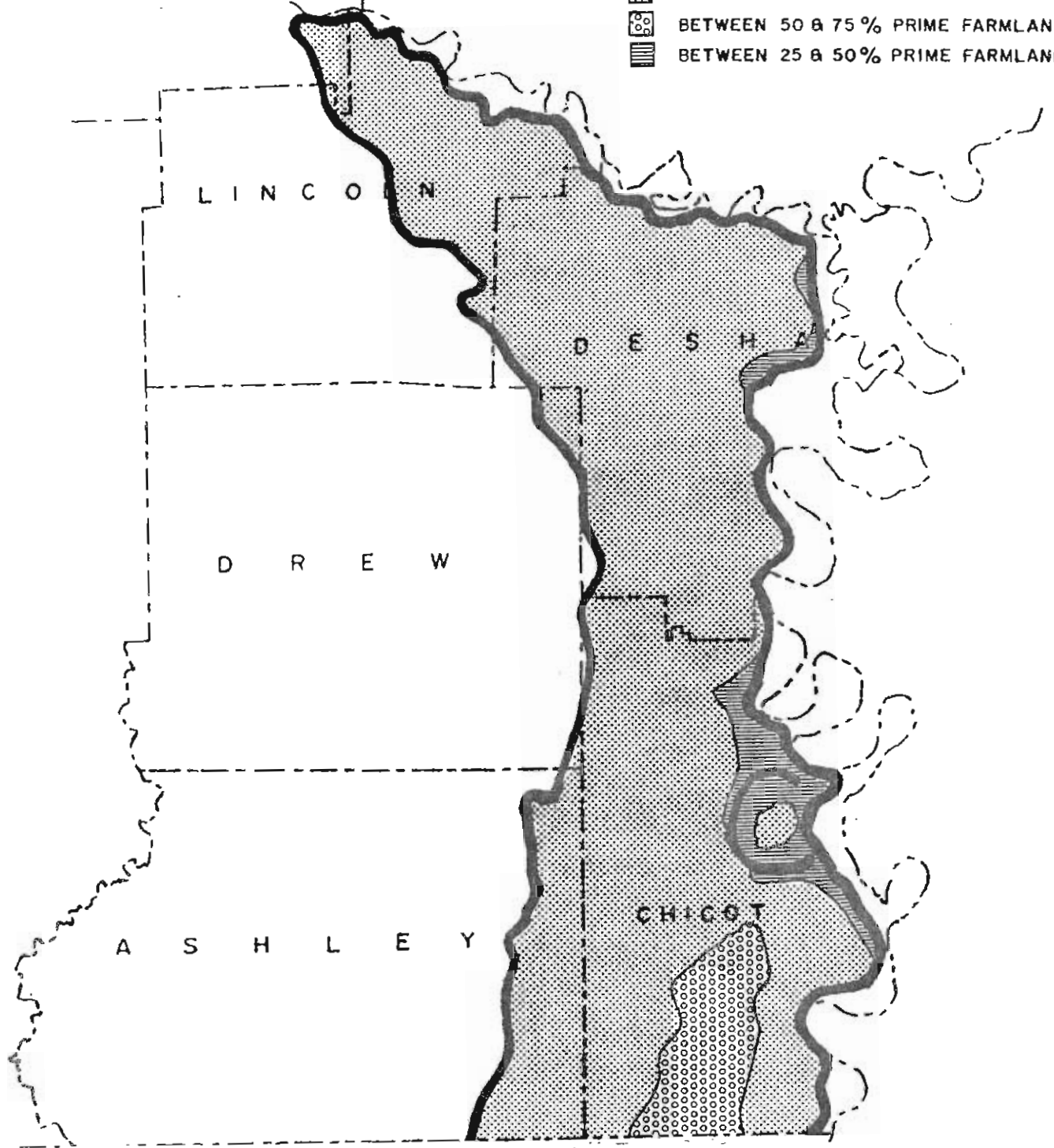
PRIME FARMLAND

(BY PERCENT)

J E F F E R S O N

LEGEND

-  OVER 75 % PRIME FARMLAND
-  BETWEEN 50 & 75 % PRIME FARMLAND
-  BETWEEN 25 & 50 % PRIME FARMLAND



Source: U.S.D.A. - Soil Conservation Service, 1983

FIGURE 2-3

SOIL RESOURCES

Major Land Resource Area

The Southern Mississippi Valley Alluvium is the only major land resource area found in the basin, as shown on Figure 2-4. <2> This area consists of broad alluvial plains. The deep soils are developed from thick Alluvial or Eolian deposits. The soils are deep and rapidly permeable to very slowly permeable. Surface textures are mainly sandy loam, silt loam, or clay. Slopes are level to nearly level and some areas are undulating. This resource area is used extensively for the production of cultivated crops.

Geographic Regions 1/

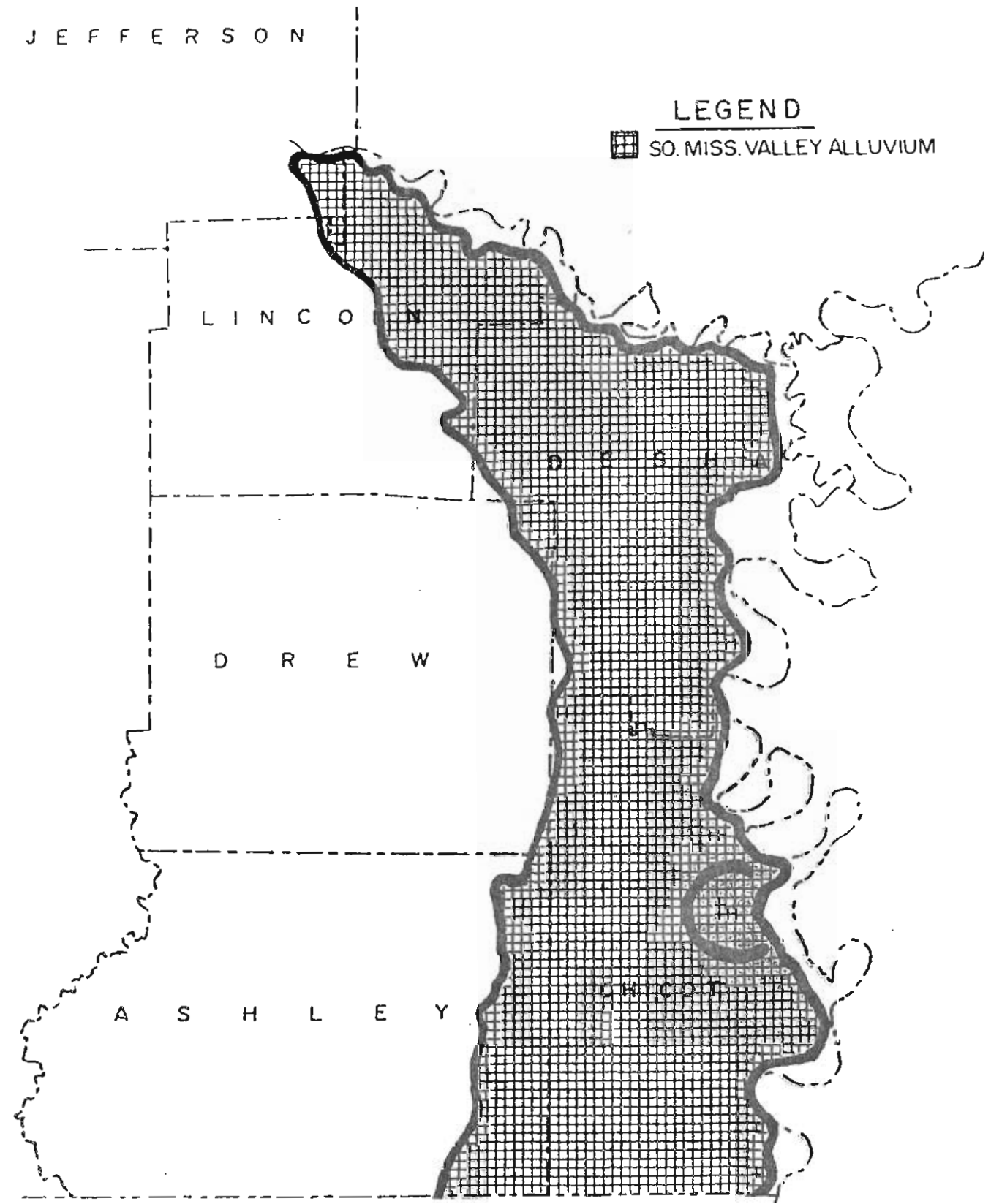
This basin is blessed with productive soils; however, these soils vary widely in terms of parent material, topography, texture, permeability, and use. Soils in the basin can be described by the geographic regions they occupy. (See Table 2-4). These two regions are: Bottomlands and Terraces and Loessial Plains. A description of each follows.

Bottomlands and Terraces. Soils of the Bottomlands and Terraces consist of broad alluvial plains and low terraces. The soils are developed in deep clayey, loamy or sandy alluvial sediments. Slopes typically range from level to gently sloping, while a few escarpments may range to moderately steep. Most of these areas are cleared and used for cropland. Important crops include cotton, grain sorghum, rice, soybeans, and wheat. Some areas remain forested and are important for hardwood timber production and wildlife habitat. A few areas are used for pasture and hayland. These soils make up about 93 percent or 802,400 acres of this basin.

Loessial Plains. Soils of the Loessial Plains consist of broad, dominantly level to nearly level areas in the eastern part of the State. These soils are developed in loess deposits underlain by loamy and clayey sediments. Thickness of loess deposits range from two, to more than four feet in thickness. Slopes typically range from level to nearly level, while a few areas may range to moderately sloping. These areas are used extensively for cultivated crops with rice and soybeans as major crops. These soils make up the remaining seven percent or 61,400 acres in the basin.

1/ All of the following narratives, maps, descriptions and other information pertaining to soils were contributed by the State Soil Scientist of the U.S.D.A. - Soil Conservation Service.

MAJOR LAND RESOURCE AREAS ^{1/}



^{1/} U.S.D.A. - Soil Conservation Service, Arkansas Statewide Study. Arkansas Resource Base Report, September, 1981.

FIGURE 2-4

General Soil Units

There is a total of 14 major soils which are grouped into five general soils units of the Bottomland and Terraces and four major soils which are grouped into one general soil unit of the Loessial Plains. All of these soil units are shown in Table 2-4 and their locations are shown on Figure 2-5, General Soils Map.

The corresponding numbers for the following General Soils Map and their descriptions are as follows:

24. SHARKEY-ALLIGATOR-TUNICA. Deep, poorly drained, very slowly permeable, level to nearly level, clayey soils on bottomlands.

These soils are on broad flats that were formerly back swamps and slack water areas of the Mississippi River and its tributaries. Sharkey and Alligator soils formed in clayey alluvium. Tunica soils formed in clayey alluvium 20 to 36 inches thick overlying loamy alluvium.

Approximately 40 percent of this unit is Sharkey soils; about 15 percent is Alligator soils; about 10 percent is Tunica soils; and the remaining 35 percent is soils of minor extent.

Sharkey soils typically have a very dark grayish brown silty clay or clay surface layer. The subsoil is dark gray or gray, mottled clay. Alligator soils typically have a dark gray or gray silty clay or clay surface layer. The subsoil is gray, mottled clay. Tunica soils typically have a dark grayish brown silty clay or clay surface layer. The subsoil is dark gray, mottled clay overlying light grayish brown loam.

The minor soils in this unit include Acadia, Bowdre, Commerce, Desha, Dundee, Earle, Forestdale, and Newellton.

The soils in this unit are used mainly for cultivated crops such as rice and soybeans. A few areas which are frequently flooded are used mostly for woodland and wildlife habitat.

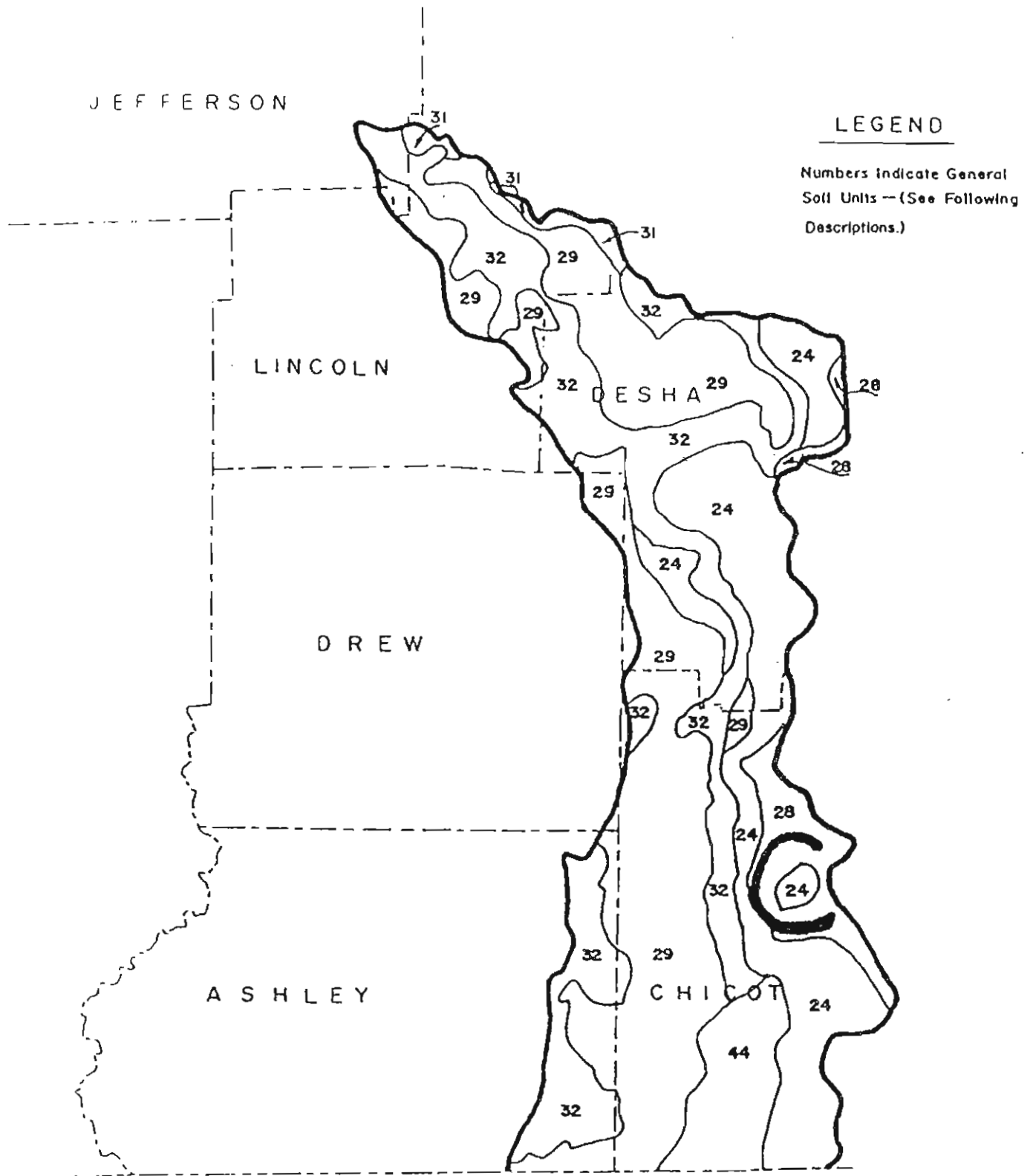
TABLE 2-4

GENERAL SOIL UNITS BY GEOGRAPHIC REGIONS

GEOGRAPHIC REGIONS	GENERAL SOIL UNITS
Bottomlands and Terraces	24 Sharkey - Alligator - Tunica 28 Commerce - Sharkey - Crevasse - Robinsonville 29 Perry - Portland 31 Roxana - Dardanelle - Bruno - Roellen 32 Rilla - Hebert
Loessial Plains	44 Calloway - Henry - Grenada - Calhoun

Source: U.S.D.A., Soil Conservation Service.

GENERAL SOILS MAP



Source: U.S.D.A. - Soil Conservation Service

FIGURE 2-5

28. COMMERCE-SHARKEY-CREVASSE-ROBINSONVILLE. Deep, poorly drained to excessively drained, very slowly permeable to rapidly permeable, level to gently undulating, clayey, loamy and sandy soils on flood plains.

These soils are on flood plains of the Mississippi River. Commerce and Robinsonville soils formed in loamy, stratified alluvium. Sharkey soils formed in clayey alluvium. Crevasse soils formed in sandy alluvium.

Approximately 25 percent of this unit is Commerce soils; about 15 percent is Sharkey soils; about 10 percent is Crevasse soils; about 10 percent is Robinsonville soils; and the remaining 40 percent is soils of minor extent.

The somewhat poorly drained, moderately slowly permeable Commerce soils typically have a dark grayish brown silt loam surface layer. The subsoil is dark grayish brown, mottled or grayish brown, mottled silt loam or silty clay loam. The poorly drained, very slowly permeable Sharkey soils typically have a very dark grayish brown silty clay or clay surface layer. The subsoil is dark gray or gray, mottled clay. The excessively drained, rapidly permeable Crevasse soils typically have a dark grayish brown loamy sand or loamy fine sand surface layer. The underlying material is dark gray brown to yellowish brown loamy fine sand, loamy sand or sand. The well drained, moderately rapidly permeable Robinsonville soils typically have a dark grayish brown very fine sandy loam or fine sandy loam surface layer. The underlying material is typically brown stratified fine sandy loam to loamy very fine sand.

The minor soils in this unit include Convent, Coushatta, Dundee, Mhoon, Morganfield, and Newellton.

The soils in this unit are used mainly for cultivated crops, such as cotton and soybeans in areas protected from flooding, while areas which are subject to frequent flooding are mainly used for pasture and woodland or cultivated crops requiring a short growing season.

29. PERRY-PORTLAND. Deep, poorly drained and somewhat poorly drained, very slowly permeable, level to nearly level, clayey soils on bottomlands.

These soils are on broad flats that were formerly backswamps and slack water areas of the Arkansas River. The soils formed in clayey alluvium.

Approximately 55 percent of this unit is Perry soils, about 20 percent is Portland soils and the remaining 25 percent is soils of minor extent.

The poorly drained Perry soils typically have a dark gray or gray clay or silty clay surface layer. The upper part of the subsoil is gray clay and the lower part is reddish brown clay. The somewhat poorly drained Portland soils typically have a dark grayish brown clay or silty clay surface layer. The subsoil is reddish brown clay.

The minor soils in this unit include Desha, Hebert, Latanier, Moreland, Norwood, Rilla, Roellen, and Wabbaseka.

The soils in this unit are used mainly for cultivated crops, such as rice and soybeans. A few areas which are frequently flooded are used mostly for woodland and wildlife habitat.

31. ROXANA-DARDANELLE-BRUNO-ROELLEN. Deep excessively drained to poorly drained, rapidly permeable to slowly permeable, level to nearly level, loamy, sandy, and clayey soils on flood plains of the Arkansas River.

Roxana, Dardanelle, and Bruno soils are on level to gently undulating natural levees. Roellen soils are on broad flats of flood plains and low terraces. Roxana and Dardanelle soils formed in loamy alluvium, Bruno soils formed in sandy alluvium, and Roellen soils formed in clayey alluvium.

Approximately 35 percent of this unit is Roxana soils; 15 percent is Dardanelle soils; 10 percent is Bruno soils; 10 percent is Roellen soils; and the remaining 30 percent is soils of minor extent.

The well drained, moderately permeable Roxana soils typically have a reddish brown very fine sandy loam surface layer. The underlying material is brown very fine sandy loam, silt loam, or loamy very fine sand. The well drained, moderately permeable Dardanelle soils typically have a very dark grayish brown surface layer. The subsoil is reddish brown silt loam or silty clay loam.

The excessively drained, rapidly permeable Bruno soils typically have a brown sandy loam or loamy sand surface layer. The underlying material is grayish brown or brown loamy sand with thin strata of finer textures. The poorly drained, slowly permeable Roellen soils typically have a very dark gray silty clay or clay surface layer and a dark gray, mottled clay subsoil.

The minor soils in this unit include Caspiana, Crevasse, Gallion, Iberia, Moreland, Morganfield, Norwood, Rilla, and Severn.

The soils in this unit are used mainly for cultivated crops, while a few areas are in pasture or woodland.

32. RILLA-HEBERT. Deep, well drained and somewhat poorly drained, moderately permeable and moderately slowly permeable, level to gently sloping, loamy soils on bottomlands.

These soils are on natural levees along former channels of the Arkansas and Red Rivers. The soils formed in loamy alluvium.

Approximately 40 percent of this unit is Rilla soils, about 30 percent is Hebert soils and the remaining 30 percent is soils of minor extent.

The well drained Rilla soils typically have a brown silt loam surface layer and a reddish brown silty clay loam subsoil. The somewhat poorly drained Hebert soils typically have a dark grayish brown silt loam surface layer and a reddish brown, mottled silty clay loam subsoil.

The minor soils in this unit include Caspiana, Desha, Keo, Latanier, McGehee, Moreland, Norwood, Perry, Portland, and Yorktown.

The soils in this unit are used mainly for cultivated crops such as cotton, soybeans, and winter small grains.

44. CALLOWAY-HENRY-GRENADA-CALHOUN. Deep, moderately well drained to poorly drained, slowly permeable, level to moderately sloping, loamy soils on upland terraces.

These soils are on broad flats and sideslopes of terraces of the Loessial Plains. These soils formed in deposits of loess which is typically more than four feet thick.

Approximately 20 percent of this unit is Calloway soils, 20 percent is Henry soils, 10 percent is Grenada soils, 10 percent is Calhoun soils and the remaining 40 percent is soils of minor extent.

The somewhat poorly drained Calloway soils typically have a dark grayish brown silt loam surface layer and a grayish brown, mottled silt loam subsurface layer. The subsoil is yellowish brown, mottled silt loam underlain by a compact, brittle fragipan. The poorly drained Henry soils typically have a grayish brown silt loam surface layer and a gray, mottled silt loam subsurface layer. The subsoil is gray, mottled silt loam or silty clay loam underlain by a compact, brittle fragipan. The moderately well drained Grenada soils typically have a brown silt loam surface layer and a yellowish brown silt loam or silty clay loam subsoil underlain by a compact, brittle fragipan. The poorly drained Calhoun soils typically have a dark grayish brown silt loam surface layer and a light brownish gray, mottled subsurface layer. The subsoil is typically grayish brown, mottled or light brownish gray, mottled silt loam or silty clay loam.

The minor soils in this unit include Crowley, Foley, Fountain, Hillemann, Loring, Memphis, Tichnor, and Zachary.

The level to nearly level soils in this unit are used mainly for cultivated crops such as rice and soybeans. The gently sloping to moderately sloping soils are used mainly for pasture, soybeans, and winter small grains.

Soil Surveys

The Soil Surveys and interpretations are made cooperatively with the University of Arkansas Agricultural Experiment Station, Agricultural Extension Service, U.S. Forest Service, Arkansas Highway Department, the seventy six Soil and Water Conservation Districts, and other State and Federal agencies.

Types of information listed in these soil surveys are soil properties, predicted crop yields on the various soils, and engineering uses and limitations of the soils found in the counties. Data contained in the engineering section include soil suitability regarding septic tank filter fields, sewage lagoons, dwellings, and other non-farm uses.

Soil surveys for this basin have been completed. The counties and the date of their publication are as follows: Chicot (1967), Desha (1972), Drew (1976), Ashley (1979), Lincoln (1981), and Jefferson (1981).

CHAPTER III
WATER RESOURCE INVENTORY

WATER RESOURCE INVENTORY

This basin has an estimated 1100 miles of channels; 33 impoundments or natural lakes which exceed 5 acres; 110 impoundments smaller than 5 acres; and groundwater found in three major aquifers. <5> <15> <16>

In 1980, this basin used an average of 400.4 million gallons of water a day <23>, and excluding water used to produce electric energy, represents about 7.6 percent of the total water used in the State. This amount of water use results in the basin being ranked fifth in the State by comparison to the total amount of water used by each of the other basins in the State. Irrigation, for the production of food and fiber, accounts for about 90 percent of the total water used in the basin, most of which comes from groundwater. As can be seen from Figure 3-1, the demand for most of this water occurs during June, July, and August, some of the driest months of the year.

SURFACE WATER

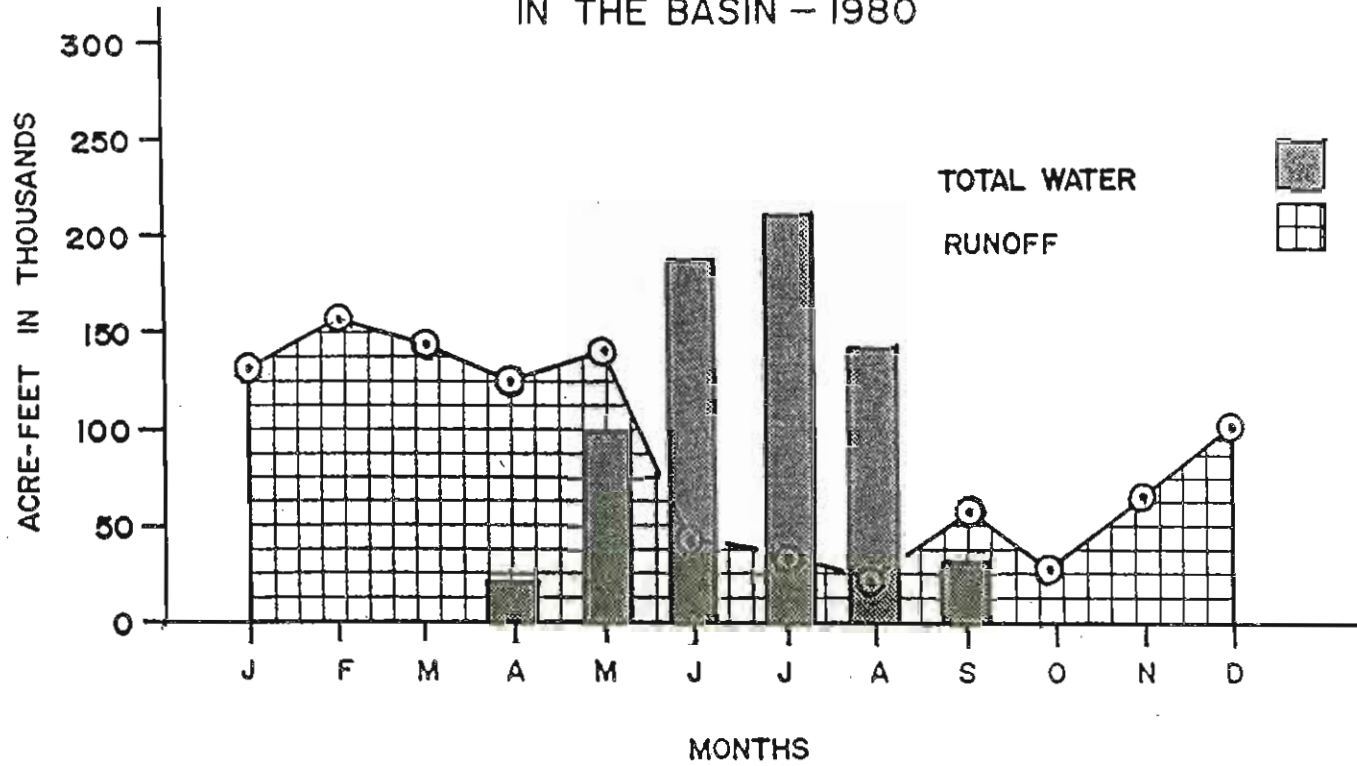
Streams

Quantity

This basin is included in Reach IV of the Red River Compact. The compact is an agreement between the states of Arkansas, Oklahoma, Texas, and Louisiana. The purpose of the compact is to promote comity between these participating states by cooperating in the equitable apportionment and development of the water in specific river basins as provided by the interstate compact agreements. <30>

Paragraph (b) of Section 7.02 of Article VII of the Red River Compact, which pertains to the surface waters in this basin, Reach IV, between Arkansas and Louisiana, reads, in part, as follows: ".....Arkansas shall allow a quantity of water equal to forty (40) percent of the total weekly runoff originating above the state boundary to flow into Louisiana."

TOTAL AGRICULTURAL WATER WITHDRAWAL AND RUNOFF IN THE BASIN - 1980



Source: Arkansas Statewide Study, Phase V, "Agricultural Water Study," U.S.D.A., S.C.S. and E.R.S., in cooperation with Arkansas Soil and Water Conservation Commission, August, 1983.

Source: U.S.G.S. Stream Gage Data, Water Year 1958-1968.

FIGURE 3-1

The use of this water is subject to low flow provisions as explained in Paragraph (b) of Section 7.03 under Special Provisions. This paragraph reads, in part, as follows: "The State of Arkansas does not guarantee to maintain a minimum low flow for Louisiana in Reach IV. However, on the following streams when the use of water in Arkansas reduces the flow at the Arkansas-Louisiana state boundary to the following amounts:"

- (1) Boeuf River - 40 cfs
- (2) Bayou Macon - 40 cfs

"The State of Arkansas pledges to take affirmative steps to regulate the diversions of runoff originating or flowing into Reach IV in such a manner as to permit an equitable apportionment of the runoff as set out herein to flow into the State of Louisiana."

There are about 21 major streams and these, with their tributaries, account for the estimated 1100 miles of channels located within the basin. <3> The major streams include Boeuf River, Bayou Macon, Cypress Creek, Big Bayou, LaFourche Bayou and Oakwood Bayou.

The average discharge for this basin is about 1,058,000 acre-feet per year and the current annual use of both surface and groundwater amounts to 400.4 MGD or about 450,000 acre-feet per year. Of this annual use, about 150,000 acre-feet per year was obtained from surface water sources and the remaining 300,000 acre-feet per year was taken from groundwater sources. <23>

The amount of water used in 1980 (450,000 acre-feet) is about half (43 percent) of the average annual runoff of over one million acre-feet/year. More than 80 percent of the average annual runoff occurs in a six month period from December through May. Each of these months has more than 100,000 acre-feet of runoff and February has the highest recorded runoff total of over 150,000 acre-feet per month.

Water Quality <17>

Surface waters tend to collect runoff-borne impurities. Levels of these impurities vary from one watershed to the next, reflecting the changing chemical and physical conditions of the soils and vegetation. If certain impurities - including sediment, nutrients, pesticides, and organic residue - collect in surface waters at levels exceeding specific tolerances of aquatic organisms or otherwise limit the human use and enjoyment of waters, the waters are said to be polluted.

Water pollutants may be categorized as either point source or nonpoint source pollutants, based upon the nature of the pollutant source. Point sources are those discharges which enter the streams by discrete conveyances such as pipes, conduits, or ditches. Wastewater treatment is necessary to remove pollutants before the effluent is discharged from point sources.

Nonpoint source pollution is the result of the erosive force of water and it originates from a broad geographic area. Nonpoint sources are primarily associated with rural lands, although runoff from urban lands is also a significant source of nonpoint pollution in some areas. These sources characteristically produce dissolved minerals, nutrients, toxic substances, and sediment. By volume, sediment is the greatest single water pollutant. Sediment tends to smother aquatic life, cloud waters, and fill stream channels and lake beds. Studies indicate sediment is the primary vehicle of nutrient and pesticide entry into surface waters.

There are no significant sources of natural pollution that exist within this basin. All pollution is man-induced.

Point sources <3>

The point sources that discharge within the basin are predominantly municipalities. The discharges from these municipal STP's (Secondary Treatment Plants) have been overshadowed, however, by the impact of the nonpoint source discharges from agricultural runoff. Published information on all current point sources (municipal, industrial, etc.) can be obtained from the Arkansas Department of Pollution Control and Ecology.

Nonpoint sources

Most of the sources of pollutants affecting water quality in this basin are nonpoint in nature because of the extensive agricultural activities on the land. The effects of point sources are often masked by the nonpoint contributions. Agricultural runoff causes high turbidity and excessive levels of pesticides in the water.

The Nonpoint Source Pollution Assessment Summaries prepared by the Arkansas Soil and Water Conservation Commission for the Arkansas Department of Pollution Control & Ecology show that approximately five pounds of pesticides are used per acre of agricultural lands in this basin. <3> Current monitoring conducted by the Department of Pollution Control and Ecology has shown that commonly used agricultural pesticides are frequently found in surface water samples in excess of national standards.

In 1977, more than 4 million pounds (pounds of active ingredients) of pesticides of all types (including herbicides, insecticides, fungicides, etc.) were applied to agricultural and forest lands in this basin. <3> In addition, more than 66,250 tons of fertilizers were used. About 73 percent of the fertilizers applied was nitrogen, about one percent was phosphorous, and about 6 percent was potash, and the remainder was mixed fertilizers. <3>

Water quality data is collected in this basin as part of the Arkansas Department of Pollution Control and Ecology's routine ambient stream monitoring program. There are two stream monitoring stations in the basin. Their locations are as follows: OUA 15A-Boeuf River near the Arkansas-Louisiana line, and OUA 32-Big Bayou near Jerome, Arkansas. (As of August 1983 OUA-32 has been discontinued). In addition to the usual parameters, both stations are monitored for pesticides and heavy metals. OUA 15A is also monitored biologically. <3>

A survey of recent data (1976-1977) from the ambient monitoring network indicates several violations of the Arkansas Water Quality Standards (e.g., total phosphorous and turbidity). There were also several parameters which exceeded levels recommended by Quality Criteria for Water (EPA, 1976), especially in the area of pesticides. <3> (See Table 3-1).

The difference between the yearly average (1977-1978) for the corrected chlorophyll "a" shown under the Biological Monitoring Data heading of Table 3-1 were probably caused by unreliable testing equipment and procedures. New sampling techniques and equipment were implemented in 1978 to give more reliable and consistent data.

Routine violations of the stream standards for turbidity depict the predominant land use of cropland in the basin and the need to control soil erosion. The major streams in this basin are listed in Arkansas Department of Pollution Control and Ecology Regulation No. 2 as BW, which means that the streams will be suitable for desirable species of fish, wildlife, and other aquatic and semi-aquatic life, raw water source for public water supplies, secondary contact recreation, and other uses. Current surface water quality has prohibited most of these uses. <3>

In the past, the major emphasis in this basin was drainage and flood protection. The emphasis on stream channelization has damaged stream habitat and increased flows. This condition of highly turbid waters with toxic agricultural chemicals has created an undesirable environment for stream fishery. <3>

TABLE 3-1

SUMMARY OF PARAMETERS EXCEEDING RECOMMENDED LEVELS

	Iron	Manga- nese	Total Phos- phorus	Turbi- dity	Cad- mium	Cop- per	Diss. O ₂	Zinc	Lead	DDT	OOE	Methyl Para- thion	End- rin	Diel- drin	Lasso	Toxa- phene	Fecal Coli- form
QUA 15A	$\frac{20}{20}$	$\frac{20}{20}$	$\frac{20}{20}$	$\frac{3}{8}$	$\frac{4}{10}$	$\frac{5}{19}$	$\frac{1}{21}$	$\frac{1}{19}$	$\frac{6}{18}$	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{9}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{4}{9}$	$\frac{3}{20}$
QUA 32	$\frac{21}{21}$	$\frac{21}{21}$	$\frac{23}{23}$	$\frac{12}{23}$	$\frac{3}{9}$	$\frac{4}{20}$	$\frac{1}{24}$	$\frac{1}{20}$	$\frac{5}{19}$	-	$\frac{1}{10}$	$\frac{3}{8}$	$\frac{4}{10}$	$\frac{5}{10}$	$\frac{2}{10}$	$\frac{3}{11}$	$\frac{1}{20}$

x = Samples exceeding recommended levels

$\frac{x}{y}$:

y = Total number of samples taken during 1976 and 1977

Biological Monitoring DataCorrected Chlorophyll \bar{a} :Yearly Average

1977 1978

QUA 15A 21.65 10.63

Chlorophyll \bar{a} is a good general indicator of one amount of nutrients present in a stream. A yearly average less than 10 indicates clear, clean water. Averages greater than 10 indicate varying degrees of degradation.

Source: Arkansas Department of Pollution Control and Ecology

Benthic Diversity Index

1977

QUA 15A 1.6

In general, the benthic diversity index for streams in Arkansas may be assessed as follows:

> 2.5 : good
2.0 - 2.5 : average
< 2.0 : poor

Effects and restrictions

The effects of surface water pollution and its restriction on the various categories of water users in the basin are briefly discussed in the following paragraphs.

(a) Public Water Supply. There are no surface waters currently being used for public water supplies. The effect of nonpoint pollution on these surface waters has discouraged its use for this purpose. This is because of the high cost that would be involved in its treatment.

(b) Self-supplied Industry. Only one industry, a paper mill, is located in the basin and in 1980 used 11.6 million gallons per day of surface water. Nonpoint pollution of surface water may restrict certain types of industry in the future.

(c) Rural Domestic Use. Rural domestic water is supplied by groundwater in this basin. No known use of surface water for domestic supply is known to exist and would not be encouraged.

(d) Fuel-electric Power. There is no known use for this purpose in the basin although the surface water quality would not be restrictive for this use.

(e) Fish and Wildlife. There are no major wildlife impoundments in this basin and most of the game species are concentrated between the main levees and the Mississippi River. Sampling done on sediment and fish from streams within the basin have shown that many of the pesticides used in the past (DDT, Dieldrin, Endrin, etc.) can still be detected throughout the stream environments. <3>

(f) Agriculture. Agricultural uses of surface water in this basin would not be restricted for any use except for fish and minnow farms. However, in 1980 fish and minnow farms used 4.2 MGD of surface water for this purpose. During the same year, there were 0.3 MGD of surface water used by livestock and 117.2 MGD used for the irrigation of rice and other crops.

(g) Esthetics. The condition of highly turbid surface waters that exists in this basin has severely degraded the esthetic values. Sediment reaching the streams is carrying heavy loads of nutrients which cause excessive growth of nondesirable algae and other aquatic plants which are visually displeasing.

(h) Recreation. None of the 21 streams in this basin that were inventoried and assessed by the Conservation Districts were found suitable for body contact sports. Lake Chicot, the largest natural lake in the State, is divided by a causeway into two portions. The upper end of the lake is the only Class A body of water in this part of the State and is used extensively for recreational purposes. The lower end of the lake, which once supported good fishing and recreation, has been severely degraded over the last several decades due to increased sedimentation and agricultural chemicals. An estimated 265,200 tons of sediment per year are entering the lake. <3>

Existing USDA (SCS) and Corps of Engineers Projects

The majority of flood control projects which have been completed in the basin have been constructed by the Soil Conservation Service (SCS) and the Corps of Engineers. The Corps of Engineers works of improvement generally consist of large and intermediate multiple purpose projects of which flood control benefits are a substantial portion. The major emphasis of the SCS program has been small multiple purpose watershed projects (not to exceed 250,000 acres in area), usually for the purpose of watershed protection (land treatment), flood prevention and drainage.

The Watershed Protection and Flood Prevention Act, Public Law 83-566 (PL-566), was approved by the President on August 4, 1954. This Act authorizes the Secretary of Agriculture to cooperate with local organizations having authority under State law to carry out, maintain, and operate works of improvement for flood prevention or for the conservation, development, utilization, and disposal of water in watersheds or subwatershed areas. Both technical and financial assistance is provided under the PL-566 Program to prevent or reduce flood damages.

Channel improvement by the Corps of Engineers was authorized by the Flood Control Act of 22 December 1944, as amended by the Acts of 24 July 1946, 17 May 1950, 3 July 1958, 23 October 1962, and 27 October 1965. The Flood Control Act of 13 August 1968 authorized construction of a 6,500 cubic foot per second pumping plant and related works to divert floodwater that is presently entering Lake Chicot, the largest (5200 surface acres) natural lake in Arkansas.

There are twenty-nine (29) watersheds located within the basin. Thirteen (13) of these are completed PL-566 Projects and represent about 53 percent of the total area of the basin. <19> See Table 3-2 and the Status Map (Figure 3-2) of PL-566 Projects. A total of about 612 miles of channel improvements have been installed under this program within the thirteen completed projects.

The Corps of Engineers have completed an additional 270 miles of channel work for the purpose of flood control and to provide adequate outlets for the surrounding tributary lands. <20> The pumping plant and related works which were planned to divert floodwater from entering Lake Chicot are presently under construction. <21> See Figure 3-3 Corps of Engineers Projects. A total of about 882 miles of channel works have been completed in the basin by these two agencies. There is still about 2.5 miles of channel improvement remaining to be done by the Corps in association with the pumping plant relating to Lake Chicot.

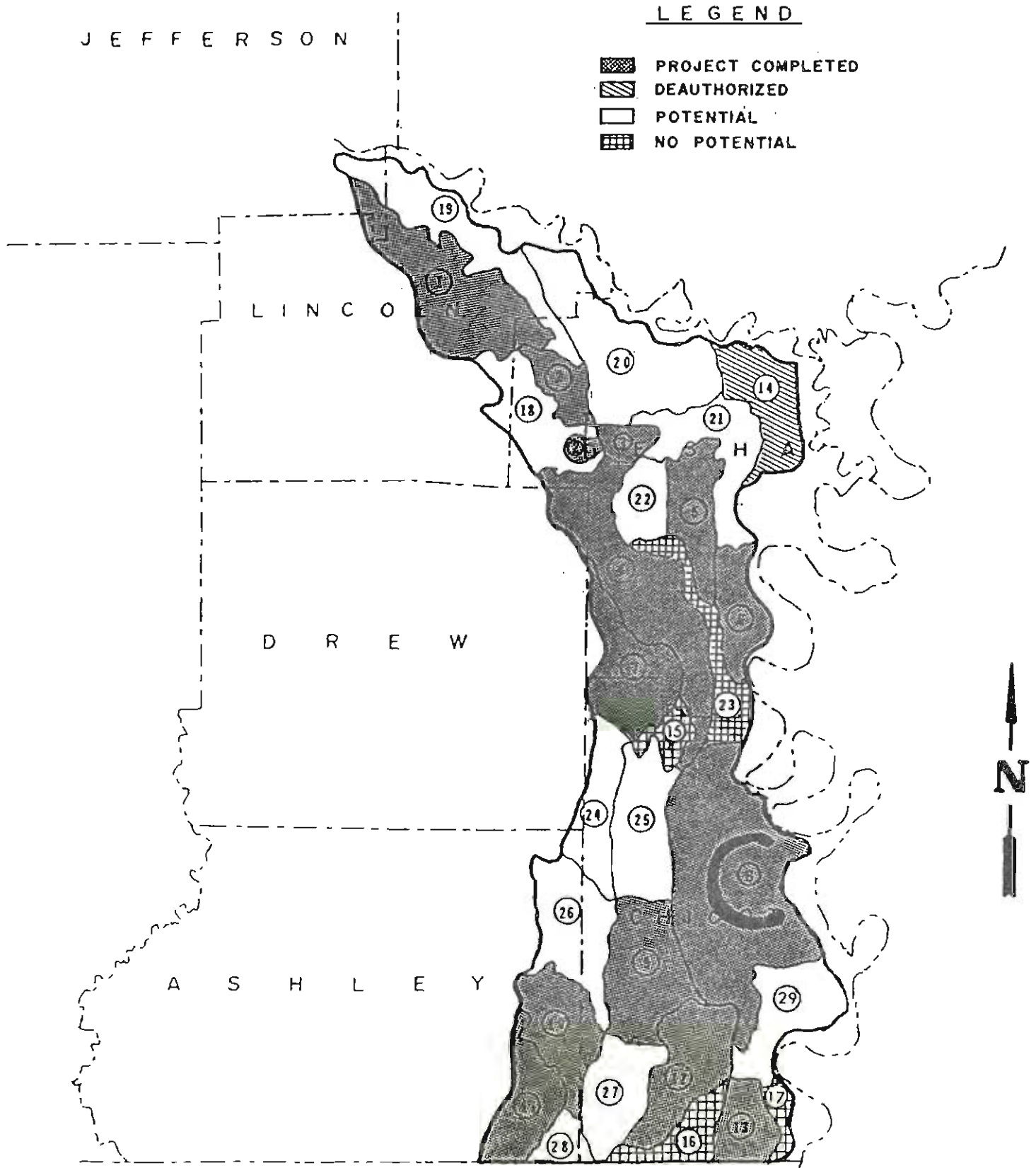
TABLE 3-2

STATUS OF PUBLIC LAW - 566 WATERSHED PROGRAM ^{1/}

MAP WATERSHED NUMBER	WATERSHED NAME	DRAINAGE AREA (Acres)	P. L. - 566 PROJECTS		STRUCTURES PLANNED		STRUCTURES INSTALLED		PURPOSE ^{3/}
			POTENTIAL	STATUS ^{2/}	CHANNELS (Miles)	DAMS (Number)	CHANNELS (Miles)	DAMS (Number)	
1	Grady Gould	48,960	-	7	-	-	96	0	WP, FP, & DR
2	Randolph - Walnut Lake	13,440	-	7	-	-	24	0	WP, FP, & DR
3	Wells Bayou	14,720	-	7	-	-	24	0	WP, FP, & DR
4	Canal 18	39,040	-	7	-	-	43	0	WP, FP, & DR
5	Kelso - Rohwer	26,880	-	7	-	-	37	0	WP, FP, & DR
6	Arkansas City	16,000	-	7	-	-	23	0	WP, FP, & DR
7	Chicot - Desha and Drew	41,280	-	7	-	-	53	0	WP, FP, & DR
8	Chicot	117,440	-	7	-	-	121	0	WP, FP, & DR
9	Crooked Bayou	31,360	-	7	-	-	49	0	WP, FP, & DR
10	Fleschmans Bayou	26,880	-	7	-	-	33	0	WP, FP, & DR
11	Camp Bayou	21,760	-	7	-	-	31	0	WP, FP, & DR
12	Caney Bayou	35,200	-	7	-	-	50	0	WP, FP, & DR
13	Ark - La	23,040	-	7	-	-	28	0	WP, FP, & DR
14	Red Fork	23,360	Yes	8	-	-	-	-	-
15	Upper Crooked Bayou	8,320	No	-	-	-	-	-	-
16	Lower Caney Bayou	11,840	No	-	-	-	-	-	-
17	Grand Lake	5,120	No	-	-	-	-	-	-
18	Little Wagon Bayou	24,000	Yes	-	-	-	-	-	-
19	Canal 19	49,280	Yes	-	-	-	-	-	-
20	Oak Log Bayou	56,640	Yes	-	-	-	-	-	-
21	Amos Bayou - Cypress Creek	25,600	Yes	-	-	-	-	-	-
22	Coon Bayou	22,720	Yes	-	-	-	-	-	-
23	Clay Bayou	30,080	No	-	-	-	-	-	-
24	Upper Big Bayou	24,960	Yes	-	-	-	-	-	-
25	Main Ditch Canal	29,120	Yes	-	-	-	-	-	-
26	Middle Big Bayou	33,280	Yes	-	-	-	-	-	-
27	La Fourche Bayou	27,520	Yes	-	-	-	-	-	-
28	Coffee Bayou	8,640	Yes	-	-	-	-	-	-
29	Otter Bayou	27,200	Yes	-	-	-	-	-	-

^{1/} U.S.D.A. - Soil Conservation Service - State of Arkansas Watershed Data Listing and Hydrologic Unit Data, 1982.^{2/} Status Codes:
7 - Project Completed
8 - Deauthorized^{3/} Purpose:
WP - Watershed Protection
FP - Flood Prevention
DR - Drainage

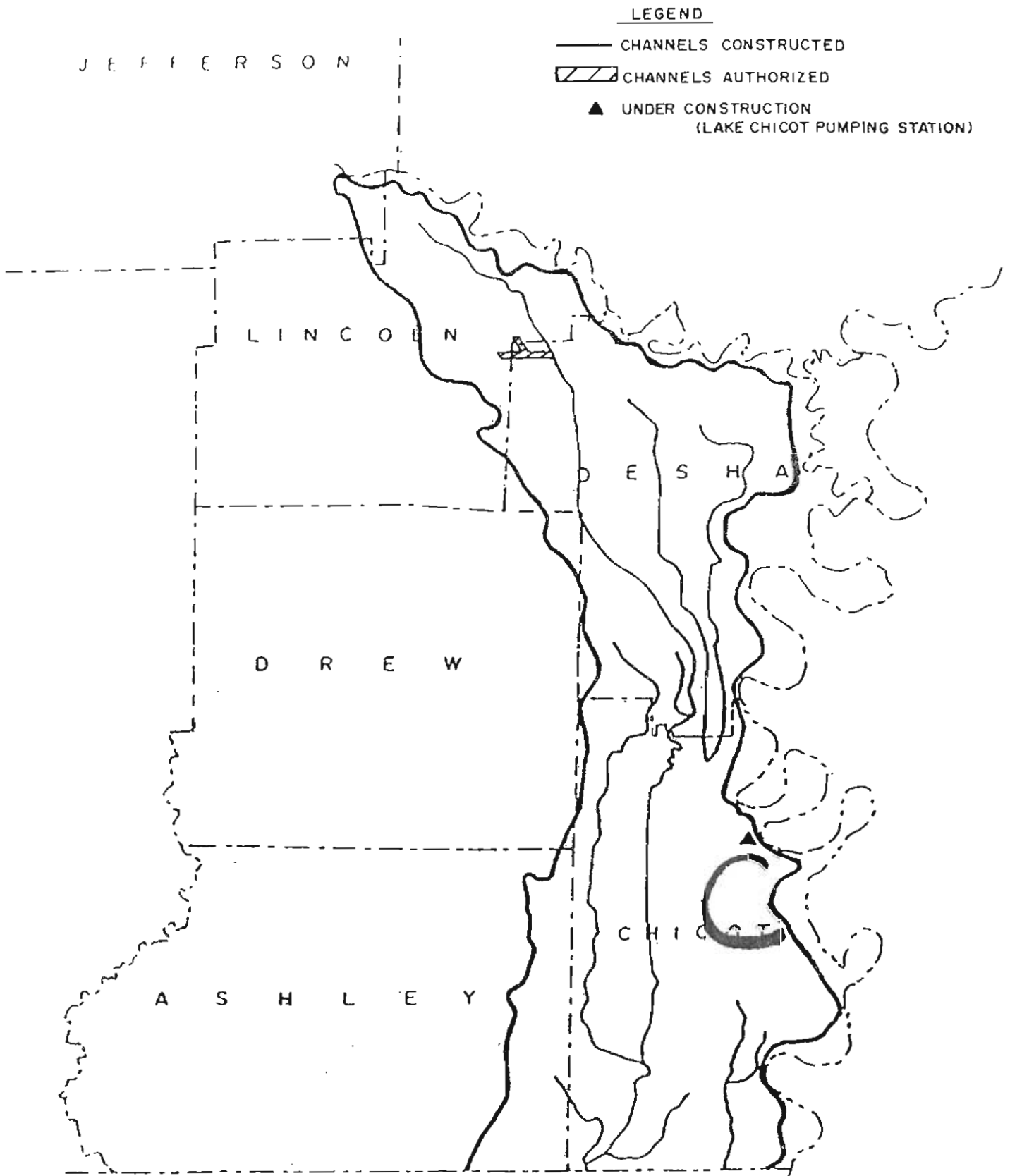
STATUS OF PUBLIC LAW-566 WATERSHED PROGRAM



SOURCE: SCS Watershed Work Plans
River Basin and Watershed Progress Map; SCS, December, 1980

FIGURE 3-2

CORPS OF ENGINEERS PROJECTS



Source: U.S. Army Corps of Engineers, Vicksburg District, 1981.

FIGURE 3-3

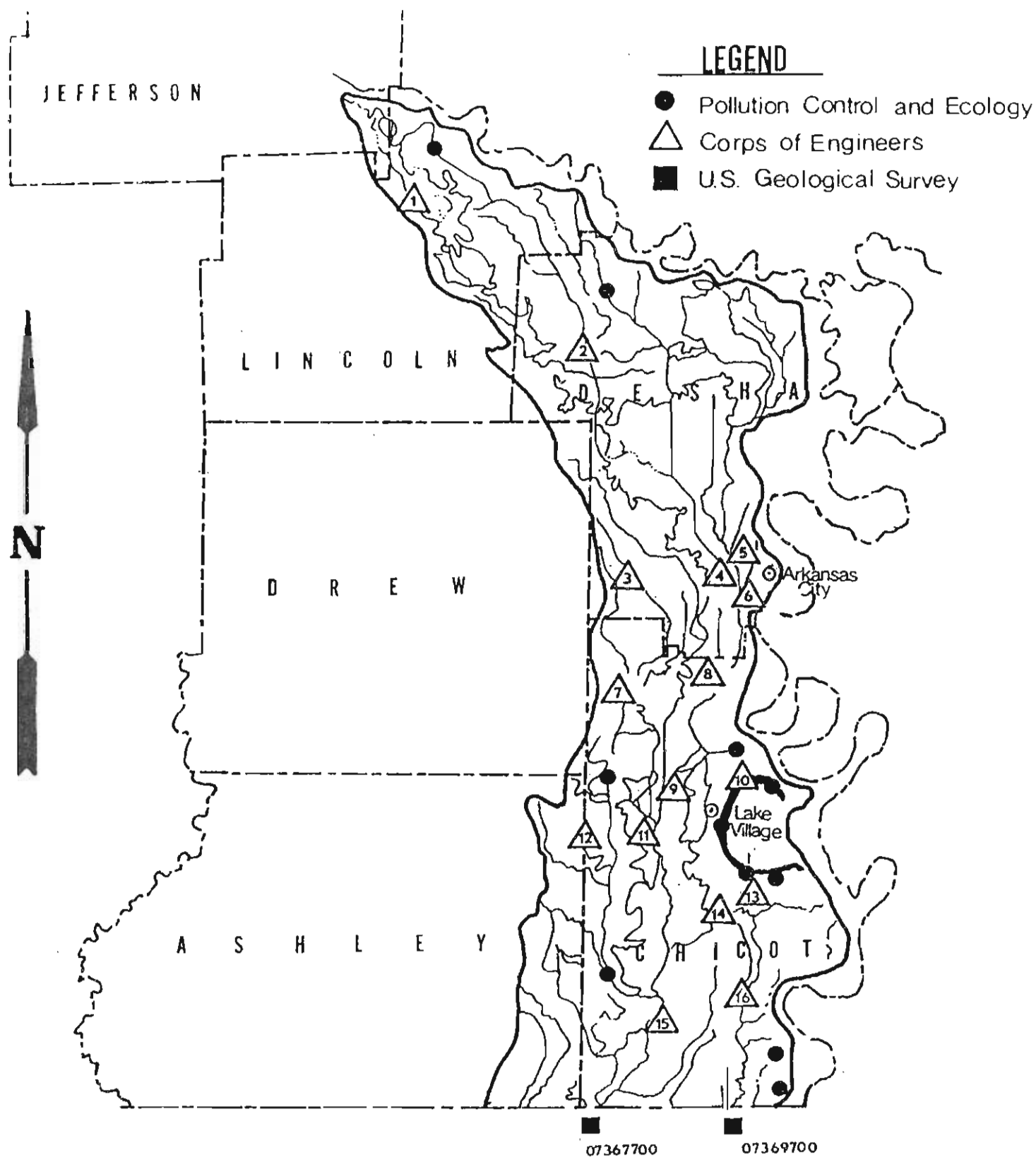
Water Recording Stations

The twenty nine most significant water-stage and water-quality recording stations are shown on Figure 3-4, the General Location of Water Recording Stations Map and the data pertaining to these gages are shown in Table 3-3. <22> <12> These gages are jointly read, maintained and published by the U.S. Army Corps of Engineers, USGS, and ADPC&E. Figure 3-4 shows only 11 of the most significant water quality stations monitored by ADPC&E. Data on twenty-four stations are stored at the Department and can be obtained by interested parties. A current listing of water quality monitoring stations can be obtained by contacting ADPC&E and asking for the publication Water Pollution control Work Program (106 Plan) FY 1984. The records for the two U.S.G.S. gages located just south of the Arkansas-Louisiana state line are considered to have only poor to fair records. This is a result of an interconnecting system of bayous and drainage channels which produce, at certain stages, an interchange of flow and during extreme floods, considerable flow bypasses these gages.

Water Usages

In 1980, this basin used an average of 400.4 million gallons a day of water. This represents about 7.6 percent of the water used in the State, excluding water used to produce electric energy. About 90 percent of the water used in the basin was for the purpose of irrigation, with the rice industry being responsible for about 82 percent of this consumption. Included in the average 400.4 MGD, was 133.3 million gallons a day or 33.3 percent, which was obtained from surface water sources. <23> This represents about 11.1 percent of the average surface water used in the State. Most of the 133.3 MGD of surface water (88 percent) was used to irrigate about 43,100 acres of cropland. This acreage included the irrigation of 30,800 acres of rice and 12,300 acres of various other crops. <23> The remaining 12 percent of surface water used in the basin was for self-supplied industries, fish and minnow farms, and various rural uses. See Table 3-4 and Figure 3-5 for the total amount of water used for each purpose within the basin and the source of this water. Table 3-5 shows the use of water for each category by source and by each of the six counties within the basin.

GENERAL LOCATIONS OF WATER RECORDING STATIONS



Source: Arkansas Department of Pollution Control and Ecology, U.S. Corps of Engineers, Vicksburg District, and United States Geological Survey.

FIGURE 3-4

TABLE 3-3
 STREAM GAGE LOCATIONS
 (by Agencies)

Water-Stage Recorders Operated by the Corps of Engineers, Vicksburg District

	Years of Record	Drainage Area (sq.mi.)	Max. Stage Feet	Min. Stage Feet	Bank Full Stage Feet
1. Deep Bayou near Grady	29	102	17.59	-0.42	13
2. Canal No. 19 near Dumas	18	162	30.18	12.74	-
3. Black Pond Slough near McGehee	26	11	13.30	Dry	-
4. Canal No. 19 near Arkansas City	30	255	26.44	Dry	22
5. Canal No. 43 near Arkansas City	30	138	25.89	6.50	26
6. Canal No. 81 near Arkansas City	30	157	30.24	10.77	28
7. Big Bayou near Dermott	26	60	15.60	-1.60	-
8. Macon Lake near Macon Lake	27	335	27.60	8.10	-
9. Diverson Canal near Boeuf River, Macon Lake	38	303	19.20	Dry	-
10. Connerly Bayou near Lake Village	38	364	26.87	6.10	-
11. Boeuf River near Lake Village	30	355	22.80	1.14	24
12. Big Bayou near Lake Village	30	102	16.80	Dry	19
13. Ditch Bayou near Lake Village	38	404	25.46	4.57	27
14. Canal No. 4 near Chicot	38	Indet.	22.30	2.74	20
15. Boeuf River near Eudora	38	640	21.52	0.50	21
16. Bayou Macon near Eudora	38	Indet.	27.43	0.81	18

Additional data for these recorders can be obtained from the Corps of Engineers, Vicksburg District.

TABLE 3-3 (Cont'd)

USGS STREAM GAGE LOCATIONS ^{1/}

GAGE NO.	LOCATION	YEARS OF RECORD	DRAINAGE AREA (sq. mi.)	MAX. FLOW (cfs)	MIN. FLOW (cfs)	AVERAGE DISCHARGE ^{2/} (AF/yr)	REMARKS
07367700	Boeuf River near Ark-La State Line	17	785	16,500	0	689,700	Records poor
07369700	Bayou Macon near Kilbourne, La.	17	504	4,740	0	368,000	Records fair

^{1/} Additional data for these gages can be obtained from Water Resources Data for Louisiana, Part 1, Department of Interior, Geological Survey - 1974.

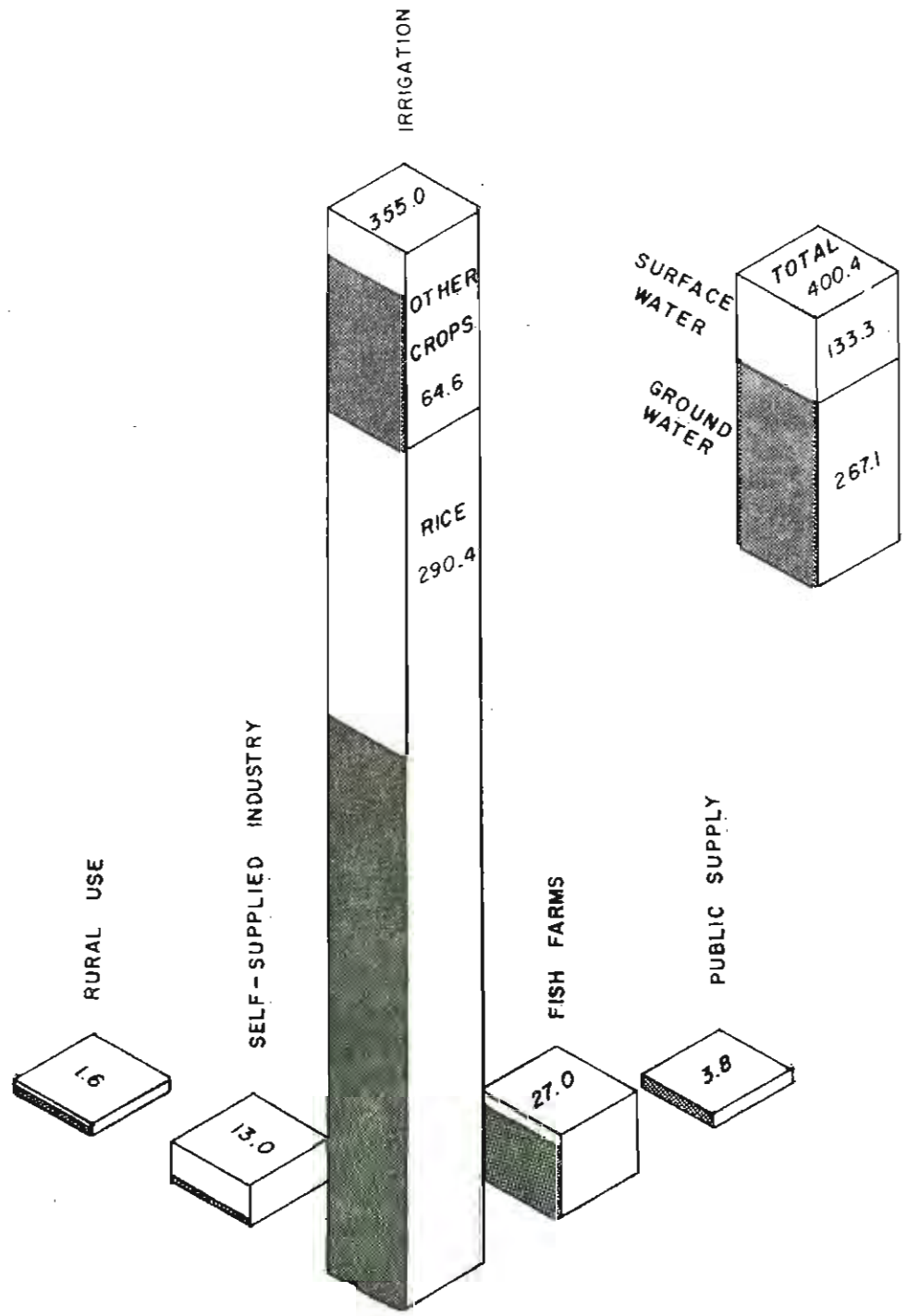
^{2/} Eleven years of record (1958-1968).

TABLE 3-4

USE OF WATER IN BASIN, BY CATEGORY - 1980 ^{1/}
(MILLION GALLONS PER DAY)

USE CATEGORY	GW ^{2/}	SW ^{3/}	TOTAL
PUBLIC SUPPLY	3.8	-	3.8
SELF-SUPPLIED IND.	1.4	11.6	13.0
RURAL USE:			
DOMESTIC	1.1	-	1.1
LIVESTOCK	0.2	0.3	0.5
SUBTOTAL	1.3	0.3	1.6
IRRIGATION:			
RICE	186.9	103.5	290.4
OTHER CROPS	50.9	13.7	64.6
SUBTOTAL	237.8	117.2	355.0
FISH & MINNOW FARMS	22.8	4.2	27.0
WILDLIFE IMPOUNDMENTS	-	-	-
HYDROELECTRIC AND THERMOELECTRIC ENERGY	-	-	-
TOTAL	267.1	133.3	400.4

^{1/} USGS FILE DATA^{2/} GROUNDWATER^{3/} SURFACE WATER



WATER USED IN THE BOEUF-TENSAS BASIN — 1980

IN MILLION GALLONS PER DAY

FIGURE 3-5

Source: U.S.G.S. File Data, 1980.

TABLE 3-5

USE OF WATER, BY SOURCE AND COUNTIES, IN BASIN ^{1/}
(MILLION GALLONS PER DAY)

CATEGORY	COUNTIES												TOTAL	
	ASHLEY		CHICOT		DESHA		DREW		JEFFERSON		LINCOLN		GW ^{2/}	SW ^{3/}
	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW		
PUBLIC SUPPLY	0.230	- ^{4/}	1.755	-	1.353	-	0.032	-	-	-	0.474	-	3.844	-
SELF SUPPLIED IND.	-	-	0.029	-	0.966	11.615	-	-	-	-	0.402	-	1.397	11.615
RURAL USE:														
DOMESTIC	0.128	-	0.444	-	0.475	-	-	-	-	-	0.043	-	1.090	-
LIVESTOCK	-	-	0.120	0.179	0.017	0.026	-	-	-	-	0.048	0.051	0.185	0.256
SUBTOTAL	0.128	-	0.564	0.179	0.492	0.026	-	-	-	-	0.091	0.051	1.275	0.256
IRRIGATION:														
RICE	-	-	57.432	64.765	90.271	30.188	-	-	-	-	39.171	8.598	186.874	103.551
OTHER CROPS	10.603	0.268	6.482	2.232	28.013	10.361	-	-	-	-	5.860	0.859	50.958	13.720
SUBTOTAL	10.603	0.268	63.914	66.997	118.284	40.549	-	-	-	-	45.031	9.457	237.832	117.271
FISH & MINNOW FARMS	1.383	-	4.341	2.322	14.150	1.835	-	-	2.384	-	0.564	-	22.822	4.157
TOTAL	12.344	0.268	70.603	69.498	135.245	54.025	0.032	-	2.384	-	46.562	9.508	267.170	133.299

^{1/} U.S.G.S. file data (1980)^{2/} GW - Groundwater^{3/} SW - Surface water^{4/} Dashes indicate no water was used from that source.

As can be seen from Table 3-5, Chicot County used more surface water than any other county, almost all of which was used for the purpose of rice production. A total of 207 relifts (surface water) were reported in the study area during 1982. <24> Table 3-6 shows the number of acres irrigated for each of the major crops in the individual counties and the source of this water.

There is no water used for fuel-electric power and no navigation exists in the basin. There is also no water used for the specific purpose of wildlife and according to the Arkansas Natural and Scenic Rivers Commission, there are no high quality streams found in the basin.

Water Use Trends in the Study Area

As can be seen from the charts in Figure 3-6, water use for all categories, except for rural domestic use, has increased during the past 20-year period from 1960 to 1980. <25> The most obvious increase in water use was for the purpose of irrigation. Total irrigation water use from both surface and groundwater sources has increased by six fold during this time period, increasing from about 50 million gallons per day to about 300 MGD, an increase of 500 percent.

Total water used in 1970 for irrigation more than doubled the amount used in 1960 and more than doubled again from 1970 to 1980. While the demand for water used for irrigation has been increasing in distressing increments since 1960, it is interesting to note that the amount of groundwater being used is decreasing in relation to the amount of surface water being used for that purpose. In 1960, about 76 percent of the water that was used for irrigation came from groundwater sources; in 1970, about 67 percent came from groundwater; and in 1980, about 63 percent was obtained from groundwater sources. Almost 10 times as much surface water was used for irrigation in 1980 (112 MGD), as was used in 1960 (12 MGD). During the last 10 year period from 1970 to 1980, surface water used for the purpose of irrigation almost tripled, increasing from about 43 MGD to almost 112 MGD.

TABLE 3-6

CROPS IRRIGATED - (Acres) ^{1/}
by County and Source

COUNTY	CROPS									
	RICE		SOYBEANS		COTTON		OTHER CROPS AND PASTURE		TOTAL	
	GW	SW	GW	SW	GW	SW	GW	SW	GW ^{2/}	SW ^{3/}
ASHLEY	- ^{4/}	-	360	240	9,765	-	-	-	10,125	240
CHICOT	17,153	19,343	3,000	2,000	3,000	-	-	-	23,153	21,343
DESHA	26,556	8,852	15,075	7,425	10,710	1,890	-	-	52,341	18,167
DREW	-	-	-	-	-	-	-	-	-	-
JEFFERSON	-	-	-	-	-	-	-	-	-	-
LINCOLN	11,699	2,565	1,480	370	3,848	427	600	-	17,627	3,362
SUBTOTAL	55,408	30,760	19,915	10,035	27,323	2,317	600	-	103,246	43,112
GRAND TOTAL	86,168 Acres		29,950 Acres		29,640 Acres		600 Acres		146,358 Acres	

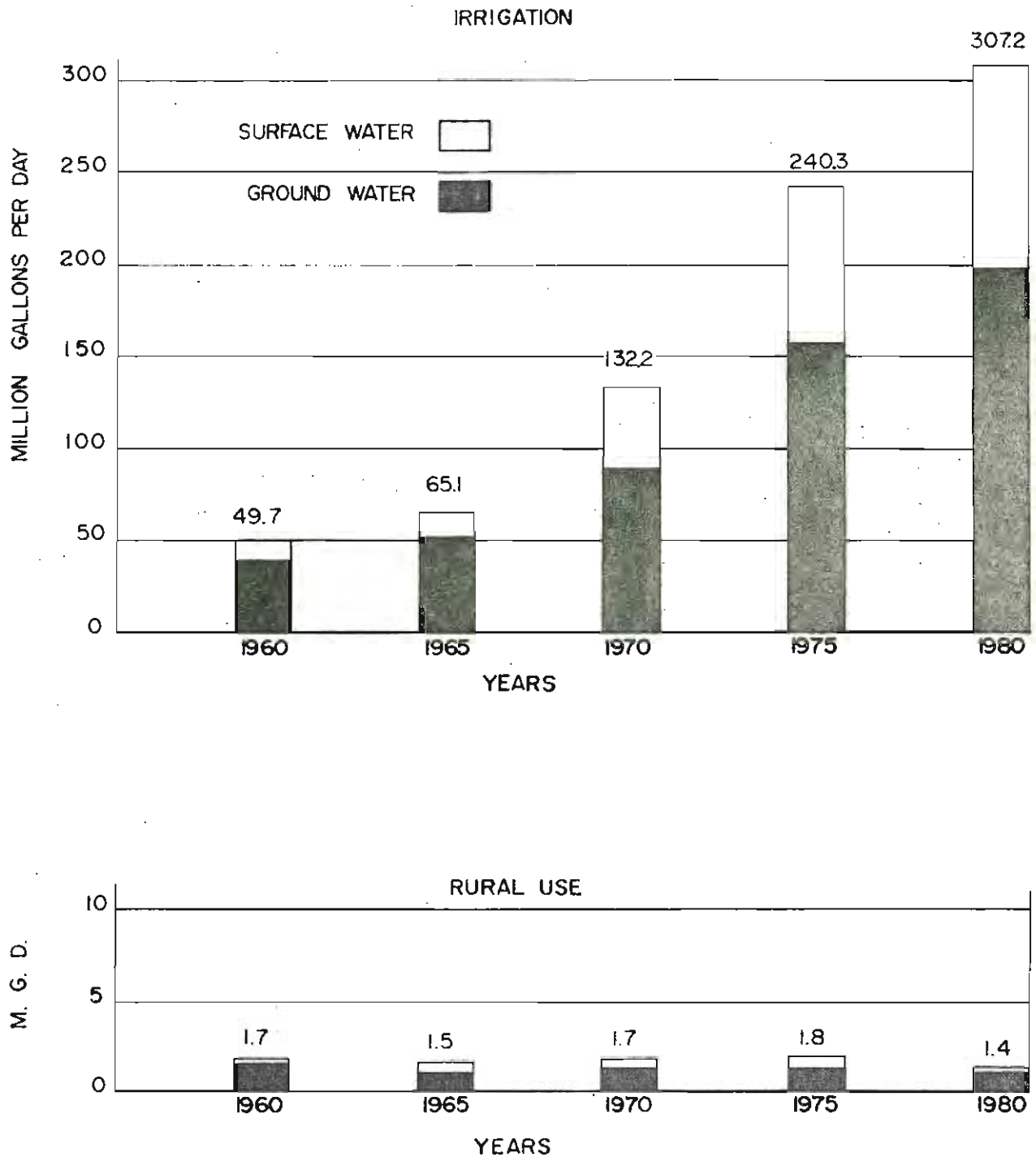
^{1/} U.S.G.S. file data (1980)

^{2/} Groundwater

^{3/} Surface water

^{4/} Dashes indicate no water was used from that source.

WATER USE TREND IN THE STUDY AREA

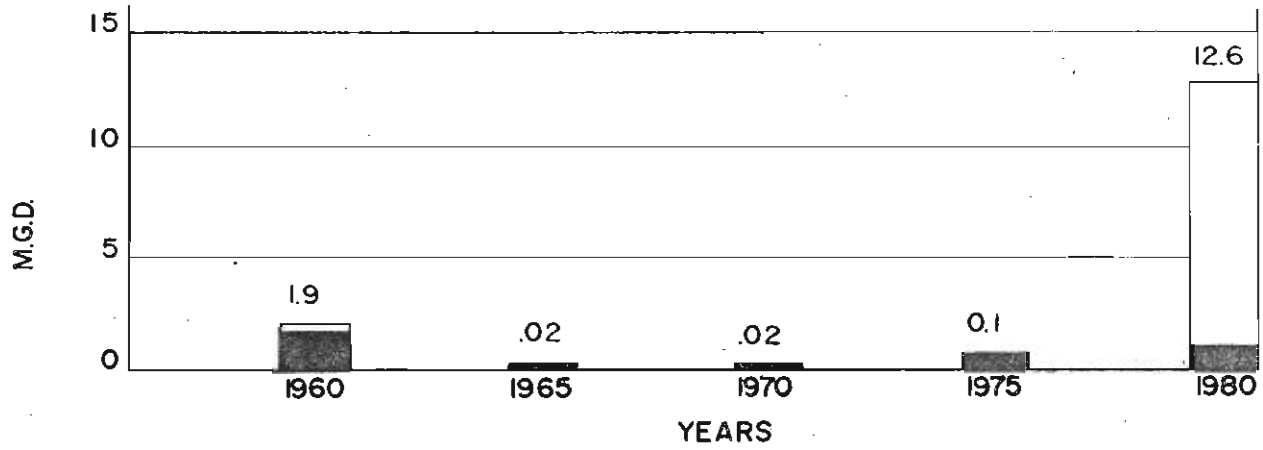


Source: Arkansas Geological Survey, Use of Water in Arkansas, publications from 1960 to 1980.

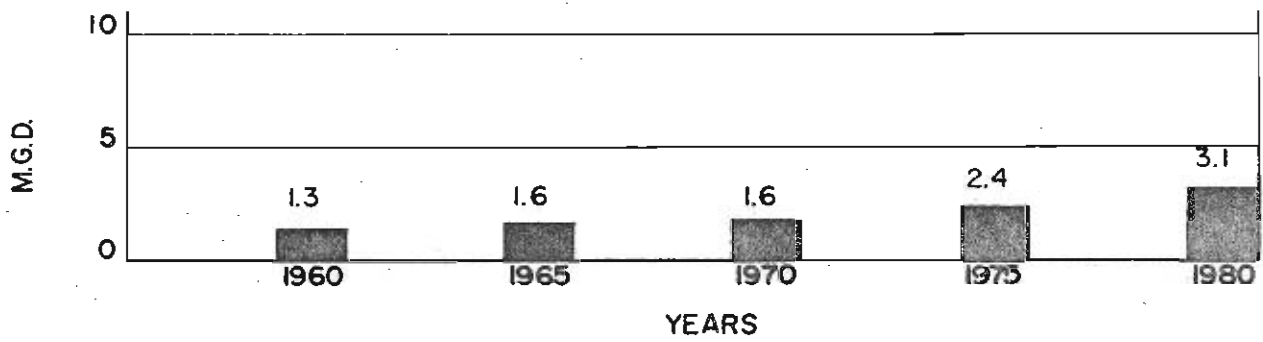
FIGURE 3-6

WATER USE TREND
IN THE
STUDY AREA
(CON'T.)

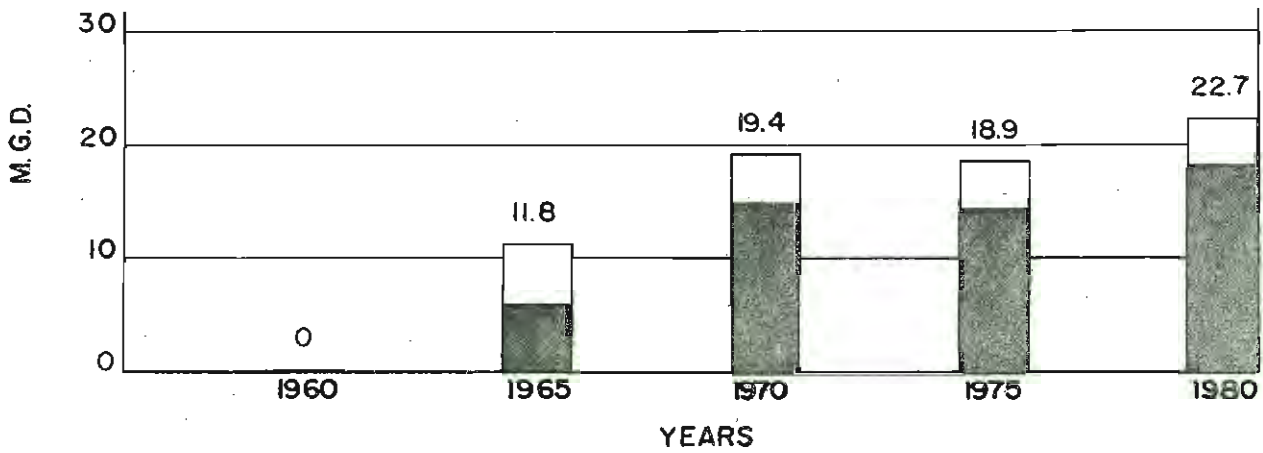
SELF-SUPPLIED INDUSTRY



PUBLIC SUPPLY



FISH FARMS



Impoundments

Quantity

There are thirty-three impoundments in the basin which exceed 5-acres. <15> These impoundments have a total surface area of 11,632 acres and impound a total of 77,161 acre-feet of storage. Lake Chicot is the largest impoundment, with a surface area of about 5,200 acres. There is also an estimated 110 impoundments in the study area which are less than 5 acres. Their total surface areas are estimated to be about 140 acres and their total storage capacities are estimated to be about 1,700 acre-feet. The various purposes and locations of the "exceeding five-acre impoundments" are shown by ownership in Table 3-7.

Quality

The Department of Pollution Control and Ecology has water quality data on Lake Chicot and Grand Lake, both of which are located in Chicot County. These are natural lakes which were created by the meandering of the Mississippi River.

Over the last several years, water quality in the upper end of Lake Chicot has begun to deteriorate and has raised the fears of local citizens that it will follow in the path of the lower end. The National Entrophication Survey, which was conducted in 1975, confirmed that the upper end of the lake is in danger of being severely degraded. This is due to very high nutrient loading caused by increasing agricultural activities in the drainage basin of the upper end.

Two different projects, one by the Soil Conservation (SCS) and one by the Corps of Engineers (COE), are underway to combat the water quality problems in Lake Chicot. The project by the SCS is attempting to alleviate nonpoint pollution in the drainage basin at its source, on privately owned farms.

The project presently under construction by the COE takes a different approach. They are building a series of water control structures and a pump station. The pump station will intercept the highly polluted waters flowing into the lake and pump them into the Mississippi River.

Grand Lake, which is in southeastern Chicot County, has problems almost identical with Lake Chicot. The National Entrophication Survey revealed it to be highly enriched with nutrients and pesticides from agricultural activities. Presently, no projects are proposed for Grand Lake to rectify the poor water quality.

TABLE 3-7

BASIN IMPOUNDMENTS EXCEEDING 5-ACRES
(by Ownership)

ARKANSAS GAME AND FISH COMMISSION

COUNTY	NUMBER/NAME	USE ^{1/}	AREA-(Acres)	CAPACITY-(Ac.-Ft.)
ASHLEY	Wilson Brake	R	180	1,260
SUBTOTAL	1	-	180 Acres	1,260 Acres
<u>PRIVATE</u>				
DREW	2	R,L,I,Ir	450	1,500
LINCOLN	9	R,I,Ir	1,240	4,710
DESHA	5	R,Ir	2,020	6,620
CHICOT	16	R,Ir	7,742	63,071
JEFFERSON	0	-	-	-
ASHLEY	0	-	-	-
SUBTOTAL	32	-	11,452 Acres	75,901 Ac.-Ft.
BASIN TOTAL	33	-	11,632 Acres	77,161 Ac.-Ft.

^{1/} R - Recreation
L - Livestock
I - Industrial
Ir- Irrigation

Source: Arkansas Soil & Water Conservation Commission.

Usages

The present usages of the impoundments in this basin are for recreation and for agricultural purposes such as irrigation, livestock, and fish and minnow farms. Table 3-7 gives the various usages of these impoundments by counties.

GROUNDWATER

An average of 400.4 million gallons a day of water was used in 1980 and of this amount, 267.1 million gallons a day or 66.7 percent came from groundwater sources. <23> This represents about 6.6 percent of the total groundwater used in the State. The majority of this water (89 percent) was used to irrigate about 103,200 acres of cropland. This acreage included irrigation of about 55,400 acres of rice and about 47,800 acres of other crops. <23> The remaining 11 percent of groundwater used in the basin was used for public water supply, self-supplied industries, fish and minnow farms, and for various rural uses.

See Table 3-4 and Figure 3-5 for the total amount of water used for each purpose within the basin and the source of this water. Table 3-5 shows the use of water for each category by source and by each of the six counties within the basin. As can be seen from this table, Desha County used more groundwater than any other county, almost all of which was used for the purpose of rice production. A total of 700 wells were reported in the study area during 1982. <24> Table 3-6 shows the number of acres irrigated for each of the major crops in the individual counties and the source of this water.

Description of Aquifers <26>

Groundwater in the Boeuf-Tensas Basin is derived principally from deposits of Quaternary Age and two artesian aquifers, the Cockfield and Sparta formations of the Claiborne Group. The Claiborne Group is of Tertiary Age. <26> The general relationship of these aquifers is illustrated by Figure 3-7. A brief description of each of these aquifers and characteristics of their water follows:

Quaternary Aquifer

This unconfined aquifer consists of alluvial deposits of the Arkansas, Mississippi, and smaller streams. These deposits consist of clays, silts, sands, and gravel. In general, silts and clays occur at and near the surface with sands and gravels being more dominant with depth. As illustrated in Figure 3-8, these materials are complexly layered with lenses, wedges, plugs and fingers of different materials.

Thickness of these unconsolidated materials vary from less than 50 feet to nearly 200 feet. The thicker sections represent the larger river valleys which have undergone filling. This variation in thickness is illustrated in Figure 3-9. The greater thickness in Desha County probably represents the trend of the Arkansas River while the deeper part in Chicot County is representative of a former channel of the Mississippi River.

The average saturated thickness is about 80 feet. Despite this relatively thin saturated thickness, yield commonly exceeds 1,000 gallons per minute. One well in southeast Chicot County is reported to yield 6,000 gallons per minute.

The water from this aquifer is basically a hard calcium bicarbonate type, high in dissolved iron with considerable variations from place to place. There is a zone of more strongly mineralized water, extending in a north-south direction the entire length of the basin. Figure 3-10 delineates the area with concentrations exceeding 500 parts per million of dissolved solids and in the areas around Dumas, Lake Village, and Eudora with concentrates greater than 1,000 parts per million. Higher concentrations of dissolved solids ranging up to 3,720 parts per million are found just west of Eudora.

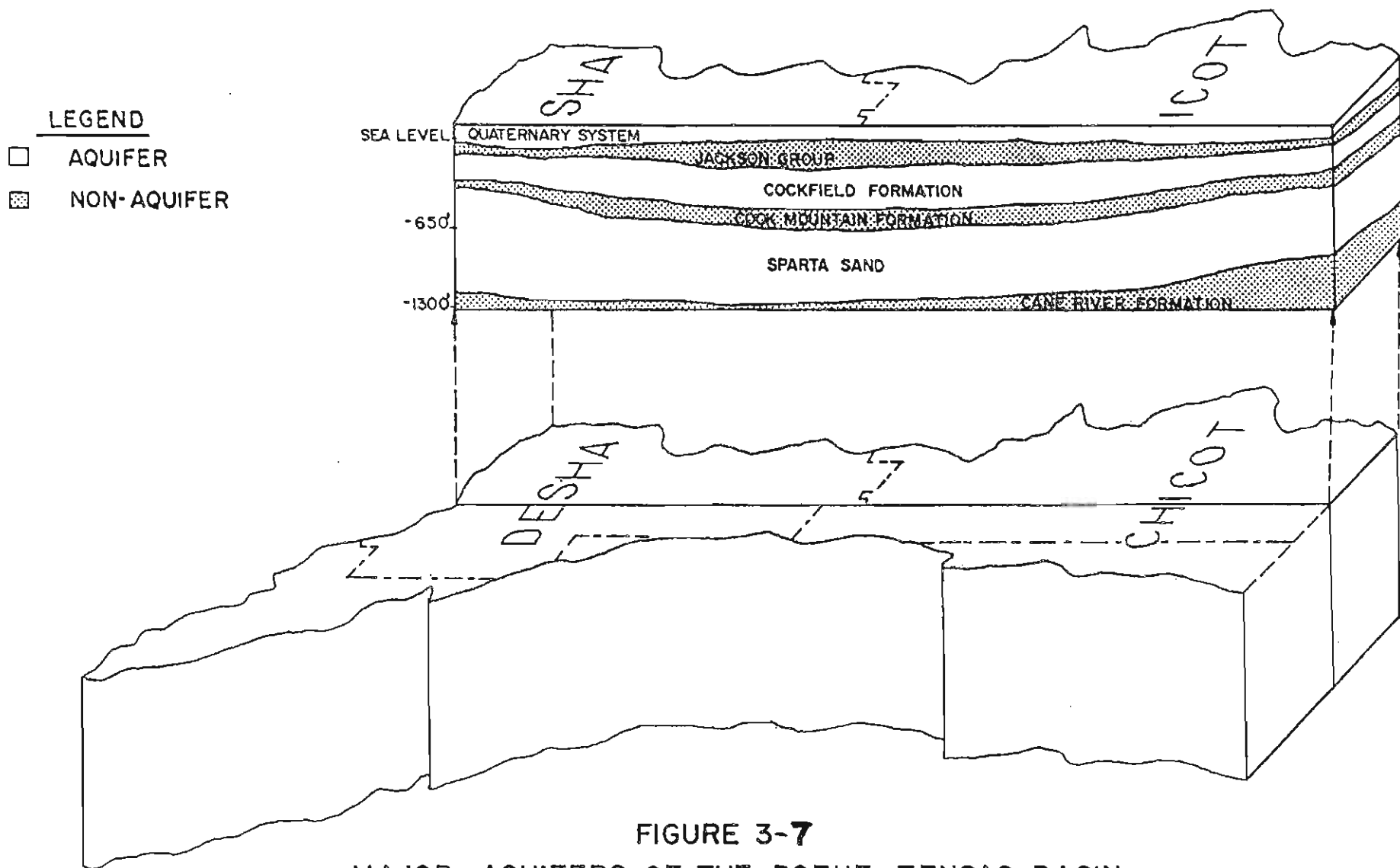
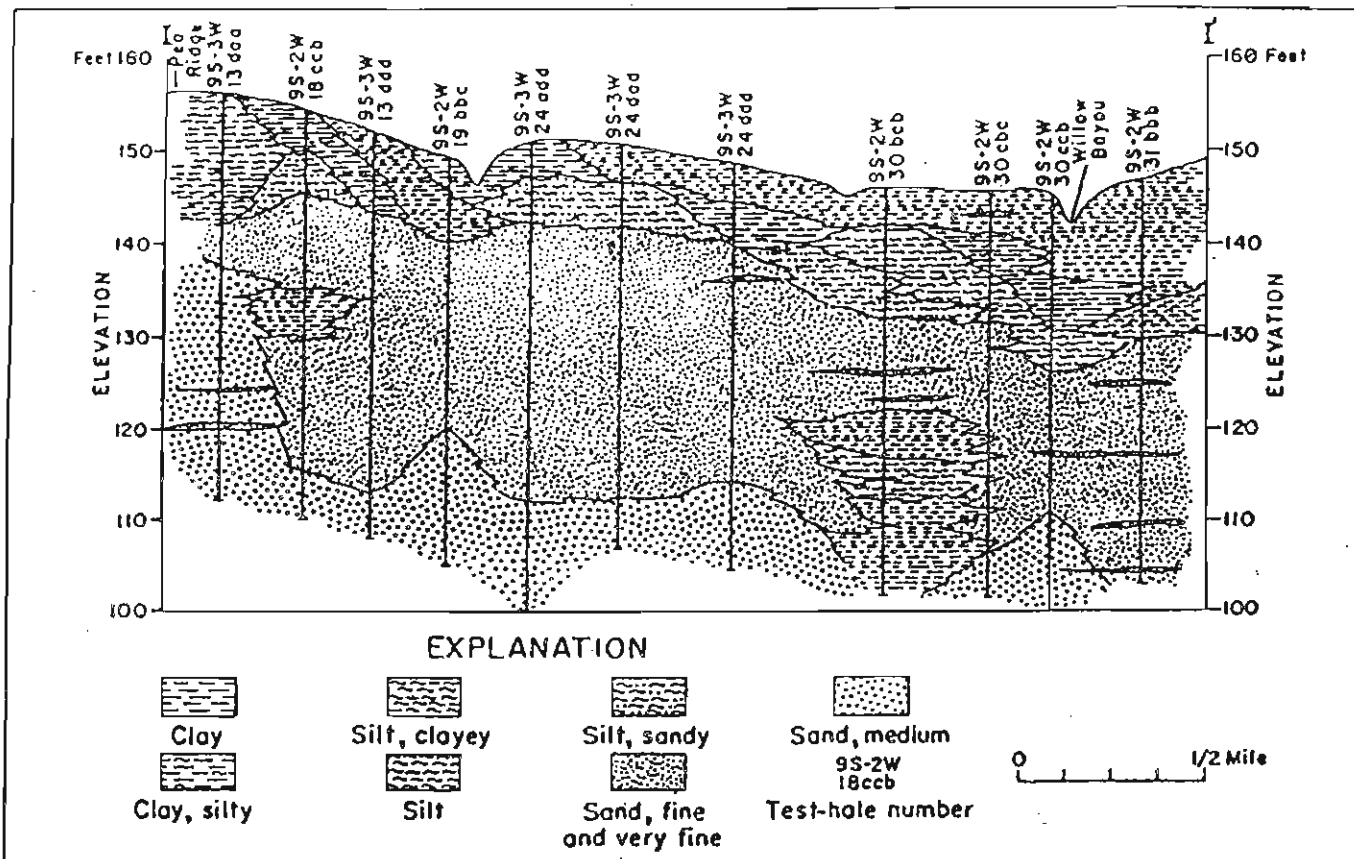


FIGURE 3-7
MAJOR AQUIFERS OF THE BOEUF-TENSAS BASIN



From Arkansas Geological Commission Water Resources Circular No. 6
FIGURE 3-8 GEOLOGIC SECTION THROUGH PART
 OF THE
 QUATERNARY ALLUVIUM OF DESHA COUNTY

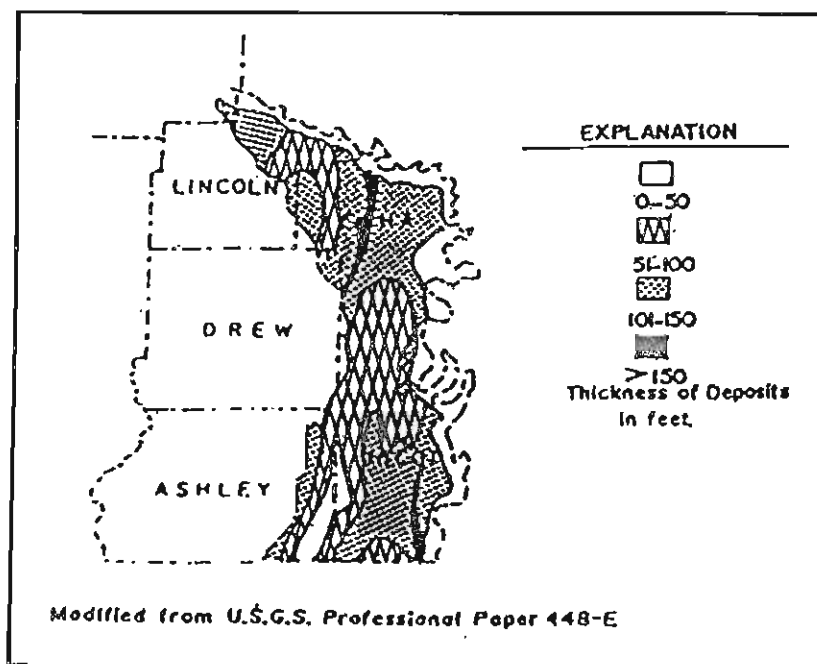
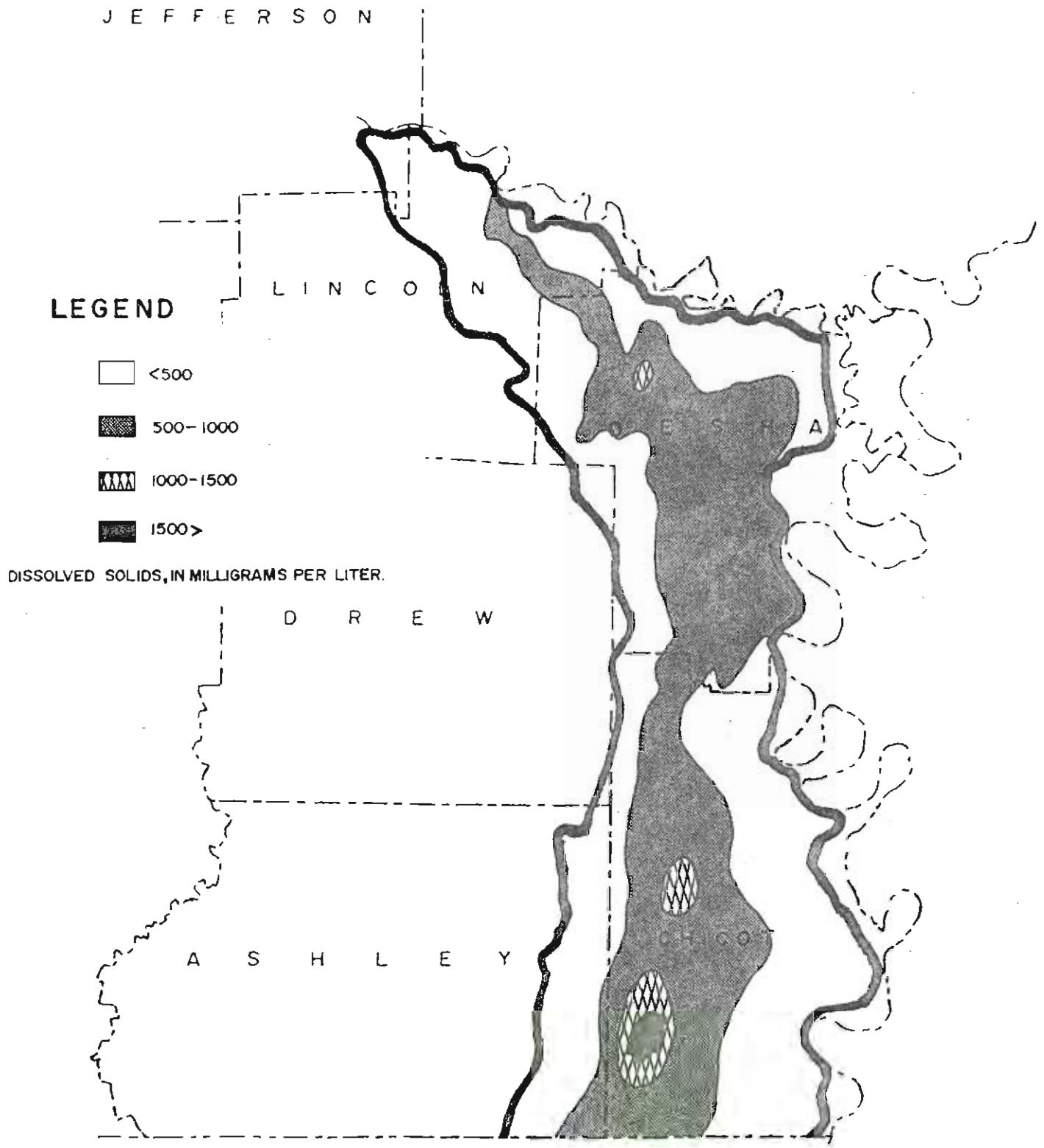


FIGURE 3-9 THICKNESS OF QUATERNARY DEPOSITS IN THE
 BOEUF-TENSAS BASIN

DISSOLVED SOLIDS AND CHLORIDE IN THE ALLUVIAL AQUIFER



DISSOLVED SOLIDS, IN MILLIGRAMS PER LITER.

Modified from U.S.G.S. Open-file Report "Hydrology of the Bayou Bartholomew Alluvial Aquifer-Stream System, Arkansas."

FIGURE 3-10

It has been suggested by Broom and Reed (1973) that concentrations of highly mineralized water are due to natural causes related to the velocity and depth of groundwater movement and the nature of the sediments in the basin. Others have speculated, as a result of high levels of sodium and chloride, that the highly mineralized water is rising from a deeper source, possibly through abandoned oil wells.

Withdrawals doubled between 1965 and 1980 but water levels have changed very little. While the lack of a downward trend in water levels does not pose a problem, increased seasonal drawdowns may be a potential problem due to the lateral movement of saltwater from contaminated areas. Currently, insufficient data exist to quantify the relationship between seasonal withdrawals and lateral movement of saltwater. An important source of recharge is from the Arkansas River above Lock and Dam Number Two, as well as the Mississippi River. Also, there is recharge from the Lower Ouachita Basin. During periods of heavy pumping water levels will decline 15 to 20 feet. This decline will promptly be recharged prior to the next water use season. This indicates a potential of greater amounts of water available for pumping. Water withdrawn in 1980 from the Quaternary aquifer in this study area represents only about 6 percent (215.5 MGD) of the State's total pumpage from this aquifer. (See Figure 3-11).

The limiting factor in water use from this aquifer is quality rather than quantity. Very little is used for domestic and industrial purposes due to its chemical composition. This has resulted in this water source being developed almost exclusively for agricultural uses.

Tertiary Aquifers

Immediately underlying the alluvial aquifer are the marine clays and marls of the Jackson Group. The Jackson Group is underlain by several zones of sand between dominantly clay layers. The entire sequence below the Jackson is known as the Claiborne Group which is composed of four formations. These formations are, from top to bottom, the Cockfield Formation, the Cook Mountain Formation, the Sparta Sand, and, the lowest, the Cane River Formation.

The Cockfield and Sparta are the aquifers that provide most of the water for municipal water supply systems within the basin. The cities of Lake Village, Eudora and Dermott, in the southern part of the basin, have wells in the Cockfield while the cities of McGehee, Tillar, Rohwer, Watson, Dumas, Gould, Grady, Tamo, and Cummins Prison Farm have wells in the Sparta.

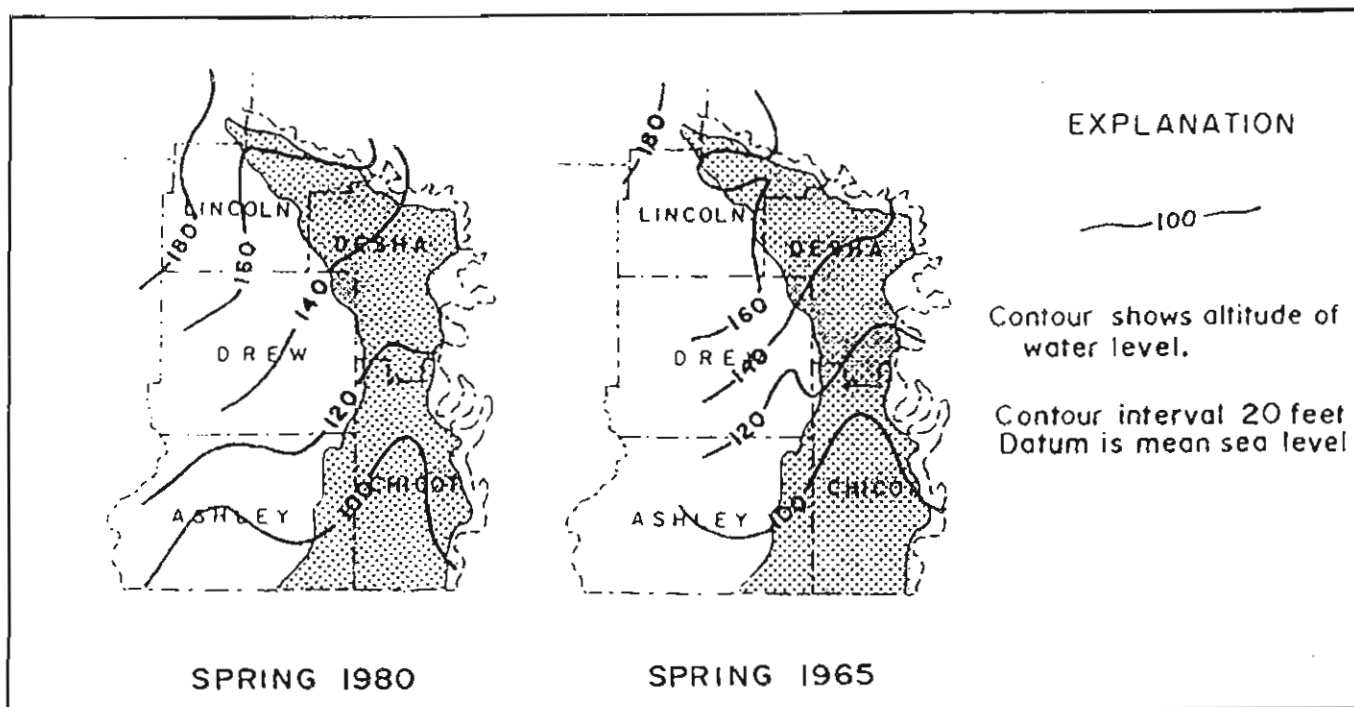
Both aquifers are thought to be nonmarine in origin. Both are artesian and yield water of a sodium bicarbonate type. Dissolved solids in both aquifers increase from the upper part of the basin to the lower part of the basin. This varies from about 124 to 854 ppm. Sodium ranges from less than 10 ppm in the north to 315 ppm in the south. Water from the Cockfield is too highly mineralized for use in the extreme southern part of the basin, while water from the Sparta is too highly mineralized for use over much of Chicot County.

Both formations consist of a number of interconnected layers of fine to medium grained sands within layers of clays, shales and lignitic material. They differ in that the Sparta is thicker (700 to 800 feet) than the Cockfield (300 to 400 feet). The sands within the Cockfield are finer grained and do not have as high a percentage of the total formation as do the sands of the Sparta.

Well yields in the Cockfield vary from a few, to several hundred gallons per minute, and average about 100 gallons per minute. The Sparta has yields up to about 1000 gallons per minute in Desha County. Water withdrawn in 1980 from the Cockfield formation in the study area represents about 26 percent (1.85 MGD) of the State's total pumpage from this aquifer while pumpage from the Sparta during the same period of time represents only about one percent (1.73 MGD) of the State's total pumpage from this aquifer.

Water levels are declining from the south to the north in Chicot County where levels range from 10 feet to 60 feet below the surface. In Desha County, water levels continue to decline in a north-west direction. At Tamo, the level is about 140 feet below the surface. The water level decline is illustrated by Figures 3-12 and 3-13.

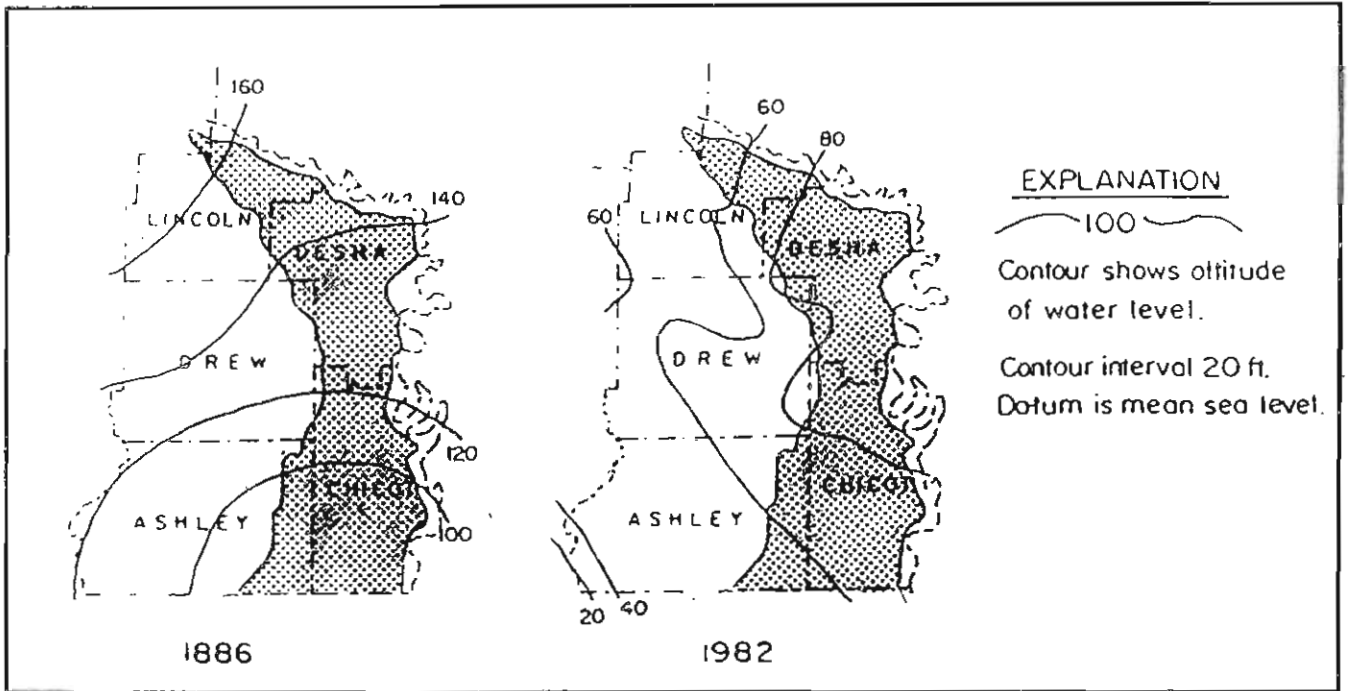
PAST AND RECENT WATER LEVELS IN QUATERNARY DEPOSITS



Data Source: Maps and data in Water Resource Summary Number 4, and circular on ground-water levels for spring 1980, both prepared by U.S.G.S. in cooperation with the Arkansas Geological Commission.

FIGURE 3-11

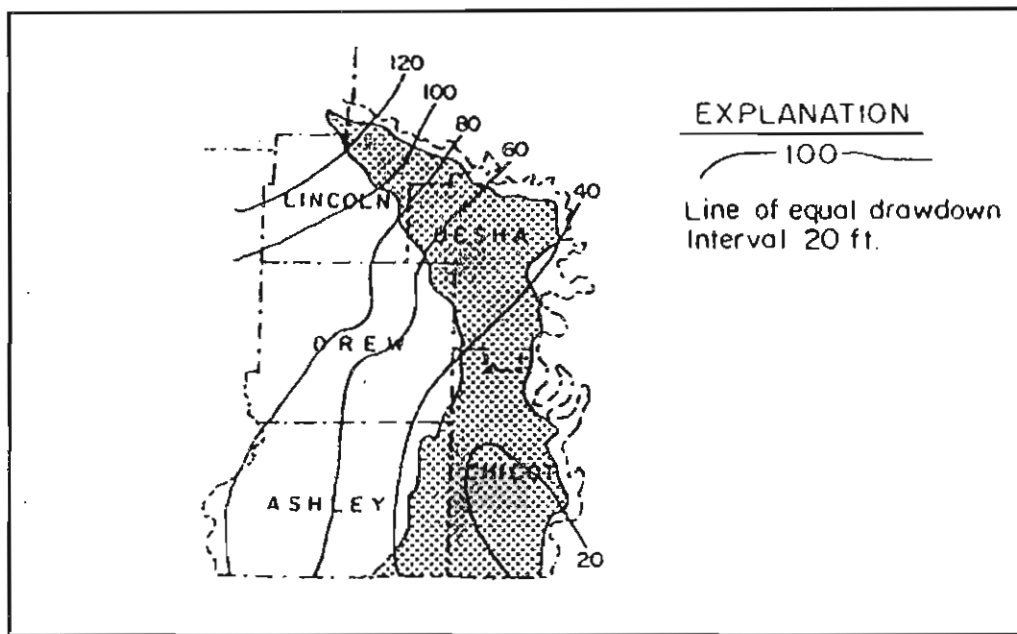
PAST AND RECENT WATER LEVELS IN THE SPARTA SAND



Data Source: Maps modified after data in Water Resources Summary Number 4, & circular on ground-water levels for spring 1980, both prepared by U.S.G.S. in cooperation with the Arkansas Geological Commission.

FIGURE 3-12

LOWERING OF WATER LEVELS IN THE SPARTA SAND, 1886-1982.



Based on U.S.G.S. Hydrologic Investigation Atlas HA-434, and U.S.G.S. Open File Report 82-852.

FIGURE 3-13

CHAPTER IV
PROJECTIONS (YEARS 2000 AND 2030)

PROJECTIONS (YEARS 2000 AND 2030)

A key phase of the "State Water Plan" is the determination whether or not water will be available in sufficient quantity and quality to meet the demands placed on this resource in future years. To do this, projections are needed in the following categories within this area.

POPULATION PROJECTIONS

First priority is given to the human needs for water. To determine the amount of water necessary to meet this demand, projections were made for the year 2000 and the year 2030 for the study area. Projections for the year 2000 were made by the Arkansas Department of Pollution Control and Ecology. The Arkansas Soil and Water Conservation Commission's staff extended these projections to the year 2030.

Based on the 1980 census of population data, there were a total of 37,553 people living in the study area (Chicot and Desha Counties). By the year 2000, the number of people living in this area is projected to increase to 40,950, an increase of about 9 percent and by the year 2030, projections indicate the population will be 45,720, an increase from the year 2000 figure of about 11.6 percent. The above figures amount to an overall increase from 1980 to the year 2030 of about 22 percent. (See Table 4-1 for additional information on population projections).

PROJECTED LAND USE

A detailed analysis of the present land base was made. This analysis was based principally on present land use, the soils and the slopes of the soils. It was found that potential changes that probably would occur were within the accuracy limits of "RIDS" (U.S.D.A., Arkansas Statewide Study Data). <1> For this reason it was assumed there would be no major changes in land use. Most of the expected changes would involve a small reduction of cropland.

TABLE 4-1

POPULATION PROJECTIONS
IN THE STUDY AREA

COUNTY	YEARS				
	1980		2000 ^{1/}		2030 ^{2/}
CHICOT	17,793		19,200		20,970
DÉSHA	19,760		21,750		24,750
TOTAL (Study Area)	37,553		40,950		45,720
PERCENT CHANGE		+9.0%		+11.6%	

1/ Source: Arkansas Department of Pollution Control & Ecology

2/ Source: Arkansas Soil & Water Conservation Commission

PROJECTED ACRES OF IRRIGATED CROPS

More important to this study was the development of projected acres of irrigated crops. Irrigation is the single largest consumptive use of water within the basin. The projections for the year 2030 were made in conjunction with the Arkansas Statewide Study, Phase V, by the Economic Research Service. <24> During the next 50 years, the irrigated acres will increase almost two and one quarter times, from about 200,000 acres in 1980 to about 430,000 acres by the year 2030. It is expected that non-irrigated crops will be about 260,000 acres at that time. The projected acres of crops are shown in Table 4-2.

TABLE 4-2
PRESENT AND PROJECTED IRRIGATED CROPS ^{1/}
(Years 1980, 2000 and 2030)

YEARS	CROPS IN ACRES					
	COTTON	CORN	SOYBEANS	RICE	SORGHUM	TOTAL ^{2/}
1980	37,283	394	61,718	94,193	0	193,588
2000	47,400	200	151,800	89,200	300	288,900
2030	62,500	0	287,000	81,500	800	431,800

^{1/} Source: Arkansas Statewide Study, Phase V, "Agricultural Water Study," U.S.D.A., S.C.S. and E.R.S., in cooperation with Arkansas Soil and Water Conservation Commission, August, 1983.

^{2/} Excludes Acreage on Wheat, Vegetables, Orchards & Vineyards, and Hayland.

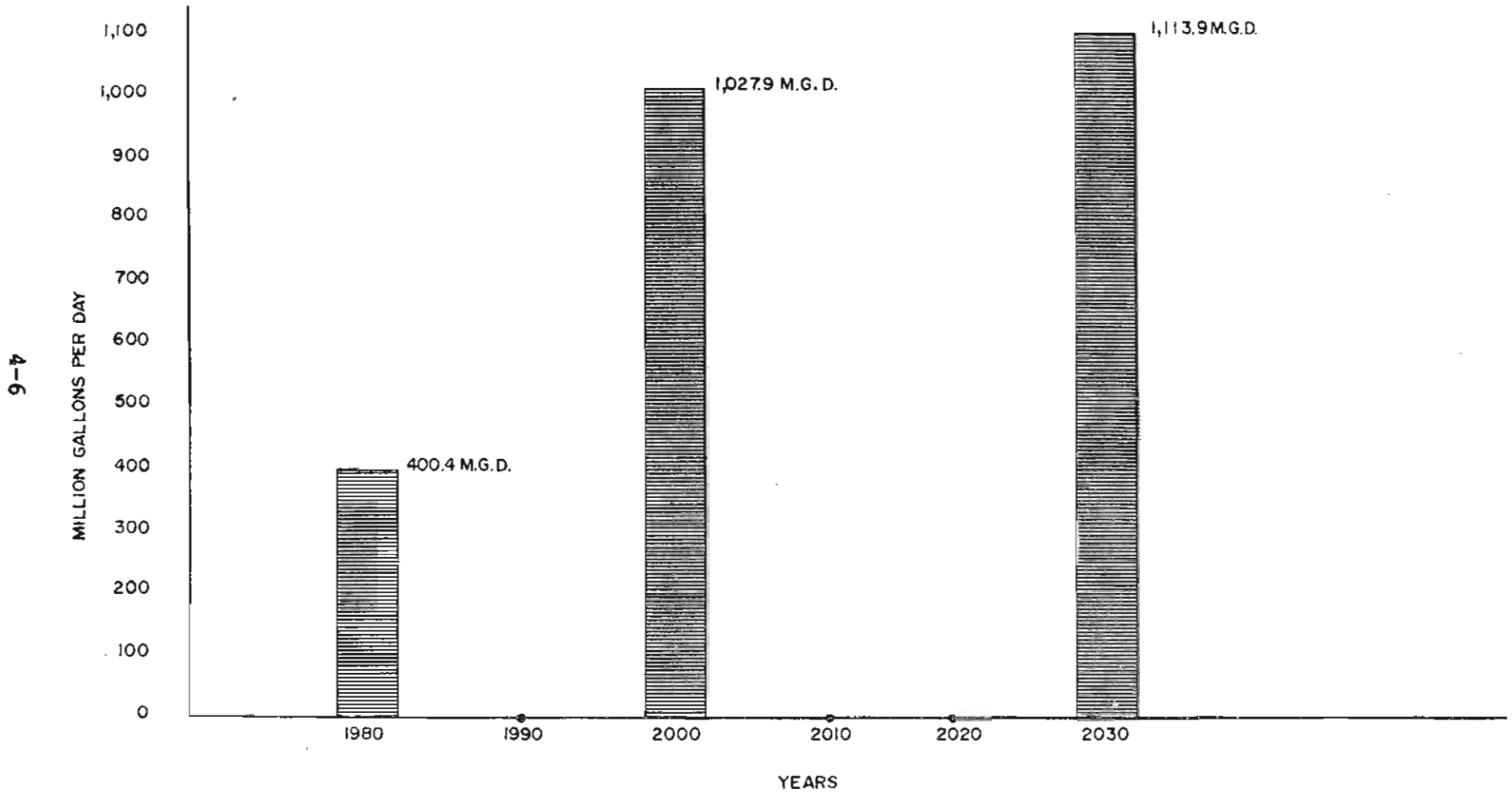
WATER USE PROJECTIONS

Total water use projections in this basin indicate a tremendous increase in the demand for water during the next 20 years. By the year 2000, almost 1028 MGD will be required to meet the needs of water users. This is about two and one-half times the total amount of about 400 MGD used in 1980. However, during the next 30 year period, from the year 2000 to 2030, only about an 8 percent increase in water use is expected, from about 1028 MGD to about 1114 MGD (See Figure 4-1). The assumption used to reduce the 2030 demand was an increase in efficiency in the use of irrigation water. If the future efficiencies remain the same as present, the increase in use from the year 2000 to 2030 will be about 20 percent (See Table 4-4 on Page 4-9). It should be noted that in making these projections of water demands, the availability of water was not used as a constraint nor was capital investment considered. An assumption was made that land owners and operators would make the investments in irrigation equipment and systems rather than in additional land holdings and dry land farming equipment.

In 1980, about 33 percent of the total water used was obtained from surface sources. To meet future water demands, surface water must be the major source. Until ongoing studies are completed as to the extent that groundwater sources can be safely utilized, it is impossible to determine the demand for surface water.

A brief discussion on projected water use for each of the major categories is discussed in the following paragraphs. (Refer to Table 4-3 for information regarding this portion of the plan).

TOTAL WATER USE PROJECTIONS BY YEARS



Source: U.S.G.S. - 1980; Arkansas Soil & Water
Conservation Commission-2000 and 2030

FIGURE 4-1

TABLE 4-3

WATER USE PROJECTIONS - BY YEARS
(in MGD)

USE CATEGORY	YEARS				
	1980 ^{1/}			2000 ^{2/}	2030 ^{2/}
	GW ^{3/}	SW ^{4/}	TOTAL	TOTAL	TOTAL
PUBLIC SUPPLY	3.8	0.0	3.8	6.4	9.1
SELF-SUPPLIED INDUSTRY	1.4	11.6	13.0	17.6	33.6
RURAL USE:					
DOMESTIC	1.1	0.0	1.1	1.1	1.2
LIVESTOCK	0.2	0.3	0.5	8.0	11.9
SUBTOTAL (Rural Use)	1.3	0.3	1.6	9.1	13.1
IRRIGATION ^{5/}	260.6	121.4	382.0	994.8	1,058.1
TOTAL	267.1	133.3	400.4	1,027.9	1,113.9

^{1/} Source: U.S.G.S. - 1980

^{2/} Arkansas Soil & Water Conservation Commission

^{3/} Groundwater

^{4/} Surface Water

^{5/} Includes Fish Farms and On-Farm Wildlife and Recreation Uses

Public Water Supply

All water presently used for public water supplies is obtained from groundwater sources and future water use is also expected to come from this source. In 1980, 3.8 MGD of water was used for public water supplies. Water use projections indicate that by the year 2000, water used for public water supplies will be about 6.4 MGD, an increase of about 70 percent. By the year 2030, the demand for water is projected to be about 9.1 MGD, an increase of about 40 percent from the year 2000 figure. The above figures amount to an overall increase from 1980 to the year 2030 of about 140 percent.

Self-Supplied Industries

In 1980, self-supplied industries obtained only about ten percent of its water from groundwater sources. Total water use for self-supplied industries is projected to increase from 13.0 MGD in 1980 to about 33.6 MGD in 2030, an increase of about 160 percent.

Rural Use

Domestic

All water presently used for rural domestic purposes is obtained from groundwater sources. In 1980, 1.1 MGD of groundwater was used for domestic needs. Water demands for domestic needs will remain almost constant for the next 50 years. Future water use projections show that this same amount will be used in the year 2000 and by the year 2030, this amount will increase to only 1.2 MGD.

Livestock

In 1980, only about 0.5 MGD were used by livestock and about 0.2 MGD, or 40 percent came from groundwater sources. By the year 2000, water used for livestock is expected to increase by about 1500 percent, going from a total of about 0.5 MGD to about 8.0 MGD. Water use projections for the next 30 year period, from the years 2000 to 2030, indicate that the total water to be used for livestock will increase from about 8.0 MGD to about 11.9 MGD, an increase of about 50 percent. The above figures amount to an overall increase from 1980 to the year 2030 of about 2,300 percent.

Irrigation

About 68 percent of the water used in this basin is for the production of food and fiber and comes from groundwater sources. Agriculture is expected to continue to be the single largest user of water in the basin in the future. Water use projections indicate that water used for irrigation will increase from 382 MGD in 1980 to about 995 MGD by the year 2000, an increase of about 160 percent. During the time period from 2000 to the year 2030, water used for irrigation will tend to level off, increasing from about 995 MGD to about 1,058 MGD, an increase of a little over six percent. This small increase in water used, between the years 2000 and 2030, is credited to higher water use efficiencies. If planned efficiencies are not met, the increase will be about 18 to 20 percent. The above figures amount to an overall increase from 1980 to the year 2030 of about 175 percent.

Table 4-4 gives the total volume of water, by month and time frame, that must be provided to meet irrigation demands.

TABLE 4-4
PUMPING VOLUMES IN BASIN BY MONTHS AND YEARS ^{3/}
(Acre-Feet)

MONTHS	YEARS			
	1980 ^{1/}	2000 ^{1/}	2030 ^{1/}	2030 ^{2/}
January	462	668	791	711
February	462	668	791	711
March	517	891	1,055	948
April	9,528	15,375	18,191	16,354
May	100,601	163,216	193,116	173,617
June	187,826	304,706	360,528	324,125
July	211,621	343,365	406,269	365,248
August	143,054	232,067	274,581	246,856
September	30,488	49,466	58,528	52,618
October	1,211	2,005	2,373	2,133
November	509	893	1,054	949
December	465	780	923	830
TOTAL	686,744	1,114,100	1,318,200	1,185,100

^{1/} Efficiencies estimated at 60 percent.

^{2/} Efficiencies estimated at 75 percent.

^{3/} Source: Arkansas Statewide Study, Phase V, "Agricultural Water Study," U.S.D.A., S.C.S. and E.R.S., in cooperation with Arkansas Soil and Water Conservation Commission, August, 1983.

CHAPTER V

PROBLEMS AFFECTING EXISTING WATER AND RELATED LAND RESOURCES

PROBLEMS AFFECTING EXISTING WATER AND RELATED LAND RESOURCES

Often, a history of plenty can lead to belated recognition of emerging resource problems. We have all heard that Arkansas has an abundance of water, but what we are now beginning to realize is that water is not always available when needed nor is its quality always that required. In addition, increases in population and economic activity have resulted in sharp yearly increased water requirements, requirements which are projected to increase even more sharply over the next 50 years.

As shown earlier in this report, there is an abundance of water in this basin with an average annual rainfall exceeding 50 inches per year and large quantities of groundwater found in the three major aquifers.

People in the basin, however, are becoming more aware and concerned of the fact that these water resources are not inexhaustible and are not exempt from misuse and mismanagement.

A series of public meetings were held within each Conservation District to determine the public's preception of, and concerns with, problems associated with soil, water, and related resources. These meetings fulfilled the requirements of the Soil and Water Resources Conservation Act (RCA) passed by Congress in 1977.

This Act directed the Secretary of Agriculture to conduct a continuing appraisal of the status and condition of our soil, water, and related resources. The purpose of RCA is to insure that programs administered by the Secretary of Agriculture for the conservation of soil, water, and related resources is responsive to the nation's long term needs. Broadbased participation in the RCA effort by groups, organizations, and the general public is a primary objective of the Act and is necessary to ensure that SCS programs respond to the public needs. Included in the following list are those concerns and problems voiced by the public and various State and Federal agencies. The categories of expressed concern, within the basin, were as follows: <31>

Soil Erosion	Water Quality
Flooding	Water Quantity - Surface Water
Drainage	Food and Fiber
Water Supply	Fish and Wildlife
Water Management	Recreation

While all of the above soil and water resource concerns have merit, there are six categories that are major in scope. The six major soil and water resource problems in this basin are: (1) surface water quantity (during peak demand months); (2) groundwater quality and quantity (high chloride concentration in groundwater of the alluvium aquifer and lowering of water levels in the Sparta Sands located in the northern portion of the basin); (3) nonpoint pollution sources of surface water; (4) urban and rural flooding; (5) drainage; and (6) fish and wildlife destruction.

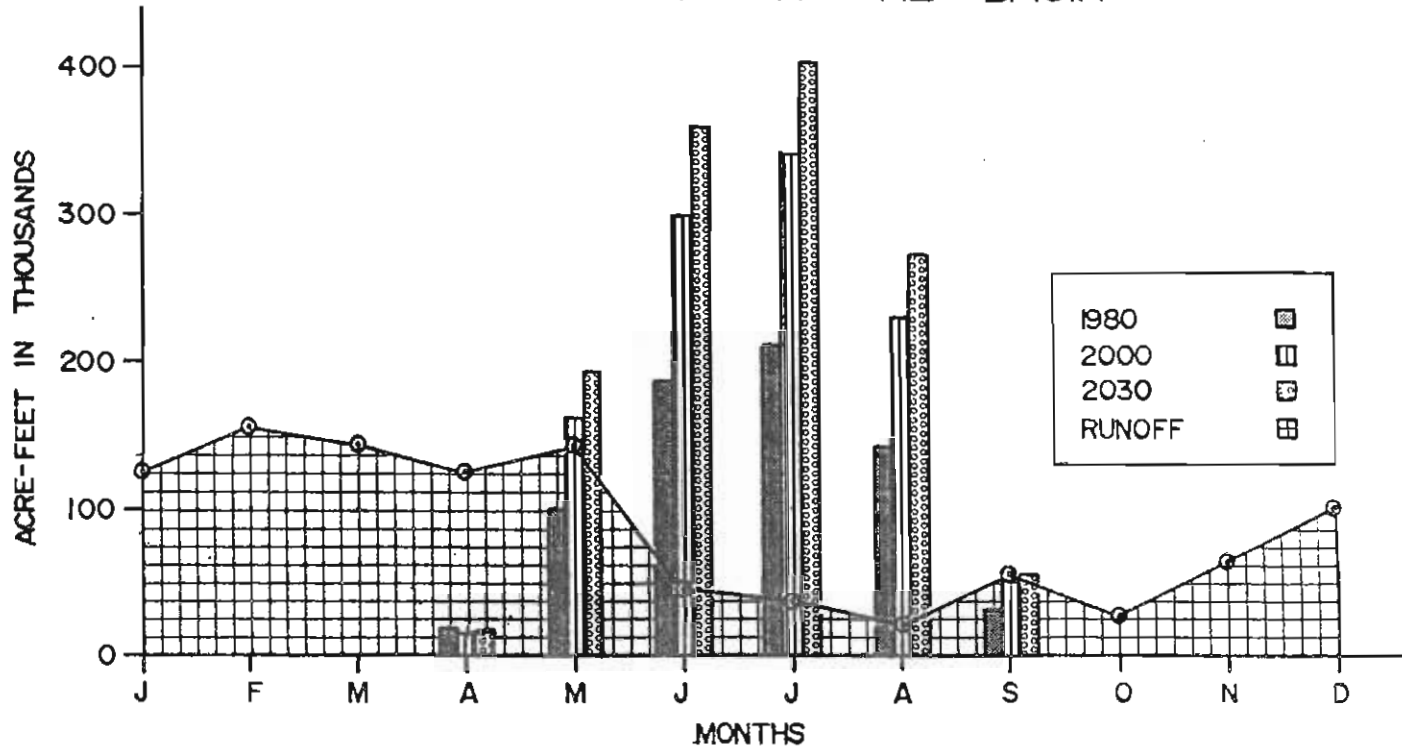
SURFACE WATER QUANTITY

Even though this basin has a large average annual rainfall of over 50 inches, most of it occurs during the fall and winter months of the year when the demand for water is at its lowest. This situation results in most of the rain that falls on the basin running off without being utilized. Consequently, the demand for water is highest during the dry, hot summers when rainfall (runoff) is lowest. See Figure 5-1. Streams, impoundments and rivers become low during these periods and in some cases streams cease to flow and impoundments dry up.

The 1980 data shown in Figure 5-1 indicates that of the approximate 643,100 acre-feet of water that was withdrawn for agricultural purposes during the four month peak demand period from May through August, only about 246,400 acre-feet or 38 percent of the needed water was available from runoff. However, not all of the 246,400 acre-feet can be used because of agreements with Louisiana in the Red River Compact and instream flow requirements.

One can readily see from Figure 5-1 that the demand versus surface water availability is critical now and will worsen during the next 50 years. Water pumped for agricultural purposes during the same four month period (May through August) is projected to increase from the 643,100 acre-feet used in 1980 to about 1,043,400 acre-feet in the year 2000, an increase of about 62 percent. By the year 2030, about 1,234,500 acre-feet, or an increase of about 18 percent, will be needed for this purpose. The overall percentage increase in demand for water for this purpose from the year 1980 to the year 2030 is about 92 percent. Average monthly runoff, however, during this same 50 year period, is expected to remain about the same.

PROJECTED TOTAL AGRICULTURAL WATER WITHDRAWAL AND RUNOFF IN THE BASIN



Source: Arkansas Statewide Study, Phase V, "Agricultural Water Study," U.S.D.A., S.C.S. and E.R.S., in cooperation with Arkansas Soil and Water Conservation Commission, August, 1983.

Source: U.S.G.S. Stream Gage Data, Water Year 1958-1968.

Source: Arkansas Soil and Water Conservation Commission - Projections.

FIGURE 5-1

The poor distribution of rainfall during the growing season severely affects crop yields and thus the economy of the area and the State. James L. Gattis, Agricultural Engineer of the University of Arkansas, defined a drought as "any period of 20 days or more, each ten days of which has less than 1/2 inch of rainfall." In his study of thirty-three years of record "there have been three droughts of more than 50 days' duration. Droughts of 40 to 49 days have occurred four times, or about once every eight years. Much more frequent are droughts of 30 to 39 days which occurred ten times or an average of about once every three years. Droughts of 20 to 29 days were the most frequent of those recorded. They occurred 30 times in 33 years, an average of almost once each year. Less frequent were droughts of 25 to 29 days, which occurred 17 times, or about every other year." <34> It is during these dry periods when supplemental water is needed for irrigation to prevent extensive damage during the growing season to agricultural crops.

With the present increasing cost of production and prices of agricultural products, supplemental irrigation by farmers is a must for their economic survival. Few farmers can survive several years of low yields as a result of droughts.

GROUNDWATER QUALITY AND QUANTITY <26>

Quality

Quaternary System. Groundwater in the Quaternary deposits suffers from excessive levels of chloride at several localities. High concentrations of dissolved solids are found in a zone extending north-south through the basin, and locally high levels of chloride occur within this zone (See Figure 3-10 on Page 3-31).

The U. S. Health Service cautions against the use of drinking water containing more than 250 ppm of chloride. High levels of chloride in irrigation water, when applied to poorly drained soils, will cause the soils to develop a severe salinity problem and will adversely affect crop production. Chloride concentrations of up to 1,500 ppm have been reported west of Eudora and concentrations up to 400 ppm occur west of Lake Village along Big Bayou.

In addition to these areas of high chlorides identified in published reports, recent sampling by the U. S. Geological Survey indicates other locations where chlorides are alarmingly high and suggests that the situation may be worsening, as indicated by soil salinity problems northeast of Tillar, Arkansas. They report that during the past several years irrigation has been suspended on a number of plots as a result of increasingly high chloride content of the groundwater, and that local interests in Chicot and Desha Counties are concerned about the suitability of ground water for future agricultural production in the area.

Claiborne Group. Water from the Sparta Sand is too saline for normal use over most of Chicot County and the quality of water from the Cockfield is somewhat degraded in the same area. However, both problems are due to natural causes and at present can not be remedied. There is currently no evidence that the water quality problems of the Claiborne are increasing or that there is any significant spreading of saltwater in the aquifer; however, there is limited data available that defines the nature and extent of saltwater in these aquifers. It is possible, with the small number of monitoring wells, that slow, undetected spreading of saltwater may be occurring. At present, water quality is degraded enough to limit industrial development in the basin.

Quantity

Quaternary System. Water levels in most wells in the Quaternary deposits of the Boeuf-Tensas basin are within 20 feet of the surface and have shown no significant decline in the last 15 years despite relatively heavy pumping. The aquifer has been a source of abundant groundwater and is in no danger of depletion during the study planning period. A study to determine the safe yields of the aquifer is underway.

Claiborne Group.

Cockfield Formation. The Cockfield Formation has not been pumped as heavily as the other two aquifers in the basin owing to the fact that it is not as predictable a source of large quantities of groundwater. However, the relatively low rates of recharge to the aquifer have resulted in a gradual lowering of water levels.

Five observation wells in the Cockfield Formation in Chicot County showed 1981 water levels ranging from about 10 to 65 feet below ground level, with an average yearly decline of 0.73 feet per year from 1977 to 1981. This lowering represents no immediate threat during the study planning period to regional water supplies since water levels are still at least 140 feet above the top of the formation.

Sparta Sand. Water levels in the Sparta Sand are depressed and are falling at a high rate, especially at the northern end of the basin. In 1981, the public supply well at McGehee in southern Desha County showed Sparta water levels to be about 65 feet below ground level, but at Tamo on the extreme northeast end of the basin, the water level was 141 feet below the surface. Over the period from 1977 to 1981, the water level had fallen at an average yearly rate of 1.31 feet at McGehee and 4.17 feet at Tamo.

These dropping water levels result from very heavy pumping of the Sparta at several locations outside the Boeuf-Tensas Basin. An extensive cone of depression has developed in the Sparta around Pine Bluff and the effects have spread into the Boeuf-Tensas Basin. Similar cones of depression at Magnolia and El Dorado in Arkansas and at Monroe, Louisiana have resulted in lowered water levels over the entire region of southern and southeastern Arkansas. This lowered regional water level contributes to the more immediate effects of pumping at Pine Bluff.

It is difficult to predict future rates of decline because of changing patterns of water use. The International Paper Company, one of the major consumers of water from the Sparta at Pine Bluff, has recently taken steps to reduce its use of groundwater in favor of Arkansas River water. Reduced rates of withdrawal at Pine Bluff will allow natural recharge to have a favorable effect on Sparta water levels.

However, there has been a trend toward greater use of the Sparta for irrigation in the Grand Prairie.

The use of the Sparta as a groundwater resource during the next 50 years in this Basin is partly dependent on events and economic forces which operate outside the basin. The Sparta, however, will continue to be a dependable source for high quality water within the Basin. Heavy pumping centers outside the basin will be forced to reduce withdrawals from the Sparta, due to economics, before lowered water levels in the Boeuf-Tensas Basin become a critical problem.

NONPOINT POLLUTION SOURCES OF SURFACE WATER <3>

There are nine activities that affect water quality in this basin. (The watershed names and numbers referred to in this section can be found in Figure 3-2 and Table 3-2 of this report). A discussion of each follows:

Soil Erosion

Soil erosion is a serious and major concern in this basin with an estimated 1,809,800 tons of sediment being delivered to the individual watershed outlets within the basin annually. However, only 526,700 tons of sediment are being delivered to the outlets of the basin. The greatest amounts are at the watershed outlets of Chicot, Oak Log Bayou, Caney Bayou, and Grady-Gould watersheds, with estimated annual deliveries of 274,700 tons; 130,200 tons; 125,500 tons; and 116,700 tons, respectively. An estimated 265,200 tons of sediment per year is currently entering Lake Chicot. Since the greatest amount of erosion (98 percent) comes from sheet and rill erosion on cropland, it is assumed that this is also the major source of sediment (see Tables 5-1 and 5-2).

TABLE 5-1
SUMMARY OF EROSION BY SOURCE

EROSION SOURCE	TONS PER YEAR	PERCENT OF TOTAL
Road Surface Erosion	34,904	0.6
Road Bank Erosion	21,262	0.4
Gully Erosion	3,741	0.1
Streambank Erosion	56,152	1.0
Sheet and Rill Erosion	5,374,432	97.9
TOTAL	5,490,491	100.0

Source: 1977 RIOS Data

TABLE 5-2
SHEET AND RILL EROSION BY LAND USE

LAND USE	PERCENT OF TOTAL LAND USE	AVG. EROSION RATE (TONS/ACRE/YEAR)	PERCENT OF EROSION CONTRIBUTED BY LAND USE
Cropland	84.8	7.26	99.02
Grassland	2.1	1.01	0.85
Forests	7.1	0.12	0.13
Urban and Built-up	1.8	0.2	0.0
Water and Other	4.2	0.0	0.0
TOTAL	100.0	6.22	100.0

Source: 1977 RIDS Data

Soil scientist estimate that for most soils, the average annual rate of soil loss should not exceed five tons per acre or the soil-forming process will not keep pace with soil loss. <32> In this basin, cropland erosion rates were under five tons per acre annually in only three watersheds. The average erosion rate for cropland in this basin is 7.26 tons per acre per year, with a range between a low of 4.24 tons per acre in Watershed #11, to a high of 12.50 tons per acre in Watershed #15.

To make these figures more meaningful, a ton of soil is roughly equivalent (1.2 c.y.) to a cubic yard. An inch of topsoil covering an acre would weigh about 160 tons. Six inches of topsoil, the depth normally cultivated in modern agriculture, weighs about 1000 tons. Thus, an estimate that a given field is losing 12.5 tons per year (the maximum in this basin) means that it will lose an inch of topsoil every 13 to 15 years, and the whole plow layer in roughly 100 years.

The overall average rate on grassland is 1.01 tons per acre annually and the average erosion rate for forestland is 0.12 tons per acre annually.

Construction

Construction activities (i.e. housing and highway construction) may temporarily (6 to 18 months) disturb natural vegetation and accelerate erosion and sediment delivery to streams. A 1977 inventory revealed 1363 disturbed acres on construction sites. The greatest activity was in Watershed #7 with 340 disturbed acres, all of which were slightly eroding (0-10 tons per acre annually). Next was Watershed #8 with slight erosion on 4 acres and moderate erosion (10-50 tons per acre annually) on 219 acres. Erosion was rated slight on 560 acres in Watershed #2, slight on 160 acres in Watershed #4, and slight on 10 acres in Watershed #24.

Subsurface Disposal

Subsurface disposal involves the use of septic tank absorption fields or soil areas for absorption of effluent from septic tanks. A subsurface tile system is laid out in such a way that effluent is uniformly distributed. If the effluent is not adequately absorbed by the soil, it may seep to the surface and be transported by surface water to neighboring streams. Properties which influence the capacity of the soil to absorb effluent include permeability, depth to water table, depth to bedrock, and flood hazard.

Factors such as permeability rates slower than 0.6 inches per hour, or a seasonal water table, or impervious material less than 4 feet below the tile trench are considered severe limitations. Permeability rates between 0.6 to 1.0 inches per hour, a seasonal water table, or impervious materials between 4 and 6 feet below the tile trench are considered moderate limitations. Both severe and moderate limitations are difficult and costly to overcome.

A 1977 inventory revealed that 41.9 percent, or 3,640 households out of a total of 8,671 in the basin, depended on septic tank filter fields to dispose of their sewage. The entire northern half of the basin has severe limitations for septic tank filter fields because of slowly permeable soils, high water tables, and occasional flooding. Similar problems are found over about 70 percent of the lower half of the basin. Some suitable soils are found along either shore of Lake Chicot, in a narrow band extending from Hailey southward to the town of Chicot, and in a narrow band along Highway 65 from Dermott to near the Louisiana line.

Hydrological Modifications

Significant hydrological modifications have been made as a consequence of its conversion from an area of wetland hardwoods to an area of highly developed agriculture. A total of about 882 miles of channel work has been completed in the basin. This includes about 612 miles installed under the P.L.-566 program and about 270 miles installed by the Corps of Engineers. These modifications have occurred in 21 of the basin's 29 watersheds for the purposes of watershed protection, flood prevention and drainage. Maintenance of channels and ditches is done by dredging or by chemical control of weeds and brush. Dredging causes increased sedimentation for short periods of time. Banks not adequately vegetated contribute sediment to streams below. All uncontrolled areas along streams adjacent to fields are a source of sediment. There are numerous small ditches and field drains within the basin, the majority of which have been stabilized. Some banks are still sloughing and contributing to the sediment load. These ditches and drains also serve as carriers of pesticides leaving fields.

The U. S. Army Corps of Engineers has commenced construction on channels, a pumping plant, and two water control structures which will divert water that now enters Lake Chicot. The pumping plant will lift water through the Mississippi River levee and thus allow it to flow directly into the Mississippi River.

Land Disposal Sites

There are eight active and nine abandoned refuse disposal areas in the basin which cover 225 acres and 118 acres, respectively. Watershed #18 has three landfill sites covering 123 acres, with 120 acres active. One abandoned dump (three acres) with no cover in Watershed #16 is reported to be contaminating a nearby stream. The apparent effect on water quality of the remaining sites is slight to none.

Roadside and Roadway

The basin contains a little over 1,100 miles of roads, including 470 miles of two-lane paved highways, and the remainder in graveled roads. Erosion is classed as moderate on 13 miles of paved roads and slight on 457 miles. On graveled roads, only 6 miles were reported to have moderate erosion and the remainder were classed as slight. Erosion rates varied from one ton per mile annually in Watershed #3, to a high of 70 tons per mile annually in Watershed #20. Overall, roads contributed only about one percent to the total soil movement in the basin.

Road ditches serve as drainageways for roads and most enter directly into small streams where they deposit their sediment loads.

Streambank Erosion

This basin contains approximately 338 miles of eroding streambanks. Streambank erosion contributes an estimated 56,152 tons of sediment per year to these streams. This sediment enters the streams at a low rate of 42.5 tons per mile per year in Watershed #20 to a high of 8,469 tons per mile per year in Watershed #9.

Streambank erosion may or may not be attributed directly to human activity, but in most instances it is apparent that erosion has been accelerated where land use activities such as tillage farming, livestock operations, roadways or construction are ongoing near the stream. A large part of this erosion is caused from the natural meandering of the stream and the fluctuation of the water levels. The average streambank soil loss in the basin from all causes, was estimated to be 165.8 tons per year per mile of stream.

Urban Runoff

Major urban areas include 12 incorporated towns that cover a total of 15,812 acres, including open land. Among the largest of these are Lake Village, with 3,000 acres of residential area; Eudora, with 2,000 acres of residential area; and Dumas, with 1,400 acres of residential area. See Table 5-3 for land use in each town.

TABLE 5-3

LAND USE OF URBAN AREAS ^{1/}

(in acres)

City	Open Land	General Residential	General Commercial	Light Industrial	Heavy Industrial	Other	Total
Grady	800	100	100	0	0	0	1,000
Gould	400	200	200	40	0	0	840
Dumas	200	1,400	120	180	0	0	1,900
McGehee	1,500	200	750	750	0	0	3,200
Jerome	142	100	15	0	30	0	287
Winchester	220	100	0	0	0	0	320
Montrose	20	150	15	0	0	30	215
Portland	40	270	20	0	90	240	660
Parkdale	20	90	20	5	0	505	640
Wilmot	15	285	40	0	20	820	1,180
Lake Village	500	3,000	50	10	0	0	3,560
Eudora	60	2,000	15	15	20	0	2,110

^{1/} Arkansas Department of Pollution Control and Ecology.

Towns reporting no street cleaning activities were Grady, Gould, Montrose, Portland, Parkdale, and Wilmot. Dumas uses a street sweeper twice weekly and deposits waste in a landfill. McGehee uses a sweeper weekly and also deposits waste in the landfill. The remaining towns clean their streets manually each week and either deposit waste in low areas of the town or in landfills. Lake Village flushes its storm drains every two years. Storm water from towns is disposed of by underground lines or open ditches which transport pollutants directly to streams.

Gully Erosion

A 1978 Conservation District inventory revealed about 166 acres of moderately (10-50 tons per acre annually) and one acre of slightly less than 10 tons per acre annually) eroding gullies in the segment. According to RIDS, segment gullies are eroding at an annual rate of 3,741 tons.

The district's inventory showed that there were 60 acres and 55 acres of moderately eroding gullies in Watersheds #12 and #26, respectively.

URBAN AND RURAL FLOODING <1> <2>

There are about 474,903 acres located within the floodplain of this basin. Land use within the floodplain consists of about 355,831 acres of cropland, 89,593 acres of forestland and about 29,479 acres of grassland.

The 100-year frequency flood would inundate and cause severe losses on the entire 474,903 acres in the floodplain.

Floodwater problems, due to excessive runoff from high intensity or long duration rainfalls, occur throughout the basin. An estimated 10,200 acres of cropland flood annually. About 96,000 acres of cropland flood once every two years and about 121,400 acres of cropland flood at least once every five years.

Crop production is limited for the most part to late variety crops such as soybeans because of the continuing threat of flooding. Floods often cause complete crop failures on acres with inadequate outlets and on lands adjacent to major drainageways. The floodwater produces agricultural damages by restricting land use, increasing production cost, decreasing quality of products and decreasing yields.

An estimated 9.5 million dollars in damages occur annually to crops, pasture and forestland within the floodplain. Total damages, which includes damages to roads and bridges, urban areas and other agricultural properties, are estimated to be about 15.0 million dollars annually.

DRAINAGE

Damages received by crops in this basin from poor surface drainage are in the form of delayed planting and replanting of crops, retarded growth, disrupted cultivating and harvesting operations, and poor stands. These conditions are attributable to the nearly level topography, lack of on-farm field drains, lack of major outlets, inadequate natural drains and the poorly drained soils. About 83 percent of the soils in this basin are described as poorly drained and somewhat poorly drained soils and consequently have a wetness problem. <14> The remaining 17 percent are described as well drained and moderately well drained.

FISH AND WILDLIFE DESTRUCTION

The major wildlife resource problem in the basin has been the conversion of woodland and wetland to cropland. This has reduced food and cover for woodland and wetland species. Farm game species that usually benefit from the conversion of woodland and wetland to cropland have increased only slightly because of the "cleanness" of modern farming practices.

The major fishery resource problem is highly turbid water caused by suspended and colloidal sediments. Some of the deleterious effects of these conditions are clogged gills, smothered spawning sites, decreased feeding distances by sight feeders, accelerated eutrophication, and an environment which favors species tolerant of these conditions, usually "rough" fish.

Sampling done on sediment and fish from streams in this basin have shown that many of the pesticides used in the past (DDT, Dieldrin, Endrin, etc.) can still be detected throughout the stream environments. Since 1973, there have been two fish kills in this basin attributed to pesticides. Recent fish samples have revealed high levels of DDE. The high levels of DDT and its metabolites (DDE and DDD) in the fish flesh are of particular concern. The U.S. Food and Drug Administration has set the maximum allowable concentration of total DDT and metabolites at 5 parts per million

for commercial fish (edible portion). All three samples (Table 5-4) of whole fish exceeded the limit but DDT and its metabolites tend to concentrate in the internal organs of fish that would be included in a whole fish analysis but excluded from a fish flesh analysis. While these levels for whole fish appear to be alarmingly high, the amount of DDT, DDE and DDD found in fish flesh is usually 1/10 to 1/4 the quantity found in whole fish. These levels of DDT and its metabolites are the highest found anywhere in the State. <3>

TABLE 5-4

FISH FLESH ANALYSIS

(mg/kg)

Species	DDT	DDE	DDD	Dieldrin	Endrin	Arsenic	Cadmium	Chromium	Copper	Mercury	Lead
<u>Sample 1:</u> Bottom Feeders	-	6.89	2.25	0.08	0.031	-	-	-	-	-	-
<u>Sample 2:</u> Bottom Feeders	0.30	5.19	1.39	0.04	0.012	0.15	0.14	-	0.51	0.40	-
Predators	-	9.05	3.05	0.10	0.048	0.34	0.11	0.13	0.12	-	0.14

Source: Arkansas Department of Pollution Control and Ecology Monitoring Data.

Location: GUA 15A - Boeuf River near the Arkansas-Louisiana line.

CHAPTER VI
SOLUTIONS AND RECOMMENDATIONS

SOLUTIONS AND RECOMMENDATIONS

The overriding policy of the Arkansas Soil and Water Conservation Commission in the area of water management is to insure Arkansans with sufficient water quantity of a quality satisfactory for the intended beneficial use.

This basin is, and will continue to be, a highly productive agricultural region. Present productivity could be increased greatly with an increase of supplemental irrigation of its principal dryland crops - soybeans and cotton.

To increase profit margins and to insure against complete crop failures, the land owners and operators are expected to increase their investments for irrigation systems, rather than invest in land for larger operations and dryland farming equipment during the next 20 to 40 years. Based on 1980 prices, investment cost for irrigation was \$195.23 per acre in this basin. This is a total of about 38 million dollars. On a per acre basis, the cost in this basin is about 22 dollars more than the average for the State. The conversion to irrigation of major crops, rather than increasing size of farms and purchasing new dryland equipment, will increase from 193,588 acres in 1980 to about 431,800 acres in 2030, an increase of about 123 percent. (See Table 4-2 on Page 4-4).

By the year 2030, it is expected that further economies in distribution efficiencies and application management, along with conservation measures, will allow the projected acreage to be irrigated with only about a 42 percent increase of irrigation water pumped.

The present problems within the basin and recommended methods to solve these problems are discussed, by problem, on the following pages.

SURFACE WATER

When considered on an average annual basis, there is a plentiful supply of surface water. However, considering the flows and demands on these flows during the months of May, June, July and August, as shown in Figure 5-1, (Page 5-4) there is a need for additional surface water to meet the projected demand.

Surface water quality is satisfactory for irrigation purposes at present. Pollution by sediment, plant nutrients and pesticides renders the surface flows unsuitable for other beneficial use without extensive treatment.

Institutional Setting

The major institutional problem is the lack of a water law which would allow maximum utilization and management of the resource. Arkansas has historically embraced the Riparian doctrine of Old English law. Courts of law have included reasonable use. Act 81 of 1957 gave the Soil and Water Conservation Commission the power to allocate surface water during periods of shortage. The riparian doctrine does not allow for use on non-riparian land or interbasin transfer of water.

Solutions

a. The recommended solution is the changing of Arkansas law to allow for non-riparian use and interbasin transfer of water.

Interbasin transfer of water means the physical conveyance of water from one basin to another that would provide for both riparian and non-riparian needs. Water from the Arkansas River (Arkansas River Basin) and/or Bayou Bartholomew (Lower Ouachita Basin) could be transferred to this basin (Boeuf-Tensas) in order to meet the projected 62 percent increase in demand for irrigation water by the year 2000 and the overall increase of 92 percent in demand from 1980 to 2030. (See Figure 5-1, Page 5-4 for more detailed information). This transfer of water could be accomplished by diverting Arkansas River water into Ditch 43 in the Boeuf-Tensas Basin.

Also, the presently authorized project (Flood Control Act of 1966) for flood control, Bayou Bartholomew, Arkansas, and Louisiana should be reactivated and the authorization expanded to include water supply for the Boeuf-Tensas and the Lower Ouachita basins as a project purpose.

Other points of diversion along the Arkansas River exist from Pine Bluff to Yoncopin. A diversion at Pine Bluff could outlet into Bayou Bartholomew and be transferred from Bayou Bartholomew to tributary channels of the Boeuf River. This plan would involve three separate basins.

The Vicksburg District Corps of Engineers has a study underway to further evaluate water supply needs and availability in the basin. This study will address, in detail, surface and groundwater quantity and quality and will study alternatives and recommend solutions for providing the needed supplemental surface water.

b. An alternative to allow the use of more surface water, without changing or modifying existing law, would be to construct on-farm storage reservoirs. This would be a more costly alternative. At present, existing on-farm reservoir storage capacity is 8,357 acre-feet. To meet the projected surface water demand for the year 2000, an estimated 62,000 acres of land would need to be dedicated to this type of reservoir. An additional 62,700 acres of land would be required by the year 2030.

There is an additional change in state law needed to make possible the developing and implementing of water management strategies to insure an equitable sharing and pricing of surface water. The Arkansas Soil and Water Conservation Commission, in cooperation with the Department of Pollution Control and Ecology, has underway a draft of the "State Water Management Strategy." This report should serve as a guide to legislators, federal agencies, and state and local officials for the development of state water programs. Included in this report will be the issues deemed most critical and those needing immediate state attention. Also to be included are the recommendations considered by the Arkansas Soil and Water Conservation Commission to be the best approaches for dealing with the state's emerging problems.

GROUNDWATER

Quality is the major problem associated with groundwater in this basin.

There is also a potential problem not related to lack of water quantity, but having the same effect. This problem is that most of the public water supply systems do not have back-up wells for use during periods when repairs are being made to their equipment. There is not sufficient storage to supply the sustaining needs of their customers. There are twenty public water supply systems of which ten are one-well systems. Storage facilities for eight of the systems have capacities of less than a one day supply.

Institutional Setting

The major institutional problem is the lack of statutory authority that would allow any agency to do more than study groundwater. <30>

Water Management Districts should be authorized and established to develop management strategies for conjunctive use of surface and groundwater and be able to place them into practice. These districts would conduct monitoring and other duties needed to insure delivery of a high quality product.

Because of the nature and occurrence of groundwater, umbrella authority should be vested in a statewide regulatory agency to insure that local governing bodies would not adversely affect other geographical areas.

Solutions

Solutions to groundwater problems cannot be undertaken without a new water law that would require reporting of accurate water use data and provide for conjunctive management ground and surface water. With present conditions this most valued resource is nearing the point where corrective actions would not be feasible.

At present, the Arkansas Department of Pollution Control and Ecology, in conjunction with the Soil and Water Conservation Commission, has a contract with the United States Geological Survey to study and determine those areas within the State with groundwater problems. Portions of this study, using available data, will address the specific pollutants, their magnitude and probable source.

The Vicksburg District Corps of Engineers has initiated an indepth study of the very complex water problems within the basin. This study will include detailed methodology to identify and determine the cause of the pollution problems of groundwater, conjunctive use modeling studies, and other potential sources of surface waters.

The solution to the public water supply problem rests primarily with financial solvency of the systems. Most municipal rates do not include the total cost of maintenance or any replacement cost. However, this problem is common throughout the State and not just to this basin area.

NONPOINT POLLUTION SOURCES OF SURFACE WATER

The major contributor to pollution is from nonpoint sources. This is a result of 89.4 percent of the basin area being devoted to agricultural pursuits. About 74.4 percent of the basin in 1980 was devoted to clean tilled crops; 10.8 percent to rice culture; and 4.2 percent to grassland. Sediment is the major pollutant. It also acts as a vehicle for the transport of applied nutrients and pesticides into surface streams.

Institutional Setting

The basin, like all others within the State, is entirely within the boundaries of conservation districts. These districts are legal entities of State Government and are funded in part from funds administered from the various quorum courts and from State funds administered by the Arkansas Soil and Water Conservation Commission. The major function of these districts, organized under authority of Act 197 of the General Assembly of the State of Arkansas in 1937, as amended, is to assist the owners and farm operators in developing individual land use plans on their farms. These plans show necessary corrective methods, works of improvement, and best management practices necessary to control soil erosion, improve surface water quality, lower floodwater and sediment damages, and further the conservation, development and utilization of soil and water resources. Each conservation district has entered into a memorandum of agreement with the Soil Conservation Service, U.S.D.A., to provide them with technical assistance. The Department of Agriculture administers a cost sharing for certain on-farm conservation practices through county offices of the Agricultural Stabilization and Conservation Service.

Solutions

The most cost effective solution recommended to control the double barrel pollution effect of sediment is an intensive public education effort on the part of each affected conservation district. This effort should include all agricultural agencies and related agricultural organizations and users. This education effort should stress not only the beneficial physical effects of the various agricultural practices but the economic benefits that could be expected to accrue.

It is expected that with the continued expansion of an irrigated agricultural practice that some of the presently cultivated land will change to pasture and woodlands. This would help reduce the problem.

FLOODING AND SURFACE DRAINAGE

Adequate outlets for agricultural drainage are available to about 87.8 percent of the basin area.

Institutional Setting

As a result of the flood control and interior drainage efforts, this area has a large number of legal entities whose function is to develop and maintain the works of improvement. There are two levee districts. These are (1) Frenchtown-Auburn Levee District, domiciled in Pine Bluff, and (2) the Southwest Levee District, domiciled in McGehee. The latter district maintains the "Main Line" levees in Chicot, Desha, and Lincoln Counties.

Drainage districts were formed to construct and maintain works of improvement. Many of the smaller districts have gone out of existence. Those remaining maintain works of improvement constructed by the Vicksburg District Corps of Engineers.

At present, there are ten drainage districts. They are listed below with their domicile:

- (1) Upper Grassy Lake - Inactive
- (2) Cousart Drainage District - Pine Bluff
- (3) Long Lake Drainage District - Grady
- (4) Cummins Drainage District - Gould
- (5) Lincoln Drainage District - Inactive
- (6) Cypress Creek Drainage District - McGehee
- (7) Dermott Drainage District - Dermott
- (8) Chicot County Drainage District - Lake Village
- (9) Eudora-Western Drainage District - Eudora
- (10) Grand Lake Drainage District - Inactive

With the Department of Agriculture Public Law 566, as amended, small watershed programs, administered by the Soil Conservation Service, came the watershed improvement districts to maintain these locally sponsored projects. In some cases the watershed improvement district absorbed the drainage district and in other cases, watershed improvement districts lie within active drainage districts. The 13 districts in the basin are:

- (1) Camp Bayou Watershed Improvement District - Wilmot. This district absorbed the Camp Bayou District which was the first drainage district in the state of Arkansas, formed in 1916.
- (2) Canal 18 Watershed Improvement District - McGehee.
- (3) Caney Bayou Watershed Improvement District - Eudora.
- (4) Chicot Watershed Improvement District - Lake Village.
- (5) Chicot, Desha, and Drew Watershed Improvement District - McGehee. This district absorbed Drainage District #4 of Desha County.

- (6) Arkansas City Watershed Improvement District - McGehee. (Sub-District #1, Cypress Creek D.D.)
- (7) Ark-La Watershed Improvement District - Eudora. This district absorbed Bayou Macon Drainage District #3.
- (8) Crooked Bayou Watershed Improvement District - Lake Village.
- (9) Grady-Gould Watershed Improvement District - Gould. This district absorbed the Kirsch Lake D.D.
- (10) Fleschman Bayou Watershed Improvement District - McGehee.
- (11) Kelso-Rowher Watershed Improvement District - McGehee.
- (12) Randolph-Walnut Lake Watershed Improvement District - Dumas.
- (13) Wells Bayou Watershed Improvement District - Tillar.

Solutions

Flooding and drainage problems can be solved by either structural or non-structural measures. Structural solutions include such measures as channel improvement and land grading. Non-structural solutions relate to land treatment measures and floodplain management. Floodplain management is probably the most viable alternative in this basin. It is doubtful, due to lack of public interest, that additional channel improvements would ever be installed to alleviate the remaining annual flood damage of about \$15,000,000. This is true even though several portions of the basin have the potential for improvements.

Congress established the National Flood Insurance Program with the "National Flood Insurance Act" of 1968. The program is administered by the Federal Insurance Administration (FIA) within the Federal Emergency Management Agency (FEMA). The Arkansas Soil and Water Conservation Commission (ASWCC) is the designated State Coordinator Agency for Arkansas. Act 629 of 1969 was enacted by the Arkansas General Assembly; it authorizes cities, towns, and counties, where necessary, to enact and enforce floodplain management which will curtail losses in flood prone areas.

This insurance is available from private insurance firms at reasonable rates. All rural residences within the basin, with the exception of those in Drew County, have the opportunity to participate in this program. Urban residents, who reside in towns that have been identified as having flood hazard areas, with the exception of those who reside in Wilmot, Parkdale, Winchester and Mitchellville, may also insure their property.

It is further recommended that farm owners and operators install adequate field drains and on-farm mains and laterals with appurtenant structures, to improve surface drainage and increase the effectiveness of irrigation. Land forming such as grading, smoothing and leveling will also aid in the orderly removal of surface water whether it is from rainfall or irrigation.

FISH AND WILDLIFE

The recently completed pumping plant and the diversion of the sediment laden floodwaters into the Mississippi River rather than into Lake Chicot should improve the present poor sport fishery resource of this lake. Fish samples taken from the lower part of the lake by biologist of the Arkansas Game and Fish Commission indicated a fish population of 288 pounds per acre. Roughfish principally made up these samples.

The proposed diversion of a higher quality water for irrigation purposes during the growing season should improve the sport fishery resource in both the Boeuf and Bayou Macon Rivers. A Dingell-Johnson survey of the principal streams of the basin was conducted during the 1950's by the Arkansas Game and Fish Commission. This survey evaluated the streams relative to the quality of sport fish habitat. Nearly all streams including The Bayou Macon River, above the NW 1/4, S 10, T17S, R2W, and the Boeuf River, above the NW 1/4, S 30, T17s, R2W were rated "in need of water or fundamental improvements."

With the projected increase of supplemental irrigation there should be land use changes from clean tilled cropland to grassland or other uses. These changes will affect relatively small areas that, because of their location on operating units, will be difficult to irrigate or dryland farm. This will serve to reduce erosion and its subsequent result of degradation of water quality. These areas will also provide additional wildlife habitat.

The further reduction of erosion beyond that realized by voluntary efforts of the farm operators could be gained through rigid enforcement of nonpoint pollution standards and/or additional government provided incentives to reduce erosion and thus improve water quality.

CHAPTER VII
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