WATER WITHDRAWALS IN THE BLACK WARRIOR-TOMBIGBEE BASIN IN ALABAMA, 1985-87

By Will S. Mooty

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CONTENTS

ILLUSTRATIONS

TABLES

[All tables are placed in back of report]

CONVERSION FACTORS

For use of readers who prefer to use metric (International System) units, conversion factors for inch-pound units used in this report are listed below:

Multiply inch-pound unit	by	To obtain
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	259.0	hectare (ha)
acre	4,047	square meter (m^2)
gallon per minute (gal/min)	0.06308	liter per second (L/s)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)

Sea Level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929".

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ABSTRACT

Public-supply and industrial water withdrawals were inventoried for the Black Warrior-Tombigbee basin in west-central Alabama. The study area is primarily forested and agricultural land with the exception of the area around the city of Birmingham. A water-resource capacity analysis was done to determine a risk rating for each inventoried facility, evaluating the likelihood of the facility exceeding the capacity of its current source of water at the existing level of use. Published reports and other data on file were used in this analysis to determine the source capacity and the effects withdrawals had on each water source.

The Birmingham Water Works Board in the Black Warrior basin withdrew and imported about 75.6 million gallons per day of water from the Cahaba basin in 1987 for distribution primarily in the Black Warrior basin for public supply. Additional interbasin transfers of water occurred in Winston County in the Black Warrior basin, where the towns of Haleyville and Double Springs imported a total of 1.36 million gallons per day in 1987 from the Tennessee basin.

The Gorgas Power Plant and the Greene County Steam Plant were the largest users of water in the study area, respectively drawing 872 and 404 million gallons per day in 1987. However, more than 90 percent of the water withdrawn by these power plants were returned to the rivers. The largest withdrawal of water in the basin for other than power generation was by the Birmingham Industrial Water Works Board which withdrew 59.0 million gallons per day. Of that amount, 41.8 million gallons per day of water was sold to the Birmingham Water Works Board for public-water supply.

Approximately 96 percent of all withdrawals of water in the study area were from surface-water sources. Surface water accounted for 88 percent of withdrawals for public-water suppliers and 99 percent of withdrawals by self-supplied industries.

Many of the ground-water users in the Black Warrior basin rely on ground-water supplies from the Pottsville aquifer. Yields to wells in the Pottsville are generally less than 100 gallons per minute and water levels may decline during extended drought periods. Water-supply systems using the Pottsville as their source of water supply were rated as a moderate risk to exceed the water-resource capacity.

Potential water quality problems exist where petroleum producing formations are near the land surface and are in contact with ground-water supplies and where the ground-water supplies contain high concentrations of dissolved solids. Any water-supply wells in these areas were rated as a moderate risk to experience water quality or quantity problems in the future. If problems had been experienced in the past at a facility, it was given a high risk rating.

INTRODUCTION

This report and a companion report for Mississippi, "Water Withdrawals in the Black Warrior-Tombigbee basin and Alcorn County, Mississippi, 1985-87" (Barber, 1991), are the result of a project conducted by the U.S. Geological Survey and funded by the U.S. Army Corps of Engineers. The Alabama and Mississippi water inventories described in these reports are part of a larger study being conducted for Congress by the U.S. Army Corps of Engineers on the Tenn-Tom Waterway as authorized by Public Law 87-639. The study area in Alabama includes all or part of 20 counties within the Black Warrior-Tombigbee basin (fig. 1).

The project area encompasses the drainage basin of the Tombigbee River from its point of confluence with the Alabama River in southern Alabama, northward to the Alabama-Mississippi State line, and the entire Black Warrior River basin (fig. 1). The area covers roughly the western third of Alabama and includes all or parts of the following counties: Blount, Choctaw, Clarke, Cullman, Etowah, Fayette, Franklin, Greene, Hale, Jefferson, Lamar, Lawrence, Marengo, Marion, Marshall, Pickens, Sumter, Tuscaloosa, Walker, Washington, and Winston.

The objectives of this report are to present: 1) an inventory of municipal, industrial, commercial, and power generation water users in the basin; 2) an assessment of the likelihood that the demands on public-water supply and self-supplied industrial water systems will exceed the capacity of their source of water or that the systems will experience water quality problems.

Public-water suppliers, self-supplied industries, self-supplied commercial facilities, and power generation facilities withdrawing more than 0.01 Mgal/d (million gallons per day) of water were inventoried during this investigation. Ground- and surface-water source capacities were determined using low-flow data for streams, withdrawal records from water-use facilities, and ancillary data in U.S. Geological Survey files.

DESCRIPTION OF THE STUDY AREA

The study area is underlain by geologic formations ranging in age from Cambrian to Quaternary. Detailed descriptions of the characteristics and location of the various geologic formations in the study area can be found in Special Map 221, Geological Survey of Alabama (Osborne and others, 1989). The northern part of the Black Warrior basin is predominantly underlain by the Pottsville Formation of Pennsylvanian age. The southern half is underlain by various formations of Cretaceous age. The upper Tombigbee basin is underlain by Cretaceous formations. The northern part of the lower Tombigbee basin is underlain by Cretaceous formations while the southern part is underlain by Tertiary formations.

The study area encompasses part of four physiographic sections: the Cumberland Plateau, the Alabama Valley and Ridge, the East Gulf Coastal Plain, and the Alluvial-Deltaic Plain (fig. 2) (Sapp and Emplaincourt, 1975). Upper parts of the Black Warrior basin are in the Appalachian Plateau area of the Cumberland Plateau section. This area is characterized by rugged, submaturely to maturely dissected sandstone and shale plateaus of moderate relief. The Fall Line which identifies the boundary between the Appalachian Plateau and the East Gulf Coast Plain lies just

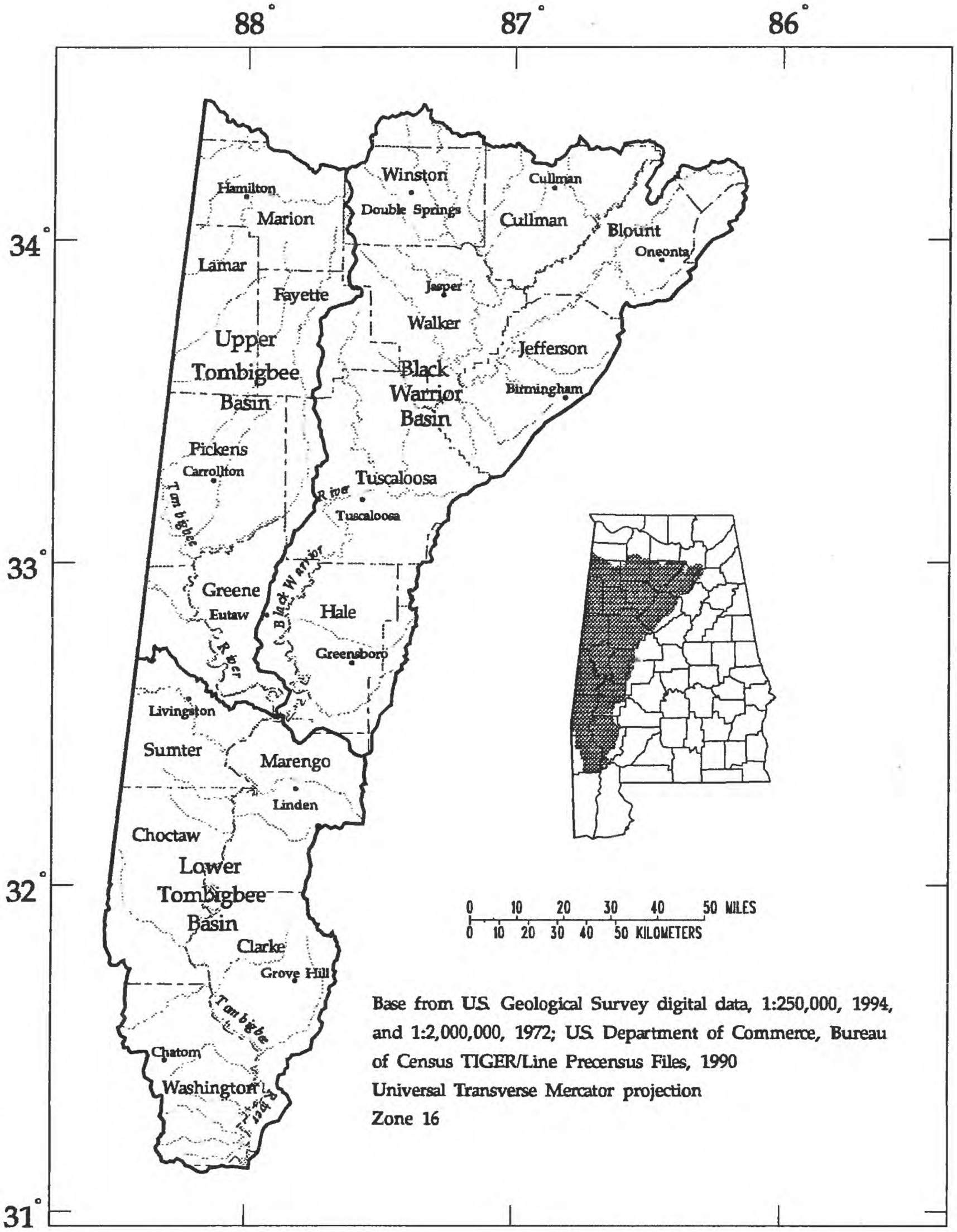


Figure 1.--Location of the Black Warrior, upper Tombigbee, and lower Tombigbee basins in Alabama.

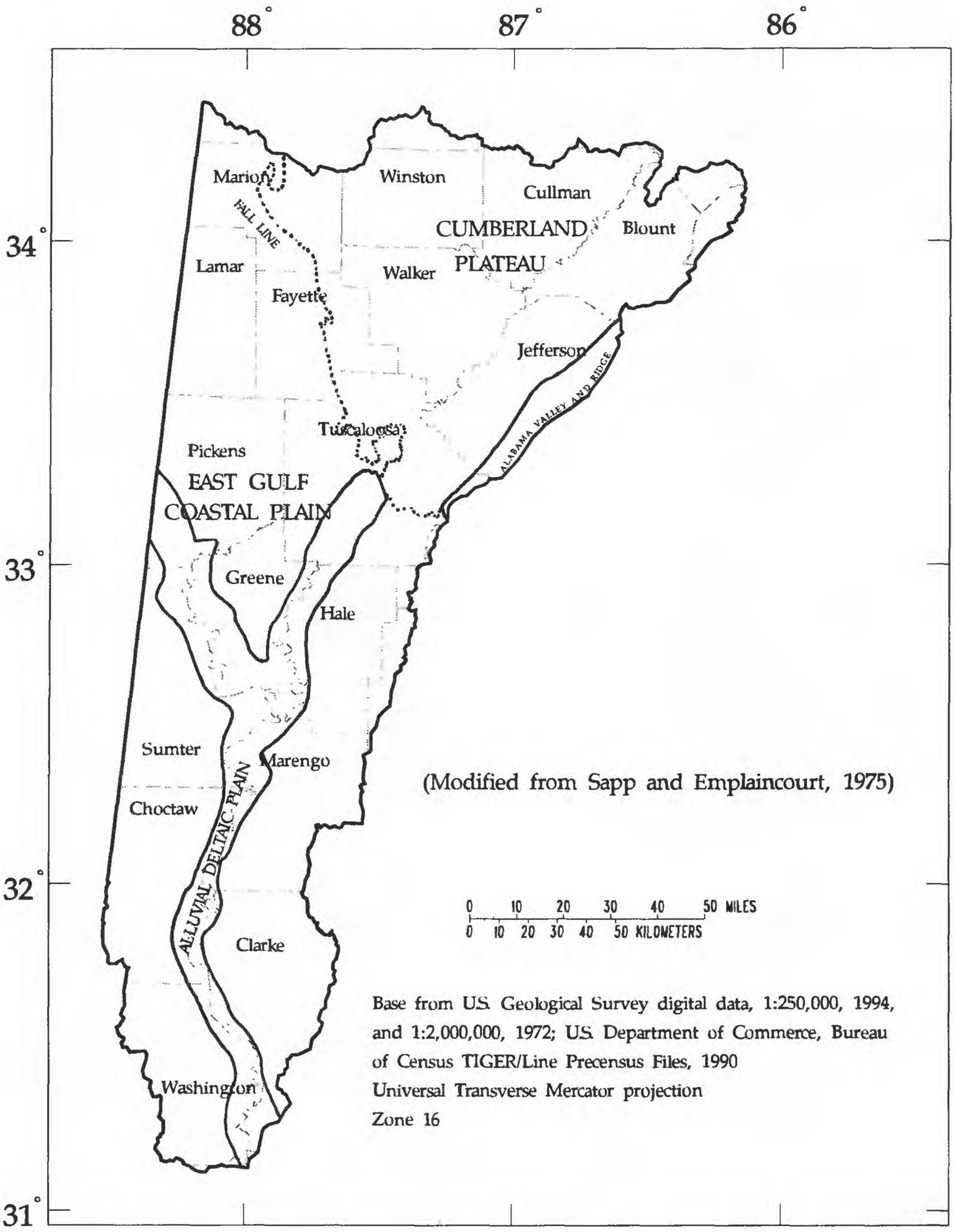


Figure 2.--Physiographic regions of the study area.

north and east of Tuscaloosa. South of the Fall Line the topography is low and gently rolling. This area is characterized by maturely eroded uplands and mature stream valleys (Harkins and others, 1980).

The northern part of the Tombigbee basin lies in the Fall Line Hills district of the East Gulf Coastal Plain. The topography in this area is low and gently rolling.

The lower part of the Tombigbee River flows through the Black Prairie district of the East Gulf Coastal Plain physiographic section and flows through the Chunnenuggee Hills district, the Flatwoods subdistrict, the Southern Red Hills district, the Buhrstone Hills subdistrict, the Lime Hills district, the Hatchetigbee Dome subdistrict, and the Southern Pine Hills district. The area varies from an undulating, deeply weathered plain on chalk and marl at the confluence of the Tombigbee and Black Warrior Rivers at Demopolis to a series of sand hills, cuestas, rugged limestone, and finally terrigenous sediments of the Citronelle Formation (Pliocene and Pleistocene) at the southern extent of the basin.

The study area has a humid subtropical climate. Average annual temperatures range from about 60 °F in the northern part to 68 °F in the southern part of the area (Lineback and others, 1974). The study area has abundant rainfall with average annual precipitation ranging from about 56 inches in the northern part to 48 inches in the central part to 64 inches in the southern part of the study area.

BLACK WARRIOR BASIN

Basin Description

The Black Warrior basin encompasses about 6,275 square miles in north-central Alabama (fig. 3). Counties that are wholly or partially included in this part of the study area are Etowah, Blount, Marshall, Jefferson, Cullman, Lawrence, Winston, Walker, Tuscaloosa, Hale, and Greene. Natural resources in the basin include coal, coal-bed methane, iron ore, limestone, dolomite, extensive woodlands, and fertile soils. The development of these natural resources have made this area one of the most highly industrialized river basins in the southeastern United States. The area includes the city of Birmingham and its surrounding communities, which constitute the largest urban area in Alabama. Birmingham proper has a population of more than 284,000 with about 140,000 people living in nearby suburbs (Alabama Department of Economic and Community Affairs, 1984). Other urban centers in the basin with populations of more than 10,000 are Cullman (13,100), Jasper (11,900), and Tuscaloosa (75,200).

The headwaters of the Black Warrior River are in the Appalachian Plateau. The Black Warrior River is formed by the confluence of Mulberry Fork and Locust Fork about 20 miles west of Birmingham and flows for about 174 miles to Demopolis, Alabama. Lewis Smith Lake (Walker, Winston, and Cullman Counties) is one of the largest reservoirs in the State. The reservoir is used for hydroelectric power generation, recreation, and industry. Some of the water released from the reservoir to the Sipsey Fork is withdrawn by the Birmingham Industrial Water Works Board (BIWWB) for delivery to industries in Jefferson County and to the Birmingham Water Works Board (BWWB) for distribution in the Black Warrior and Cahaba Basin.

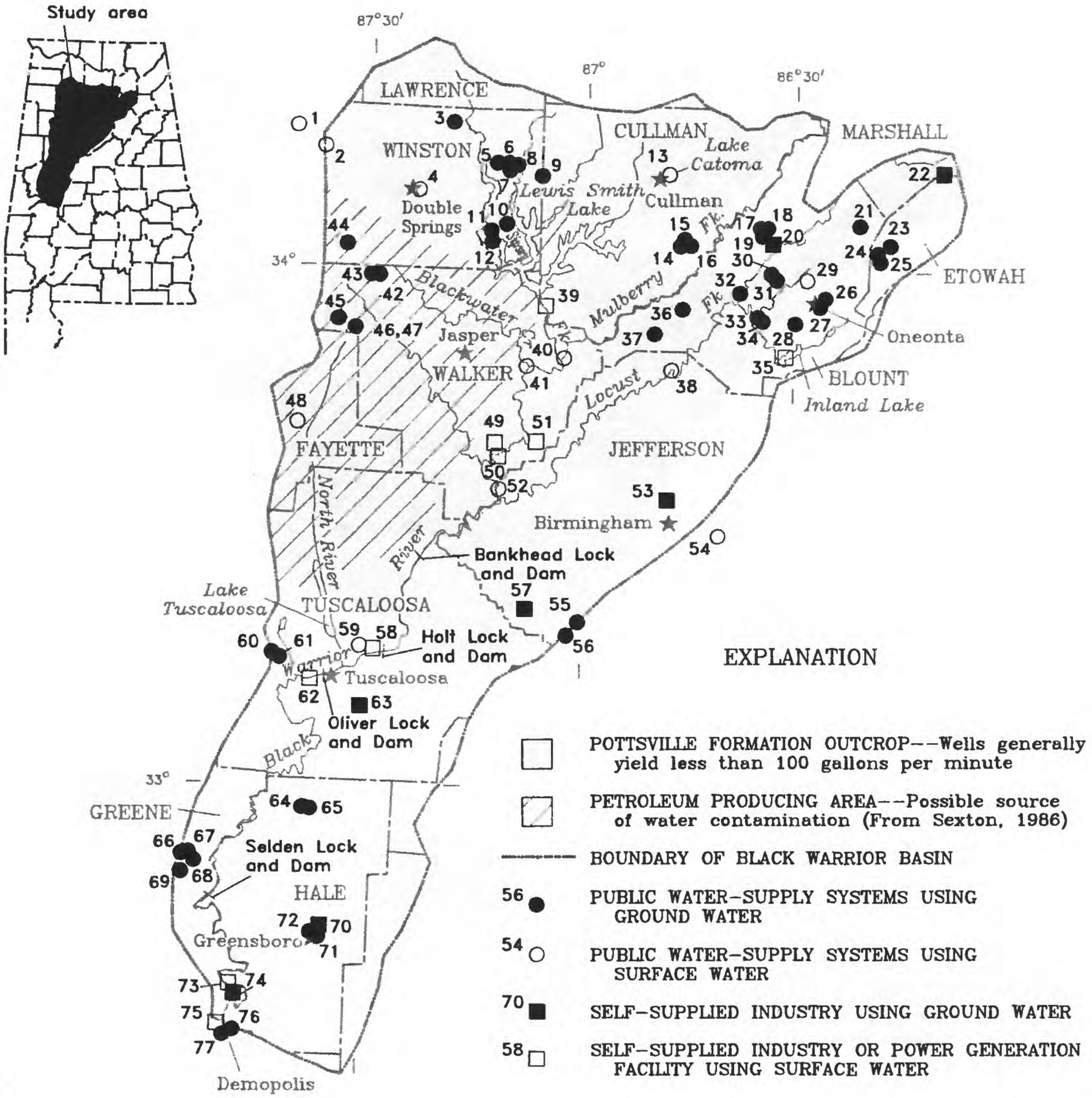


Figure 3.--Black Warrior basin showing public, industrial, and power generation water-supply withdrawal locations and areas of potential water quality or quantity problems.

Hydrology

Surface Water

Major streams include Sipsey Fork, Mulberry Fork, Locust Fork, North River, Blackwater Creek, and the Black Warrior River. Major reservoirs in the area are Lewis Smith Lake, Inland Lake, Lake Catoma, and Lake Tuscaloosa. Dams in the basin are Lewis Smith Dam, Bankhead Lock and Dam, Holt Lock and Dam, Oliver Lock and Dam, and Selden Lock and Dam (table 1). Major withdrawals from reservoirs in the basin are described in the following.

Lewis Smith Lake: There are no major urban areas adjacent to the lakeshore. Withdrawals are as high as 50 Mgal/d during dry months and as low as 5 Mgal/d during wet months for public supply and industrial use in Jefferson County. Withdrawals by the BIWWB for 1987 averaged 8.05 Mgal/d (tables 2A and 2B; fig. 3).

Bankhead Lock and Dam: Major withdrawals from the lake are at the Gorgas and Miller Power Plants upstream on Mulberry Fork (tables 2A and 2B; fig. 3). The city of Sumiton also withdraws water from the reservoir for public supply.

Holt Lock and Dam: There are no major withdrawals of water from the reservoir.

William Bacon Oliver Lock and Dam: Since the closing of the Gulf States Paper Company plant in Tuscaloosa in 1978, there are no longer any major withdrawals of water from the reservoir.

Armistead I. Selden Lock and Dam: Major withdrawals from the reservoir occur at the upper end near Tuscaloosa (tables 2A and 2B; fig. 3).

The area north of the Fall Line and the area south of the Fall Line differ and should be considered separately (fig. 2). North of the Fall Line the predominant geologic unit is the Pottsville Formation of Pennsylvania age; south of the Fall Line, various Cretaceous formations predominate. Streams above the Fall Line in the Black Warrior basin have a lower recession index than those below the Fall Line (Bingham, 1982). The recession index indicates that streams that originate in areas above the Fall Line will have a lower base flow and will reach base flow sooner than streams with similar sized drainage basins that originate in the Cretaceous formations. The Pottsville Formation has a lower capacity for storing water resulting in higher runoff and lower sustained flow for streams in the area. The Cretaceous formations have a relatively higher capacity for storing water resulting in less surface runoff and higher base flows for streams originating in the Cretaceous outcrops.

Ground Water

Ground-water supplies are obtained from several geologic formations in the basin. In the northern part of the basin, ground water occurs in various sedimentary rocks of Paleozoic age. In the northeastern part of the basin, water occurs in Cambrian and Ordovician carbonate formations that usually yield sufficient water to supply municipalities and industries. In the central and northwestern parts of the basin, ground water occurs in sandstone and shales of the Pottsville Formation of Pennsylvanian age. Wells in the Pottsville generally yield less than 100 gal/min

(gallons per minute) and water levels may decline during extended dry periods (fig. 2). South of the Fall Line the Cretaceous formations include three excellent aquifers. The Coker and Gordo aquifers, which are sometimes discussed collectively as the Tuscaloosa aquifer (Williams and others, 1986) and the Eutaw aquifer. Yields to properly constructed wells in these aquifers usually exceed 100 gal/min.

Parts of Tuscaloosa, Fayette, Walker, and Winston Counties have petroleum producing formations (fig. 2). The potential exists for water supplies in these areas to be contaminated locally by oil field brines, if the brines are not properly reinjected into the deep formations. The highest risk for contamination would occur in areas near oil or gas wells where highly mineralized water spilled on the surface could seep back into the ground and contaminate the ground-water supplies or drain into streams and contaminate surface-water supplies.

UPPER TOMBIGBEE BASIN (Alabama)

Basin Description

The upper Tombigbee basin in Alabama encompasses about 3,710 square miles in west-central Alabama (fig. 4). The headwaters of the Tombigbee River are in northeastern Mississippi where the completed Tenn-Tom Waterway now connects the Tennessee and Tombigbee Rivers. The river flows southward for a little more than 100 miles from the point it enters in Pickens County to the point of confluence with the Black Warrior River at Demopolis. The Tom Bevill Lock and Dam (formerly the Aliceville Lock and Dam) near Pickensville, which was completed in 1989, was the last structure to be completed on the Tenn-Tom Waterway.

The basin is primarily rural with no community having a population of more than 6,000. Some of the larger communities in the basin and their population are Red Bay (3,200), Hamilton (5,100), Winfield (3,800), Guin (2,400), Vernon (2,600), Fayette (5,300), Aliceville (3,200), and parts of Demopolis (total population 7,700) (Alabama Department of Economic and Community Affairs, 1984). Agricultural and forest products comprise a large part of the industrial output of the basin.

Hydrology

Surface Water

Major streams in the basin are the Buttahatchee River, Sipsey River, Luxapallila Creek, Coal Fire Creek, Lubbub Creek, Noxubee River, and Tombigbee River. The Tom Bevill Lock and Dam near Pickensville and the Gainesville Lock and Dam are flow regulating facilities on the upper Tombigbee basin in Alabama (table 1).

Streamflow recession indices in the northeastern parts of the basin generally are higher in areas where the Coker, Gordo, and Eutaw Formations crop out than in the southwestern part of the basin where the Cretaceous Selma Group crops out. The Coker, Gordo, and Eutaw aquifers have a relatively high capacity for storing water resulting in higher base flows for streams. The Selma Group is composed of dense chalk formations of low permeability. The chalk has a low capacity for storing water resulting in a high rate of surface runoff.

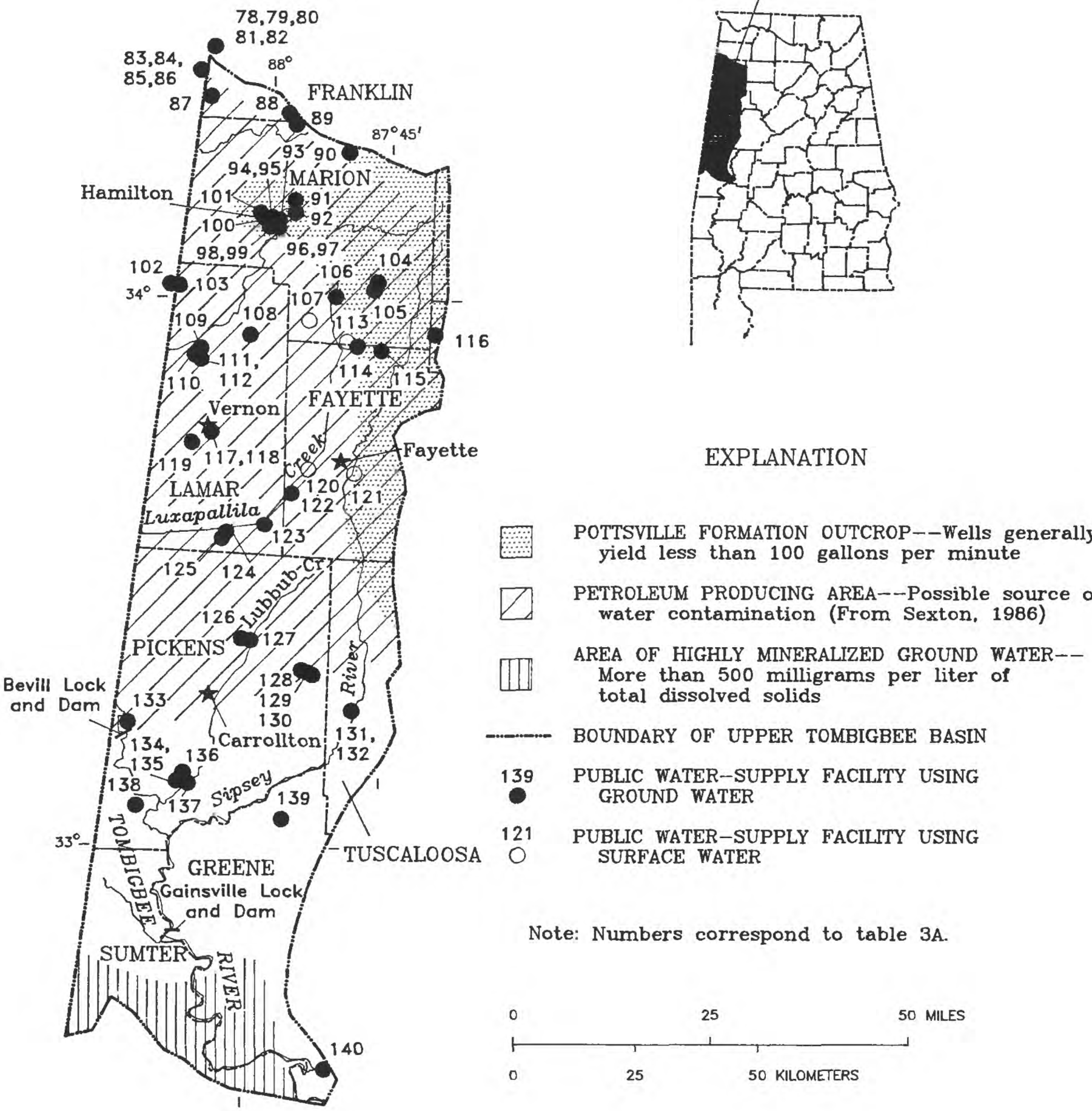


Figure 4.--Upper Tombigbee basin showing public water-supply withdrawal locations and areas of potential water quality or quantity problems.

Ground Water

Excellent ground-water supplies are available in all but the northeastern and extreme southern parts of the basin (fig. 4). In the northeastern part, the Pottsville aquifer generally yields less than 100 gal/min to water wells. In the southern part of the basin, ground-water supplies are sometimes highly mineralized and unsuitable for public use. The sand and gravel deposits in the Coker, Gordo, and Eutaw aquifers generally supply more than 100 gal/min to properly developed wells and yields are not severely affected by extended dry periods.

Approximately the northern half of the basin is underlain by petroleum producing formations (fig. 4). These formations are a potential source of contamination to water supplies. Contamination could occur if highly mineralized water is pumped out of petroleum producing formations and is allowed to seep back into the ground as a result of improper disposal techniques.

LOWER TOMBIGBEE BASIN

Basin Description

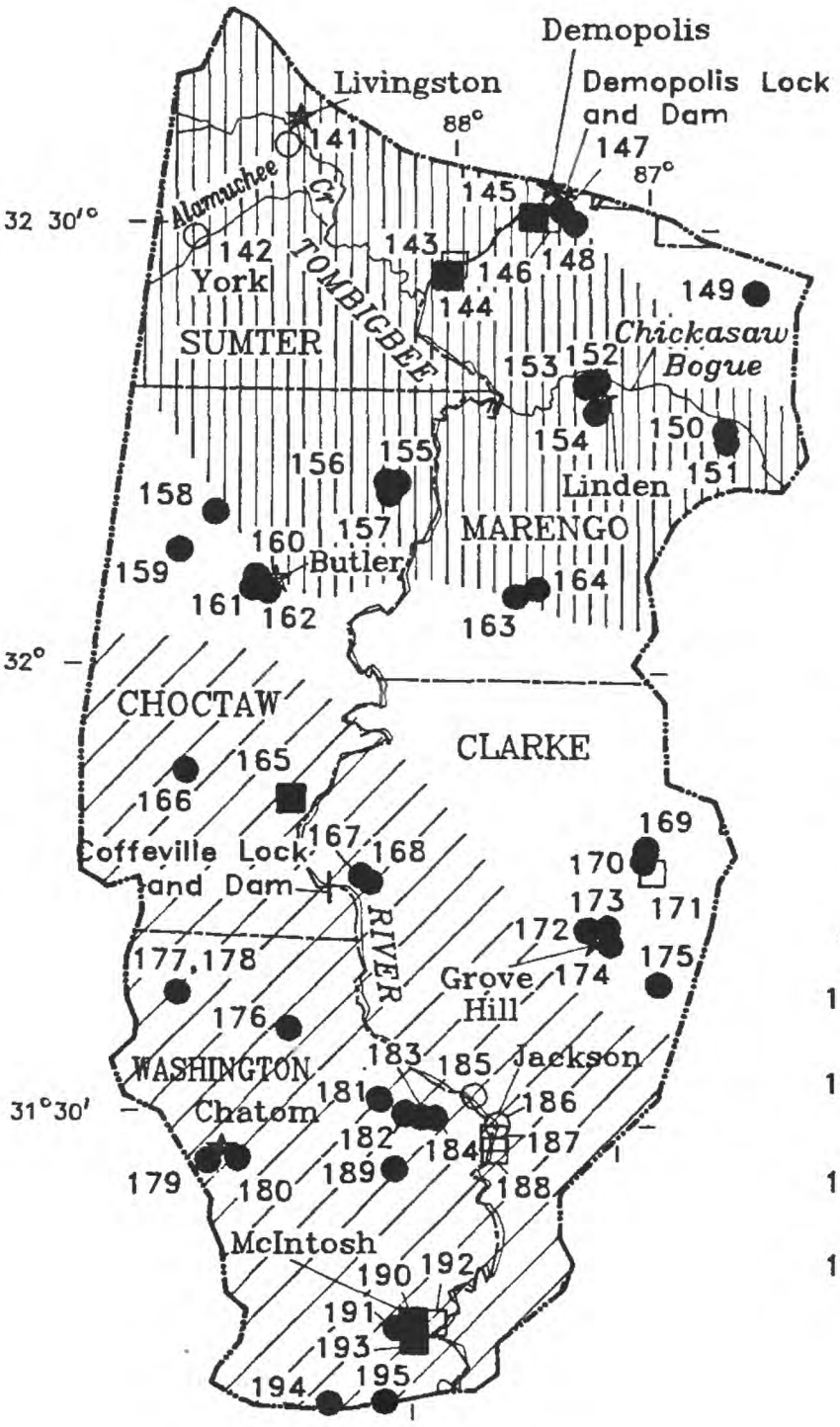
The lower section of the Tombigbee River from its point of confluence with the Black Warrior River at Demopolis to its point of confluence with the Alabama River near McIntosh is about 175 miles in length (U.S. Army Corps of Engineers, 1985). The drainage basin covers about 4,140 square miles (fig. 5). Counties wholly or partially within the basin are Sumter, Marengo, Choctaw, Clarke, and Washington. There is a high degree of industrial development along the river at Demopolis and along the lower reach of the river in Washington and Clarke Counties, There is extensive development of petroleum resources in the southern half of the basin. The basin is sparsely populated with agriculture and forest occupying much of the land area. Major urban areas in the basin are Demopolis (population 7,700), Jackson (6,100), Livingston (3,200), York (3,400), and Linden (2,800) (Alabama Department of Economic and Community Affairs, 1984).

The lower Tombigbee basin begins in the Black Prairie district of the East Gulf Coastal Plain physiographic section and flows through the Chunnenuggee Hills district, the Flatwoods subdistrict, the Southern Red Hills district, the Buhrstone Hills subdistrict, the Lime Hills district, the Hatchetigbee Dome subdistrict, and the Southern Pine Hills district (Sapp and Emplaincourt, 1975).

Hydrology

Surface Water

Major streams in the basin are the Tombigbee River, Sucarnoochee River, Alamuchee Creek, Chickasaw Bogue, Okatuppa Creek, and Bassett Creek. Streams in the upper end of the basin flow through the Selma Chalk. Sediments in this area have low permeability to water resulting in rapid runoff of precipitation and poor sustained flow of small streams.



EXPLANATION

PETROLEUM PRODUCING AREA--Possible source of water contamination (From Sexton, 1986)

AREA OF HIGHLY MINERALIZED GROUND WATER--More than 500 milligrams per liter of total dissolved solids

BOUNDARY OF LOWER TOMBIGBEE BASIN

175 PUBLIC WATER-SUPPLY FACILITY USING GROUND WATER

185 PUBLIC WATER-SUPPLY FACILITY USING SURFACE WATER

193 SELF-SUPPLIED INDUSTRY USING GROUND WATER

188 SELF-SUPPLIED INDUSTRY OR POWER GENERATION FACILITY USING SURFACE WATER

Note: Numbers correspond to tables 2A and 3A.

0 25 50 MILES

0 25 50 KILOMETERS

Figure 5.--Lower Tombigbee basin showing public, industrial, and power generation water-supply withdrawal locations and areas of potential water quality or quantity problems.

There are two major flow regulating structures on the lower section of the Tombigbee River. The Demopolis Lock and Dam is located 4 miles below the confluence of the Tombigbee and Black Warrior Rivers. The reservoir formed by the dam extends 53 miles up the Black Warrior River to Selden Lock and Dam and 68 miles up the Tombigbee River to Gainesville Lock and Dam.

The Coffeeville Lock and Dam is about 23 miles northwest of Jackson and 3 miles west of Coffeeville. The lake formed by the dam extends about 97 miles upstream to the Demopolis Lock and Dam. The Coffeeville Dam is the most downstream dam on the Tenn-Tom Waterway.

Geologic units that crop out south of the Selma Group consist of sand, gravel, and clay that have a much higher capacity for storing and transmitting water. Streams originating in these formations have a higher base flow than those originating in the Selma Group. This runoff characteristic is evident during extended dry periods when many streams in the Selma Group will have no flow, and streams to the south continue to flow.

Ground Water

Major aquifers in the lower Tombigbee basin are the various formations in the Miocene Series, the Lisbon, Nanafalia, Providence-Ripely, and Eutaw. The Miocene sediments consist mostly of clay, sand, gravel, and sandstone. Sand and gravel make up approximately 50 percent of the bulk of the sediment (Walter, 1976). Properly constructed wells in the Miocene sediments may yield 300 to more than 1,000 gal/min (Hinkle, 1984).

The Lisbon aquifer includes all or part of the Moodys Branch Formation, Gosport Sand, Lisbon Formation, Tallahatta Formation, Hatchetigbee Formation, Bashi Formation, and the upper part of the Tuscahoma Formation. The Lisbon Formation is the predominant water-bearing zone in the aquifer. The aquifer is composed mostly of unconsolidated sand and clay beds, and locally of consolidated carbonate rocks. The aquifer is not as widely used in western Alabama as it is in central and eastern parts of the State (Williams and others, 1986d). Most wells completed in the Lisbon aquifer yield from 10 to 100 gal/min.

The Nanafalia aquifer is composed of the basal sands of the Tuscahoma Formation, the Nanafalia Formation, and the Naheola Formation. The aquifer consists of mostly unconsolidated sand and clay beds, but locally includes carbonate rocks (Williams and others, 1986c). Properly constructed wells may yield from 60 to 600 gal/min.

The Providence-Ripley aquifer is composed of consolidated and unconsolidated sand and clay beds. The aquifer is not as widely used in western Alabama as it is further to the east. The aquifer thins westward in Marengo County where the Ripley Formation is composed mostly of clays and the Providence Sand is replaced by the Prairie Bluff Chalk aquifer (Williams and others, 1986b). Yields to wells in the Providence-Ripley aquifer range from about 70 gal/min to more than 100 gal/min.

The Eutaw aquifer is composed of regionally extensive basal and isolated sand beds in the upper part of the Eutaw Formation (fig. 2) (Williams and others, 1986a). In some parts of the basin, water supplies in the Eutaw aquifer are highly mineralized and are unsuitable for use as a public-water supply (fig. 5). Yields to the wells in the Eutaw aquifer range from 100 to 1,000 gal/min.

METHODOLOGY

Water-use data were obtained from the public-supply, self-supplied industrial and commercial, and power generation facilities. The names and locations of public-supply facilities in the study area were obtained from the Alabama Department of Environmental Management. The names and locations of self-supplied industrial and commercial facilities withdrawing more than 0.01 Mgal/d were obtained through the National Pollution Discharge Estimation System data files.

The study area is divided into three sections: 1) the Black Warrior basin, 2) the upper Tombigbee basin, and 3) the lower Tombigbee basin (fig. 1). There is a discussion about the water users in each area and any water quality or quantity problems that have been experienced in the past or that could occur in the future. These factors were used to determine a risk rating for each facility based on the likelihood that the demands on the system will exceed the capacity of their source of water.

RISK RATINGS

The risk ratings were determined differently for ground-water and surface-water users. For ground-water systems, a subjective rating system was developed based on the amount of water withdrawn by a facility, the hydrologic information describing the availability of ground water, and the quality or quantity problems that the facility has experienced. The facility was assigned a low risk rating if (1) no water quality or quantity problems have occurred at the facility and (2) ample supplies of water of acceptable quality are available to meet the demands of the system for the near future. A moderate risk rating was assigned if the facility is in an area where ground-water supplies are limited or unreliable during drought periods, or where the ground water contains high concentrations of dissolved solids or is susceptible to contamination. A high risk rating was assigned to those facilities in areas with poor water resources in terms of quality or quantity and where water-supply problems have been experienced in the past.

For facilities using surface water as their primary source of water supply, the same risk rating system was used; however, the rating was based on the withdrawal rates of the facility and the source capacity of the stream or reservoir. The source capacity of an unregulated stream was defined as the 7-day 10 year low-flow value ($7Q_{10}$). The $7Q_{10}$ is the lowest mean discharge for 7 consecutive days that occurs at an average frequency of once in 10 years (Bingham, 1982; Hayes, 1978). For regulated streams, the source capacity was defined as the lowest mean discharge for 30 days for the period of record at the nearest flow regulating facility (locks and dams). For facilities that have an impounded stream for a water-supply reservoir, such as Cullman, Ala., the $7Q_{10}$ was computed for unregulated streams in nearby basins of similar drainage areas and geologic characteristics. An average value was computed and used as the source capacity of the impounded stream.

Because of the differences in geologic setting and data availability, the risk analysis in the companion report for Mississippi relied more on the quantity of water used and the trend in water levels in the aquifers.

ASSESSMENT OF WITHDRAWALS AND RISK RATINGS IN THE BLACK WARRIOR BASIN

Public Water-Supply Systems

Surface water accounts for more than 95 percent of the 154 Mgal/d of water for public supply in the Black Warrior basin (table 3A and 3B). Of the 154 Mgal/d of surface water used, about 77 Mgal/d are imported from outside the basin. The BWWB withdrew and imported 75.6 Mgal/d for public supply from the Cahaba basin. The BWWB also purchased 41.8 Mgal/d from the Birmingham Industrial Water Works Board. The BIWWB withdraws water from Inland Lake and Sipsey Fork. Additional imports of water to the Black Warrior basin occur in Winston County where the towns of Haleyville and Double Springs purchased 1.36 Mgal/d in 1987 from the Upper Bear Creek Water System in the Tennessee basin.

North of Tuscaloosa public-supply facilities using ground water rely primarily on supplies from the Pottsville aquifer. The Pottsville generally is a poor aquifer with yields to wells rarely exceeding 100 gal/min. Water occurs only in joints, fractures, and bedding planes. Water levels may decline in the Pottsville during extended dry periods because the aquifer does not have the capacity to store much water. All wells in the Pottsville were rated as a moderate risk to exceed the source capacity (tables 3A and 3B).

A few wells in the eastern part of the basin are completed in aquifers in rocks of Cambrian and Ordovician age. Water supplies in these aquifers generally occur in solution joints and cavities in limestone and dolomite. Well yields exceeding 100 gal/min are common.

Public-supply facilities using ground water in the southern third of the Black Warrior basin rely on supplies from the Coker, Gordo, and Eutaw aquifers. These are excellent aquifers and yields to properly constructed wells commonly exceed 100 gal/min.

Power Generation Water Withdrawals

The largest water users in the Black Warrior River basin are the Gorgas Power Plant 872 Mgal/d) and the Greene County Steam Plant (404 Mgal/d) (tables 2A and 2B). However, these power plants consume less than 10 percent of the water that is withdrawn.

Self-Supplied Industrial and Commercial Water Withdrawals

Approximately 97 percent of the water withdrawn for industrial and commercial use in the basin is surface water. The BIWWB withdraws water from Inland Lake in Blount County and from Sipsey Fork in Walker County. This water is sold to the Birmingham Water Works Board for public supply (41.8 Mgal/d in 1987) and to various industries in the Birmingham area. The BIWWB withdraws water from Inland Lake at the maximum allowable rate (determined by the amount of inflow to the reservoir, 41.9 Mgal/d in 1987, and withdraws the balance of the water needed from Sipsey Fork (17.1 Mgal/d in 1987). All other self-supplied industrial and commercial facilities in the basin each use less than 0.01 Mgal/d.

Self-Supplied Domestic Water Users

The number of self-supplied domestic users and the amount of water withdrawn varies but averages less than 1 Mgal/d in most counties (table 4). In Cullman and Jefferson Counties, the public-supply facilities service about 99 percent of the population; whereas, in Hale and Winston Counties, the percentage of the population served by public-supply facilities is only 65 to 70 percent. In Winston County, the number of people served by public-supply facilities will most likely increase due to limited ground-water supplies. However, in Hale County excellent ground-water supplies are readily available in most areas of the county; therefore, the number of self-supplied domestic users will probably remain about the same. Virtually all water withdrawn by self-supplied domestic users is ground-water.

Agricultural Water Withdrawals

Agricultural water uses in the basin include crop irrigation, aquaculture, and drinking water for cattle, hogs, and poultry. Withdrawals for agriculture for counties in the Black Warrior basin amounted to about 46 Mgal/d (table 5) in 1985, of which 69 percent was ground water. Almost one-half of that amount, 21.0 Mgal/d, was withdrawn in Hale County where there is extensive catfish farming. Although table 5 indicates that 15.6 Mgal/d of ground water and 5.42 Mgal/d of surface water were used for livestock watering and aquaculture in 1985.

ASSESSMENT OF WITHDRAWALS AND RISK RATINGS IN THE UPPER TOMBIGBEE BASIN

Public Water-Supply Systems

Ground water accounts for over 75 percent of the 9.33 Mgal/d of water withdrawn by public suppliers in the basin (tables 3A and 3B). Most communities have wells that produce water from Coker, Gordo, or Eutaw aquifers. The town of Hamilton is one of the larger communities with wells tapping the Pottsville aquifer. Because wells in the Pottsville usually yield less than

100 gal/min, Hamilton Water Works and Sewer Board uses 11 wells to supply enough water to meet their demands (0.93 Mgald/d in 1987). Only three communities in the basin use surface water for all or part of their public-water supply. Any facility that relies on ground-water supplies from the Pottsville was given a moderate risk rating.

The communities of Guin and Fayette use surface water for all of their public-supply water while Winfield uses both surface and ground water. The withdrawal sites for the public water-supply systems are on unregulated small streams. In all three communities, the $7Q_{10}$ for the streams are higher than the average demands from the water systems (tables 3A and 3B). At Guin the $7Q_{10}$ is 0.52 Mgal/d and the average rate of withdrawal by the water-supply system in 1987 was 0.43 Mgal/d. Guin was given a moderate risk rating because it could experience water shortages during an extreme drought.

There is some interbasin transfer of water from the Tennessee River basin. Red Bay Water Works has four wells in the upper Tombigbee basin and another four wells in the Tennessee basin. Total withdrawal by Red Bay Water Works was 0.36 Mgal/d in 1987.

Self-Supplied Industrial and Commercial Water Withdrawals

There were no self-supplied industrial or commercial water users in the basin that withdrew more than 0.01 Mgal/d in 1987. There are a few large industries in the basin but they either used less than 0.01 Mgal/d or they were supplied water by a public water-supply system.

Self-Supplied Domestic Water Users

The number of self-supplied domestic water users in counties in the basin ranges from 25 to 42 percent of the total county population in 1985 and the amount of water withdrawn for domestic supply was less than 1 Mgal/d in all counties in the basin (table 4) (Baker and Mooty, 1987). With excellent sources of ground water readily available in most parts of the basin and because of the rural demographics of the basin, these numbers may remain fairly constant. All self-supplied domestic water users in the basin rely on ground water.

Agricultural Water Withdrawals

Total water withdrawals for agricultural purposes amounted to about 7.4 Mgal/d in 1985 in the upper Tombigbee basin. Of this amount, only about 0.1 Mgal/d was used for crop irrigation and the remainder was for livestock watering and aquaculture (table 5). Approximately 68 percent of the total withdrawals for agricultural purposes were ground water and 32 percent were surface water in 1985.

ASSESSMENT OF WITHDRAWALS AND RISK RATINGS IN THE LOWER TOMBIGBEE BASIN

Public Water-Supply Systems

The towns of York and Livingston in the lower Tombigbee basin use surface water as a primary source of water supply (fig. 5). Jackson Water Works and Sewer Board depends on the Tombigbee River as an emergency supply source, but rarely uses it. Ground water accounted for more than 75 percent of the 6.5 Mgal/d of water withdrawn for public supply in the basin in 1987.

Ground-water supplies in the northern end of the basin often are highly mineralized and have chloride concentrations exceeding drinking water standards. Ground-water quality problems occur locally throughout this part of the basin. All facilities using ground water in this area were given a moderate risk rating. Linden was given a high risk rating due to the history of water quality problems in the area.

In the southern half of the basin there are salt domes and petroleum producing formations. These formations may be as shallow as 400 to 500 feet below land surface and may be hydraulically connected to some of the aquifers. It is feasible that contamination of an aquifer could occur in some areas and make the ground water unsuitable for public-supply use (Hinkle, 1984). Contamination of ground-water supplies from improperly disposed saline water from petroleum wells is also a possibility. Thus, any public-supply facilities using ground water in these areas were rated as a moderate risk to experience water quality or quantity problems at some time in the future.

Power Generation Water Withdrawals

The Charles R. Lowman Power Plant in Washington County withdrew 54.0 Mgal/d of surface water for power generation in 1987. Less than 9 percent (4.6 Mgal/d) of the water withdrawal was consumed.

Self-Supplied Industrial and Commercial Water Withdrawals

Total self-supplied industrial and commercial water use in the basin in 1987 was about 62 Mgal/d (tables 2A and 2B). Of this amount, over 87 percent or about 54 Mgal/d was surface water.

Much of the ground-water withdrawn at some chemical facilities in Washington County is from "corrective action" wells. For many years the industries disposed of chemical waste products in ponds near the factories. The ground-water supplies in the vicinity of the ponds became contaminated with these chemicals. In order to prevent the chemicals from spreading further into the ground-water system, wells were placed around the perimeter of the contaminated site. Water is withdrawn from these wells, treated to remove harmful chemicals, and discharged into the Tombigbee River.

All of the industrial withdrawals were within the capacities of their water sources resulting in a low risk rating for all self-supplied industrial water users in the basin. There are no self-supplied commercial water users in the basin withdrawing more than 0.01 Mgal/d.

Self-Supplied Domestic Water Users

The number of self-supplied domestic water users in the basin varies from 23 to 51 percent of the total population and water use for domestic supply in each county was less than 1 Mgal/d (table 4). Adequate ground-water supplies are readily available in all parts of the basin except for some areas in the northern part of the basin where ground-water supplies are often highly mineralized (fig. 6). This mineralization probably accounts for the low percentage of self-supplied domestic users in Sumter and Marengo Counties, but not in Clarke County. Clarke County is sparsely populated and most people live near a community with a public-supply system.

In Choctaw and Washington Counties, the populations are sparse and not concentrated. The communities with public water-supply systems are relatively small and the water-supply systems are not as extensive. The number of self-supplied domestic users is about 48 percent of the county population in Choctaw County and 51 percent in Washington County. All self-supplied domestic water users in the basin rely on ground water.

Agricultural Water Withdrawals

Total agricultural water withdrawals in the basin amounted to 4.6 Mgal/d in 1985 (table 5). Ground water accounted for 64 percent of the withdrawals. All withdrawals were for livestock watering. There were no significant withdrawals for crop irrigation in the basin.

SUMMARY

Water-use rates by public-water suppliers, self-supplied industrial and commercial facilities, self-supplied domestic water users, and agriculture were determined in the Black Warrior-Tombigbee basin in Alabama. For public-water suppliers and self-supplied industrial and commercial facilities, the likelihood that the water demands will exceed the capacity of the source or that the facility will experience water quality problems were assessed in terms of low, moderate, or high risk ratings.

The Black Warrior basin is the most industrialized and populated basin in the study area. Many areas of the basin rely on water from the Pottsville aquifer. The Pottsville is considered a poor aquifer with yields to wells usually less than 100 gal/min. Significant declines in water levels in the Pottsville occur during extended dry periods.

The Birmingham Water Works Board (Black Warrior basin) withdrew and imported about 75.6 Mgal/d of water from the Cahaba basin for public-water supply in 1987. Additional inter-basin transfers of water occurred in Winston County (Black Warrior basin) where the towns of Haleyville and Double Springs purchased and imported a total of 1.36 Mgal/d in 1987 from the Tennessee basin.

The percentage of the total population in each county that is self-supplied varied, but the amount of water used for domestic supply in most counties was less than 1 Mgal/d. In Jefferson and Cullman Counties, almost 100 percent of the population was supplied by public water-supply facilities. In Washington, Blount, and Choctaw Counties, the self-supplied population was 45 to 51 percent of the total county population.

Localized water-quality problems related to petroleum production occur in the lower Tombigbee basin and parts of the upper Tombigbee and Black Warrior basins. Municipal wells in these areas were rated as having a moderate to high risk of exceeding their source capacity or experiencing water-quality problems. In the lower Tombigbee basin, formations that are often associated with petroleum supplies are sometimes as shallow as 400 to 500 feet from land surface and there is a potential for ground-water supplies to be locally contaminated from brines associated with these formations. Municipal wells in this area were rated as having a moderate risk of exceeding their source capacity or experiencing water-quality problems.

An area of highly mineralized ground water exists in norther parts of the lower Tombigbee basin. Water supplies in this area often do not meet drinking water standards because of high chloride concentrations. Municipal wells in this area were rated as a moderate or high risk of experiencing water quality or quantity problems in the future.

Approximately 96 percent of all water withdrawn in the study area was surface water. Surface water accounted for 88 percent of withdrawals by public-water suppliers and 99 percent of withdrawals by self-supplied industries.

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Table 1.--Major reservoirs and dams in the Black Warrior-Tombigbee basin

Basin	Dam or reservoir name	County	Surface area of reservoir (in acres)	Purpose
Black Warrior	Lewis Smith Lake	Walker Winston Cullman	21,000	Flood control Power generation Recreation
Black Warrior	Bankhead Lock and Dam	Walker Jefferson Tuscaloosa	9,200	Navigation Flood control Power generation Recreation
Black Warrior	Holt Lock and Dam	Tuscaloosa	3,200	Navigation Flood control Recreation
Black Warrior	Oliver Lock and Dam	Tuscaloosa	within original river banks	Navigation Flood control Recreation
Black Warrior	Selden Lock and Dam	Greene Hale Tuscaloosa	7,800	Navigation Flood control Recreation
Upper Tombigbee	Gainesville Lock and Dam	Pickens Greene Sumter	6,400	Navigation Flood control Recreation
Upper Tombigbee	Bevill Lock and Dam	Pickens	8,100	Navigation Flood control Recreation
Lower Tombigbee	Demopolis Lock and Dam	Hale Greene Sumter	10,000	Navigation Flood control Recreation
Lower Tombigbee	Coffeeville Lock and Dam	Sumter Marengo Clarke Choctaw	8,800	Navigation Flood control Recreation

Table 2A.--Industrial and power generation withdrawals and locations in the Black Warrior-Tombigbee basin, 1987

[Site number corresponds to numbers in figures 3, 4, and 5; SIC code, Standard Industrial Classification Code (Executive Office of the President, Office of Management and Budget, 1987) (see table 2B); Water source, name of surface water source or geologic formation of the ground-water source; BWWB, Birmingham Water Works Board.]

Site number	SIC code	Hydrologic unit	Latitude	Longitude	Water source	Withdrawals (in million gallons per day)	
20	20	03160111	340315	863445	Paleozoic	0.50	combined withdrawal for three wells
22	20	03160111	341200	871055	Paleozoic	.21	combined from two wells
39	49	03160110	335558	870602	Sipsey Fork	17.12	majority is delivered to BWWB
35	49	03160111	335010	863303	Inland Lake	41.86	majority is delivered to BWWB
49	12	03160109	333920	871225	Bakers Creek	.01	
50	49	03160109	333840	871150	Mulberry Fork	872.0	
51	49	03160111	333945	870710	Mulberry Fork	9.0	
53	33	03160111	333257	864828	Paleozoic	.08	
57	12	03160112	332030	870800	Paleozoic	.47	
58	28	03160112	331600	872830	Harris Lake	.40	
62	30	03160113	331215	873625	Black Warrior River	.59	
63	24	03160113	330900	873030	Cretaceous	.21	
70	20	03160113	324235	873530	Cretaceous	.06	
73	49	03160106	323610	874655	Black Warrior River	404.0	
74	49	03160106	323610	874655	Cretaceous	.14	
75	32	03160113	323105	874855	Black Warrior River	.18	
143	26	03160201	322722	875837	Tombigbee River	21.5	
144	26	03160201	322722	875837	Cretaceous	.86	well #1
145	28	03160201	323045	875200	Cretaceous	.50	combined from two wells
146	28	03160201	323045	875200	Tombigbee River	3.68	
165	13	03160201	315100	881100	Tertiary	.008	well #1
		03160201	315100	881100	Tertiary	.004	well #2
		03160201	315100	881100	Tertiary	.004	well #4
		03160201	315100	881100	Tertiary	.007	well #5
		03160201	315000	880800	Tertiary	.004	well 13-9
		03160201	315000	880800	Tertiary	.005	well 13-5
171	24	03160203	314700	874330	Bassett Creek	.10	
187	49	03160203	312912	975432	Tombigbee River	54.0	
188	24	03160203	312850	875420	Tombigbee River	19.5	
190	28	03160203	311645	880000	Tertiary and alluvium	2.98	numerous wells
192	28	03160203	311611	875840	Tertiary	8.88	
193	28	03160203	311545	880015	Tertiary	2.88	six wells

Table 2B.--Water withdrawals and risk ratings for self-supplied industries and power generation facilities in the Black Warrior-Tombigbee basin, 1987

[Note: the order of the facilities in table 2B corresponds to the order of the facilities in table 2A as they appear in figures 3, 4, and 5; Risk rating, probability that the facility will exceed the capacity of the water source; L, low; M, moderate; Mgal/d, million gallons per day; gal/min, gallons per minute; ft^3/s, cubic feet per second; BIWWB, Birmingham Industrial Water Works Board.]

County	SIC code	Total facility withdrawals (Mgal/d)	Aquifer or surface water source	Number of employees	Risk rating	Comments
Black Warrior basin						
Marshall	20	0.21	Paleozoic rocks	650	L	0.84 Mgal/d purchased. Sufficient quantities available for normal operations.
Blount	20	.50	Paleozoic rocks	750	L	Yields more than 100 gal/min are usually available from properly constructed wells. 0.36 Mgal/d are released to Graves Creek.
Blount, Cullman	49	41.86 17.12	Inland Lake, Sipsey Fork	--	L	The source capacity for Inland Lake is about 3.2-9.7 Mgal/d based on low-flow comparisons with adjacent basins However, the large storage capacity of the lake creates a buffer for extended dry periods. The BIWWB pumps as much as possible from Inland Lake then completes amount needed from Sipsey Fork.
Walker	12	.01	Bakers Creek	7	M	Source capacity is 0.35 Mgal/d, however, shortages have been reported during extended dry periods.
Walker	49	872	Mulberry Fork	550	L	Source capacity of Mulberry Fork is 23.9 Mgal/d. An estimated 865 Mgal/d are returned to the river.
Jefferson	49	9.0	Mulberry Fork	379	L	Source capacity of Mulberry Fork is 23.9 Mgal/d.
Jefferson	33	.08	Paleozoic rocks	160	L	0.01 Mgal/d purchased. Well yields exceed 100 gal/min from properly constructed wells.
Jefferson	12	.47	Paleozoic rocks	5	L	No shortages reported. 0.48 Mgal/d are released to abandoned mine pits.
Tuscaloosa	28	.40	Harris Lake	22	L	0.02 Mgal/d purchased. No shortages reported. May purchase more if necessary. 0.40 Mgal/d are released to the Black Warrior River.

Table 2B.--Water withdrawals and risk ratings for self-supplied industries and power generation facilities in the Black Warrior-Tombigbee basin, 1987--Continued

County	SIC code	Total facility withdrawals (Mgal/d)	Aquifer or surface water source	Number of employees	Risk rating	Comments
Black Warrior basin--continued						
Tuscaloosa	30	0.59	Black Warrior River	2,500	L	0.01 Mgal/d purchased. 30-day low flow for period of record at Oliver Lock and Dam is 62.0 Mgal/d.
Tuscaloosa	24	.21	Cretaceous rocks	30	L	Well yields exceed 100 gal/min from properly constructed wells. No shortages reported.
Hale	20	.06	Cretaceous rocks	182	L	Well yields more than 100 gal/min from properly constructed wells. 0.10 Mgal/d purchased.
Greene	49	404	Black Warrior River	167	L	30-day low flow for period of record at Demopolis Lock and Dam is 614 ft^3/s or 397 Mgal/d. However, there have been only four 30-day periods with less than 1,000 ft^3/s since 1929. Also, 404 Mgal/d are returned to the river which includes some sewage treatment discharge.
		.14	Cretaceous rocks			
Marengo	32	.18	Black Warrior River	105	L	30-day low flow for period of record at Demopolis Lock and Dam is 614 ft^3/s or 397 Mgal/d. However, there have been only four 30-day periods with less than 1,000 ft^3/s since 1929. 0.04 Mgal/d are purchased. 0.04 Mgal/d are released to the Black Warrior River.
		.14	Cretaceous rocks			
Upper Tombigbee basin						
no facilities						
Lower Tombigbee basin						
Marengo	26	21.5	Tombigbee River	499	L	30-day low flow for period of record at Demopolis Lock and Dam is 614 ft^3/s or 397 Mgal/d. There have been only four 30-day periods with less than 1,000 ft^3/s since 1929. 22.3 Mgal/d are released to the Tombigbee River.
		.86	Cretaceous rocks			
Marengo	28	3.68	Tombigbee River	42	L	0.05 Mgal/d purchased. 30-day low flow for period of record at Demopolis Lock and Dam is 614 ft^3/s or 397 Mgal/d. There have been only four 30-day periods with less than 1,000 ft^3/s since 1929. 4.18 Mgal/d are released to the Tombigbee River.
		.50	Cretaceous rocks			

Table 2B.--Water withdrawals and risk ratings for self-supplied industries and power generation facilities in the Black Warrior-Tombigbee basin, 1987--Continued

County	SIC code	Total facility withdrawals (Mgal/d)	Aquifer or surface water source	Number of employees	Risk rating	Comments
Lower Tombigbee basin--continued						
Choctaw	13	0.05	Tertiary rocks	14	L	Sufficient quantities available. Water is used for petroleum production.
Clarke	24	.10	Bassett Creek	300	L	Source capacity of Bassett Creek is 0.39 Mgal/d. 0.10 Mgal/d are released to Bassett Creek.
Clarke	24	19.5	Tombigbee River	487	L	30-day low flow for period of record at Coffeeville Lock and Dam is 1,750 ft^3/s or 1,130 Mgal/d. 20.2 Mgal/d released to Tombigbee River. Amount includes some purchased water.
Washington	49	54.0	Tombigbee River	160	L	30-day low flow for period of record at Coffeeville Lock and Dam is 1,130 Mgal/d. 49.4 Mgal/d are released to the Tombigbee River.
Washington	28	8.88	Tombigbee River	1,200	L	30-day low flow for period of record at Coffeeville Lock and Dam is 1,130
		2.98	Tertiary and alluvial deposits			Mgal/d. 11.6 Mgal/d are released to the Tombigbee River.
Washington	28	2.88	Tertiary rocks	300	L	2.03 Mgal/d released to the Tombigbee River. Mostly water from corrective action wells.

* SIC (Standard Industrial Classification) Code Major Group
- 12 Bitumiuous Coal and Lignite Mining
- 13 Oil and Gas Extraction
- 20 Food and Kindred Products
- 24 Lumber and Wood Products
- 26 Paper and Wood Products
- 28 Chemicals and Allied Products
- 30 Rubber and Miscellaneous Plastic Products
- 32 Stone, Clay, Glass, and Concrete Products
- 49 Electric, Gas, and Sanitary Services

Table 3A.--Public-supply withdrawal locations in the Black Warrior-Tombigbee basin, 1987

[Site numbers in the table correspond to the site numbers in figures 3, 4, and 5.
Aquifer abbreviations: Mtfm, Tuscumbia Limestone, Fort Payne Chert, and Monteagle Limestone, undifferentiated; C-O, Cambrian and Ordovician rocks; Tn-c, Nanafalia and Clayton Formations; lPpv, Pottsville Formation; Mbl, Bangor Limestone.Kc, Coker Formation; Ke, Eutaw Formation; Kg, Gordo Formation; Kt, Tuscaloosa Formation; Tl, Lisbon Formation; Tmu, Miocene sediments.
*, interbasin transfer of water; Mgal/d, million gallons per day.]

Site number	Facility name	Hydrologic unit	Source		Source of water	Withdrawals (Mgal/d)
			Latitude	Longitude		
Black Warrior basin						
1	Upper Bear Creek Water, Sewer, and Fire Protection	06030006	3416006	0874025	Bear Creek	1.48*
2	Haleyville Water and Sewer Board	03160110			Purchased from Upper Bear Creek Water, Sewer, and Fire Protection	1.15*
3	Grayson	03160110	341645	0871905	Mbl	.10
4	Double Springs Water Board	03160110			Purchased from Upper Bear Creek Water, Sewer, and Fire Protection	.21*
5	Addison Water Works	03160110	341216	0871200	Mbl	.05
6	Addison Water Works	03160110	341231	0871050	lPpv	.05
7	Addison Water Works	03160110	341120	0871117	lPpv	.04
8	Addison Water Works	03160110	341201	0871000	lPpv	.05
9	Arley	03160110	341026	0870626	lPpv	.02
10	Arley	03160110	340512	0871041	lPpv	.03
11	Arley	03160110	340414	0871303	lPpv	.03
12	Arley	03160110	340252	0871324	lPpv	.03
13	Cullman Power Board	03160109	341102	0864842	Lake Catoma	8.94
14	Hanceville Water Works	03160109	340337	0864629	lPpv	.06
15	Hanceville Water Works	03160109	340338	0864613	lPpv	.08
16	Hanceville Water Works	03160109	340338	0864616	lPpv	.04
17	Blountsville Utilities Board	03160109	340514	0863556	Mtfm	.11
18	Blountsville Utilities Board	03160109	340516	0863519	Mtfm	.11
19	Blountsville Utilities Board	03160109	340502	0863536	Mtfm	.11
21	Snead Water Works	03160111	340543	0862302	lPpv	.20
23	Walnut Grove Water Works	03160111	340329	0861834	C-O	.07
24	Altoona Water Board	03160111	340239	0862004	C-O	.02
25	Altoona Water Board	03160111	340143	0861939	C-O	.02
26	Oneonta Utilities Board	03160111	335858	0862714	C-O	.34
27	Oneonta Utilities Board	03160111	335631	0862831	C-O	.43
28	Allgood Water Works	03160111	335417	0863110	C-O	.04
29	Oneonta Utilities Board	03160111	335910	0863027	Calvert Prong	.23
30	Cleveland Water Works	03160111	335952	0863432	lPpv	.03
31	Cleveland Water Works	03160111	335924	0863404	lPpv	.18
32	Nectar Water System	03160111	335731	0863735	lPpv	.08
33	Pine Bluff Water Authority	03160111	335459	0863604	lPpv	.09
34	Pine Bluff Water Authority	03160111	335450	0863559	lPpv	.09
36	Hayden Water System	03160111	335539	0864647	Mtfm	.01

Table 3A.--Public-supply withdrawal locations in the Black Warrior-Tombigbee basin, 1987--Continued

Site number	Facility name	Hydrologic unit	Source Latitude	Source Longitude	Source of water	Withdrawals (Mgal/d)
Black Warrior basin--Continued						
37	Mt. High-Rock Springs Water and Fire Protection Authority	03160111	335239	0865016	Mbl	.15
38	Warrior Water Works	03160111	334820	0864806	Locust Fork	0.39
40	Sipsey	03160109	334912	0870320	Mulberry Fork	.38
41	Jasper Utilities Board	0316019	334854	0870803	Mulberry Fork	4.68
42	Nauvoo Water Works	03160109	335906	0872759	lPpv	.06
43	Nauvoo Water Works	03160109	335912	0872913	lPpv	.05
44	Lynn Water Works	03160110	340257	0873246	lPpv	.05
45	Kansas	03160109	335408	0873321	lPpv	.03
46	Carbon Hill	03160109	335317	0873136	lPpv	.08
47	Carbon Hill	03160109	335317	0873137	lPpv	.09
48	Berry Water Works	03160112	334142	0873913	Bays Lake	.32
52	Sumiton Water Works	03160109	333420	0871205	Mulberry Fork	.65
54	Birmingham Water Works Board	03150202	332705	0864250	Cahaba River	75.55*
55	Roupes Valley Water Authority	03160112	331822	0870015	Paleozoic formations	.49
56	Roupes Valley Water Authority	03160112	331657	0870200	Paleozoic formations	.43
59	Tuscaloosa Water and Sewage	03160112	331556	0873033	Lake Tuscaloosa	19.46
60	Coker Water and Fire Protection	03160113	331450	0874121	Kc	.20
61	Coker Water and Fire Protection	03160113	331446	0874117	Kc	not used
64	Moundville	03160113	325715	0873709	Kg	.43
65	Moundville	03160113	325711	0873627	Kg	.12
66	Eutaw Water System	03160113	325142	0875436	Ke	.15
67	Eutaw Water System	03160113	325028	0875313	Ke	.16
68	Eutaw Water System	03160113	325026	0875249	Ke	.11
69	Greene County Housing Authority	03160113	324910	0875355	Ke	.01
71	Greensboro Utilities	03160113	324216	0873523	Ke	.28
72	Greensboro Utilities	03160113	324211	0873533	Ke	.53
76	Demopolis Utility	03160113	323013	0874714	Ke	.56
77	Demopolis Utility	03160113	323006	0874817	Ke	.09
Upper Tombigbee basin						
78	Red Bay Water Works	06030006	344649	088070401	Kc	.04*
79	Red Bay Water Works	06030006	342449	088070402	Kc	.04*
80	Red Bay Water Works	06030006	342640	0880659	Kc	.04*
81	Red Bay Water Works	06030006	342628	0880650	Kc	.04*
82	Red Bay Water Works	06030006	342627	0880643	Kc	.04*
83	Red Bay Water Works	06160101	342457	0880911	Kc	.04
84	Red Bay Water Works	03160101	342457	0880909	Kc	.04
85	Red Bay Water Works	03160101	342456	0880907	Kc	.04
86	Red Bay Water Works	03160101	342455	0880901	Kc	.04
87	Vina Water Works	03160101	342141	0880652	Kc	.05
88	Hodges Water Works	03160101	341858	0875530	lPpv	.02
89	Hodges Water Works	03160101	341817	0875524	lPpv	.02
90	Hackleburg Water Board	03160103	341613	0874900	lPpv Kt	.08
91	Hamilton Water Works and Sewer Board	03160103	341053	0875635	lPpv	.03

Table 3A.--Public-supply withdrawal locations in the Black Warrior-Tombigbee basin, 1987--Continued

Site number	Facility name	Hydrologic unit	Source Latitude	Source Longitude	Source of water	Withdrawals (Mgal/d)
Upper Tombigbee basin--Continued						
92	Hamilton Water Works and Sewer Board	03160103	340938	0875644	lPpv	0.09
93	Hamilton Water Works and Sewer Board	03160103	340901	0875836	lPpv	.11
94	Hamilton Water Works and Sewer Board	03160103	340829	0875921	lPpv	.11
95	Hamilton Water Works and Sewer Board	03160103	340839	0875921	lPpv	.14
96	Hamilton Water Works and Sewer Board	03160103	340755	0875920	lPpv	.14
97	Hamilton Water Works and Sewer Board	03160103	340757	0875930	lPpv	.00
98	Hamilton Water Works and Sewer Board	03160103	340814	0875951	lPpv	.00
99	Hamilton Water Works and Sewer Board	03160103	340823	0880002	lPpv	.15
100	Hamilton Water Works and Sewer Board	03160103	340852	0880053	lPpv	.01
101	Hamilton Water Works and Sewer Board	03160103	340949	0880149	lPpv	.15
102	Detroit	03160103	340137	0881028	Kt	.02
103	Detroit	03160103	340141	0881019	Kt	.02
104	Brilliant	03160107	340151	0874513	lPpv	.09
105	Brilliant	03160107	340059	0874600	lPpv	.09
106	Twin Water Authority	03160105	340000	0875100	Kc	.05
107	Guin Water Works and Sewer Board	03160103	335751	0875408	Purgatory Creek	.43
108	Beaverton Water Works	03160103	335600	0880107	Kt	.02
109	Sulligent	03160103	335408	0880739	Kt	.08
110	Sulligent	03160103	335345	0880837	Kt	.09
111	Sulligent	03160103	335307	0880740	Kt	.08
112	Sulligent	03160103	335307	0880740	Kt	.08
113	Winfield Water Works and Sewer Board	03160105	335533	0874840	Luxapallila Creek	.45
114	Winfield Water Works and Sewer Board	03160105	335500	0874800	lPpv	.12
115	Glen Allen Water Works	03160107	335428	0874440	lPpv	.02
116	Eldridge Water System	03160107	335515	0873710	lPpv	.04
117	Vernon	03160105	334529	0880629	Kt	.00
118	Vernon	03160105	334537	0880625	Kt	.00
119	Vernon	03160105	334403	0880817	Kt	.87
120	Fayette Water Works	03160105	334123	0875345	Luxapallila Creek	1.07
121	Fayette Water Works	03160107	334050	0874821	Sipsey River	0.01
122	Belk Water System	03160105	333856	0875554	lPpv	.06
123	Kennedy Water Works	03160105	333449	0875934	Kt	.07
124	Millport Water Works	03160105	333333	0880436	Kt	.06
125	Millport Water Works	03160105	333335	0880439	Kt	.08
126	Reform	03160106	332237	0880108	Kg	.29
127	Reform	03160106	332229	0880056	Kg	.23

Table 3A.--Public-supply withdrawal locations in the Black Warrior-Tombigbee basin, 1987--Continued

Site number	Facility name	Hydrologic unit	Source Latitude	Source Longitude	Source of water	Withdrawals (Mgal/d)
Upper Tombigbee basin--Continued						
128	Gordo Water and Sewer Board	03160106	331918	0875400	Kc	0.05
129	Gordo Water and Sewer Board	03160106	331915	0875350	Kc	.11
130	Gordo Water and Sewer Board	03160106	331848	0875314	Kc	.21
131	Buhl-Elrod-Holman	03160107	331526	0874802	Alluvium	.04
132	Buhl-Elrod-Holman	03160107	331526	0874802	Kc	.04
133	Pickens County Water System	03160106	331337	0881555	Ke	.11
134	Aliceville Water and Sewer Board	03160106	330713	0881005	Kg	not used
135	Aliceville Water and Sewer Board	03160106	330712	0881007	Ke	.34
136	Aliceville Water and Sewer Board	03160106	330741	0880911	Kg	not used
137	Aliceville Water and Sewer Board	03160106	330718	0880855	Kg	.41
138	Pickens County Water System	03160106	330353	0881500	Ke	.48
139	Union Water Works	03161016	330309	0875639	Kg	.06
140	Forkland	03160106	323625	0874953	Ke	.06
Lower Tombigbee basin						
141	Livingston Water Works	03160202	323505	0881138	Sucarnoochee River	.83
142	York Water Works	03160202	322824	0881948	Lake Louise	.61
147	Demopolis Utility Department	03160201	323123	0875012	Ke	.21
148	Demopolis Utility Department	03160201	323012	0874927	Ke	.47
149	Faunsdale Water Works	03160201	322615	0873545	Kg	.07
150	Thomaston Water Works and Gas Board	03160201	321616	0873735	Ke	.02
151	Thomaston Water Works and Gas Board	03160201	321601	0873728	Ke	.02
152	Linden Utilities Board	03160201	321935	0874746	Ke	.20
153	Linden Utilities Board	03160201	321925	0874756	Ke	.20
154	Linden Utilities Board	03160201	321800	0874750	Ke	.20
155	Pennington Water Works	03160201	321235	0880308	Tn-c	.03
156	Pennington Water Works	03160201	321234	0880344	Tn-c	.03
157	Pennington Water Works	03160201	321206	0880312	Tn-c	.03
158	North Choctaw County Water Works	03160201	321018	0881644	Tn-c	.03
159	North Choctaw County Water Works	03160201	320745	0881914	Tn-c	.02
160	Butler Water Works	03160201	320538	0881302	Tn-c	.11
161	Butler Water Works	03160201	320518	0881340	Tn-c	.11
162	Butler Water Works	03160201	320517	0881245	Tn-c	.11
163	Myrtlewood	03160201	320523	0875339	Tnf	.05
164	Sweet Water	03160201	320545	0875200	Tnf	.03
166	Gilbertown Water Works	03160201	315241	0881904	Tl	.10
167	Coffeeville Water Works	03160203	314546	0880525	Tl	.02
168	Coffeeville Water Works	03160203	314530	0880458	Tl	.03
169	Fulton Utility Board	03160203	314736	0874321	Tn-c	.03
170	Fulton Utility Board	03160203	314705	0874332	Tn-c	.04
172	Grove Hill Water Works	03160203	314219	0874710	Tmu	.24
173	Grove Hill Water Works	03160203	314224	0874644	Tmu	.08
174	Grove Hill Water Works	03160203	314147	0874622	Tmu	.13
175	Grove Hill Water Works	03160203	313848	0874211	Tmu	.06
176	Frankville Water System	03160203	313619	0881007	Tmu	.05
177	Millry Water System	03160203	313813	088184801	Tmu	.05

Table 3A.--Public-supply withdrawal locations in the Black Warrior-Tombigbee basin, 1987--Continued

Site number	Facility name	Hydrologic unit	Source Latitude	Source Longitude	Source of water	Withdrawals (Mgal/d)
Lower Tombigbee basin--Continued						
178	Millry Water System	03160203	313813	088184802	Tmu	.05
179	Chatom Utilities Board	03160203	312744	0881510	Tmu	.12
180	Chatom Utilities Board	03160203	312736	0881437	Tmu	.13
181	St. Stevens Water Systems	03160203	313115	0880215	Tmu	.05
182	Leroy Water and Fire Protection	03160203	313040	0880104	Tmu	not used
183	Leroy Water and Fire Protection	03160203	313025	0875959	Tmu	.05
184	Leroy Water and Fire Protection	03160203	313017	0875900	Tmu	.05
185	Jackson Water Works and Sewer Board	03160203	313149	0875612	Hoven Spring	1.03
186	Jackson Water Works and Sewer Board	03160203	312923	0875419	Tombigbee River	emergency supply
189	Wagarville Water System	03160203	312628	0880153	Tmu	.04
191	McIntosh Water and Fire Protection	03160203	311600	0880122	Tmu	.19
194	Fairford Water and Fire Protection	03160203	311053	0880610	Tmu	.03
195	Calvert Water System	03160203	310953	0880236	Tmu	.05

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987

[The order of the facilities in table 3B corresponds to the order of the sites in table 3A as they appear in figures 3, 4, and 5. Aquifer abbreviations: Mtfm, Tuscumbia Limestone, Fort Payne Chert, and Monteagle Limestone, undifferentiated; C-O, Cambrian and Ordovician rocks; lPpv, Pottsville Formation; Mbl, Bangor Limestone; Kt, Tuscaloosa Formation; Kc, Coker Formation; Kg, Gordo Formation; Ke, Eutaw Formation; Tl, Lisbon Formation; Tmu, Miocene sediments. Risk Ratings: Risk that facility will exceed the source capacity of the water supply. L, low; M, moderate; H, high. Abbreviations: gal/min, gallons per minute; Mgal/d, million gallons per minute; ft^3/s, cubic foot per second, *, interbasin transfer of water; **, a part of the total withdrawal is interbasin transfer of water.]

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites
Black Warrior Basin							
Marion	Upper Bear Creek Water, Sewer and Fire Protection	1.48*	Bear Creek	see Haleyville and Double Springs		L	Capacity of Bear Creek is 4.65 Mgal/d, well below the average rate of use. Water from this facility is sold to Haleyville and Double Springs in Winston County.
Winston	Haleyville Water and Sewer Board	1.15*	Purchased from Upper Bear Creek	2,850	8,550	L	See Upper Bear Creek Water System.
Winston	Grayson	.10	Mbl	26	78	L	Well yields more than 100 gal/min usually available from properly constructed wells.
Winston	Double Springs Water Board	.21*	Purchased from Upper Bear Creek	721	2,163	L	See Upper Bear Creek Water System.
Winston	Addison Water Works	.01	lPpv and Mbl Purchased from Cullman	571	1,713	M	System periodically has water shortages during extended dry periods.
Winston	Arley	.11	lPpv	531	1,593	M	Well yields usually less than 100 gal/min.
Cullman	Cullman Power Board	8.94	Lake Catoma	6,800	19,400	M	There is no flow into the lake during extreme dry periods. The large storage capacity of the lake has prevented any severe shortages in the past but continued growth of the water system may exceed the capacity of the lake during a severe drought. Voluntary rationing measures have been used at times in recent year.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Black Warrior basin--Continued							
Blount	Snead Water Works	0.20	IPpv	834	2,502	M	Well yields are usually less than 100 gal/min.
Etowah	Altoona Water Board	.04	C-O	350	1,350	M	Water is available but sometimes hard to locate. Additional sources are being sought.
Etowah	Walnut Grove Water Works	.07	C-O	230	654	M	Do.
Blount	Blountsville Utilities Board	.33	Mtfm	781	2,343	L	Well yields more than 100 gal/min are available from properly constructed wells.
Cullman	Hanceville Water Works	.18 .26	IPpv Purchased from Cullman Power Board	1,430	4,290	M	Yields from wells are usually less than 100 gal/min. See comments on Cullman Power Board.
Winston	Lynn Water Works	.05	IPpv	220	660	M	Do.
Walker	Nauvoo Water Works	.11	IPpv	530	1,590	M	Do.
Walker	Kansas	.03	IPpv	200	350	M	Do.
Blount	Mt. High-Rock Springs Water and Fire Protection Authority	.15	Mbl	1,330	3,990	L	Well yields more than 100 gal/min from properly constructed wells.
Blount	Hayden Water Works	.01	Mtfm	257	771	L	Do.
Blount	Nectar Water System	.08	IPpv	225	675	M	Yields from wells are usually less than 100 gal/min.
Blount	Cleveland Water Works	.21	IPpv	575	1,725	M	Do.
Blount	Oneonta Utilities Board	1.00	Calvert Prong C-O	2,873	8,619	L	Capacity of the river is 3.30 Mgal/d.
Blount	Allgood	.04	C-O spring	200	750	L	Yields over 100 gal/min are usually available from properly constructed wells.
Blount	Pine Bluff Water Authority	.18	IPpv	760	2,280	M	Yields from wells usually less than 100 gal/min.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Black Warrior basin--continued							
Jefferson	Warrior Water Works	0.39	Locust Fork	1,020	3,400	L	Source capacity is 3.30 Mgal/d, well above the rate of use.
Walker	Sipsey	.38	Mulberry Fork	1,900	5,700	L	Source capacity is 23.9 Mgal/d, well above the average use rate.
Walker	Jasper Utilities Board	4.68	Mulberry Fork	6,000	18,000	L	Source capacity is 23.9 Mgal/d, well above the average use rate.
Fayette	Berry	.32	Bays Lake	709	2,700	M	Low flows for many streams near Bays Lake are 0-1.0 ft^3/s. Inflow into the lake is probably zero during extended dry periods.
Walker	Sumiton Water Works	.65	Mulberry Fork	2,600	7,800	L	Source capacity is 23.9 Mgal/d, well above the average use rate.
Jefferson	Birmingham Water Works Board	41.78	Purchased from Birmingham Industrial Water Works Board from Inland Lake and Sipsey Fork.	161,140	483,420	M	Source capacity for Mulberry Fork downstream from the Sipsey Fork before Lewis Smith Dam was built was about 14.9 Mgal/d. The capacity for Inland Lake is 3.2-9.7 Mgal/d based on comparisons with adjacent basins. Water is also supplied from the adjacent Cahaba River basin. The 7-day 10-year low flow for the Cahaba River near Acton is 0.0 ft^3/s. Long periods of drought require cutbacks in water use.
		75.55*	Cahaba River, outside the Black Warrior River				
Jefferson	Roupes Valley Water Authority	.92	Paleozoic formations	3,010	9,030	M	Well yields more than 10 gal/min are possible in this area but are difficult to find. Additional sources are being sought.
Tuscaloosa	Tuscaloosa Water and Sewage	19.46	Lake Tuscaloosa	32,638	97,914	L	Keener & others (1975) reported the safe yield of the lake 200 Mgal/d.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Black Warrior basin--Continued							
Tuscaloosa	Coker Water Works and Fire Protection Authority	0.20	Kc	663	1,999	L	Well yields more than 100 gal/min usually available from properly constructed wells.
Hale	Moundville	.55	Kg	360	1,080	L	Do.
Greene	Eutaw Water System	.42	Ke	1,225	3,675	L	Do.
Greene	Greene County Housing Authority	.01	Ke	201	603	L	Do.
Hale	Greensboro Utilities	.81	Ke	1,373	4,119	L	Do.
Marengo	Demopolis Utility Department	1.33	Ke	2,700	8,100	M	Yields more than 100 gal/min can be produced from some wells in this area, but the water is often highly mineralized.
Upper Tombigbee basin							
Franklin	Red Bay Water Works	.36**	Kc	1,273	4,819	L	Yields from properly constructed wells are usually more than 100 gal/min.
Franklin	Vina Water Works	.05	Kc	162	510	L	Yields from properly constructed wells are usually more than 100 gal/min.
Franklin	Hodges	.04	lPpv	260	780	M	Yields from wells are usually less than 100 gal/min.
Marion	Hackleburg Water Board	.08	lPpv and Kt	537	1,611	L	The facility should have no supply problems based on current use rates and the quantities usually available from wells in the area.
Marion	Hamilton Water Works and Sewer Board	.93	lPpv	2,486	7,458	M	Yields from wells usually less than 100 gal/min.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Upper Tombigbee basin--continued							
Lamar	Detroit	0.04	Kt	150	450	L	Yields more than 100 gal/min are usually available from properly constructed wells. Petroleum production in the area could feasibly cause some problems, but it has not been a problem in the past.
Lamar	Sulligent	.33	Kt	827	2,841	L	Do.
Lamar	Beaverton	.02	Kt	260	780	L	Do.
Marion	Guin Water Works and Sewer Board	.43	Purgatory Creek	1,300	3,900	M	Source capacity is 0.52 Mgal/d, very near the average use rate.
Marion	Twin Water Authority	.05	Kc	230	690	L	Yields usually more than 100 gal/min from properly constructed wells.
Marion	Brilliant	.18	lPpv	436	1,308	M	Yields from wells usually less than 100 gal/min.
Marion	Winfield Water Works and Sewer Board	.57	Luxapallila Creek and lPpv	1,844	5,532	L	Source capacity of Luxapallila Creek is 21.3 Mgal/d, well above the average use rate.
Fayette	Glen Allen Water Works	.02	lPpv	140	420	M	Yields from wells usually less than 100 gal/min.
Walker	Eldridge Water System	.04	lPpv	170	510	M	Do.
Lamar	Vernon	.87	Kt	1,120	3,360	L	Well yields more than 100 gal/min are usually available from properly constructed wells. Petroleum production in the area could feasibly cause some problems, but it has not been a problem in the past.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Upper Tombigbee basin--continued							
Fayette	Fayette Water Works	1.08	Sipsey River Luxapallila Creek	2,300	6,900	L	Capacity for Sipsey River is 7.76 Mgal/d and for Luxapallila Creek is 21.3 Mgal/d. Both are well above the average rate of use.
Fayette	Belk Water System	.06	IPpv	160	480	M	Yields from wells are usually less than 100 gal/min.
Lamar	Kennedy Water Works	.07 .22	Kt Purchased from Vernon.	250	750	L	Well yields more than 100 gal/min are usually available from properly constructed wells. Petroleum production in the area could feasibly cause some problems, but it has not been a problem in the past.
Lamar	Millport Water Works	.14	Kt	496	1,488	L	Do.
Pickens	Reform	.52	Kg	849	2,547	L	Do.
Pickens	Gordo Water and Sewer	.37	Kc	835	2,505	L	Well yields more than 100 gal/min usually available from properly constructed wells.
Tuscaloosa	Buhl-Elrod-Holman Water Authority	.08	Alluvium, Kc	417	1,251	L	Do.
Pickens	Pickens County Water System	.59	Ke	2,062	6,186	L	Do.
Pickens	Aliceville Water and Sewer	.75	Kg, Ke	1,057	3,171	L	Do.
Greene	Union	.06	Kg	315	945	L	Do.
Greene	Forkland	.06	Ke	320	960	L	Do.
Lower Tombigbee basin							
Sumter	Livingston Water Works	.83	Sucarnoochee River	1,110	3,300	L	Source capacity is 42.0 Mgal/d, well above the average use rate.
Sumter	York Water Works	.61	Lake Louise	1,137	3,471	L	Source capacity is 1.8 Mgal/d, somewhat greater than the average use rate.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Lower Tombigbee basin--continued							
Marengo	Faunsdale Water Works	0.07	Kg	128	384	M	Yields more than 100 gal/min can be produced from some wells in this area, but the water is often highly mineralized.
Marengo	Linden Utilities Board	.60	Ke	1,029	3,087	H	History of problems with poor water quality.
Marengo	Thoomaston Water Works and Gas Board	.04	Ke	276	828	M	Yields exceeding 100 gal/min can be produced from some wells in this area, but the water is often highly mineralized.
Choctaw	Pennington Water Works	.09	Tn-c	254	762	M	Do.
Choctaw	North Choctaw County Water Works	.05	Tn-c	331	993	M	Do.
Choctaw	Butler	.33	Tn-c	841	2,523	M	Do.
Marengo	Myrtlewood	.05	Tn	284	852	M	Do.
Marengo	Sweet Water	.03	Tn	117	351	M	Do.
Choctaw	Gilbertown	.10	Tl	940	2,820	M	Yields more than 100 gal/min are available from properly constructed wells, but petroleum producing formations in the area increase the possibility of contamination of water supplies.
Clarke	Coffeeville Water Works	.05	Tl	657	2,071	M	Do.
Clarke	Fulton Utility Board	.07	Tn-c	170	510	L	Well yields more than 100 gal/min are usually available from properly constructed wells.
Clarke	Grove Hill Water Works	.51	Tmu	848	2,544	L	Do.

Table 3B.--Water withdrawals and risk ratings for public-supplies in the Black Warrior-Tombigbee basin, 1987--Continued

County	Facility name	Total system withdrawals (Mgal/d)	Water source	Number of connections	Population served	Risk rating	Comments (includes source capacity for surface water sites)
Lower Tombigbee basin--continued							
Washington	Millry Water System	0.10	Tmu	320	960	M	Well yields more than 100 gal/min usually available from properly constructed wells. Petroleum producing formations in the area increase the possibility of contamination of the water supplies.
Washington	Franklin Water System	.05	Tmu	242	726	M	Do.
Washington	Chatom Utilities Board	.25	Tmu	520	1,560	M	Do.
Washington	St. Stevens Water System	.05	Tmu	190	570	M	Do.
Washington	Leroy Water and Fire Protection Authority	.10	Tmu	300	900	M	Do.
Clarke	Jackson Water Works and Sewer Board	1.03	Hoven Spring and Tombigbee River	2,300	6,900	L	Plant operates at about 50 percent of capacity and has the Tombigbee River as an emergency source.
Washington	Wagarville Water System	.04	Tmu	160	480	M	Well yields more than 100 gal/min usually available from properly constructed wells. Petroleum producing formations in the area increase the possibility of contamination of the water supplies.
WAshington	McIntosh Water and Fire Protection Authority	.19	Tmu	657	2,071	M	Do.
Washington	Fairford Water and Fire Protection Authority	.03	Tmu	160	480	M	Do.
Washington	Calvert Water System	.05	Tmu	198	594	M	Do.

Table 4.--Self-supplied domestic withdrawals in the Black Warrior-Tombigbee basin, 1985

County	Total county population (thousands)	Estimated self-supplied population (thousands)	Estimated water withdrawals, million gallons/day (all ground water)	Percent of county population in Black Warrior-Tombigbee basin (HUC 03160000)
Blount	37.0	16.55	1.24*	96.4
Choctaw	17.1	8.20	.61	100.0
Clarke	28.0	7.73	.58	100.0
Cullman	64.2	.64	.05*	97.2
Etowah	103.5	1.04	.08*	6.0
Fayette	18.9	7.44	.56	100.0
Franklin	28.4	6.93	.52*	2.1
Greene	11.3	4.80	.36	100.0
Hale	15.6	4.76	.36	100.0
Jefferson	676.6	3.24	.24*	79.8
Lamar	16.5	6.47	.48	100.0
Marengo	25.2	8.91	.72*	95.0
Marion	31.0	7.71	.58*	87.3
Marshall	69.4	1.00	.07*	22.9
Pickens	21.7	6.78	.51	100.0
Sumter	17.0	3.87	.29	100.0
Tuscaloosa	139.1	10.42	.78*	99.8
Walker	69.6	12.46	.93	100.0
Washington	17.6	9.06	.68*	86.9
Winston	22.4	7.75	.58*	95.0
Totals	1,430.1	135.76	10.22	

* Includes parts of county outside the Black Warrior-Tombigbee basin.

Table 5.--Agricultural water withdrawals in the Black Warrior-Tombigbee basin, 1985 (from Baker and Mooty, 1987)

[Note: Withdrawal values shown are for the entire county including areas outside the Black Warrior-Tombigbee basin. Abbreviations: Mgal/d, million gallons per day.]

County	Livestock withdrawals (Mgal/d)			Irrigation withdrawals (Mgal/d)			Acres irrigated (thousands)	Percent of county in Black Warrior-Tombigbee basin (HUC 03160000)
	Ground water	Surface water	Total	Ground water	Surface water	Total		
Blount	0.94	0.34	1.28	0.09	0.83	0.92	2.10	94.0
Choctaw	.43	.23	.66	0	0	0	0	98.4
Clarke	.21	.16	.37	0	0	0	0	74.9
Cullman	4.29	.81	5.10	0	.16	.16	.35	94.7
Etowah	1.15	.40	1.55	0	.29	.29	1.31	20.3
Fayette	.17	.12	.29	0	.01	.01	.04	100.0
Franklin	.62	.25	.87	0	0	0	0	8.8
Greene	2.67	1.11	3.78	.02	.07	.09	.26	100.0
Hale	15.60	5.42	21.02	0	.08	.08	.28	100.0
Jefferson	.15	.12	.27	.08	1.51	1.59	3.56	78.2
Lamar	.12	.13	.25	0	0	0	0	100.0
Marengo	.61	.41	1.02	0	0	0	0	90.9
Marion	.52	.20	.72	0	0	0	0	92.3
Marshall	1.80	.33	2.13	0	.13	.13	.35	14.2
Pickens	1.16	.38	1.54	.35	.35	.70	1.04	100.0
Sumter	1.52	.71	2.23	0	0	0	0	100.0
Tuscaloosa	1.05	.46	1.51	.29	.10	.39	.40	99.0
Walker	.51	.20	.71	0	.03	.03	.06	100.0
Washington	.18	.15	.33	0	0	0	0	70.8
Winston	.95	.24	1.19	0	0	0	0	98.2
Total	34.65	12.17	46.82	.83	3.56	4.39	9.75	

* Includes aquaculture.