THE TENNESSEE RIVER BASIN

Source Water Assessment

5/1/2009

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May 2009 Update: James A. Collins

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INTRODUCTION

This document and accompanying maps and compact disc were prepared by the Tennessee Valley Authority (TVA) in support of the Alabama Department of Environmental Management (ADEM), Source Water Assessment Program. This source water assessment package was prepared to comply with the U.S. Safe Drinking Water Act Amendments of 1996 (P.L. 104-182) and the subsequent guidance document prepared by the U.S. Environmental Protection Agency (EPA).

The information and data used in the preparation of this source water assessment package for Limestone County Water and Sewer Authority were obtained from existing sources and databases, relying heavily on EPA's Envirofacts Web site, Office of Management and Budget (OMB) and the Unison Institute's Emergency Planning and Community Right-to-Know Web site, ADEM's databases, TVA's databases, and the U.S. Department of Agriculture's electronic information system. A complete listing of these information sources is presented at the end of this document.

This source water assessment package consists of four components: 1) this document, the purpose of which is to integrate all of the components; 2) a geographic information system (GIS) produced 7.5 minute topographic map of the source water protection area (SWPA); 3) a map delineating the Limestone County Water and Sewer Authority watershed; and 4) a compact disc containing the GIS ArcView project file used to produce the SWPA map and a folder containing the freeware, ArcExplorer, which will allow viewing of the GIS data if ArcView is not available.

THE TENNESSEE RIVER BASIN

The Tennessee River Basin lies in a seven-state area in the southeastern United States. Its drainage area covers 40,900 square miles mostly in the state of Tennessee, but with parts also in Alabama, Kentucky, Virginia, North Carolina, Georgia, and Mississippi. The Tennessee River begins in Knoxville, Tennessee, with the joining of the French Broad and Holston Rivers. It continues westward to Paducah, Kentucky, where it enters the Ohio River, only 46 miles upstream of the confluence of the Ohio and Mississippi Rivers. In terms of discharge, the Tennessee River is the fifth-largest river in the United States and the seventh-largest in North America.

The Tennessee River Basin is composed of two fan-shaped basins connected in the vicinity of Chattanooga, Tennessee, by a relatively narrow valley. The 21,400 square mile area upstream, or east of Chattanooga, includes the slopes of the Blue Ridge and Great Smoky Mountains and is dominated by rugged forested areas. The remaining 19,500 square mile area downstream and west of Chattanooga, is dominated by relatively flatter, open fields, woodlands, and rolling hills. Approximately 60 percent of the total watershed is forested, while the remaining 40 percent is open land and pasture.

The Tennessee River drainage is one of three major drainage groups within the state of Alabama. It drains approximately 13 percent or 6826 mi^2 of Alabama's surface area. The Tennessee River's average daily flow entering and exiting Alabama is approximately 37,600 cubic feet per second (cfs) and 51,600 cfs, respectively, an increase of approximately 14,000 cfs. The TVA manages the Tennessee River for navigation, flood control, to generate electric power, and for recreation. The Tennessee River flowing through Alabama is impounded by four reservoirs: Guntersville, Wheeler, Wilson, and Pickwick with a total surface area of 203,510 acres of water.

Hydrologic Overview

The Tennessee River Basin is one of the wettest regions in the United States. The Gulf of Mexico and the Caribbean Sea, located only a short distance to the south, are major sources of moisture. As there is no significant barrier between the Basin and the Gulf, prevailing winds from the south and west bring this moisture across the Basin. The Basin is also subject to heavy rainfall from dissipating hurricanes moving across the southeastern United States.

The long-term (1894-1993) average annual precipitation for the Basin is 51 inches per year. The heaviest rainfall concentrations occur in the mountainous highlands of the eastern region, where annual precipitation often exceeds 90 inches. Approximately half of the annual rainfall is received in winter and early spring, from December until mid-April. March is typically the wettest month; while September and October are likely to be the driest. Monthly average rainfall ranges from 3 to 5.6 inches.

Flood Potential

The high rainfall and runoff rates in the Tennessee Valley have rendered the area vulnerable to flooding. In general, flood-producing storms occur in an area within the Tennessee River Basin on the average of about once every two years. The major flood season in the Valley is December through mid-April, with the highest frequency of storms occurring in March. Widespread cyclonic storms with heavy, persistent rainfall occur more frequently during the winter season. Dormant vegetation and ground conditions favor a high rate of runoff during the same period. The worst winter storms can cover the entire Valley for several days. It is not unusual for one large winter storm to be followed by another, even larger, storm three to five days later. Conversely, the worst summer storms tend to be short, intense, and relatively localized, resulting from thunderstorms or decadent tropical storms that have moved inland. These summer storms generally affect a smaller portion of the Valley, with heavy rains typically covering an area of 3000 square miles.

Reservoir System and Uses

The Tennessee River Basin is controlled by a system of dams operated by TVA. The TVA reservoir system is operated as an integrated, multipurpose system. (A schematic of the TVA's water control system is shown in Figure 1.) Major objectives are to provide for navigation, flood control, hydropower generation, summer recreation levels, and minimum flows for the maintenance of water quality and aquatic habitat. Additionally, the reservoir system supports fossil and nuclear power generation by providing condenser cooling water and dissipating thermal waste loads.

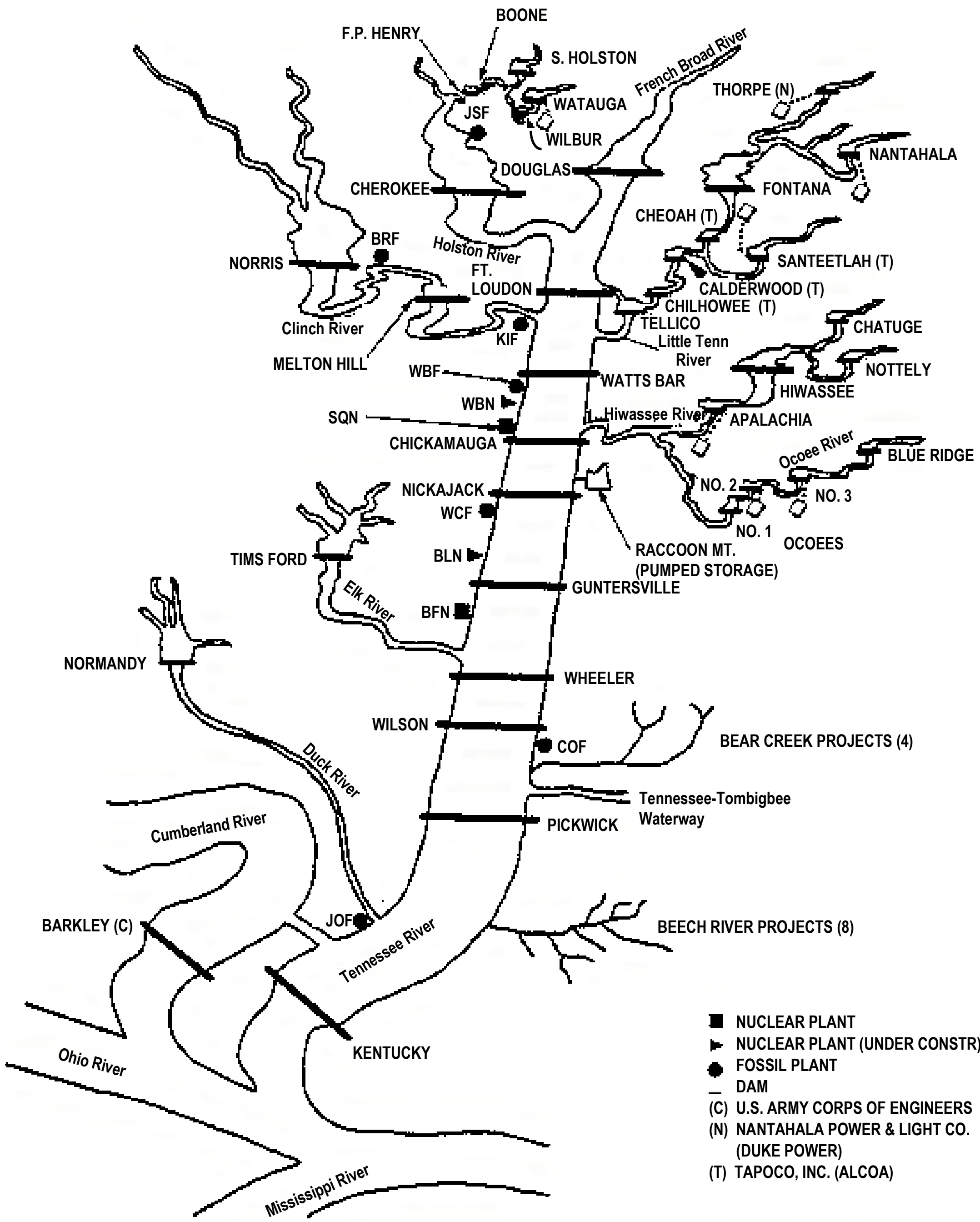


Figure 1. The TVA Water Control System

The Tennessee River is an integral part of the Interconnected Inland Waterways System of the United States. This system, that extends from the Great Lakes to the Gulf of Mexico, includes the Mississippi, Missouri, Illinois, Ohio, Tennessee, and Arkansas River systems. The Inland Waterways System connects the Tennessee River system with 21 other states.

The Tennessee River provides a navigable channel for its entire length from Knoxville, Tennessee, to Paducah, Kentucky, a distance of 650 miles through a series of nine locks and dams on the mainstream of the river. The minimum channel depth is 11 feet, which provides sufficient depth for vessels with a 9-foot draft. The minimum channel width in dredged cuts is 300 feet with some widening on bends. Most locks in the system are 100 by 600 feet, considered a standard for modern barge traffic of low to medium traffic levels. Newer locks, such as the one constructed at Pickwick Dam and planned for Kentucky Dam, are larger, measuring in the range of 110 feet by 1000 feet.

In 1995, commercial barge traffic on the Tennessee River reached a total of 48 million tons. The three largest ports in the system, in order of importance, are: Decatur, Alabama; Chattanooga, Tennessee; and Guntersville, Alabama. Maintenance and operation of the Tennessee River waterway is the joint responsibility of TVA, the U.S. Coast Guard, and the U.S. Army Corps of Engineers.

Power Generation

TVA reservoirs are operated to maximize hydropower generation to the extent possible in light of satisfying other multipurpose uses. Hydroelectric power is the most economical form of electricity available in the TVA system because incremental costs for hydropower (the costs that vary with production levels) are very low. TVA's hydropower generation accounts for approximately 20 percent of its generation capacity.

In the TVA power system, hydropower is used primarily for peaking purposes, to provide additional power quickly during those times of the day when power demands are highest.

Water Quality

Overall, the Tennessee River is considered to be a clean river. In general, there is no one pervasive water quality concern in TVA reservoirs, but there are a collection of concerns affecting various uses. Most of these concerns, however, can be related to two major water quality issues. The first issue relates to point and nonpoint pollution, which tends to affect specific reservoirs and specific water uses. A related issue is that of toxic substances, which have been found in sediments and fish in reservoirs with otherwise good water quality. The second primary water quality issue is the occurrence of low dissolved oxygen (DO) levels in the tailwater areas below TVA dams. Low DO levels can stress aquatic life and limit the ability of the water to assimilate wastes.

Nonpoint source pollutants, which can contribute as much as five times more DO-consuming wastes than point sources, are the principal cause of water quality concerns in the Tennessee Valley. Nonpoint source pollution results from a variety of activities in the watershed related to agriculture (runoff from fertilizer and pesticide applications, erosion and animal wastes), mining (sedimentation and acidification from tailings), land development, and urbanization (storm sewers, combined storm and sanitary sewer overflows, and septic systems).

Other Reservoir Uses

Although the Tennessee River/reservoir system is operated primarily for the purposes of flood control, navigation, power generation, recreation, and water quality, there are several other incidental benefits derived from the system. The reservoir system is also used for water supply, maintenance of public health, support of economic development, and support of wildlife, fisheries, and threatened and endangered species. There is some use of streams, rivers, and private reservoirs for municipal and industrial water supply, but it is relatively small. Public water systems, which serve about 80 percent of the Tennessee Valley residents, use about 450 to 550 million gallons per day. The remaining 20 percent of Valley residents use individual wells. Over 300 industrial water systems also withdraw water for industrial processes and cooling. However, the total water withdrawn for both industrial and municipal purposes amounts to only about 2 to 3 percent of the annual average flow of 64,000 cubic feet per second at the mouth of the Tennessee River. Consumptive use is even less, as close to 75 percent of this water is returned to the system. Furthermore, irrigation demand in the Valley is small and not expected to grow.

Physiography

Physiography concerns the structure and type of underlying geologic formations, as well as the local geologic and climatic forces that shape the landscape. Along with several other factors, an area's physiography determines the natural water quality conditions of local streams, rivers, and lakes. In northern Alabama (Figure 2) there are three physiographic sections: the Highland Rim, Cumberland Plateau, and East Gulf Coastal Plain.

The Highland Rim in its entirety extends from the glacial boundary in Indiana south through Nashville to the Tennessee River in Alabama. The Highland Rim in Alabama is located in the northwestern portion of the state and is drained exclusively by the Tennessee River. It is characterized by extensive exposure of Tuscumbia limestone and Fort Payne chert of upper Mississippian age. Exceptions to this characterization occur when major streams such as the Elk River expose strata of greater age. Valley floors are predominantly limestone at altitudes of 500 feet, while ridges are typically composed of sandstone and are nearly 1000 feet. There are three districts in Alabama delineated in the Highland Rim: the Tennessee Valley, Little Mountain, and Moulton Valley. All three districts gently slope to the west and eventually disappear beneath East Gulf Coastal Plain deposits.

The Tennessee Valley, Little Mountain, and Moulton Valley districts are drained by the Tennessee River and its tributaries. The Tennessee Valley district, which comprises the red clay lands on both sides of the Tennessee River, is the largest district in the Highland Rim. The level parts of the Valley contain numerous springs, small ponds, limestone sinks, and caves formed by solution of the underlying limestone. Tributaries to the north are the Elk River, Cypress Creek, Butler Creek, Limestone Creek, and Bluewater Creek. Tributaries to the south are Town Creek, Spring Creek, Big Nance Creek, and Flint Creek. During times of drought, water from springs often augments streamflows, and some springs, such as Tuscumbia Spring, supply drinking water. Streams draining south to the Tennessee River usually flow year-round, and many have exceptionally good water quality. Small headwater streams flowing north through the

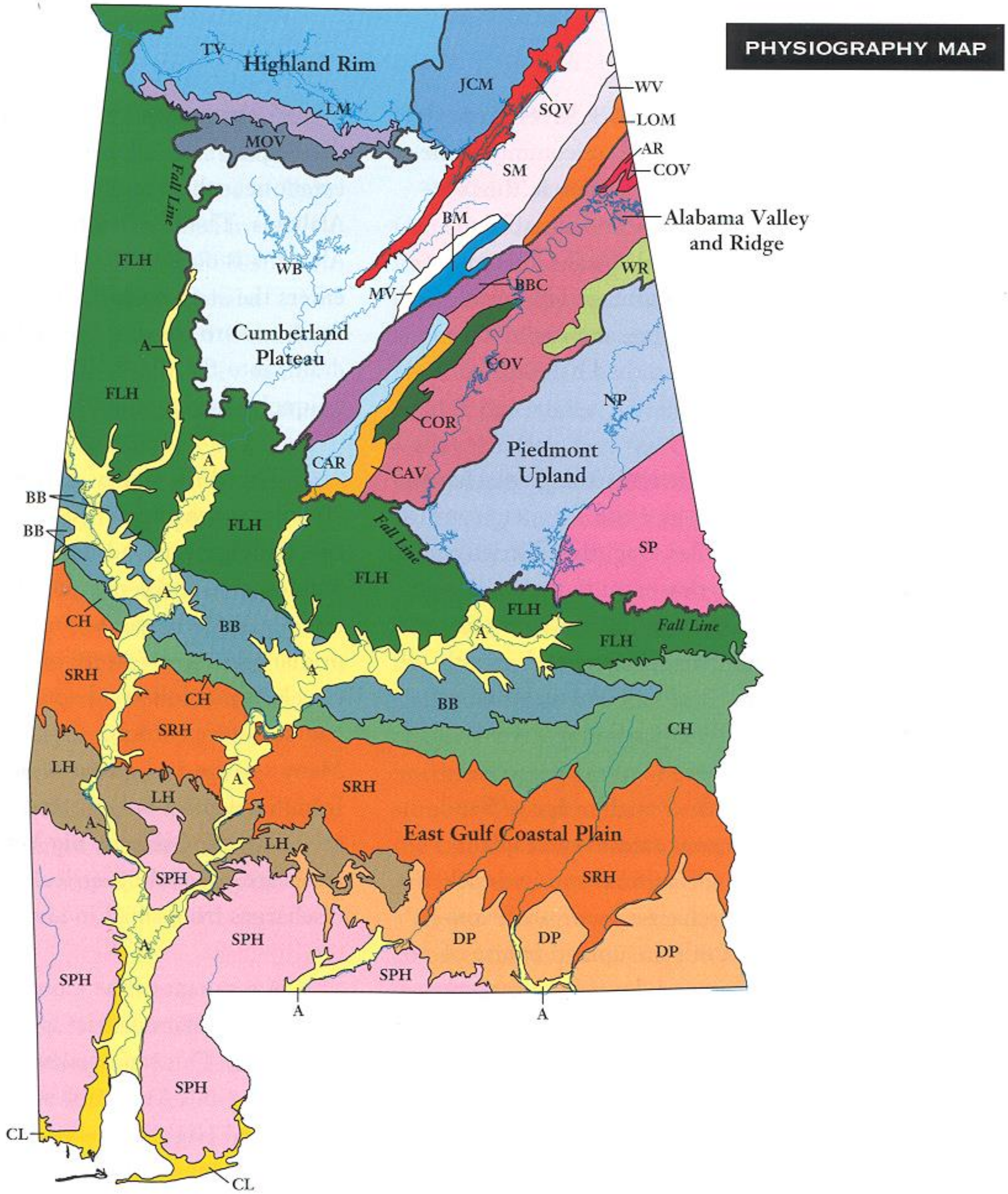


Figure 2. **Physiography Map Illustrating Five Major Sections in Alabama: Highland Rim, Cumberland Plateau, Alabama Ridge and Valley, Piedmont Upland, and East Gulf Coastal Plain**

Little Mountain and Moulton Valley districts are dry channels or stagnant pools during late summer. Some of these streams receive agricultural runoff and permitted wastewater discharges, which contribute to water quality degradation during low streamflows.

Natural vegetation types which characterize the Highland Rim include mixed mesophytic, oak-hickory, swamp forest, and cedar barrens. The mixed mesophytic types include canopy species, such as white and red oaks, elm, sugar maple, beech, cucumber tree, and basswood and are restricted to steep slopes with calcareous soils. Oak-hickory is found on ridges and dry slopes and includes oaks, hickories, pines, sweetgum, and blackgum. Swamp forests may have formerly occurred in the low, flat areas along the Tennessee River which have now been inundated. This type included gums, oaks, water hickory, sycamore, and ironwood. Cedar barrens are stands of red cedar which occur only in areas where there are large outcroppings of Tuscumbia limestone.

The Tennessee River system within the Highland Rim was, and still is, of great importance to wildlife. Although the Tennessee River is impounded for its entire length through the region, it provides valuable habitat for aquatic birds. In addition, a number of freshwater fishes occur only in the tributary streams and rivers of the Tennessee River system.

LIMESTONE COUNTY WATER AND SEWER AUTHORITY, WATERSHED DESCRIPTION

Limestone County Water and Sewer Authority water supply intake is located at Elk River Mile (ERM) 31.36 on the east side of the river. The upstream drainage area to Tims Ford Dam covers 1296 square miles and is illustrated in the watershed delineation map accompanying this report. This map was produced using the state of Alabama's 11 digit hydrologic unit code (HUC) by TVA's GIS facility in Norris, Tennessee.

The hydrology of the Elk River at Limestone County Water and Sewer Authority's water supply intake is controlled by the releases at the upstream Tims Ford Dam (ERM 133.3). Tims Ford Reservoir pool elevations annual operating guidelines are shown in Figure 3.

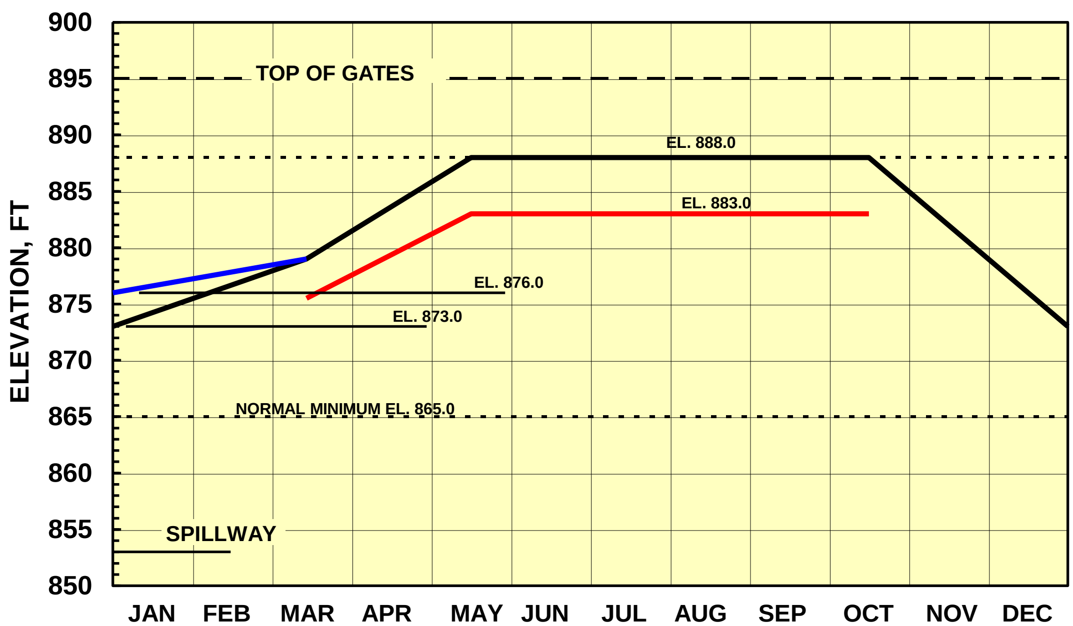


Figure 3. Tims Ford Dam Operating Guidelines Illustrating Annual Reservoir Release Elevations in Feet Above Sea Level

The operating guide for Tims Ford Dam is typical of other Tennessee River headwater dams and can be categorized into four main periods: winter flood season, fill period, recreation season, and drawdown season. During the winter flood season (mid-December to mid- to late March), lake levels are held below the flood guides to provide storage capacity for higher winter flows. Between late March and mid-May, spring rains are used to fill the reservoirs to reach summer recreation levels. During the summer, lake levels are held high until mid-October. Lake levels then are drawn down to winter pool in preparation for the next flood season.

Water Use Classification

The state of Alabama has established water use classifications for its inter- and intrastate waters. Use classifications apply water quality criteria adopted for particular uses based on existing utilization, uses reasonably expected in the future, and those uses not now possible because of correctable pollution, but which could be made if the effects of pollution were controlled or eliminated. Use classifications utilized by the state of Alabama are: public water supply, swimming and other whole body water-contact sports, shellfish harvesting (coastal waters only), fish and wildlife, agricultural and industrial water supply, industrial operations, navigation, and outstanding Alabama water.

The Elk River in the vicinity of the Limestone County Water and Sewer Authority intake (ERM 31.36) from ERM 5.0 to U.S. Hwy. 31 near Elkton, Tennessee, is classified by the state of Alabama as suitable for swimming and fish and wildlife.

Water Quality

The TVA conducts routine water, sediment, benthos, and fish sampling in three areas as part of its Vital Signs Monitoring Program to evaluate the ecological health of Tims Ford Reservoir: the inflow area; the transition zone, where water velocity decreases due to increased cross-sectional area; and the forebay, the area near the dam. In addition, the Tim's Ford Tailwater is sampled for fecal coliform bacteria at seven sites from Old Stone Bridge near Fayetteville, Tennessee, to Garner Ford below Tims Ford Dam.

Summary/Key Ecological Health Finding for 1998: The overall ecological health rating for Tims Ford Reservoir was poor in 1998. The only good ratings were for the fish assemblage at both sample sites. Dissolved Oxygen (DO) and benthos rated poor at both sampling locations. DO levels, as in past years, were less than 2 mg/L throughout most of the lower water column during summer and at or near zero on the bottom from July through October. The poor ratings for the benthos community were probably tied to the low DOs near bottom. Virtually all metrics used to evaluate the benthic community rated poor at both sample locations. Chlorophyll levels were higher at both reservoir sampling sites in 1998 than in any previous year and caused the chlorophyll to rate fair at the forebay and poor at the mid-reservoir site. Sediment quality rated fair at the forebay and the mid-reservoir sites. At the forebay, elevated levels of nickel were again found (these high nickel levels have been observed in previous years); while low levels of chlordane were detected at the mid-reservoir site.

<u>Aquatic Macrophytes in 1998:</u> Not an issue in Tims Ford Reservoir.

<u>Status of Fish Consumption Advisories in 1998</u>: There are no fish consumption advisories on Tims Ford Reservoir.

<u>Status of Swimming Advisories in 1998</u>: There are no state of Tennessee swimming advisories on Tims Ford Reservoir. Fecal coliform bacteria levels in samples collected in 1997 at Estill Springs Park and the Boiling Fork and Tims Ford State Park boat launches were within state of Tennessee guidelines for water contact. Consistently high levels of bacteria were observed both in 1997 and again in 1998 at the Dry Creek recreation area. Five of seven sites failed state water quality standards for recreation in TVA tests on the Elk River below Tims Ford Dam, from Old Stone Bridge near Fayetteville, Tennessee, to Farris Creek below Tims Ford Dam.

<u>Soils/Land Use</u>

The Elk River watershed downstream of Tims Ford Dam has soils classified by the U.S. Department of Agriculture as Huntington-Wolftever-Humphreys-Lindside, Maury-Mimosa, and Cumberland-Etowah-Decatur soil associations.

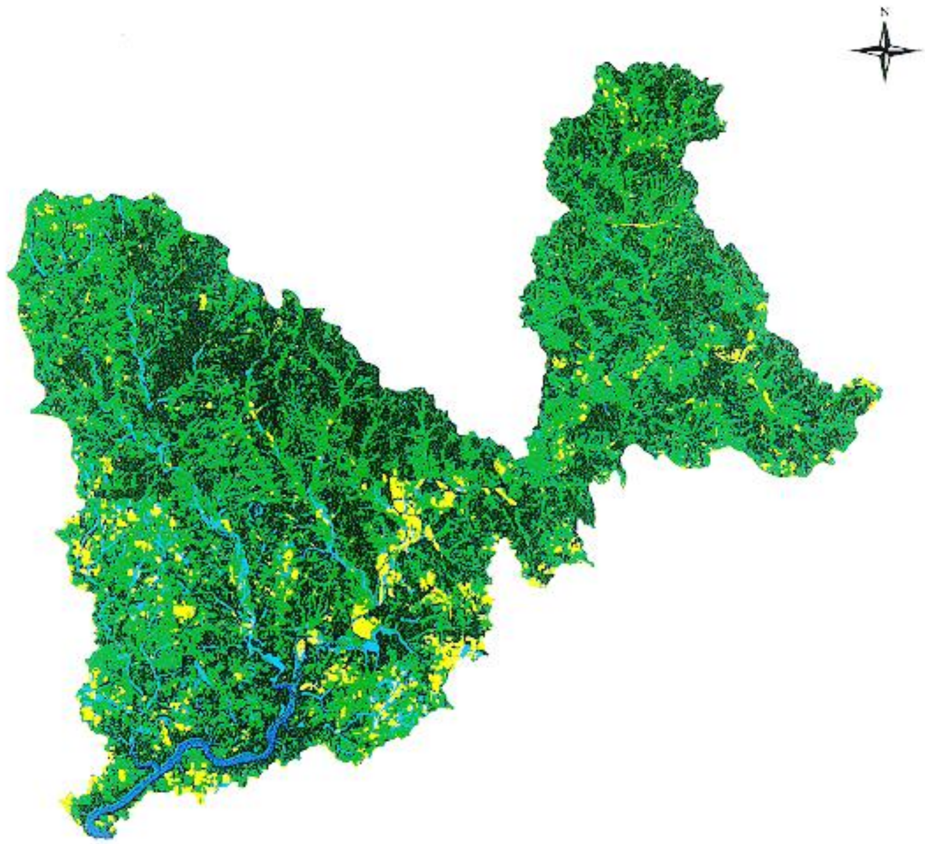
Huntington-Wolftever-Humphreys-Lindside association occupies nearly level to undulation relief in the valleys of the larger streams. The principal areas are along the Elk River and Sugar and Shoal Creeks. A large part of the Wolftever and Huntington soils are along the Elk River; most of the Humphreys is along Sugar Creek; and the Lindside areas are distributed throughout all the valleys in which this association lies. All the soils consist of alluvium deposited by streams carrying material derived from highgrade limestone, cherty limestone, and shale. Internal drainage in most places is good. There is very little acreage of poorly drained soils and only a moderate area of imperfectly drained soils, these being of the Lindside series. Much of the acreage is subject to overflow, and practically all of it is subject to occasional inundation. A large part of this association is cleared and used for corn, hay, pasture, and some cotton. In general, these soils are well suited to intensive use, as they are not subject to erosion and are relatively fertile. Most of the acreage is part of farms consisting almost entirely of soils within this association.

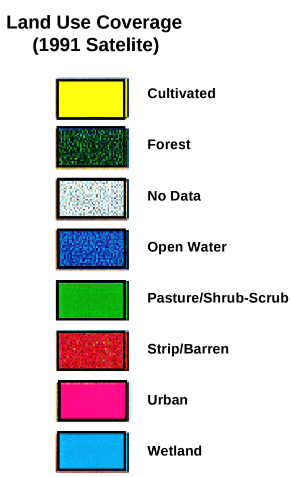
Maury-Mimosa association occupies three rather small irregular areas in the north-central part of the county, bordering the Elk River. They consist of upland soils developed over phosphatic and moderately phosphatic limestone. The areas are undulating to hilly, and the depth to bedrock in most places is shallow. The natural fertility is moderately high, but active erosion has greatly lowered the productivity. Rock outcrops, stony spots, and cherty areas are common. Corn, cotton, and hay are the chief crops and there is some acreage in pasture. Much of the acreage is particularly well suited to pasture and hay crops since the Maury soils have a high content of phosphorus.

Cumberland-Etowah-Decatur soil association occupies moderately broad, undulating to rolling, well-drained areas adjacent to Wheeler Reservoir. The soils are predominately reddish and fertile with firm but moderately permeable subsoils that are deep to bedrock. That part of the acreage on the stronger slopes has been eroded to a notable degree, much of it having lost all of its surface soil. Gentle depressions or sinks occupied by Abernathy soils are widely distributed throughout the areas. Corn, cotton, and hay or pasture are the chief crops grown in this association.

Land use data for the Elk River watershed downstream of Tims Ford Dam are illustrated in Figures 4 and 5 and were obtained from 1991 satellite coverage. In general, the watershed is approximately 47 percent forested, 45 percent pasture, 4 percent cultivated, 3 percent wetlands, and the remainder open water. The upper part of the watershed (Figure 5) to Tims Ford Dam is 48 percent pasture, 46 percent forest, 5 percent cultivated, and the remainder urban, wetland, open water, and strip-mined land.

Lower Elk River





Land Use	Acres	%HU
Cultivated	18980.9	4.5
Forest	199991.4	47.2
Open Water	4320.0	1.0
Pasture-Shrub/Scrub	188654.9	44.6
Urban	60.0	0.0
Wetland	11388.7	2.7

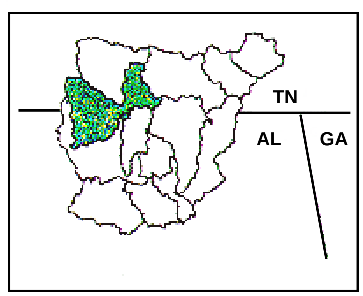
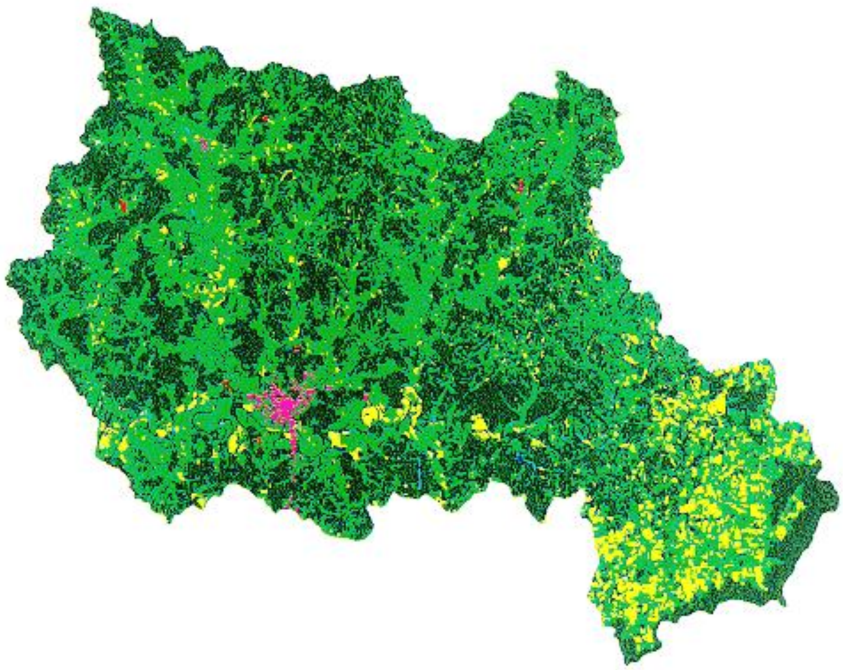
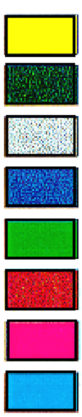


Figure 4. Lower Elk Watershed Depicting Land Use Coverage 1991

Upper Elk River



Land Use Coverage
(1991 Satelite)



Land Use	Acres	%HU
Cultivated	18211.1	5.1
Forest	164588.7	46.0
Open Water	390.9	0.1
Pasture-Shrub/Scrub	172402.3	48.2
Strip/Mined	281.1	0.1
Urban	1608.7	0.4
Wetland	526.6	0.1

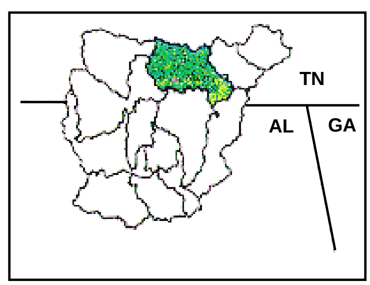


Figure 5. Upper Elk Watershed Depicting Land Use Coverage 1991

The Source Water Protection Area (SWPA)

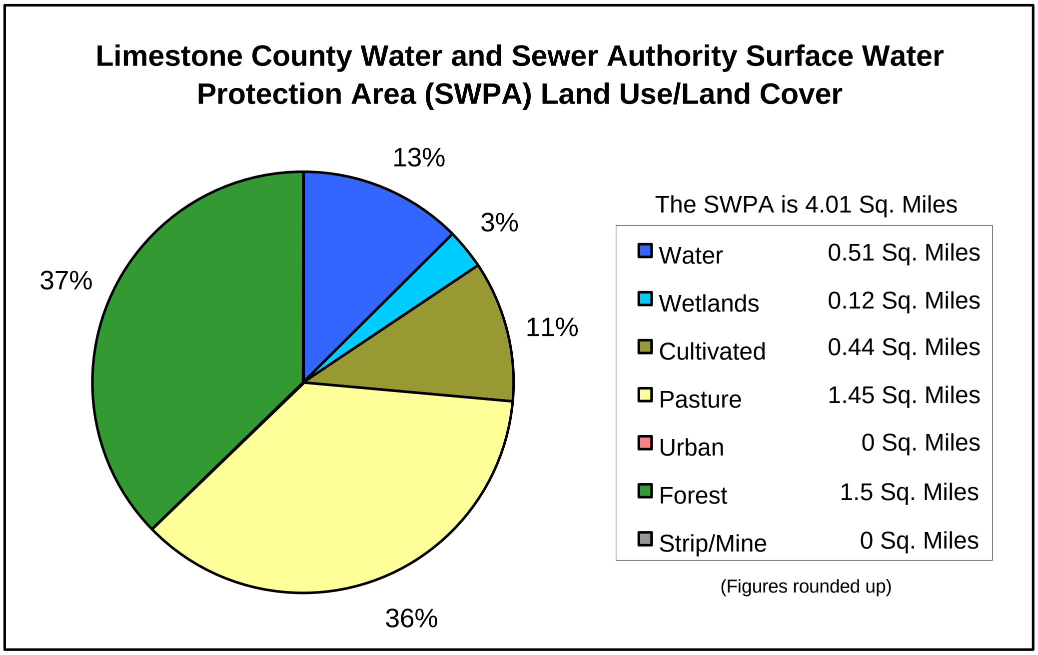
The Alabama Department of Environmental Management, Water Supply Program, defines the SWPA through its regulations as a zone extending ¼ mile downstream of the intake and 15 miles upstream of the intake. The SWPA includes a 500-foot buffer from the water's edge on each side of the river, and where known or suspected contaminants exist within 1500 feet of the water's edge, the buffer is extended to include such areas. Where a significant tributary enters the SWPA within the 15-mile segment upstream of the intake, then the SWPA also extends up the tributary for 1 mile and includes the 500-foot buffer on each side.

In developing the land use/land cover data for the SWPA, the TVA elected to extend this coverage to 1 mile from the water's edge. This was done to further assist the water supply in the development of its source water protection plan. Land use/land cover data for the Limestone County Water and Sewer Authority SWPA and the 1-mile zone from the water's edge including the SWPA are presented in Figure 6. The non-aquatic land cover in the 1-mile zone is predominately pasture and forest, followed by cultivated land, and a small percentage of wetlands.

Within the SWPA, potential sources of contamination have been identified using the databases previously mentioned. These sources include such things as the National Pollutant Discharge Elimination System (NPDES) permitted discharges, hazardous waste facilities, barge terminals, petroleum storage sites, bridges, and pipelines. These potential sources and their associated contaminants (if available) are shown in Appendix A.

Also obtained is the 1996 agricultural chemical usage for counties in the SWPA. This agricultural information is presented in Appendix B.

The SWPA and the locations of the potential sources of contamination are shown on the 7.5-minute topographic map accompanying this document. The map also shows land use for 1 mile out from the shoreline, including the SWPA. The map, locations of the potential sources of contamination, and the information in Appendix A can also be viewed from the compact disc accompanying this document. The disc contains the GIS project file which was used to generate the map and was created using ArcView 3.1 software manufactured by ESRI, Inc. Using this software enables the addition, deletion,



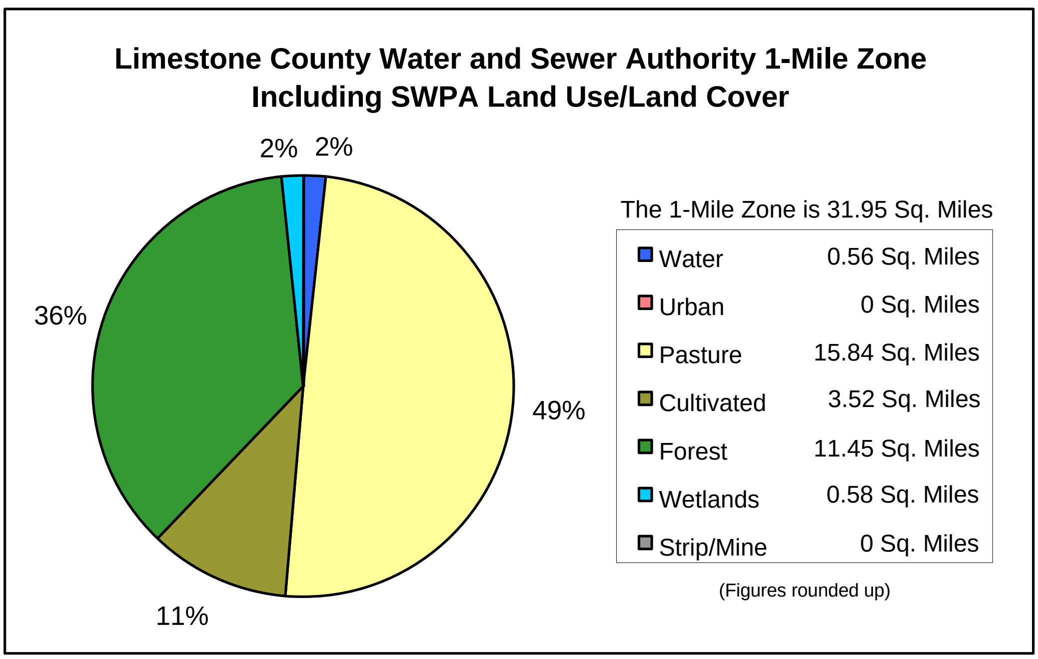


Figure 6. Land Use/Land Cover in Limestone County Water and Sewer Authority SWPA and the 1-Mile Zone Including the SWPA

or other changes to be made to the data sets that generate the map's attributes, and the printing of additional copies. The disc also contains a folder with an ArcExplorer program that will allow viewing of the ArcView project file; however, ArcExplorer is a freeware program with limited ability. In order to update data sets or change the project file, ArcView software is required. Documentation and instructions regarding the use of these programs are presented in Appendix C.

Time of Travel

Calculations made by TVA Reservoir scheduling personnel based on Tims Ford Dam releases and Elk River flow data provided the information to generate the time of travel plots shown in Figure 7. Time of travel determinations were made for two discharge rates from Tims Ford Dam, 100 cubic feet per second (cfs) and 3900 cfs. These releases represent typical low and high flow conditions in the Elk River. This time of travel plot enables personnel at the Limestone County Water Treatment Plant to estimate the time available to react to an upstream event, such as a contaminant spill. The procedure is as follows:

When the location of a spill is known, a water plant operator would determine:

1. If the spill is downstream of the plant intake. If so, it is very likely the spill will not impact the plant.

2. If the spill is upstream of the plant intake, then the travel time calculation should be performed.

    a. Locate the water treatment plant intake location on the travel time chart in Figure 7.

    b. Find out the last eight hours of dam releases from Tims Ford Dam from either the automated lake information line or the lake information web page (see Appendix D) to determine which typical flow line to read on the time of travel chart and also find out the anticipated average daily release for the dam to determine if a change in flow is scheduled.

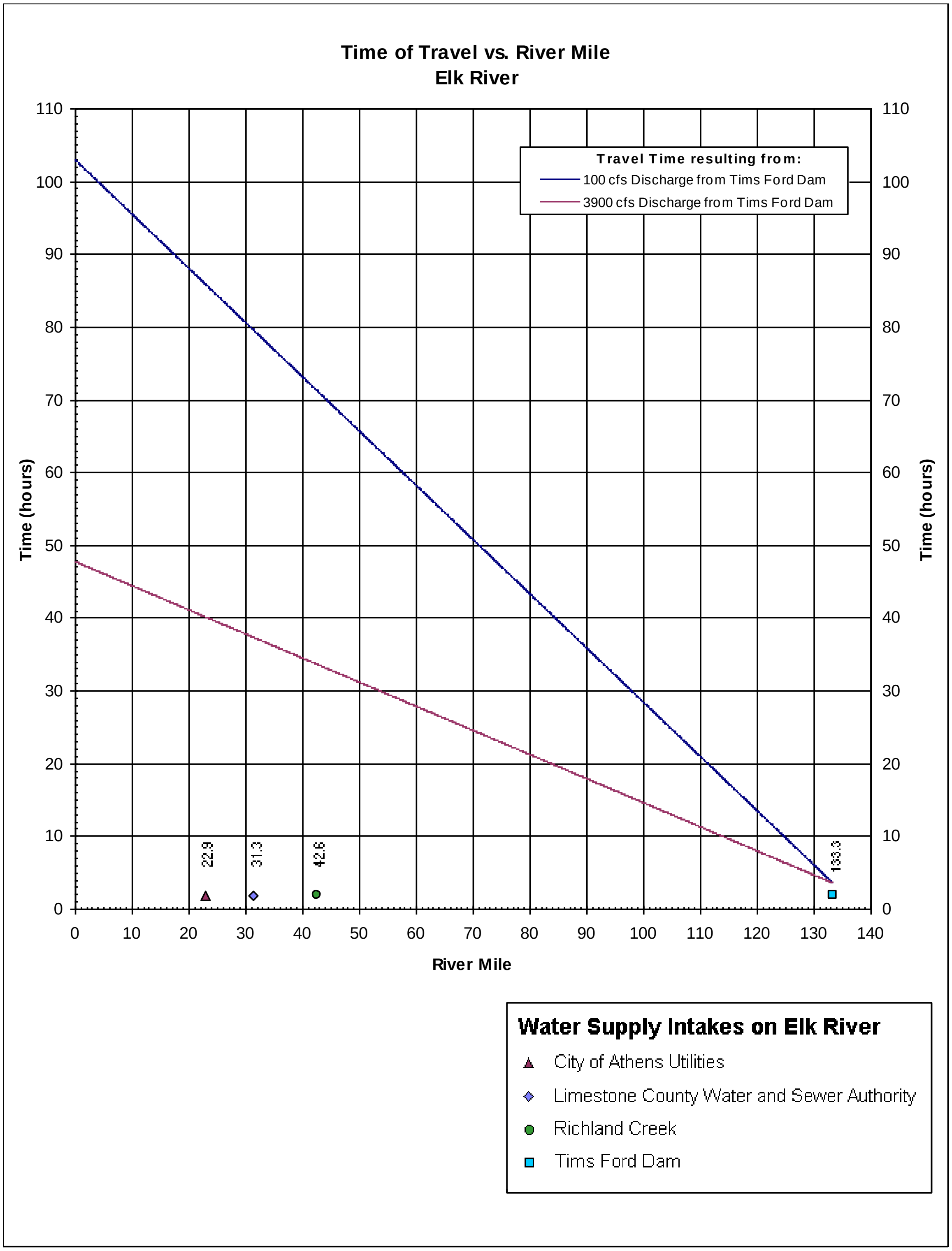


Figure 7. Travel Time Chart for the Elk River

c. Use the appropriate line closest to the dam releases and read the water travel time from the chart for the treatment plant intake, and subtract from it the water travel time from the chart for the location of the spill. The bottom axis of the chart reads left to right in the upstream direction.

The following example illustrates the procedure using Figure 7.

Example: An oil spill occurs at ERM 83 at 7:30 a.m. on 03/01/99. The Limestone County intake is located at ERM 31.3. Dam release information for Tims Ford Dam, from TVA's automated lake information line, when compared to the chart in Figure 7 indicates a typical high flow condition. Thus, from the high flow line (red line) on the chart in Figure 7, the time of travel from the spill location to the Limestone County water intake is 37 hours minus 20 hours which equals 17 hours. Considering that the time of the spill was at 7:30 a.m. on 03/01/99, the spill would arrive at the intake at approximately 12:30 a.m., or 17 hours later, on 03/02/99.

SOURCES OF INFORMATION

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Fenneman, N. M. 1938. Physiography of the Eastern United States. McGraw-Hill, New York. 714 pp.

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USDA, Alabama Agricultural Statistics Service, 1997 Census of Agriculture Limestone County Profile.

USDA, SCS, Soil Survey of Limestone County, Series 1941, No. 5.

INTERNET SOURCES OF INFORMATION

http://govinfo.library.orst.edu/cgi-bin/ag-llist?o1-103.alc

http://usda.mannlib.cornell.edu/data-ets/inputs/9x171/97171/agch0997.tex

http://www.epa.gov/enviro/index_java.html

http://www.rtk.net/rtk.data.html

Appendix A

Potential Sources of Contamination

Water Quality and Water Supply Intake Information

List of Acronyms

BRS	Biennial Reporting System
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Act Information System
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PCS	Permit Compliance System
RCRA	Resource Conservation and Recovery Act
SIC	Standard Industrial Code
TRI	Toxic Release Inventory
TRM	Tennessee River Mile
UST	Underground Storage Tank

Sources of Information

All information obtained for Limestone County Water and Sewer Authority in the source water assessment project has been provided by the Alabama Department of Environmental Management; the Tennessee Valley Authority; Envirofacts, an Internet-accessed Environmental Protection Agency database, which provides the public with direct access to environmental information; and the Emergency Planning and Community Right-to-Know Act database, which is administered by the Office of Management and Budget and the Unison Institute. The Internet addresses for these databases are listed on page 21 of this report.

INDEX TO APPENDIX A

Appendix B

Agriculture - Limestone County

AGRICULTURE LIMESTONE COUNTY

- Land in Farms (acres) 253,889
- Total Cropland (acres) 181,292
- Harvested Cropland (acres) 90,163
- Irrigated Land (acres) 4562

Crops	Livestock	Poultry
Cotton	Beef Cows	Hens and Pullets
Corn	Milk Cows	Egg Layers
Soybeans	Hogs and Pigs	Broilers
Wheat	Catfish	
Hay/Alfalfa	Sheep and Lamb	

AGRICULTURAL CHEMICAL USAGE IN COUNTIES IN THE SWPA

The agricultural chemical use estimates are based on data compiled from the Agricultural Resources Management Survey conducted during the fall of 1996 by the National Agricultural Statistics, Economic Research Service, Washington, DC. All results refer to on-farm use of herbicides and pesticides on the targeted crops for the 1996 crop year. Targeted crops include corn, upland cotton, soybeans, winter and other spring wheat. Data were collected late in the growing season or after the farm operator has indicated that planned applications were completed.

AGRICULTURAL CHEMICAL USAGE BY CROP

Soybeans

An average of 97 percent of the soybean acreage planted was treated with herbicides. The most widely-used herbicide was Imazethapyr (43 percent), followed by Pendimethalin and Glyphosate applied to 27 percent and 25 percent, respectively.

Growers applied insecticides to an average of 1 percent of the soybean acreage planted in the U.S. in 1996 (Table 1).

Winter Wheat

Winter wheat producers most widely used 2,4-D, both quantity and total area applied (Table 2). Two of the other most widely used herbicides were MCPA and Dicamba, in that order.

Corn

Atrazine was the most common herbicide for corn growers and applied at a rate of 0.99 lbs/ac. Dicamba and Metolachlor were the next two most widely used herbicides and were applied to 25 and 30 percent of the reported acreage, respectively.

Chlorpyrifos was the most widely used insecticide with 8 percent of the reported acreage. Chlorpyrifos was applied at the rate of 1.04 pounds per acre. Terbufos ranked second with 6 percent of the acreage (Table 3).

Upland Cotton

Herbicides were applied to 92 percent of the upland cotton acreage planted in the 1996 survey (Table 4). Trifluralin continued to be the most used herbicide and was applied to 57 percent of the acreage. Insecticide applications covered 79 percent of the planted acreage in 1996. Aldicarb was the most widely used insecticide and was applied to 21 percent of the planted acreage in 1996. Malathion was applied to 17 percent of the crop and had the highest total pounds applied. More than two applications were required in 1996, and the rate of application was 0.89 pounds per acre. The second-heaviest applied insecticide was Methyl Parathion, which covered 19 percent of the planted acreage. More than three applications of this were required, and the average treatment applied 0.36 pounds per acre. Area treated with other commercial chemicals totaled 60 percent of the 1996 upland cotton acreage.

Active Ingredients		
Herbicides:	**Insecticides:**	**Fungicides:**
2,4-D	Bt (bacillus thur.)	Benomyl
2,4-DB	Carbofuran	Metalaxyl
Acifluorfen	Chlorpyrifos	Thiophanate-methyl
Alachlor	Esfenvalerate	
Atrazine	Lambdacyhalothrin	
Bensulide	Methomyl	
Bentazon	Methyl Parathion	
Chloramben	Nosema Locustae	
Chlorimuron-ethyl	Permethrin	
Clethodim	Sulfur	
Clomazone	Thiodicarb	
Dicamba	Tralomethrin	
Dimethenemid		
Diuron		
Ethalfluralin	**Other Chemicals:**	
Fenozaprop	Sodium Chlorate	
Fluazifor-P-butyl		
Flumetsulam		
Flumiclorac Pentyl		
Fomesafen		
Glyphosate		
Imazaquin		
Imazethapyr		
Lactofen		
Linuron		
Metolachlor		
Metribuzin		
Nicosulfuron		
Norflurazon		
Oxyflurofen		
Paraquat		
Pendimethalin		
Qi\uizalofop-ethyl		
Sethozydim		
Sulfosate		
Thifensulfuron		
Tribenuron-methyl		
Trifluralin		

Table 1. List of Herbicides, Insecticides, and Fungicides Used to Treat Soybean Crops, 1996

Active Ingredients		
Herbicides:	**Insecticides:**	**Fungicides:**
2,4-D	Bt (Bacillus thur.)	Benomyl
Atrazine	Chlorpyrifos	Mancozeb
Bromoxynil	Dimethoate	Propiconazole
Chlorsulfuron	Disulfoton	Thiophanate-methyl
Clopyralid	Lambdacyhalothrin	Triadimefon
Cyanazine	Malathion	
Dicamba	Methyl Parathion	
Difenzoquat	Phorate	
Diuron		
Fomesafen	**Other Chemicals:**	
Glyphosate	Ethephon	
Imazamethabenz		
MCPA		
Metribuzin		
Metsulfuron-methyl		
Paraquat		
Picloram		
Propanil		
Terbutryn		
Thifensulfuron		
Triallate		
Triasulfuron		
Tribenuron-methyl		
Trifuluralin		

Table 2. List of Herbicides, Insecticides, and Fungicides Used to Treat Winter Wheat Crops, 1996

Active Ingredients	
Herbicides:	**Insecticides:**
2,4-D	Aldicarb
Acetochlor	Bifenthrin
Alachlor	Bt (Bacillus thur.)
Ametryn	Carbaryl
Atrazine	Carbofuran
Bentazon	Chlorethoxyfos
Bromoxynil	Chlorpyrifos
Butylate	Cyfluthrin
Chlorimuron-ethyl	Diazinon
Clopyralid	Dimethoate
Cyanazine	Esfenvalerate
Dicamba	Ethorprop
Dimethenamid	Fonofos
Diuron	Lambdacyhalothrin
EPTC	Methyl parathion
Flumetsulam	Permethrin
Flumiclorac Pentyl	Phorate
Glyphosate	Phostebupirim
Halosulfuron	Propargite
Imazethapyr	Tefluthrin
Lactofen	Terbufos
Linuron	Trimethacarb
MCPA	
Metolachlor	
Metribuzin	
Nicosulfuron	
Paraquat	
Pendimethalin	
Picloram	
Primisulfuron	
Propachlor	
Prosulfuron	
Pyridate	
Rimsulfuron	
Sethoxydim	
Simazine	
Sulfosate	
Thifensulfuron	
Triasulfuron	
Triclopyr	
Trifluralin	

Table 3. List of Herbicides and Insecticides Used to Treat Corn Crops, 1996

Active Ingredients	
Herbicides:	**Insecticides:**
2,4-D	Aldicarb
Acetochlor	Bifenthrin
Acifluorfen	Bt (Bacillus thur.)
Ametryn	Carbaryl
Atrazine	Carbofuran
Bentazon	Chlorethoxyfos
Bromoxynil	Chlorpyrifos
Butylate	Cyfluthrin
Chlorimuron-ethyl	Diazinon
Clopyralid	Dimethoate
Cyanazine	Esfenvalerate
Dicamba	Ethorprop
Dimethenamid	Fonofos
Diuron	Lambdacyhalothrin
EPTC	Malathion
Flumetsulam	Methomyl
Flumiclorac Pentyl	Methyl Parathion
Glyphosate	Permethrin
Halosulfuron	Phorate
Imazethapyr	Phostebupirim
Lactofen	Propargite
Linuron	Tefluthrin
MCPA	Terbufos
Metolachlor	Trimethacarb
Metribuzin	
Nicosulfuron	
Paraquat	
Pendimethalin	
Picloram	
Primisulfuron	
Propachlor	
Prosulfuron	
Pyridate	
Rimsulfuron	
Sethoxydim	
Simazine	
Sulfosate	
Thifensulfuron	
Triasulfuron	
Triclopyr	
Trifluralin	

Table 4. List of Herbicides and Insecticides Used to Treat Upland Cotton Crops, 1996

Appendix C

Documentation and Instructions

ArcView and ArcExplorer Compact Disc

ArcView Information

This project uses ArcView version 3.1.
To start ArcView project select \file\limestone.apr

Set up for Workspace Directory for Project Files:

\intake
\limestone

\avl	Arcview legend files
\html	Web pages
\images	Image files
\misc	Miscellaneous shape files
\print	Print files of layouts
\scripts	User script files
\tables	Table files
\theme	Theme layers
\1milezone	Shape files defining 1 mile zone
\landuse	Shape files for landuse
\quad	Shape file for topo index
\sites	Shape file of potential pollution source sites on map
\swpa	Shape file for source water protection area (SWPA)
\topoquads	Image files for USGS topo quad maps

Files found under workspace: \intake\limestone\avl

1milezone.avl	Legend setup file for 1 mile zone boundary
landuse.avl	Legend setup for 1 mile zone and SWPA landuse/landcover
quads.avl	Legend setup file for topo quad index
sites.avl	Legend setup file for potential pollution source sites
swpa.avl	Legend setup file for SWPA boundary

Files found under workspace: \intake\limestone\html

*.htm	Files used with hotlink to web page of each site

Files found under workspace: \intake\limestone\images

tvalogo.bmp	Used to logo on map

Coverages found under workspace: \intake\limestone\misc

alcounties	Alabama counties used on location map
tn_river	Tennessee River used on location map
watershed	Intake watershed

Files found under workspace: \intake\limestone\print

limestone.rtl	Layout print file (use this file to reprint map)
limestone_watershed.rtl	Layout print file for watershed map

Files found under workspace: \intake\limestone\scripts

hotlink.ave	Avenue script used to hotlink web pages to sites

Files found under workspace: \intake\limestone\tables

legend.txt	Table used to make site information in map

Coverages found under workspace: \intake\limestone\theme\1milezone

1milezone	1 mile zone boundary from water's edge used for SWPA, includes the SWPA

Coverages found under workspace: \intake\limestone\theme\landuse

landuse	Landuse/landcover inside 1 mile zone boundary, includes SWPA
landuse_swpa	Landuse/landcover for SWPA only

Coverages found under workspace: \intake\limestone\theme\quads

quads	Index of topoquads used in project

Coverages found under workspace: \intake\limestone\theme\sites

sites	All sites plotted on map

Coverages found under workspace: \intake\limestone\theme\swpa

swpa	SWPA boundary

Coverages found under workspace: \intake\limestone\topoquads

***.tif	Raster image files of topoquads used for project

Data Field Information Sheet for ArcView Site Shapefiles

Field	DBF Field	Field	Field Description
1	Shape	Shape	Required field used by ArcView
2	Site	Site	Used to identify sites as seen on map
3	Descriptio	Description	Description/Name of Site
4	Location_o	Locataion on Stream	Site's Location on River/Stream Based on Stream Mile Markers
5	Latitude	Latitude	Latitude of Site
6	Longitude	Longitude	Longitude of Site
* 7	Address	Address	Address of Site
* 8	City	City	City Where Site is Located
* 9	State	State	State Where Site is Located
* 10	Zip	Zip	Zip Code of Site
11	County	County	County Where Site is Located
12	Telephone	Telephone	Telephone of Contact for Site
13	Contact	Contact	Name of Contact for Site Information
14	Title	Title	Title of Point of Contact for Site
15	Epa_id	Epa id	EPA ID for Site
16	Npdes	Npdes	NPDES Permitted Discharge Number
17	Water_Supp	Water supply id	Water Supply ID
18	Tri_id	Tri id	Toxic Release Inventory ID Number
19	Cerclis	Cerclis	"Superfund" ID Number
20	Npl_status	Npl status	"Superfund" Status: NON-NPL, NPL, etc.
21	Sic	SIC	Standard Industry Code
22	Type_of_fa	Type of facility	Description of SIC
23	Number_of_	Number of outfalls	Number of Outfall Pipes for Site
24	Water_qual	Water quality 1	Summary of Water Quality Information Part 1
25	Water_qual	Water quality 2	Summary of Water Quality Information Part 2
26	Water_qual	Water quality 3	Summary of Water Quality Information Part 3
27	Water_qual	Water quality 4	Summary of Water Quality Information Part 4
28	Water_qual	Water quality 5	Summary of Water Quality Information Part 5
29	Water_qual	Water quality 6	Summary of Water Quality Information Part 6
30	Potential_	Potential contaminants 1	Inventory of all Potential Pollution Contaminants (Chemical, Oil, etc.) Part 1
31	Potential_	Potential contaminants 2	Inventory of all Potential Pollution Contaminants (Chemical, Oil, etc.) Part 2
32	Potential_	Potential contaminants 3	Inventory of all Potential Pollution Contaminants (Chemical, Oil, etc.) Part 3
33	Permitted_	Permitted contaminants 1	Inventory of all Permitted Contaminants (Chemical, Oil, etc.) Part 1
34	Permitted_	Permitted contaminants 2	Inventory of all Permitted Contaminants (Chemical, Oil, etc.) Part 2
35	Permitted_	Permitted contaminants 3	Inventory of all Permitted Contaminants (Chemical, Oil, etc.) Part 3
36	Type_of_op	Type of operation	Type of Agricultural/Livestock Operation: Confined Feed Lot, etc.
37	Commoditie	Commodities handled	Type of Commodities Handled
38	Handling_c	Handling capability	Type of Handling Capability
39	Storage_fa	Storage facilities	Type of Storage Facilities
40	Nearest_hi	Nearest highway	Nearest Highway to Barge Facility
41	Tank_type	Tank type	Underground Storage Tank Type (ADEM Database)
42	Number_of_	Number of tanks (ast)	Number Of Above Ground Storage Tanks at Site (ADEM Database)
43	Number_of_	Number of regulated tanks (ust)	Number Of Regulated Underground Storage Tanks at Site (ADEM Database)
44	Facility_s	Facility sequence number	Number Assigned Facility in ADEM PCS Database
45	Hazardous_	Hazardous waste handler id	Hazardous Waste Handler ID Number
46	Hazardous_	Hazardous waste handler type	Hazardous Waste Handler Type: Small or Large Quantity Generator
47	Short_desc	Short description	Short Description of Site Type
48	Data_sourc	Data source	Data Supplier
49	Stateplana	Stateplanary	Y Site Coordinates in TN Stateplane: Required for use with Topo Images
50	Stateplana	Stateplanarx	X Site Coordinates in TN Stateplane: Required for use with Topo Images
51	Hotlink	Hotlink	Field Used to Hotlink Site ID to Web Page in ArcView

* For Water Quality Sites, these fields contain information pertaining to the "Contact," not the "Site."

Appendix D

Lake and Dam Release Information

LAKE AND DAM RELEASE INFORMATION AVAILABLE FROM TVA

TVA's Lake Information Line

TVA's Lake Information Line (LIL) provides current and forecasted information on lake levels, current dam releases, and some information on unregulated streams. The user will need a touch-tone phone. An electronic voice provides the information requested. The phone numbers for the LIL are as follows:

Knoxville	(865) 632-2264
Chattanooga	(423) 751-2264
Muscle Shoals	(256) 386-2264
Other Locations	1 (800) 238-2264
TDD Number	1 (800) 438-2264

If these numbers are not operational or more current release information is needed, personnel at TVA's Forecast Center can be contacted at (865) 632-7064, 24 hours a day. To retrieve information for a specific dam, select the type of information required from the main voice-menu, and then enter the two-digit code for the dam of interest. The dam codes are listed below and are also available from within the LIL system.

Dam	Code
Nickajack	28
Guntersville	29
Wheeler	30
Wilson	31
Pickwick	32

When the LIL is accessed, four options will be given. Select Option 4, "Water Release Schedules." This option will give hourly dam releases (in cubic feet per second) for the last eight hours.

TVA's Lake Information Line Web Page

The same lake information is available on the Internet at the following addresses:_

Within TVA: http://insidenet.tva.gov/org/resource/h20mgmt/rso/frame.htm

External TVA: http://lakeinfo.tva.gov