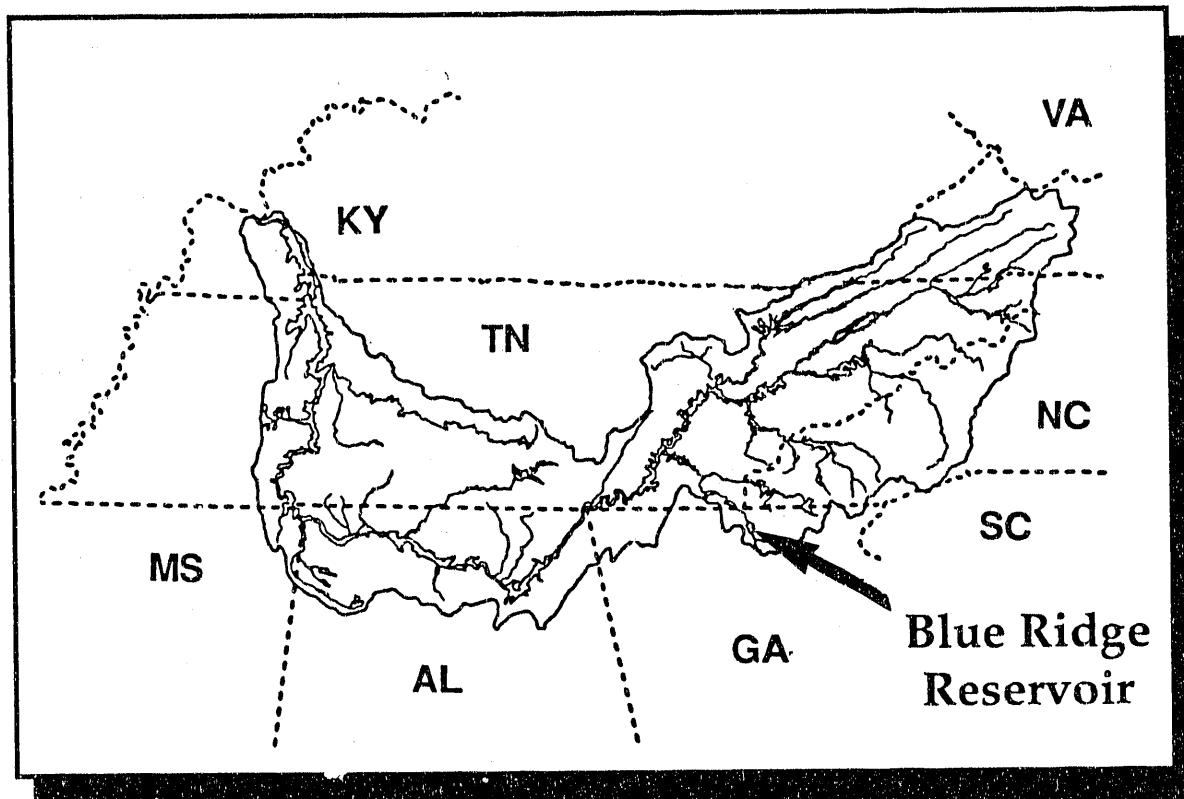


# Status of Blue Ridge Reservoir

## An Overview of Reservoir Conditions



Tennessee Valley Authority  
Resource Development  
River Basin Operations  
Water Resources Division

September 1990

Received by 881

MASTER

DEC 31 1990

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED  
db

Tennessee Valley Authority. Water Resources  
Division.

Introduction	Chattanooga, TN
Purpose and	
Description	
Reservoir Characteristics and Uses .....	7
Water Quality and Biological Conditions .....	11
Conditions Affecting Reservoir Uses .....	15
Selected Reservoir Management Agencies .....	17
Selected References .....	19

## INTRODUCTION

This is one in a series of reports prepared by the Tennessee Valley Authority (TVA) for those interested in the conditions of TVA reservoirs. This overview of Blue Ridge Reservoir summarizes reservoir and watershed characteristics, reservoir uses and use impairments, water quality and aquatic biological conditions, and activities of reservoir management agencies. This information was extracted from the most current reports and data available, as well as interviews with water resource professionals in various federal, state, and local agencies.

Blue Ridge Reservoir is a single-purpose hydropower generating project. When consistent with this primary objective, the reservoir is also operated to benefit secondary objectives including water quality, recreation, fish and aquatic habitat, development of shoreline, aesthetic quality, and other public and private uses that support overall regional economic growth and development.

The water quality of Blue Ridge Reservoir is generally very good. There are no known significant point (pipe discharges) or nonpoint sources of pollution. The reservoir waters are extremely soft, sometimes slightly acidic, and low in plant nutrients. The reservoir fish population is considered "predator heavy" because of a restricted forage base. Smallmouth bass, walleye, and bluegill are the species most sought after by anglers, but fishing pressure is low compared to other north Georgia reservoirs.

One of the most significant constraints on use of Blue Ridge Reservoir is the pattern of water level fluctuation resulting from operation for power production. Pool drawdown during the late summer limits access to some boat docks and exposes unvegetated shoreline that detracts from the scenic beauty of the area. Federal ownership of much of the shoreline of the reservoir also limits private development of lakefront property. Presently, the recreational facilities around Blue Ridge are operating at much less than their projected capacity.

Several agencies play a role in protecting and improving the beneficial uses of the reservoir and in managing day-to-day operations. The agencies most actively involved in managing the resources of Blue Ridge Reservoir are TVA, the U.S. Forest Service, and the Georgia Department of Natural Resources.

## PURPOSE AND OPERATION OF BLUE RIDGE DAM AND RESERVOIR

Blue Ridge Dam, built in 1930 by Tennessee Electric Power Company, impounds the Toccoa River from mile 53 to mile 64. TVA purchased the facility in 1939 for the sole purpose of hydropower production. Blue Ridge Dam has one hydropower unit with a generating capacity of 20,000 kilowatts--about 0.6 percent of the total hydropower capacity of the TVA system.

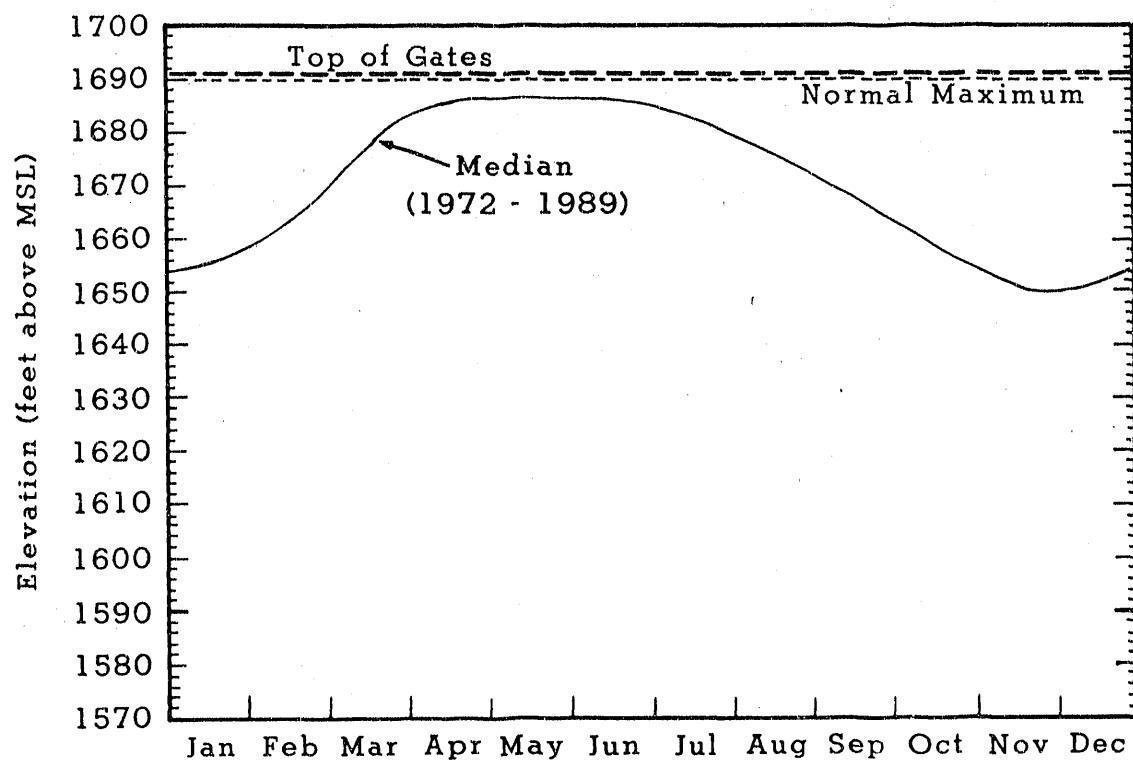
Blue Ridge Dam is operated to help meet power system demands as economically as possible. Because hydropower generation is the most economical, versatile, and dependable power source in the TVA system, it is used to provide peaking power quickly for those times when daily power demand is highest. Hydropower generation is also scheduled for high demand times of the week (generally during the 5-day workweek) and high demand times of the year (June through August, and December through February).

As a result of hydropower operations, the reservoir pool elevation varies seasonally (see figure on following page). The large amount of water used to generate power during the high power demand summer months causes the pool elevation to drop about 14 feet between April and August and another 23 feet by November. TVA is evaluating the feasibility of extending summer pool elevation through August 1 in Blue Ridge Reservoir (and several other reservoirs) to benefit recreational use.

Blue Ridge Reservoir is not operated to maintain flood storage capacity. However, substantial flood reductions have been achieved in some flood situations because the reservoir elevation happened to be low enough at the time of the flood to permit TVA to store some of the floodwaters.

TVA has informally committed to release water from Blue Ridge Reservoir when needed to provide a minimum flow of  $99 \text{ ft}^3/\text{sec}$  at Copperhill, Tennessee, to meet the water supply needs of Tennessee Chemical Company.

Blue Ridge Reservoir Annual Operating Curve



## DESCRIPTION OF WATERSHED AND RESERVOIR AREA

### Watershed Characteristics

Blue Ridge Reservoir lies entirely within Fannin County in northwest Georgia. Fannin County is rural except for four small incorporated municipalities: Blue Ridge, McCaysville, Mineral Bluff, and Morganton. The population of Fannin County is approximately 16,100 (1987 estimate) and growing about 1.3 percent each year. The populations of the cities of Blue Ridge and McCaysville, however, have been declining since 1950. As noted in the 1990 Fannin County Recreation Master Plan, completion of the Appalachian Development Highway is expected to help stabilize population growth by spurring development opportunities and providing a better transportation network for residents who work outside Fannin County.

The per capita income in Fannin County has been estimated at \$9,906 and is increasing at an annual rate of about 2.4 percent, primarily as a result of recreation, tourism and second home development.

Blue Ridge Reservoir and its 232 square mile watershed lie within the Blue Ridge Physiographic Province, an area of mountainous topography with pine and hardwood forested slopes. The soils throughout most of the watershed are rated "poor" to "unsuited" for agricultural use because of their steep slopes and severe erosion potential. The floodplain areas of the upper Toccoa River and Noontootla Creek (upstream from Blue Ridge Reservoir), contain limited areas of soils suited to cultivation. The principal crop on those lands is corn. The principal livestock operations in the county are pastured beef cattle.

About three-quarters of the population of Fannin County depend on septic tanks for wastewater disposal. The steep slopes that characterize the area make failure of septic systems a relatively common problem. Homes located near streams or along reservoir shorelines are of particular concern, as failure of their septic systems can degrade water quality.

About half of Fannin County and a significant proportion of the 232 square miles of Blue Ridge Reservoir watershed lie within Chattahoochee National Forest. About three quarters of the land in the county is commercial forest; logging on private and U.S. Forest Service lands produces about 4.9 million board feet of lumber (primarily hardwood) per year.

#### Shoreline Characteristics

Blue Ridge Reservoir has 65 miles of shoreline at full pool; 47 miles are within Chattahoochee National Forest, 3 miles are owned by TVA, and 16 miles are privately owned. Some private homes and cabins already exist on the Forest Service lands, but the Forest Service no longer grants special use permits, so no additional private dwellings can be built on these lands. About half of the privately owned shoreline has been developed. TVA anticipates a moderate rate of development on the remaining private shoreline through the 1990s.

## RESERVOIR CHARACTERISTICS AND USES

### Physical Characteristics

Blue Ridge Reservoir is small relative to most other TVA reservoirs. When full, it covers about 3200 acres and holds about 8.4 million cubic feet of water. The reservoir has a mean depth of about 60 feet and is over 130 feet deep at the dam. Other physical features of the reservoir are summarized below:

Feature	Measurement
Location, Toccoa River miles	53 to 64
Normal maximum surface elevation, feet above mean sea level	1690
Surface area, acres	3,290
Volume, acre-feet	193,000
Mean depth, feet	59
Length, miles	11
Shoreline length, miles	65
Average surface elevation, feet above mean sea level	1,670
Surface area, acres	2,640
Volume, acre-feet	132,600
Useful controlled storage volume, acre-feet (elevation 1691-1590)	183,900
Average hydraulic retention time, days	109

### Hydrologic Characteristics

The rate of discharge of water from Blue Ridge Reservoir averages about 605 cubic feet per second (cfs), although there are some days (about 46 days per year, on average) when no water at all is discharged.

### Uses of Blue Ridge Reservoir

The principal uses of Blue Ridge Reservoir are for hydropower production and recreation. An estimated 22,000 people visit the reservoir each year between April and October. Ready access to Atlanta, Georgia, via the Appalachian Development Highway, is expected to increase annual visitation of Blue Ridge to about 25,000. Activities associated

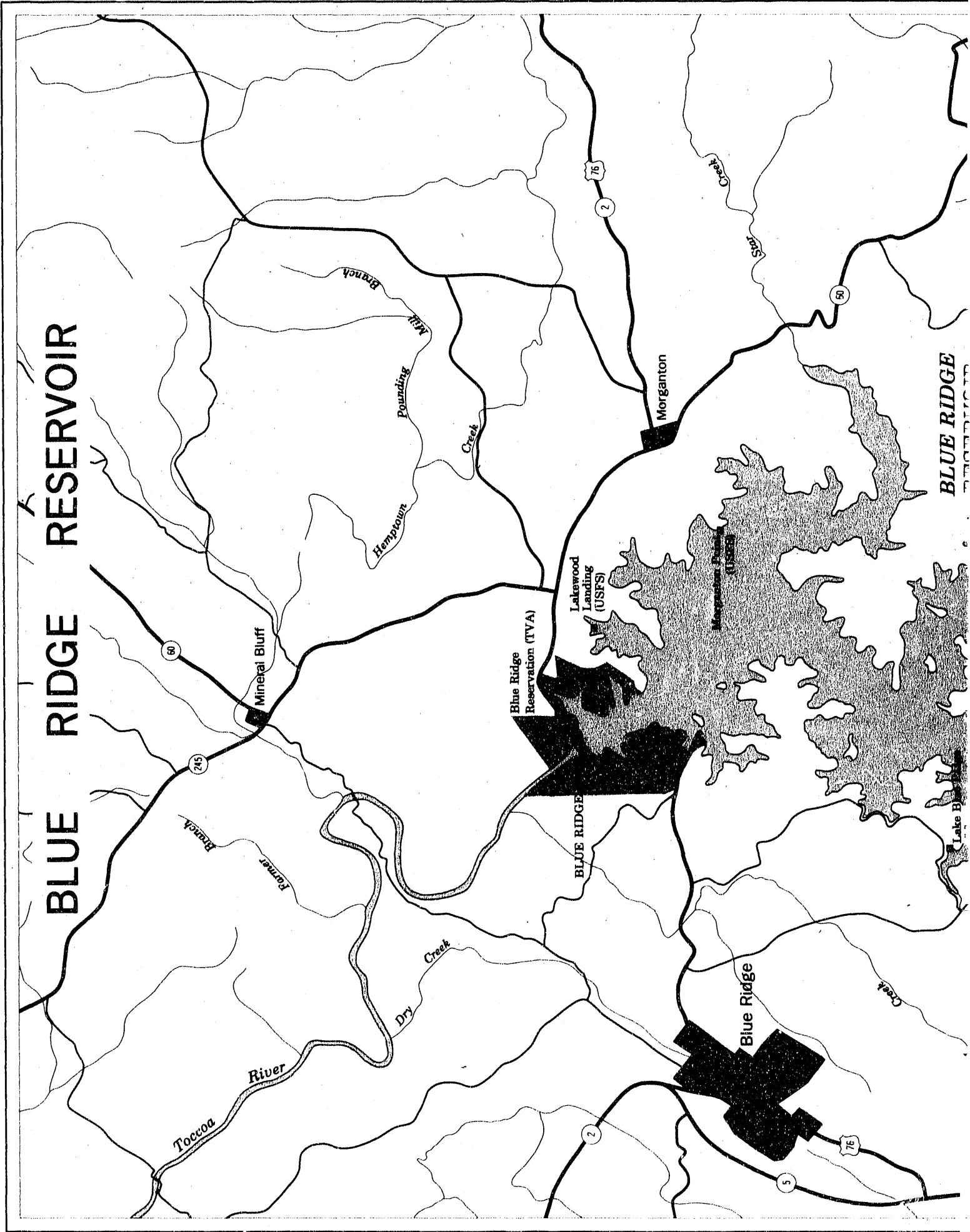
with the 1996 Olympics, to be hosted by Atlanta, are also expected to increase visitation to the area.

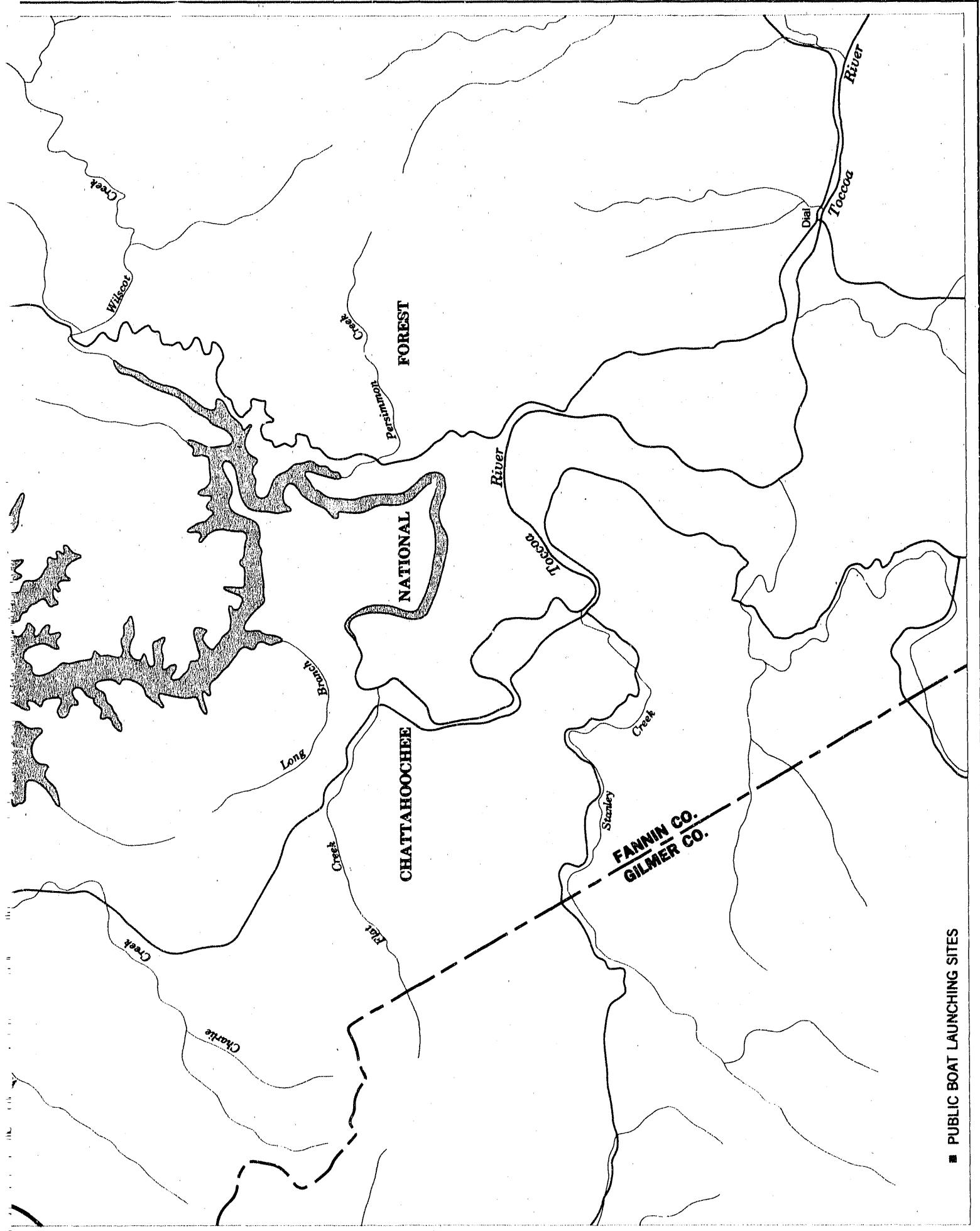
The only public beach on Blue Ridge Reservoir is operated by the U.S. Forest Service at Morganton Point (see centerfold map). There are three public launch ramps, also maintained by the U.S. Forest Service: Lake Blue Ridge, Morganton Point, and Lakewood Landing. There is one commercial marina (Blue Ridge Marina) located near the dam. Further development of the shoreline for other purposes (such as second homes or vacation homes) is limited by federal ownership of most of the shoreline. This circumstance is beneficial, however, to the water quality of the reservoir.

There are no water supply intakes or wastewater discharges in the reservoir. The city of Blue Ridge, Georgia, has a water supply intake located immediately downstream from Blue Ridge Dam.

# BLUE RIDGE RESERVOIR

# BLUE RIDGE





## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Chemical Characteristics

The water quality of Blue Ridge Reservoir strongly reflects the nature of its watershed: primarily undisturbed, forested lands underlain by metamorphic and igneous rocks. The water is somewhat acidic (mean pH 6.2), very soft (mean hardness less than 10 milligrams per liter (mg/l) and poorly buffered (mean alkalinity less than 5 mg/l). Total dissolved solids and conductivity are also very low (less than 20 mg/l and less than 20 micromhos/cm, respectively). There are no recent data on the turbidity of the water that flows into the reservoir, but water in the reservoir itself tends to be very clear (mean Secchi depth over 7 feet; mean turbidity 1.7 Nephelometric turbidity units).

### Temperature and Dissolved Oxygen

Like most of TVA's tributary reservoirs, Blue Ridge Reservoir becomes thermally stratified in summer. In early spring the sun warms the surface waters more rapidly than the deeper waters, separating the reservoir into two relatively distinct layers of different temperature. During the summer, temperature in the upper layer reaches a maximum of about 82° F, while the temperature in the bottom layer stays about 68° F or lower. The depth of the thermocline (the boundary between the two layers) varies from 10 to 25 feet. Thermal stratification continues until the surface waters cool in the autumn and the entire water column begins to mix ("turns over"). The precise time when the water column begins to mix again depends primarily on the weather, especially air temperature, rainfall, and wind. Following "turnover," the water column tends to remain mixed throughout the winter until spring, when the thermal stratification cycle begins anew.

During thermal stratification, algal photosynthesis in the sunlit upper layer of water produces oxygen, raises the pH to neutral (7.0) or higher, and produces the organic matter that provides the basis of the aquatic food chain. The organic material from aquatic organisms eventually settles and decays in the lower layer of water, using up the

dissolved oxygen. Because the water passed through the turbines in the dam is drawn from deep in the reservoir, water discharged from the reservoir is low in dissolved oxygen during the period of thermal stratification. For about 11 weeks a year, the dissolved oxygen concentration in the discharge is less than the 6.0-mg/l state criterion for trout streams. In recent years, the minimum dissolved oxygen (which usually occurs in September) has been about 3.0 mg/l. The temperature of the water released is also a concern for the tailwater fishery; the water released is normally cold enough for trout, but during periods when there is no discharge, the tailwater becomes warmer than desired for trout (68°F).

#### Bacteriological Water Quality

The bacteriological quality of Blue Ridge Reservoir is excellent. The U.S. Forest Service regularly monitors the concentration of fecal coliform bacteria at Morganton Point beach to confirm that the water quality is suitable for swimming.

#### Trophic Status

Average concentrations of the plant nutrients nitrogen and phosphorus are low in Blue Ridge Reservoir (0.55 mg/L nitrogen and less than 0.01 mg/l phosphorus); consequently, phytoplankton (microscopic algae) populations tend to be sparse. In this reservoir, the low concentration of nitrogen (which declines throughout the summer as it is taken up by phytoplankton) seems to be a more important limiting factor than the low concentration of phosphorus. The aquatic ecosystem responds to this by favoring the development of algae that are able to "fix" nitrogen--that is, to convert nitrogen gas from the atmosphere into organic nitrogen. However, even when the demand for nitrogen is met, the low levels of phosphorus limit further development of algae. Consequently, Blue Ridge Reservoir is considered "oligotrophic"--at the opposite end of the spectrum from highly productive or "eutrophic" reservoirs.

### Aquatic Organisms

Information describing individual components of the biological community of Blue Ridge Reservoir (zooplankton, benthos, mussels) is limited or nonexistent. However, the relative infertility of the reservoir is clearly reflected at the top of the aquatic food chain by the unproductive fishery. As is typical of many mountain reservoirs, the standing stock of fish is low and dominated by predator (game) fish. The following table compares biomass in pounds per acre of game, rough, and forage fishes in Blue Ridge Reservoir with other tributary reservoirs of the Tennessee River system.

Reservoir	Inclusive Dates	Number of samples	Biomass (lb/ac)			
			Game	Rough	Forage	Total
Cherokee	1949 - 1989	106	69	113	607	789
Boone	1953 - 1983	31	51	58	245	354
Melton Hill	1964 - 1982	45	20	152	126	298
South Holston	1951 - 1985	45	58	62	161	281
Tellico	1980 - 1981	4	46	113	108	267
Douglas	1949 - 1983	37	47	103	53	203
Ft. Patrick Henry	1954 - 1985	8	19	69	57	145
Watauga	1949 - 1984	38	44	38	57	139
Thorpe	1952 - 1965	6	43	<1	74	117
Norris	1949 - 1989	101	31	27	108	116
Nottely	1958 - 1970	14	44	39	23	106
Fontana	1949 - 1984	22	35	30	32	97
Blue Ridge	1958 - 1963	11	37	25	15	77
Cheoah	1952 - 1965	3	16	49	3	67
Appalachia	1952 - 1983	6	16	16	27	60
Chatuge	1953 - 1980	18	42	9	7	58
Santeetlah	1949 - 1965	11	29	7	18	55
Parksville	1951 - 1970	12	6	11	<1	18
Nantahala	1952	1	15	0	0	15

Twenty-two species of fishes are known to occur in Blue Ridge Reservoir. The principal game species are smallmouth bass, largemouth bass, and walleye. Although gizzard shad are present in the reservoir, their population is small and made up primarily of large adults. The gizzard shad population is kept at low levels by the infertility of the water and the relatively high number of predator fish in the reservoir. Periodic stocking of additional prey (threadfin shad) to augment the forage base has resulted in little apparent success.

Bluegill and whitetail shiners were the most common fish species taken in 1988 in electrofishing samples, followed by smallmouth bass, redbreast sunfish, largemouth bass, green sunfish, and yellow perch. Neither gizzard shad nor threadfin shad were collected in these samples. Capture rates for largemouth bass, smallmouth bass, and walleye were below historical catch rates for other North Carolina and Georgia storage reservoirs in the TVA system. Most of the sunfish were small, ranging in length from 2 to 6 inches, making them of little value to sport fishermen. Although not abundant, some largemouth bass of desirable size were collected. Smallmouth bass were most abundant in the 4 to 5-inch size range, but ranged up to 13 inches in length.

Smallmouth bass, walleye, and bluegill are the species most sought after by anglers, but fishing pressure on Blue Ridge Reservoir is low compared to other north Georgia reservoirs. There is also a sporadic crappie fishery in the reservoir, and a seasonal white bass fishery exists during spawning migrations in the headwater reaches of the Toccoa River.

The low standing crop of fish composed primarily of game fish is likely to continue in Blue Ridge Reservoir because the reservoir is infertile and consequently supports only a limited forage base. This condition is not expected to change under present fisheries management procedures. To improve angling success, TVA has installed numerous fish attractors in coves of Blue Ridge Reservoir. TVA and the U.S. Forest Service have also seeded some shoreline with reed canary grass to offset the lack of natural cover for the fish.

#### Threatened and Endangered Species

There are no federally listed threatened or endangered species reported from the reservoir. However, a lamprey (mountain brook lamprey) and four fish species (river redhorse, blotched chub, telescope shiner, and tangerine darter) listed by Georgia with a "Special Concern" status occur in the Blue Ridge area. Only the tangerine darter has been collected from the reservoir. The river redhorse occurs in the Blue Ridge tailwaters. The other three species are found in the Toccoa River and its tributaries.

## CONDITIONS AFFECTING RESERVOIR USE

The principal uses of Blue Ridge Reservoir are hydropower production and recreation. There are no significant water quality problems that impact these uses. Existing water quality is adequate to support additional uses (such as water supply) that are not presently in demand.

Natural circumstances or conditions resulting from the location and operation of the reservoir have both positive and negative effects on its use. The cool, clear waters of this mountain reservoir are well-suited to such recreational uses as swimming and skiing, and the mountainous backdrop provides an aesthetic quality to the area--especially when the reservoir is full. Pool drawdowns for hydropower production expose the unvegetated shoreline ("bathtub ring"), which detracts from the scenic beauty of the area and also limits access to boat docks.

The unpolluted nature of the water is also reflected in the biotic community. As a natural consequence of its relatively pristine watershed, Blue Ridge Reservoir has low concentrations of plant nutrients and therefore does not provide a food base adequate to support a well-balanced fish community. Blue Ridge has a low biomass of fish, which is typical of mountainous headwater tributary reservoirs of the Tennessee River System. This makes the reservoir "difficult to fish," which is reflected in lower fishing pressure on Blue Ridge than on other north Georgia and North Carolina tributary reservoirs.

Although there is relatively little oxygen-demanding material in the water, the depth of the reservoir, its relatively long detention time, and the location of the power intake deep in the reservoir result in a discharge that is cold and has low concentrations of dissolved oxygen. These factors, along with the intermittent nature of the discharges, adversely affect aquatic life in the tailwater.

The conditions affecting the uses of Blue Ridge Reservoir are summarized as follows:

<u>Condition</u>	<u>Use(s) affected</u>
Runoff from pristine watershed is low in nutrients	<ul style="list-style-type: none"><li>o Water tends to be clear and aesthetically pleasing</li></ul>
Pool drawdown for hydropower production	<ul style="list-style-type: none"><li>o Fish community is "predator heavy" and fishing pressure is low.</li><li>o Unvegetated shoreline ("bath tub ring") detracts from scenic beauty.</li><li>o Limits access to some boat docks.</li></ul>
Intermittent discharge of water with low dissolved oxygen and low temperature	<ul style="list-style-type: none"><li>o Adversely affects aquatic life in tailwater.</li></ul>

## SELECTED RESERVOIR MANAGEMENT AGENCIES

Several agencies have a role in investigation and monitoring of the reservoir. A number of those agencies are listed below. They provide information and assistance geared to the varying needs of the region they serve.

The Tennessee Valley Authority Water Resources Division manages the daily operation of Blue Ridge Reservoir, conducts water quality and aquatic resource monitoring and assessment programs, and develops plans for protecting and enhancing water resources. The Land Resources Division manages TVA lands along the reservoirs and monitors the status of threatened and endangered species in the area.

Tennessee Valley Authority  
Water Resources Division  
Evans Building  
Room 1W 141A  
Knoxville, Tennessee 37902-1499  
Phone: (615)-632-6770

Tennessee Valley Authority  
Land Resources Division  
P.O. Box 606  
Athens, Tennessee 37303  
Phone: (615)-632-2088

The U.S. Forest Service manages the lands and streams in Chattahoochee National Forest and maintains Forest Service recreation facilities in the area.

U.S. Forest Service  
Toccoa Ranger District  
Route 3, Box 3222  
Blue Ridge, Georgia 30513  
Phone: (404)-632-3031

The Georgia Department of Natural Resources is the primary environmental regulatory agency in Georgia. The Environmental Protection Division determines water use classifications, criteria and standards, and issues permits for wastewater discharges. It also regulates water supplies, solid and hazardous waste, and air quality. The North Georgia regional office in Atlanta has primary responsibility for activities in Fannin County.

Environmental Protection Division  
19 Martin Luther King Junior Drive  
Room 435  
Atlanta, Georgia 30334  
Phone: (404)-656-6300

The Game and Fish Division of the Georgia Department of Natural Resources is responsible for fish and game regulations, fish stocking, and boating regulations.

Game and Fish Division  
205 Butler Street  
Suite 1362  
Atlanta, Georgia 30334  
Phone: (404)-656-3523

The U.S. Environmental Protection Agency is responsible for implementation of the Clean Water Act and oversees federally mandated programs managed by the states.

U.S. Environmental Protection Agency  
345 Courtland Street, NE  
Atlanta, Georgia 30365  
Phone: (615)-347-5242

The U.S. Fish and Wildlife Service is responsible for ensuring the protection of fish and wildlife and their habitats during federally sponsored or permitted development activities and has responsibility for the identification of threatened and endangered species.

U.S. Fish and Wildlife Service  
Federal Building, Room 334  
801 Gloucester Street  
Brunswick, Georgia 31520  
Phone: (912)-265-9336

#### SELECTED REFERENCES

Colwell, S. and D. Hill. No date. The Fishery Resource of Tennessee Valley Tailwaters - Blue Ridge. Tennessee Valley Authority, Division of Water Resources.

Cox, J. 1990. Water Resources Issues Analysis: Hiwassee River Watershed. Tennessee Valley Authority, Division of Water Resources, TVA/WR/WQ--90/3.

North Georgia Regional Development Center. 1990. Fannin County Recreation Master Plan. Fannin County Recreation Commission, P-89-01-24-201.

Olem, H. 1985. Acidification Trends in Surface Waters of the Southern Appalachians. Tennessee Valley Authority, Division of Air and Water Resources, TVA/ONRED/AWR-85/13.

Placke, J. 1983. Trophic Status Evaluation of TVA Reservoirs. Tennessee Valley Authority, Division of Water Resources, TVA/ONR/WR-83/7.

Tennessee Valley Authority. 1989. TVA Reservoir Biomonitoring Program - Fish Populations: Results of 1988 Survey. Tennessee Valley Authority, System Engineering.

Tennessee Valley Authority. 1990. Tennessee River and Reservoir System Operation and Planning Review, draft Environmental Impact Statement.

Zeller, H. and B. McDonald. 1988. Estimated Economic Impact of Accessible, Stable Lake Levels in North Georgia: Lake Blue Ridge, Lake Nottely, Lake Chatuge. Submitted to TVA by the Georgia Department of Natural Resources and the University of Georgia.

#### ACKNOWLEDGMENTS

This work was funded by Federal appropriations to the Tennessee Valley Authority (TVA) for water resources management. This report was prepared by members of a project team of the Water Resources Division of TVA with other TVA staff assisting.

Your comments and suggestions are important to us! They help us better meet the information needs of reservoir users. Comments, suggestions, and requests for additional copies of this report should be directed to:

Larry R. Clark  
Water Quality Department  
Tennessee Valley Authority  
Haney Building, Room 2S 270C  
311 Broad Street  
Chattanooga, Tennessee 37402-2801  
Phone: (615) 751-7331

TVA is an equal opportunity and affirmative action employer. TVA also ensures that the benefits of programs receiving TVA financial assistance are available to all eligible persons regardless of race, color, sex, national origin, handicap, or age.

END

DATE FILMED

01/30/91

