

## SECTION 2

# CHARACTERIZATION OF THE LAKE CHATUGE WATERSHED

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### 2.1 Historical Background

The upper Hiwassee River basin has been inhabited by humans for hundreds of years and was a major population center for the Cherokee Nation when white settlers began to arrive in the early 1800s. Written references to the Appalachian Mountains and the Cherokee first occurred in the journals recording Hernando DeSoto's march through the South in the mid-sixteenth century. By 1716, trading between the Cherokee and merchants in Charleston, South Carolina in deer-hides was strong; later ginseng was also traded. White settlement of the area began in the early 1800s and the discovery of gold in North Georgia in 1828 significantly increased the influx of settlers (Homan, 2002).

In 1835, after years of court battles and debate, representatives of the Cherokee signed the Treaty of New Echota that traded all of their land in the east for land in the Indian Territory of Oklahoma. Congress ratified the Treaty in 1836 despite a substantial Cherokee petition declaring the agreement fraudulent, and in 1838 passed the Indian Removal Act when it became apparent that the Cherokee were not going to leave their land. The United States Army then forced most all of the remaining Cherokee from the Southern Appalachians in a harsh journey now known as the "Trail of Tears" (Homan, 2002). During the removal, a site located near present-day Hiawassee, GA was used to concentrate Cherokee people into groups for the journey west (*Roadside Georgia*, 10/24/2006).

By 1840, much of the area was owned by white settlers drawn by land lotteries, which awarded 40- and 160-acre tracts to homesteaders (Homan, 2002). The earliest white settlers in the area were hardy, Scotch-Irish immigrants. The people were very self-sufficient, raising their own crops and livestock for both food and clothing (Clay County Chamber of Commerce, 2006).

One of Georgia's early north-south roads passed through the Lake Chatuge watershed. The "Unicoi Road" was an upgraded Cherokee Trading Path that ran from the present-day Maryville, Tennessee area, over the Great Smoky Mountains, to the Tugaloo, GA area. The road made the Hiwassee River watershed land more valuable because it gave residents better access to markets for their crops. Towns County was formed in 1856 from parts of Rabun and Union counties; in 1861 Clay County was formed from parts of Cherokee and Macon counties (*Roadside Georgia*, 10/24/2006).

This remote and fairly isolated area was relatively undisturbed by the Civil War and "Reconstruction" following the war also had little effect on the two counties. Commercial development in Towns County in the late 1800s was hindered by the lack of an east-west road and the lack of a rail route. After World War I, when automobiles became a common mode of transportation for Americans, a road was proposed to connect Chattanooga, Tennessee, and Spartanburg, South Carolina. Today the road is

known as U. S. 76; this route gave Towns County a much-needed east-west connector and better opportunities for commercial development (*Roadside Georgia*, 10/24/2006).

All of the forestland in the Lake Chatuge watershed was heavily logged at one time or another in the early 1900s. By 1930, large-scale commercial cutting had ceased, however, small timber companies and individual landowners continued to take out old growth trees and salvage dead chestnut until the early 1960s. Timber companies sold large tracts of logged forestland to the U.S. Forest Service between 1910 and 1930, although they sometimes retained the right to continue to remove trees larger than 14 inches in diameter (Homan, 2002). To a trained eye, evidence of this widespread timbering is still evident in forestlands of the Lake Chatuge watershed.

Despite the timber boom in the early years, agriculture remained the basis of the local economy throughout much of the 20th Century. Due to the remoteness of the area from major population centers, traditional manufacturing and industrial activity has been limited. Tourism has only in recent decades become an important economic factor (Clay County Chamber of Commerce, 2006). Currently, the Lake Chatuge watershed is growing in population fairly rapidly (see part 2.4.1 for details) and also experiences significant seasonal population fluctuations due to an influx of summer residents and to recreational travel and tourism activities.

## 2.2 Hydrologic Features

### 2.2.1 Chatuge Dam

Lake Chatuge is a 7,000-acre man-made impoundment of the Hiwassee River located in the Blue Ridge Mountains of North Georgia and Western North Carolina. Congress authorized the Chatuge Reservoir project in 1941 for emergency power production associated with national defense during World War II. When the dam was built by TVA in 1942 it did not have hydropower generating capability, but was operated to store and release water as required for maximizing power production at Hiwassee Dam and others downstream. At the time, storage of water in Chatuge and neighboring Nottely Reservoirs combined to add an additional 60,000 kilowatts of generating capacity to the TVA system (TVA, June 1992b).

In 1945, Chatuge became a “multi-purpose” reservoir and was operated for downstream navigation and flood control, in addition to power production. Releases from Chatuge then helped maintain favorable navigation conditions in the Tennessee River between Knoxville and Chattanooga and helped to prevent flooding of downtown Chattanooga (TVA, June 1992b). Chatuge Dam is still operated by TVA to assist with these functions today.

In 1954, a single hydro-generating unit was placed into operation. Chatuge Dam has the smallest power capacity of any of the power-generating TVA dams, representing less than 0.3% of the total conventional hydropower in the TVA system (TVA, June 1992b). TVA continues to own and operate Chatuge Dam. Recently, as a result of the system-wide Reservoir Operations Study in 2003-2004, recreation has been added to the list of “multi-

purposes” and seasonal variations in lake levels are more strictly regulated to provide for this benefit to the local economy.

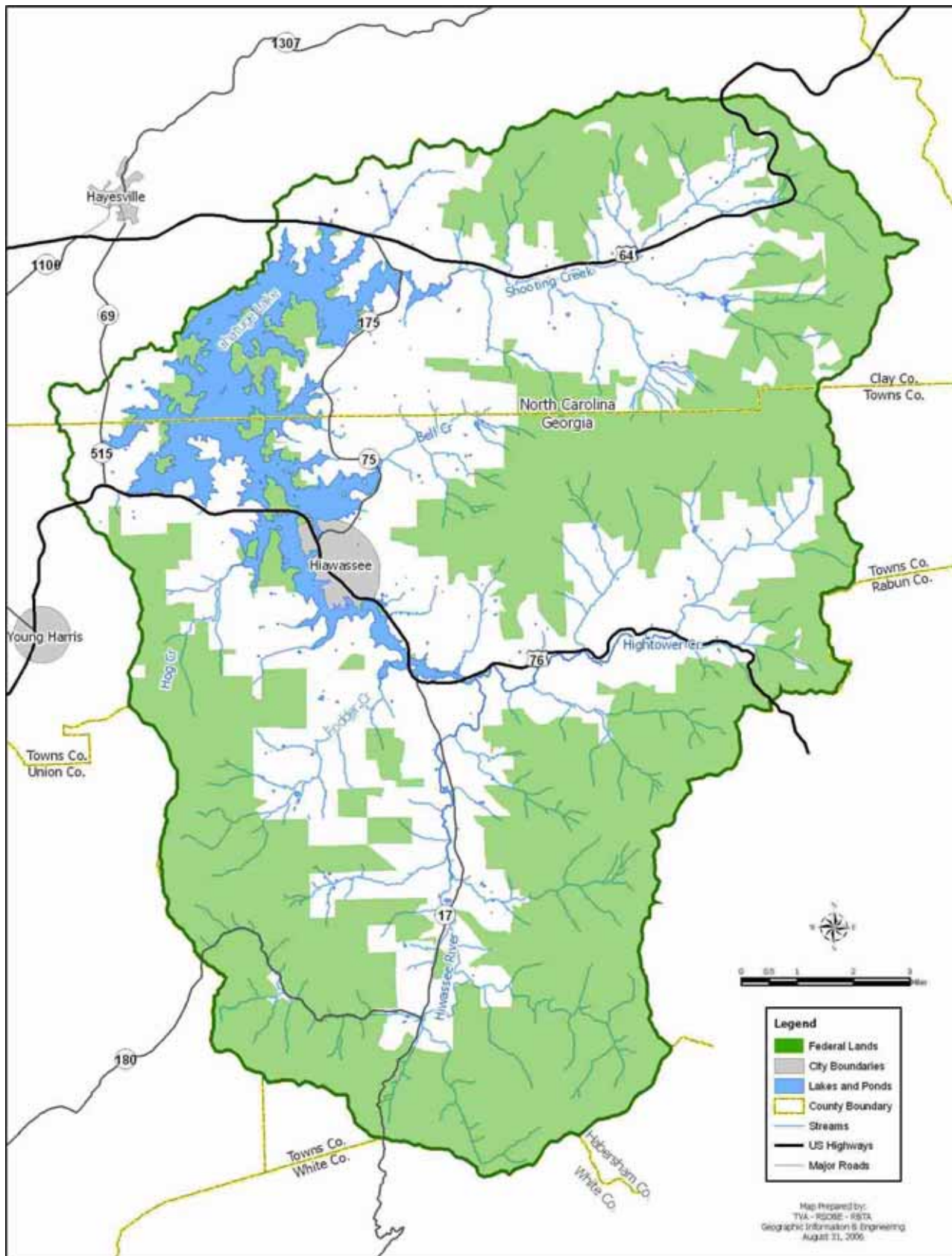
### 2.2.2 Lake Chatuge Watershed

The Hiwassee River flows north from the southern part of Towns County and forms Lake Chatuge at the confluence with Hightower Creek (Figure 3). The area of land that drains into the Hiwassee River and Lake Chatuge above Chatuge Dam is called the Lake Chatuge watershed. The Lake Chatuge watershed is approximately 189 square miles and is located entirely within Towns County, GA and Clay County, NC. Hiwassee, GA is the only municipality; however, Young Harris, GA and Hayesville, NC lie just outside the western watershed boundary.

More than 37 percent of the Lake Chatuge watershed (70.3 mi<sup>2</sup>) lies within two National Forests in the watershed: Nantahala National Forest in North Carolina and Chattahoochee National Forest in Georgia. The headwaters of the Hiwassee River and several major tributary streams lie within this federally protected forestland and feed Lake Chatuge, offering substantial water quality protection.

Major streams within the watershed include Hightower, Scataway, Fodder, Hog and Bell Creeks in Georgia and Shooting, Eagle Fork, and Giesky Creeks in North Carolina. There are two major east-west highways that cross the watershed. US Highway 64 lies along the northern sections of Lake Chatuge and Shooting Creek; US Highway 76 follows the southern border of the lake, crosses at one of the narrowest portions near Hiwassee, and then follows Hightower Creek to the west.

Figure 3. General Map of the Lake Chatuge Watershed



### 2.2.3 Stream Network and Project Sub-watershed Delineation

There are 365 miles of streams in the Lake Chatuge watershed. In most reservoirs, the largest amount of water flowing in comes from the upstream end of the watershed with relatively small flows entering between it and the dam. However, the primary inflow to Lake Chatuge, the Hiwassee River, drains less than half (44%) of the watershed. The Shooting Creek drainage area makes up nearly one quarter (23%) of the Lake Chatuge watershed, entering just above the dam (TVA, August 1991). The Shooting Creek Embayment can be treated almost like a second smaller lake because the water from the Shooting Creek watershed never really impacts the rest of Lake Chatuge and vice versa.

For the purposes of the HRWC study and to make implementation of water quality improvement projects easier in the future, the watershed was broken into 49 sub-watersheds (Figure 4). Each sub-watershed is a hydrologically correct area meaning that any runoff within that sub-watershed drains to the downstream point where the stream and the sub-watershed boundary meet. The size of the sub-watersheds is determined based on the land cover at the time of the study (2003), the location of point source discharges, as well as whether the water is free-flowing in a stream, part of the lake body, or stream channels that are sometimes influenced by reservoir operations (i.e. backwaters). For example, if the land cover over a large area is predominantly forest with some light residential development and contains all free-flowing streams, then the sub-watershed can be fairly large (e.g. Hightower Creek headwaters - 0905). But in an area that is not free flowing all year with significant water level fluctuation due to reservoir operations, the sub-watershed might be very small (e.g. Fodder Creek embayment - 0801). The Hiwassee Wastewater Treatment Plant discharge is isolated in a very small area so that impacts can be separated from other land uses (05).

The sub-watershed numbering system breaks the watershed into a “tree structure” that allows users of the computer model to determine the relative geographic position of each sub-watershed. In the computer database the pollutant loadings for a sub-watershed represent all of the nonpoint sources in the sub-watershed that accumulate at the point where the stream intersects the sub-watershed boundary. A key to the sub-watershed codes is found in Table 1 (page 13).

Figure 4. Project Sub-Watersheds Delineated for Planning Purposes

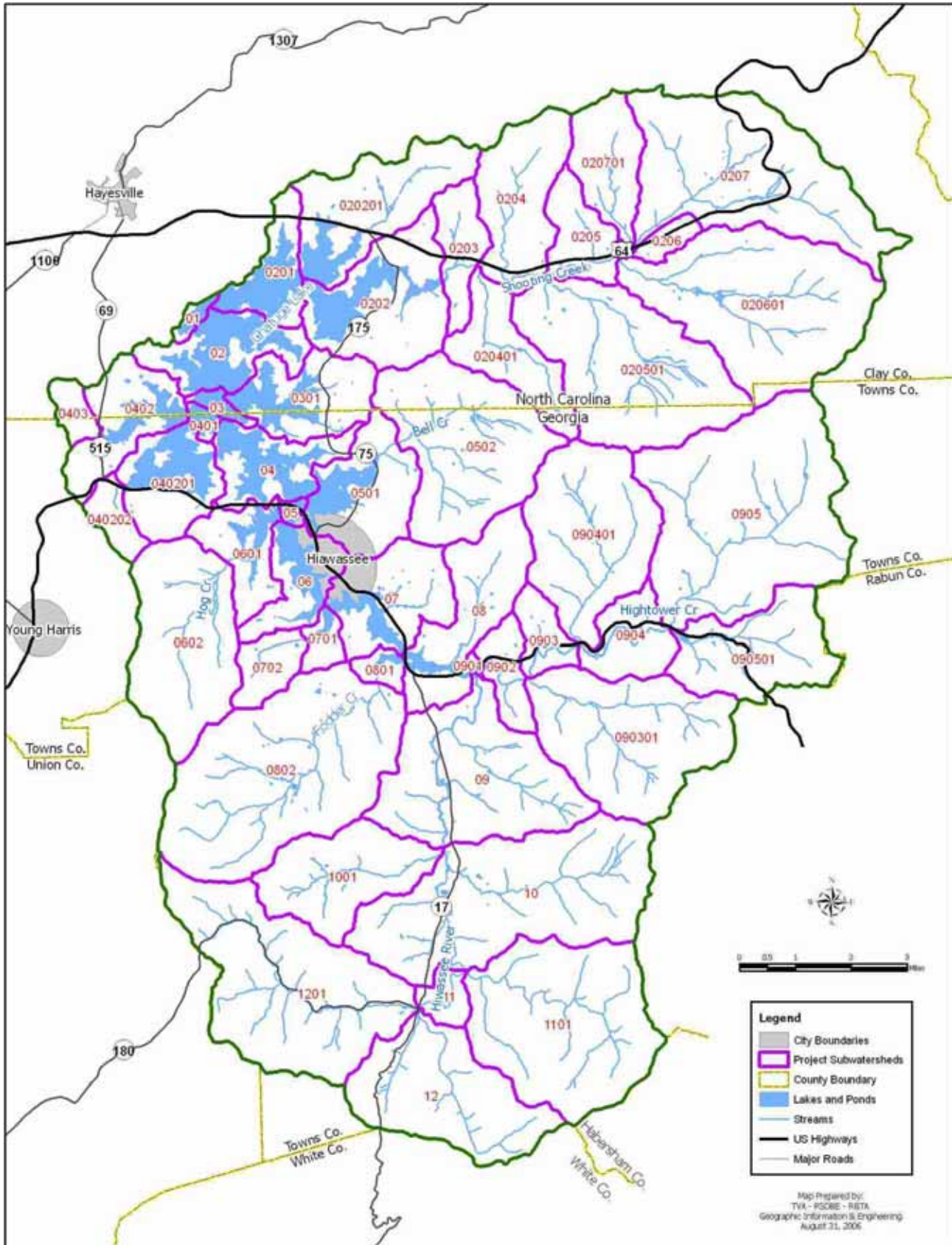


Table 1. Key to Project Sub-Watersheds Presented in Figure 4.

Sub-Watershed Code	Major Waterbody or Drainage Area	Sub-Watershed Name	State in which a majority lies
01	Lake Chatuge	Chatuge Dam	NC
02	Lake Chatuge	Lower Lake Chatuge	NC
0201	Lake Chatuge	Lower Shooting Cr Embayment	NC
0202	Lake Chatuge	Upper Shooting Cr Embayment	NC
020201	Lake Chatuge	Licklog Creek	NC
0203	Shooting Creek	Rocking Chair	NC
0204	Shooting Creek	Pounding Mill	NC
020401	Shooting Creek	Hothouse Branch	NC
0205	Shooting Creek	Jackie Cove	NC
020501	Shooting Creek	Giesky Creek	NC
0206	Shooting Creek	Old 64/New 64	NC
020601	Shooting Creek	Eagle Fork	NC
0207	Shooting Creek	Shooting Cr Headwaters	NC
020701	Shooting Creek	Vineyard	NC
03	Lake Chatuge	Chatuge at State Line	NC/GA
0301	Lake Chatuge	Sneaking Creek	NC
04	Lake Chatuge	Middle Lake Chatuge	GA
0401	Lake Chatuge	Cedar Cliff	GA/NC
0402	Lake Chatuge	Woods Creek Embayment	NC/GA
040201	Lake Chatuge	Ramey Mountain	GA
040202	Long Bullet Creek	Mining Gap	GA
0403	Woods Creek	Woods Creek	NC/GA
05	Lake Chatuge	Fairgrounds	GA
0501	Lake Chatuge	Lower Bell	GA
0502	Bell Creek	Upper Bell	GA
06	Lake Chatuge	Hiwassee	GA
0601	Lake Chatuge	Hog Cr Embayment	GA
0602	Hog Creek	Hog Creek	GA
07	Lake Chatuge	Upper Lake Chatuge	GA
0701	Lake Chatuge	Transfer Station	GA
0702	Woodring Branch	Woodring Branch	GA
08	Bearmeat Creek	Bearmeat Creek	GA
0801	Lake Chatuge	Fodder Cr Embayment	GA
0802	Fodder Creek	Fodder Creek	GA
0901	Hightower Creek	Hightower Embayment	GA
0902	Hightower Creek	Lower Hightower Cr	GA
0903	Hightower Creek	Middle Hightower Cr	GA
090301	Hightower Creek	Swallow Creek	GA
0904	Hightower Creek	Upper Hightower	GA
090401	Hightower Creek	Scataway Creek	GA
0905	Hightower Creek	Hightower Cr Headwaters	GA
090501	Hightower Creek	Little Hightower	GA
09	Hiwassee River	Cynth Creek	GA
10	Hiwassee River	Mill Creek	GA
1001	Hiwassee River	Owl	GA
11	Hiwassee River	Upper Hiwassee River	GA
1101	Hiwassee River	Corbin Creek	GA
12	Hiwassee River	Hiwassee River Headwaters	GA
1201	Hiwassee River	Soapstone	GA

## 2.3 Physical Characteristics of the Lake & Watershed

### 2.3.1 Reservoir Characteristics

Lake Chatuge is approximately 7,000 acres at normal maximum pool (elevation 1,927 feet) and holds 233,500 acre-feet of water. At minimum pool (elevation 1,905) the lake is just less than 4,000 acres and holds 118,000 acre-feet. It is smaller than average in size, but close to the median, when compared with other TVA reservoirs on tributaries to the Tennessee River (TVA, June 1992b).

Only 23% of the lake is less than 10 feet deep at normal pool. The impoundment is 13 miles long and an average of 30-33 feet deep at minimum and maximum pool respectively. The theoretical average retention time of water in the lake is 198 days (TVA, June 1992b).

### 2.3.2 Geology and Soils

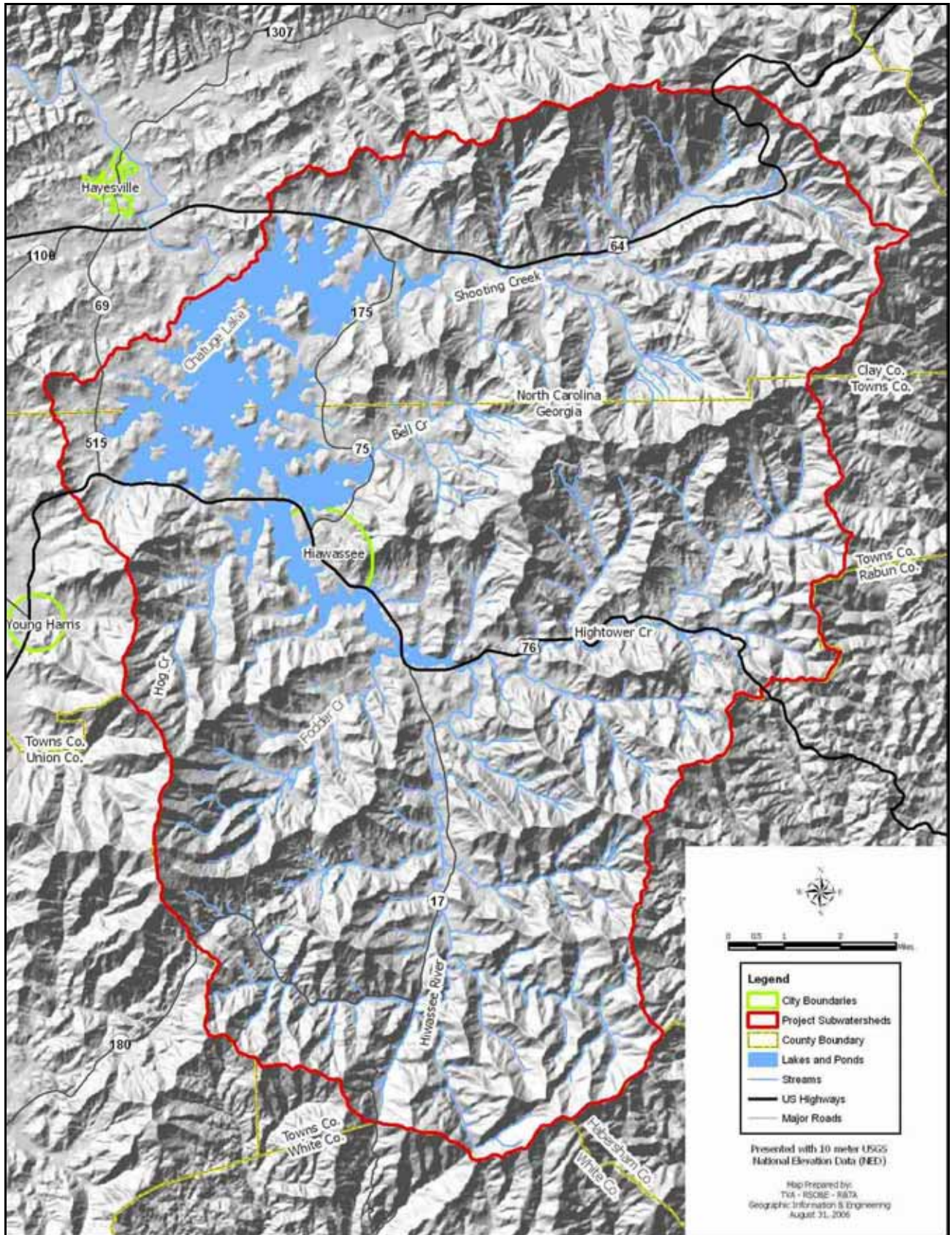
The Lake Chatuge watershed lies within the Blue Ridge Mountain physiographic province. The area is underlain predominantly by Carolina and Roan gneiss, metamorphic rocks that are similar in chemical composition to granite. Mineral resources include mica, quartzite, gold, and corundum (TVA, June 1992b).

Most soils in Towns and Clay counties are strongly acidic loam or sandy loam. Land that comprises the shoreline area of Lake Chatuge is most commonly Hayesville fine sandy loam or Dyke loam. Chatuge loam is predominant along the Hiwassee River above Lake Chatuge. All of these soil types pose moderate to severe limitations for septic systems (TVA, June 1992b).

### 2.3.3 Topography

The topography of the Lake Chatuge watershed is unique in that the steepest slopes do not occur at the very top of the watershed in the Hiwassee River headwaters. Although the Unicoi Mountains of southern Towns County are approximately 2,500 feet high and divide the Hiwassee River basin from the Chattahoochee, they are not as rugged as mountains in the northern part of the county and in North Carolina (Figure 5). The steepest slopes in the Lake Chatuge watershed are found in the mountains that divide Hightower Creek and Shooting Creek in the northern part of Towns County and the Chunky Gal Mountain along the northern boundary of the watershed in Clay County. The mountains that surround Fodder and Owl Creeks in the southeastern portion of the watershed also contain steep slopes. In general, the southern side of each mountain range within the watershed contains steeper slopes than the northern side. Valleys along streams in the Lake Chatuge watershed are very narrow when compared with the neighboring Brasstown and Tusquitee Creek watersheds to the west and north, respectively.

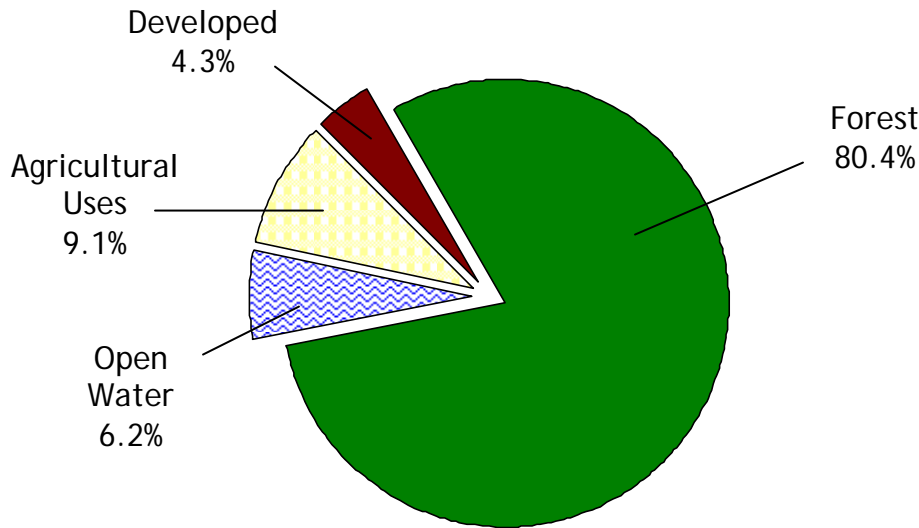
Figure 5. Topography of the Lake Chatuge Watershed



### 2.3.4 Land Cover and Land Use

Lake Chatuge makes up about six percent of the drainage area above Chatuge Dam (Figure 6). The watershed is primarily forested (80.4%) and in 2002 there were still more than 10,000 acres (9.1%) of land in agricultural uses including pasture, cropland, and hay land. Developed land is increasing and, as of 2002, represented more than four percent of the drainage area (about 5,000 acres).

Figure 6. General Land Cover above Lake Chatuge Dam by Percentage (2002)

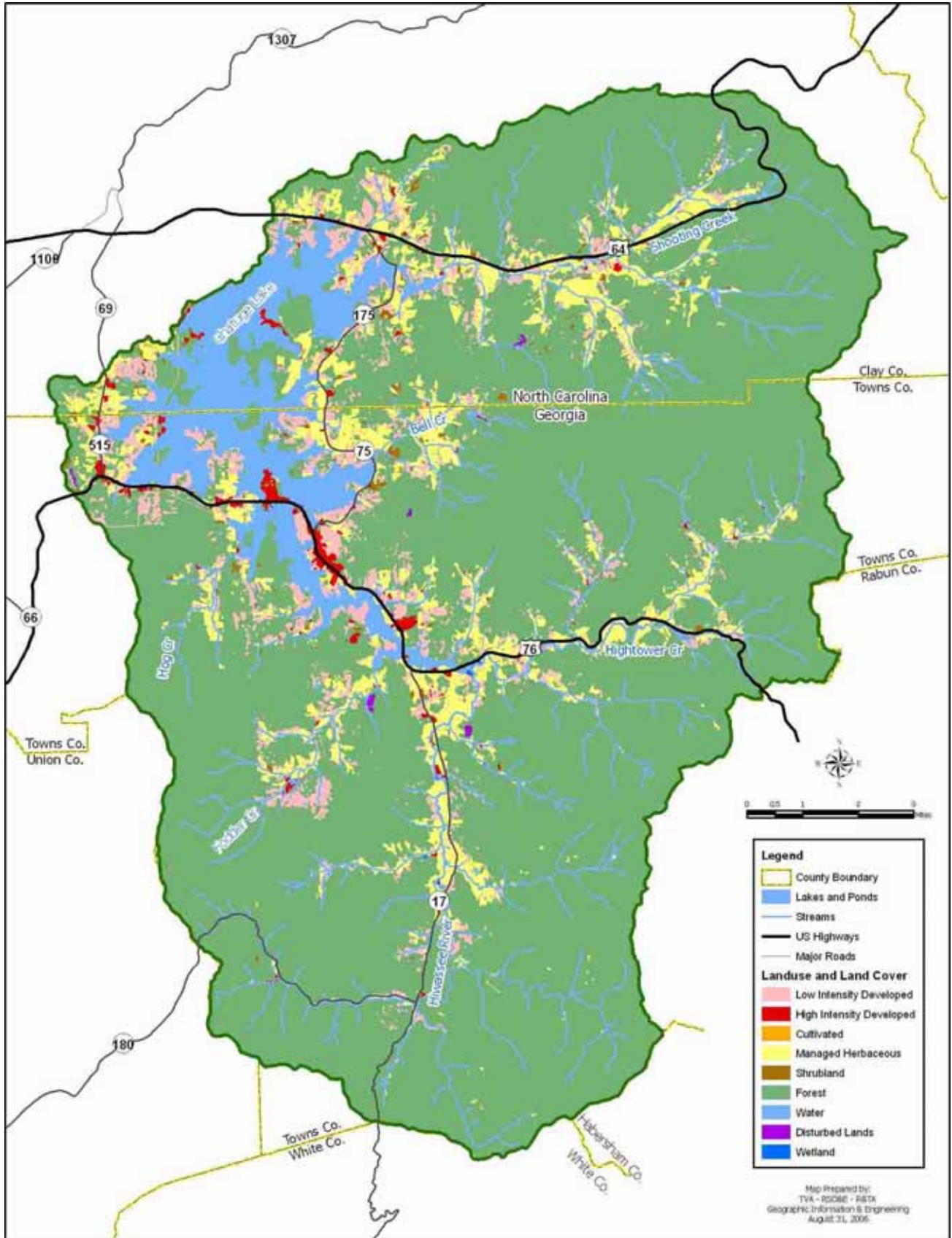


Detailed land use/cover information was obtained in 2002 for the Lake Chatuge watershed (Figure 7) as part of the Integrated Pollutant Source Identification (IPSI) analysis conducted prior to computer modeling. [Section 4.2 contains more information about IPSI.] The vast majority of the agricultural lands in the watershed are pastures and hay lands; there are less than 50 acres of traditional row crops. Golf courses (included with developed areas on Figure 7) cover 250 acres.

High intensity developed areas are primarily located along highway corridors and contain mostly commercial businesses. Low density developed areas are most commonly associated with residential subdivisions. The difference between the two types involves the amount of impervious surfaces associated with the development. [Section 5.2 contains more information about the impacts of imperviousness.]

Many of the areas presented on Figure 7 as pasture lands (managed herbaceous) and some forested areas have been developed since these data were collected in 2002, particularly in the Shooting and Hightower Creek watersheds along the major highway corridors. However, it was imperative that the land use data and water quality data be collected reasonably close together so that the computer models could be correctly calibrated. Today we have the tools to estimate the impacts of land use changes as a result. [Section 4 discusses the data collection and modeling methods used during the Coalition’s intensive study of the Lake Chatuge watershed in more detail.]

Figure 7. Map of Land Use/Cover for the Lake Chatuge Watershed (2002)



Lake Chatuge has approximately 132 miles of shoreline, of which 76 miles (58%) is privately owned. Of the eight TVA reservoirs in the Hiwassee River basin, Chatuge has the largest amount of privately owned shoreline. TVA estimated that 45% (34.2 miles) of privately owned shoreline was developed as of 1990 (TVA, June 1992b). Based on the 2002 IPSI analysis, almost all of the privately owned shoreline has now been developed.

### 2.3.5 Protected and Ecologically Sensitive Areas

#### Public Lands

More than 37 percent of the Lake Chatuge watershed (70.3 mi<sup>2</sup>) lies within two National Forests in the watershed: Nantahala National Forest in North Carolina and Chattahoochee National Forest in Georgia. Other public lands include shoreline tracts and islands owned/managed by TVA and shoreline tracts owned/managed by the NC Wildlife Resources Commission, Clay County, Towns County, and the City of Hiwassee.

#### Ecologically Sensitive Areas

Ecologically sensitive areas include rare, threatened and endangered wildlife habitats, rare natural communities, significant land forms and geological features, floodplains, wetlands, headwater streams, and other such areas that are particularly vulnerable to physical or biological alteration. The Georgia Nongame Conservation Section identifies 15 animals and 19 plants of special concern in the Tennessee River basin (of which the Hiwassee River/Lake Chatuge watershed is a part). Of these, six animals and six plants are state protected species and one animal (Bog turtle) and two plants (Swamp pink and Small whorled pogonia) are federally-protected species. Aquatic species of concern include: Hiwassee headwaters crayfish, Eastern hellbender, Silver shiner, Gilt darter, Fatlips minnow, and River redhorse. Although three natural communities have been identified in the larger Tennessee River basin in Georgia, none are reported to exist in Towns County (GADNR, 2007).

The North Carolina Natural Heritage Program identifies 9 animals and 7 plants of special concern in the Lake Chatuge watershed. Aquatic species of concern include the Hiwassee headwaters crayfish, Eastern hellbender, Seepage salamander, Bog turtle, Waterfan lichen, Large purple-fringed orchid, and Green pitcher plant. Only the Bog turtle is currently protected. Five significant natural communities are known to exist in the watershed; the Swamp forest-bog complex and the Southern Appalachian bog are aquatic communities. Additionally, there are four Significant Natural Heritage Areas that are protected in the North Carolina portion of the Lake Chatuge watershed: White Oak Stamp, Glade Gap Slopes, and Chunky Gal/Riley Knob are found within the Nantahala National Forest in the headwaters of the Shooting Creek watershed; Eller Seep is near the NC/GA state line near the lake and owned by The Nature Conservancy (NCNHP, 2007).

Lands at higher elevations contain headwater streams, springs, and seeps. Degradation of water quality and aquatic habitat in these high elevation areas significantly impacts larger streams and rivers downstream. Recognizing this, local governments in Georgia (including Towns County) have adopted "Mountain Protection" ordinances at the State's recommendation. Under these ordinances, more stringent regulations associated with

vegetative clearing and development are applied to lands situated at elevations greater than 2,200 feet in elevation. Figure 8 presents federal and non-federal lands within the Lake Chatuge watershed that lie at or above 2,200 feet above sea level. Approximately 27% of land in the Lake Chatuge watershed that lies above 2,200 feet is privately owned.

## 2.4 Population Description & Trends

There are more than 3,000 counties in the United States. According to the U.S. Census Bureau, Georgia had five of the top 10 (50%) fastest growing counties in the United States between April 1 and July 1, 2003. Georgia also had 20 of the top 100 (20%) fastest growing counties for the same period. Between 2000 and 2015, the resident population in 48 of Georgia’s 159 counties is projected to grow more than 34%. Towns and Union counties in the northeast Georgia mountains are among them (U.S. Census Bureau, 2006b).

The Lake Chatuge watershed and surrounding area experienced explosive growth in the 1990s and the population continues to grow at rates higher than the states in which it lies. Between 1990 and 2000, the population of Towns County increased by 38.0%; Clay County’s population increased 22.6% over the same period. As of 2005, the population of Towns County, GA is estimated by the U.S. Census Bureau to be 10,315, a 10.7% increase over the past five years. The Clay County, NC population is estimated to be 9,765 in 2005, an increase of 11.3% since 2000 (U.S. Census Bureau, 2006b). Roughly 25% of the population of Clay County and 80% of the Towns County population lives in the Lake Chatuge watershed for a total estimated 2005 population of 10,692.

Over 98% of the watershed population is white; however, there is an ever-growing population of Hispanic immigrants that is severely underreported by the Census. Only 1% of the population is black and approximately 0.3% is American Indian (U.S. Census Bureau, 2006b).

In general, the population of Towns and Clay counties is older than population of the United States as a whole. Towns County has more than double the US average percentage of residents over the age of 65; Clay County has nearly double the US average percentage of senior citizens. Table 2 presents age data from the 2000 Census (U.S. Census Bureau, 2006a).

Table 2. Age of Residents in the Lake Chatuge Watershed.

	Clay County, NC	Towns County, GA	United States
Median Age	46.7	48.6	35.3
Under 5 years	4.2%	4.4%	6.8%
18 years and over	81.4%	83.7%	74.3%
65 years and over	22.7%	25.9%	12.4%

Figure 8. Map of Land in the Watershed Lying At or Above 2,200 Feet in Elevation

