

CHAPTER 3

3.0 AFFECTED ENVIRONMENT

This chapter describes the current conditions of various resources in the area of Douglas and Nolichucky tributary reservoirs that could be affected by implementation of the proposed land plans.

3.1. The Reservoirs

The DNTRLMP addresses two TVA tributary reservoir projects in the northeast corner of Tennessee (Figure 1.0-1). Several characteristics of these reservoirs are listed in Table 3.1-1.

Table 3.1-1. Characteristics of Douglas and Nolichucky Reservoirs

Reservoir	Dam Location	Length of Reservoir (miles)	Flood Storage (acre-feet)	Shoreline (miles)	Summer Pool Elevation (feet above msl*)	Annual Pool Variation (feet)
Douglas	French Broad River Mile (FBRM) 32.2	43.1	1,081,880	561.0	994	40
Nolichucky	Nolichucky River Mile (NRM) 46.0	6.0	N/A	35.8	N/A	N/A

*mean sea level (msl)

Both Douglas and Nolichucky reservoirs are located in the Ridge and Valley ecoregion of Tennessee. This region occurs between the Blue Ridge Mountains on the east to the Cumberland Plateau on the west and is a relatively low-lying area made up of roughly parallel ridges and valleys that were formed through extreme folding and faulting events in past geologic time (Griffith et al. 1998). Deciduous forests dominate the plant community with a mixture of evergreen and mixed evergreen-deciduous forests. These communities provide a variety of wildlife habitat interspersed with intense agriculture, urban sprawl, and industrial properties.

A majority of the lands in and around the reservoirs are contained in the Southern Shale Valleys subregion, which consists of lowlands, rolling valleys, slopes, and hilly areas dominated by shale materials. Small farms and rural residences occur throughout where land is used for grazing or farming tobacco, corn, or hay. The remaining area around Douglas Reservoir is within the Southern Limestone/Dolomite Valleys and the Rolling Hills subregion, which is a heterogeneous region, composed predominantly of limestone and cherty dolomite. Landforms are mostly undulating valleys and rounded ridges and hills, with many caves and springs. Soils vary in their productivity, and land cover includes oak-hickory and oak-pine forests, pasture, intensive agriculture, and urban and industrial (Griffith et al. 1998).

3.1.1. Douglas Reservoir

Douglas Reservoir is a multipurpose tributary storage project located in Hamblen, Sevier, Jefferson, and Cocke counties in Tennessee and is the only TVA project on the French Broad River. Like similar projects on other major Tennessee River tributaries, Douglas is operated for multiple purposes including flood control, augmentation of flows for navigation, hydropower production, water supply, recreation, and aquatic ecology. Douglas Dam is a concrete gravity structure that was completed in 1943. It is 202 feet high and stretches 1,705 feet across the French Broad River. Its current generating capacity is 165,600 kilowatts with four generating units. Initially, the power plant had two generating units with an installed capacity of 30,000 kilowatts. Douglas Reservoir, at the top of the dam gates, has an area of more than 31,000 acres. The reservoir has 561 miles of shoreline with a surface area of 28,420 acres. It has a flood storage capacity of over 1 million acre-feet. A more detailed description of the reservoir and surrounding lands is provided in Volume II.

3.1.2. Nolichucky Reservoir

Nolichucky Reservoir is located entirely in Greene County, Tennessee, on the Nolichucky River. Tennessee Eastern Electric Company built the Nolichucky Dam and Powerhouse as a single-purpose hydropower production project. All of the Nolichucky Project facilities and rights were acquired by the East Tennessee Light and Power Company in 1929 and were acquired by TVA in 1945 (TVA 1972). The Nolichucky Dam is located about 7.5 miles south of Greeneville, in Greene County, Tennessee, on the Nolichucky River. The Nolichucky River, also known as Davy Crockett Lake, extends about 6 miles upstream. Nolichucky Dam is a concrete, gravity overflow structure, 482 feet long and (now) 94 feet high. The powerhouse measures 59 feet by 104 feet and is located on the right bank of the river just downstream from the intake structures in the dam. A more detailed description of the reservoir and surrounding lands is provided in Volume III.

3.2. Land Use

Existing land use patterns along the shoreline and on back-lying land have been influenced by whether TVA acquired the land and whether TVA has subsequently sold, transferred, or retained the land. TVA originally acquired 3,760 acres of land on the two tributary reservoirs (Table 1.2-1). About 15 percent (557 acres) of this land has been transferred for public recreation or natural resource conservation purposes. TVA presently manages a total of 3,191 acres of land on these reservoirs, which are the subject of the DNTRLMP.

On Douglas Reservoir, TVA acquired the right to flood below the 1,007-foot elevation (flowage easement rights) over 22,993 acres of privately held land to allow flexibility of reservoir operations. In a few cases on Douglas Reservoir where TVA originally acquired land, TVA retained the land below the MSC when the back-lying parcels were sold, and the sale deeds granted rights of ingress and egress across the TVA-retained strip of land. In these instances, and in some other instances where TVA acknowledges rights by policy, the back-lying landowners typically have the right to apply to TVA for permits to construct private water use facilities on the TVA-retained land. However, in most cases where TVA sold land and retained property in fee below the 1,007-foot MSC, private water use facilities will not be considered.

Most of the residential development along Douglas is on private land over which TVA purchased the right to flood to the 1,007-foot elevation (Zone 1). Across the TVA reservoir system, approximately 38 percent of the total shoreline is available for residential

development, and a third of that shoreline had been developed by the mid-1990s (see Section 1.4).

TVA owns approximately 1,136 acres along the Nolichucky River with the majority of this land being on the reservoir. TVA holds flowage easements on an additional 370 acres of land adjacent to the reservoir. At the time TVA acquired these landrights in 1945, the landrights did not include all of the affected area by the Nolichucky Dam during flood events. Since then, silt and sediment accumulations in the reservoir have raised the 100-year flood elevation up to 10 feet above what it likely was when TVA acquired the project in 1945. The federal landrights include about 51 percent of the area within the present 500-year floodplain and about 60 percent of the area within the 100-year floodplain.

In the mid-1970s, when the purpose of the project was modified to be a waterfowl sanctuary and environmental education area, TVA purchased fee title to approximately 330 acres of previous flowage easement land and fee title to approximately 163 acres of additional land adjacent to the reservoir. By 1980, the Nolichucky Project included 901 acres in fee and approximately 178 acres of flowage easements (TVA 1980).

Upstream from the Nolichucky Dam, the present 100-year flood elevation along the river varies from the 1,260.3-foot elevation at the dam site (Nolichucky River Mile [NRM] 46) to the 1,317.3-foot elevation at NRM 62.06, which is the upper limit of the floodplain study conducted by TVA in 2006 for the *Nolichucky Flood Remediation Final Environmental Impact Statement* (TVA 2006a). The 500-year flood elevation varies from the 1,266.3-foot elevation at the dam site to the 1,329.2-foot elevation at NRM 62.06.

In order to better understand shoreline development trends on the Douglas and Nolichucky reservoirs, TVA used aerial photography and Geographic Information System mapping to estimate the amount of shoreline that is available for residential development (Table 3.2-1). The percent of the available residential shoreline that has already been developed is approximately 75 percent on Douglas and 12 percent on the Nolichucky Reservoir (Table 3.2-2). In addition to the Zone 1 property along the Nolichucky Reservoir, TVA has fragments of Zone 1 property further upstream and ending at approximately NRM 63. Development around these two reservoirs over the last 15 years has been steady, as many farms have been turned into residential developments, primarily single-family homes, which is the case on the Nolichucky Reservoir. However, in recent years, multifamily developments have become more prevalent.

The amount of undeveloped shoreline on all reservoirs with open shoreline available has decreased. This decrease is due, in part, to the availability of flowage easement land for residential development. TVA's Land Policy does not allow for additional TVA-managed land to be provided for residential use; therefore, the amount of shoreline available for residential use will not change as a result of the land planning process.

Table 3.2-1. Douglas and Nolichucky Reservoirs Shoreline Ownership Data

Reservoir	Flowage Easement Shoreline		TVA-Owned Residential Access Shoreline		TVA-Owned and Jointly Managed Shoreline		TVA-Owned and -Managed Shoreline		TVA Shoreline Miles
	Miles	% of Total Miles	Miles	% of Total Miles	Miles	% of Total Miles	Miles	% of Total Miles	Miles
Douglas	493	88	3	<1	49	9	16	3	561
Nolichucky	2	12	0	0	15	79	1	5	19*

*TVA owns additional shoreline below the dam as well as upstream of the reservoir.

Table 3.2-2. Percent of Shoreline Open for Residential Development and Percent of Open Shoreline Developed

Reservoir	Percent of Total Shoreline Open for Residential Development*	Percent of Open Shoreline Developed
Douglas	88	75
Nolichucky	12	12

*Sum of flowage easement and shoreline access zones

TVA retained a total of 3,191 acres of land on the Douglas and Nolichucky reservoirs. As noted above, many of the parcels have existing land use agreements, which commit a parcel to a specific use. The majority of the land use agreements are for uses such as utilities, highways, and other public infrastructure. Most of these public infrastructure uses affect narrow linear tracts with small acreages.

Many of the land use agreements permit recreational use of TVA land, and the majority of those are for public recreation (Table 3.2-3). A large proportion of the 304 acres associated with the public recreation agreements are for boat ramps and municipal parks that are operated by local, county, and state government agencies. These include Kinser Park and Joe Johnson TWRA boat ramp on the Nolichucky Reservoir and the Point Resort and Marina (Dandridge City Park), Mountain Cove Marina (Sevier County Park), and the following TWRA boat ramps on Douglas Reservoir: Shady Grove, Walter's Bridge, Spring Creek, Nina, Leadvale, Providence Road, Rankin Access, and the Dandridge Ramp. Rankin Bottoms and Henderson Island were transferred to TWRA for wildlife management; however, they also provide opportunities for recreational use.

Table 3.2-3. Douglas-Nolichucky Reservoir Land Use Agreements by Category

Douglas-Nolichucky Reservoirs Land Use Agreement Categories	2008	
	Number of Agreements	Acres (approximate)
<i>Recreation</i>		
Public Recreation	12	304.4
Wildlife Management Areas	4	1,899.6
<i>Project Operations</i>		
Highways/Roads	2	1.1
Municipal Uses (office buildings, parking lots, industrial park, etc.)	3	0.43*
<i>Utilities</i>		
Sewer Lines	1	1.4
Septic Systems/Field Lines	1	<0.0
Electric Lines	11	19.4
Telephone Lines	3	4.0
Water Lines	2	2.3
Total	38	2,232.8

* Two of the agreements are for channel excavation on the Nolichucky River, and no acreage was available.

3.3. Recreation

The northeastern Tennessee Valley region of which the Douglas and Nolichucky reservoirs are part provides numerous opportunities for outdoor recreation within a one-day drive of nearly one-third of the nation's population. Four Tennessee state parks, two Virginia state parks, one national park, three national forests, 10 TVA reservoirs, and countless smaller parks and nature centers make up the recreation fabric of the region. Recreational opportunities provide a variety of individual and social benefits including personal development (e.g., improved physical fitness); social bonding (e.g., higher quality of family life); therapeutic and healing benefits (e.g., restored mental health); and social benefits (e.g., increased cultural identity).

The Nolichucky River is a popular local recreation resource both upstream and downstream from Nolichucky Reservoir. TVA has developed boat access sites at NRMs 46 and 106.5 and owns potential access sites at NRMs 28, 54.1, 60.4, 70.5, and 86.6. TWRA maintains developed access sites at NRM 32.1 (Easterly Bridge) and at NRM 68.6 (Davy Crockett Birthplace State Park). The river provides anglers with the opportunity to catch all species of black bass, rock bass, and muskellunge.

TWRA considers the Nolichucky River to support one of east Tennessee's better warm water sports fisheries (Samsel 2005), and several local fishermen consider the Nolichucky to be one of the best smallmouth bass streams in the country. Far upstream from Nolichucky Reservoir, the river is stocked with rainbow trout, which provides additional fishing opportunities. The Nolichucky Gorge, an upstream reach of the Nolichucky River near Erwin, Tennessee, is used by several commercial rafting companies and many recreational boaters. In 1994, the U.S. Forest Service (USFS) found part of the river in the gorge eligible for Wild and Scenic River designation.

Hunting in the vicinity of the Nolichucky River and the two reservoirs is a popular outdoor activity. Two WMAs on the reservoirs support a variety of game species, including white-tailed deer, gray squirrel, eastern cottontail rabbit, raccoon, eastern wild turkey, northern bobwhite, mourning dove, and other waterfowl (TVA and USACE 1999).

TVA-managed lands in the Douglas-Nolichucky region include about 3,191 acres along the reservoirs, some of which provide a high-quality and diverse array of recreation opportunities. Recreation facilities on TVA-managed lands include campgrounds, marinas, swimming beaches, picnic facilities, fishing piers, boat ramps, visitors' buildings, and other day use facilities.

The inventory of recreation areas on the Douglas and Nolichucky reservoirs includes public and private recreation areas. Public facilities are owned and/or operated by TVA or other government entities, whereas private facilities are commercial areas operated for profit and occur on private land, on TVA land with landrights agreements, or on combinations of private and public lands under agreement. Modern recreation facilities and amenities on shoreline properties adjacent to the reservoirs include 15 campgrounds, five marinas, 26 developed boat launches/ramps, and a myriad of day use facilities including five picnic areas, two swimming beaches, one fishing pier, and two golf courses. Detailed descriptions of recreation areas are provided in the individual RLMPs (Volumes II-III).

From a recreation perspective, Douglas and Nolichucky reservoirs are somewhat different. Douglas is a large, open reservoir with developed recreation resources; the reservoir attracts and supports most of the typical water recreation activities in upper east Tennessee (boating, skiing, personal watercraft). Nolichucky Reservoir offers a relatively unique recreation resource in this area because its small size and narrow width do not attract the water recreation activities common on the larger reservoirs. Nolichucky Reservoir is one of the few reservoirs in east Tennessee where a small boat or canoe can be on the water and not be affected by the waves and noise of bigger, more powerful boats or craft. The majority of the reservoir has little development along the immediate shoreline and provides a quiet, almost solitary recreation experience.

Fifteen high-quality developed recreation facilities are provided at several TVA-managed facilities on Douglas and Nolichucky reservoirs such as Kinser Park, Sevier County Park, and Douglas Dam Reservation (see Recreation section of Volumes II and III). These facilities primarily occur on parcels allocated as Zone 6 (Developed Recreation) or Zone 2 (Project Operations, i.e., Dam Reservation). In general, TVA-managed developed recreation facilities prohibit hunting, possession and use of firearms, use and consumption of alcohol, and camping other than in designated campsites. Recreational use of motorized vehicles is restricted to roadways and is otherwise prohibited on TVA lands and in the reservoir drawdown zones. Fishing is permissible in accordance with applicable state regulations.

TVA-managed lands around the Douglas and Nolichucky reservoirs also offer opportunities for dispersed recreation, which consists of passive, informal opportunities that are predominantly nature-based or water-based. Dispersed recreation typically occurs on parcels allocated as Zone 2 (substations and dam reservations), Zone 3 (Sensitive Resource Management), Zone 4 (Natural Resource Conservation), and undeveloped Zone 6 parcels. Generally, dispersed recreation amenities include rustic trails for fishing access/walking/hiking/horseback riding, primitive campsites, unimproved swimming and launching sites, and hunting and fishing areas. As of 2008, eight areas were identified and

assessed on Douglas Reservoir. Because of its riverine nature and size, no assessment has been done for dispersed recreation on Nolichucky Reservoir. Nonetheless, opportunities for dispersed recreation exist, such as activities associated with bank fishing, fishing from small boats, canoeing, and waterfowl hunting.

Use regulations associated with dispersed recreation lands prohibit motorized vehicle use except where permissible for fishing access and primitive boat launching ramps during winter drawdown season. Hunting and fishing are permissible, unless otherwise posted, consistent with statewide regulations. Likewise, possession and use of firearms and other weapons are permitted subject to all applicable state regulations. Camping stays are limited to a maximum of 14 days within any 30-day period. After 14 days, campers must move at least 1 river mile before reestablishing a campsite. Consumption of alcohol is governed by local ordinances, unless otherwise posted at the area that provides dispersed recreation opportunities.

Some improvements may be made to dispersed recreation areas when necessary to provide access for the user (e.g., parking lot), improve health and safety of the user (e.g., installation of seasonal port-a-potties), or mitigate damage to natural resources (e.g., hardening of recreation sites to reduce severity of impacts).

3.4. Prime Farmland

The FPPA requires that all federal agencies evaluate impacts to farmland prior to converting such land permanently to nonagricultural land use. Prime farmland is defined by the U.S. Department of Agriculture (USDA) as land that has the best combination of chemical and soil physical characteristics for meeting the nation's short- and long-range needs for food and fiber. Prime farmland can consist of cultivated land, pastureland, or forestland, but it is not urban, built-up land or covered by water.

To evaluate effects to prime farmland and farmland of state importance, TVA identifies soil classifications using the USDA, Natural Resources Conservation Service Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>).

About 438 acres of prime farmland occur around the Douglas and Nolichucky reservoirs (Table 3.4-1). A detailed description of the location of prime farmland parcels is provided in the individual RLMPs and in Appendix E.

Table 3.4-1 Approximate Number of Acres and Parcels Having Prime Farmland Around the Douglas-Nolichucky Tributary Reservoirs

Reservoir	Prime Farmland	
	Acres	Number of Parcels
Douglas	245.0	9
Nolichucky	193.4	16
Total	438.4	25

The geographic extent of Douglas and Nolichucky reservoirs reaches five counties in Tennessee. The proportion of total county area in farms ranges from 15 percent in Sevier County to 67 percent in Hamblen County (Table 3.4-2). Prime farmland is found in each of

the five counties, comprising between 7 and 20 percent of the total area in a county (Table 3.4-2).

Table 3.4-2. Acreage of Prime Farmland and Farming Trends in the Counties Adjacent to Douglas-Nolichucky Tributary Reservoirs

County	Percent of Total Area in Farms*	Acres Prime Farmland	Percent Prime Farmland	Percent Change From 1987 to 2007*		
				Number of Farms	Land in Farms (Acres)	Average Size of Farms (Acres)
Cocke	23	26,959	10	-34.7	-28.1	9.6
Greene	58	81,476	20	-17.0	-15.2	1.3
Hamblen	67	7,830	7	-17.9	15.8	28.9
Jefferson	58	21,035	10	-9.5	-7.9	1.2
Sevier	15	38,757	15	-34.8	-38.5	-2.5
Total		176,057				

*USDA, Agriculture Census, <http://agcensus.mannlib.cornell.edu/>

Agriculture census data show that during a recent 20-year period, the number of farms has decreased between 9.5 and 34.8 percent (Table 3.4-2). However, during the same period, the proportion of land in farms increased in Hamblen County, and decreased between 7.9 and 38.5 percent in the other counties. In 2007, the average size of farms ranged from 80 acres in Sevier County to 97 acres in Hamblen County. Between 1987 and 2007, the average size of farms has increased in all counties except Sevier County.

3.5. Terrestrial Ecology

3.5.1. Plant Communities

Vegetation classes commonly found around the reservoirs include Forests, Woodlands, Shrublands, and Herbaceous Vegetation. Descriptions of vegetation classes are adapted from Grossman et al. (1998) and are found in the Glossary of this EIS (Section 7.2).

The Ridge and Valley ecoregion is composed of long stretches of parallel ridges and valleys that contain a variety of landforms and geologic materials. Deciduous forests dominate the plant community with a mixture of evergreen and mixed evergreen-deciduous forests. These communities provide a variety of wildlife habitat interspersed with intense agriculture, urban sprawl, and industrial properties.

Several forest types are found on TVA-owned lands around Douglas Reservoir and along the Nolichucky River. Oak-hickory forest is the most abundant forest type in the eastern U.S. (Flather et al. 1999) and in the project area. Locally, mesic cove hardwood forests and forested wetlands are also common. The numerous bird species that nest in these forest types include wild turkey, whip-poor-will, ruby-throated hummingbird, red-eyed vireo, wood thrush, gray catbird, black-throated green warbler, black-and-white warbler, ovenbird, hooded warbler, and scarlet tanager. Riparian corridors within deciduous forests in the area provide nesting habitat for Acadian flycatcher, northern parula, and Louisiana waterthrush. Many additional bird species migrate through and winter in the area. Common mammal species of deciduous forests include white-tailed deer, eastern red bat, eastern chipmunk, eastern gray and southern flying squirrels, white-footed mouse, woodland vole, short-tailed shrew, raccoon, opossum, striped skunk, gray fox, and bobcat.

Douglas Reservoir

Douglas Reservoir is part of the Lower French Broad watershed and comprises three subwatersheds (Upper, Middle, and Lower Douglas Lake) of Hydrologic Unit Code (HUC) 12 covering approximately 137,647 acres (TDEC 2008a). Vegetation classes commonly found on lands within and around Douglas Reservoir are classified as Evergreen Forest, Evergreen-Deciduous Forest, Deciduous Forest, Shrublands, and Herbaceous Vegetation.

Based on land use/land cover data obtained from TDEC (2008a), approximately 5 percent of the land cover is in the form of Evergreen Forests. These forests are mostly found on undeveloped lands surrounding the reservoirs. Evergreen-Deciduous (mixed) forests occupy approximately 3 percent of the land cover and consist of various community types such as dry and dry mesic oak-pine forests, mixed mesophytic hardwood forests, and xeric pine and pine-oak forests. Mixed mesophytic forests and xeric pine and pine-oak forests are the most common types of Evergreen-Deciduous forests in the region. The most common vegetation classes and the most diverse are the Deciduous Forests and Woodlands (approximately 35 percent). They cover large areas of the landscape and are composed of diverse communities ranging from mesic cove hardwood forests to dry to mesic oak forests and dry to xeric oak forests. These dry to xeric oak forests tend to occupy dry ridges or southwest-facing slopes. In addition, small areas (less than 1 percent) of floodplain hardwood forests along with scrub-shrub wetland communities (2.2 percent) occur along the backs of coves along Douglas Reservoir. The Herbaceous Vegetation class, in the form of row crops, grass fields, agricultural areas, and cleared areas, within transmission line rights-of-way and along roadsides is abundant where approximately 29 percent of the land use is in this form of vegetation (Table 3.5-1).

Table 3.5-1. Douglas Reservoir Land Use/Land Cover

Land Use/Land Cover Type	Percentage Based on 137,645 Acres
Evergreen Forest	5.1
Evergreen-Deciduous Forest (Mixed)	2.8
Deciduous Forest	35.4
Herbaceous Vegetation/Agricultural Areas	29.1
Woody Wetlands/Scrub-Shrub	2.4
Bare Rock/Sand/Clay	4.0
Developed Areas	6.7
Open Water	14.5

Source: TDEC 2008a

Evergreen Forests are in the form of Virginia pine, which showed evidence of harvesting due to pine bark beetle infestation and were in the process of regenerating with young trees.

Evergreen-Deciduous Forests are dominated by stands of mixed pine-hardwoods or hardwoods mixed with pines and eastern red cedar. Several types of evergreen-deciduous forests occur on lands surrounding the Douglas Reservoir such as dry and dry mesic oak-pine forests, mixed mesophytic hardwood forests, and xeric pine and pine-oak forests. Dry and dry to mesic oak-pine forests tend to be located on tops of ridges where Virginia pine, pitch pine, chestnut oak, post oak, white oak, and black gum are found in the canopy with eastern red cedar and eastern redbud present in the understory or along the shoreline. American chestnut stump sprouts were found on dry ridges. According to Murphy and

Nowacki (1997), xeric pine and pine-oak woodlands are usually found as small inclusions on ridgetops and south-facing slopes in the mountains. Historically, this community type has been maintained by frequent fires. The overstory is rather open and dominated by oaks (black, chestnut, northern red, southern red, white) and pines. The understory is predominately composed of ericaceous shrubs, such as deer-berry, low bush blueberry, mountain laurel, wintergreen, and wooly blueberry.

Mixed mesophytic forests are composed of pine (Virginia along with scattered white pine) and oak species (black, chestnut, northern red, southern red, and white). Other common trees observed were mockernut hickory, pignut hickory, shagbark hickory, tulip poplar, and sweetgum. The understory and shrub layer was composed of American holly, eastern redbud, eastern red cedar, flowering dogwood, red maple, sassafras, serviceberry, sourwood, and wild black cherry. Woody vines include Japanese honeysuckle, muscadine grape, poison ivy, and Virginia creeper. The herb layer contained many fern species and several species of wildflowers and ferns, such as bellwort, Christmas fern, ebony spleenwort, little brown jug, mayapple, and toothwort.

Deciduous Forests, the most common type of forests found in this region, occur mainly as oak-hickory forests (mesic to xeric), mesic cove hardwood forests on slopes and forested wetlands near the reservoir edges grading into scrub-shrub wetlands. More xeric oak-hickory forests are dominated by oaks (black, chestnut, northern red, southern red, and white) and hickories (mockernut, pignut, and shagbark). Black gum, muscle wood, and sourwood are common understory species.

The cove hardwood forests are scattered around Douglas Reservoir, and found on mesic slopes. These forests have a rich herbaceous layer with bloodroot, Catesby's trillium, crane fly orchid, dwarf larkspur, mayapple, Jack-in-the-pulpit, sweet Betsy, Solomon's plume, and Solomon's seal and twin-leaf, to name just a few. The forest is dominated by tulip poplar with American beech, white oak, and yellow buckeye. The understory is also diverse with black locust, flame azalea, flowering dogwood, hazelnut, redbud, sourwood, silverbell, and spicebush. Eastern hemlock is found along the streams that traverse the cove hardwood forest.

Forested wetlands are found in the back of most coves along Douglas Reservoir and grade into scrub-shrub wetlands (Shrublands). These areas are dominated by black willow, buttonbush, silky dogwood, and tag alder. In addition, persimmon is common around the shoreline, along with American sycamore, river birch, and silver maple.

Herbaceous Vegetation is commonly found in agricultural areas, within transmission line rights-of-way, along roadsides, and in grassy areas associated with the dam reservation and TVA campgrounds. Nonnative plants commonly encountered in these areas are weedy species such as fescues, hop clovers, Queen Anne's lace, yellow sweet clover, white sweet clover, white clover, and wild pansy, to name a few.

No designated critical habitat (DCH) for rare plants is present on or around Douglas Reservoir.

Nolichucky Reservoir

Nolichucky Reservoir is part of the Nolichucky watershed, and the committed and uncommitted parcels reviewed for the Nolichucky RLMP are located within two subwatersheds (Richland Creek-Nolichucky River and Pigeon Creek-Nolichucky River) of

HUC 12. These two areas comprise approximately 81,811 acres (TDEC 2008b). Vegetation classes commonly found on lands within and around Nolichucky Reservoir are classified as Evergreen Forest, Evergreen-Deciduous Forest, Deciduous Forest, Shrublands, and Herbaceous Vegetation.

Based on land use/land cover data obtained from TDEC (2008b), approximately 3 percent of the land cover is in the form of Evergreen Forests, which are most likely associated with pine plantations. No evergreen forests were observed during field reviews of the unplanned parcels along the reservoir. Evergreen-Deciduous (mixed) Forests occupy approximately 1.4 percent of the land cover and consist of various community types such as dry and dry mesic oak-pine forests, mixed mesophytic hardwood forests, and xeric pine and pine-oak forests. Mixed mesophytic forests and xeric pine and pine-oak forests are the most common types of Evergreen-Deciduous Forests in the region. Areas of Deciduous Forests and Woodlands occupy approximately 25 percent of the land cover. They are diverse communities ranging from mesic cove hardwood forests to dry to mesic oak-hickory forests. In addition, small areas (less than 1 percent) of floodplain hardwood forests and scrub-shrub wetland communities occur as riparian corridors along the river and on islands found within the river. The most abundant vegetative class found within the watershed was the Herbaceous Vegetation class (59.4 percent). This vegetation type can be found in the form of row crops, grass/hayfields, and other agricultural areas, along with cleared areas along roadsides (Table 3.5-2).

Table 3.5-2. Nolichucky Reservoir Land Use/Land Cover

Land Use/Land Cover Type	Percentage Based on 81,811 Acres
Evergreen Forest	2.7
Evergreen-Deciduous Forest (Mixed)	1.4
Deciduous Forest	25.0
Herbaceous Vegetation/Agricultural Areas	59.4
Woody Wetlands/Scrub-Shrub	0.7
Bare Rock/Sand/Clay	0.1
Developed Areas	10.0
Open Water	0.7

Source: TDEC 2008b

Evergreen Forests, in the form of pine plantations, are not common around Nolichucky Reservoir. None were observed on uncommitted parcels during field reviews.

Evergreen-Deciduous Forests occur intermittently along the ridges and bluffs and are dominated by stands of mixed pine-hardwoods or hardwoods mixed with pines and eastern red cedar. Mixed mesophytic forests are composed of pine (Virginia along with scattered white pine) and oak species (black, chestnut, northern red, southern red, and white). Other common trees observed were mockernut hickory, pignut hickory, shagbark hickory, tulip poplar, and sweetgum. The understory and shrub layer was composed of American holly, eastern redbud, eastern red cedar, flowering dogwood, red maple, sassafras, serviceberry, sourwood, and wild black cherry. Woody vines include Japanese honeysuckle, muscadine grape, poison ivy, and Virginia creeper. The herb layer contained many fern species and several species of wildflowers and ferns such as bellwort, Christmas fern, ebony spleenwort, little brown jug, mayapple, and toothwort.

Deciduous Forests, the most common type of forests found in this region, occur mainly as oak-hickory forests, mesic cove hardwood forests, and forested wetlands within riparian areas along the river grading into scrub-shrub wetlands. Oak-hickory forests are dominated by oaks (black, chestnut, northern red, southern red, and white) and hickories (mockernut, pignut, and shagbark). Black gum, muscle wood, and sourwood are common understory species. The exotic invasive species mimosa, Princess tree, and tree-of-heaven were encountered on bluffs along the Nolichucky and its tributaries.

The cove hardwood forests were found on mesic slopes and in areas where creeks entered the river. These forests have a rich herbaceous layer with alum-root, bloodroot, black cohosh, little-brown jug, mayapple, Jack-in-the-pulpit, maidenhair fern, bulbous bladder fern, sweet Betsy, Solomon's plume, and Solomon's seal, to name just a few. Japanese stilt grass and garlic mustard, two exotic invasive species, were also found in the herbaceous layer. The forest canopy is dominated by tulip poplar with American beech, white oak, and yellow buckeye. The understory is also diverse with black locust, flame azalea, flowering dogwood, redbud, sourwood, silverbell, and spicebush. Two unusual shrubs (bladdernut and leatherwood) were found in coves on parcels below Nolichucky Dam.

Riparian areas along the river are common and associated with American sycamore, box elder, eastern cottonwood, river birch, and silver maple. Scrub-shrub wetlands (**Shrublands**) are found on islands within the river. These areas are dominated by black willow, buttonbush, river cane, silky dogwood, spicebush, tag alder, and Virginia willow. Herbaceous vegetation associated with the riparian areas includes cut-leaf coneflower, water willow, scouring rush, cutgrass, touch-me-not, sensitive fern, and various rushes and sedges.

Herbaceous Vegetation is commonly found in agricultural areas, along roadsides, and in grassy areas associated with developed areas. Nonnative plants commonly encountered in these areas are weedy species such as fescues, hop clovers, Queen Anne's lace, yellow sweet clover, white sweet clover, white clover, and wild pansy.

No DCH for rare plants is present on or around Nolichucky Reservoir.

3.5.2. Invasive Plant Species

Invasive, nonnative species of plants occur on most of the committed TVA parcels around the Douglas and Nolichucky reservoirs. EO 13112 defines an invasive nonnative species as one that is not native to that ecosystem and whose introduction does or is likely to cause economic or environmental harm or harm to human health (USDA 2007). Invasive nonnative plants infest under and beside forest canopies and occupy small forest openings, increasingly eroding forest productivity, hindering forest use and management activities, and degrading diversity and wildlife habitat. They occur as trees, shrubs, vines, grasses, ferns, and forbs. Invasive species are typically robust plants without natural controls of insects and diseases and therefore are able to spread across the landscape beyond the control and reclamation measures applied by landowners and managers on individual land holdings (Miller 2003).

The Federal Noxious Weed List (USDA 2007) provides a list of invasive, nonnative plant species that are controlled by federal law. Fieldwork conducted in 2004 indicated populations of the purple loosestrife (*Lythrum salicaria*) occurred in many of the wetlands around Nolichucky Reservoir and along the reservoir shoreline (TVA 2006a); see Section

3.7 on wetlands for details. No other plants listed on the Federal Noxious Weed List of 2006 are reported from the lands around the Douglas and Nolichucky reservoirs. However, 15 species listed by the Tennessee Exotic Plant Pest Council (TN-EPPC 2001) as a severe threat to native ecosystems (Rank 1) were observed along Douglas and Nolichucky Reservoirs: autumn olive, bush honeysuckle, Chinese lespedeza, Chinese privet, English ivy, garlic mustard, Japanese honeysuckle, Japanese stilt grass, Johnson grass, kudzu, mimosa, multiflora rose, oriental bittersweet, princess tree, and tree-of-heaven. Other nonnative species such as crown vetch, tall fescue, shrubby bushclover, Queen Anne's lace, periwinkle, and small carpet grass were also encountered. All of these species have the potential to adversely impact the native plant communities because of their potential to spread rapidly and displace native vegetation. All of the TN-EPPC Rank 1 (severe threat) species are considered high priority when TVA plans management of invasive plants (James 2002).

3.5.3. Wildlife Communities

The variety of landforms, soils, climate, and geology across the Ridge and Valley ecoregion has allowed for an extremely diverse assemblage of animals. This ecoregion contains long stretches of ridges with adjacent valleys that run in a southwestern-to-northeastern direction. Deciduous forests and mixed evergreen-deciduous forests provide wildlife habitat among the intense agriculture and urban sprawl.

Seepages, streams, temporary ponds, and forested wetlands in deciduous forests provide habitat for numerous amphibians including American and Fowler's toads, green and northern cricket frogs, and a variety of salamanders including spotted, red, mud, eastern zigzag, northern slimy, and dusky salamanders. Reptiles commonly found in deciduous forests especially near water include the following: eastern fence lizard, ground skink, five-lined skink, eastern box turtle, eastern worm snake, black racer, and ring-necked snake.

Evergreen and Evergreen/Deciduous Forests account for less than 10 percent of the land cover on each reservoir. These habitats provide nesting habitat for woodland birds including pine, yellow-throated warblers, and great crested flycatcher. Birds that winter in this forest type include red-breasted and white-breasted nuthatches and dark-eyed junco. Other animals that inhabit Evergreen and Evergreen/Deciduous Forests, but are not restricted to them, include white-tailed deer, wild turkey, black bear, eastern mole, southern bog lemmings, northern fence lizard, and six-lined racerunner.

Herbaceous vegetation found in early successional habitats including old fields, agricultural lands, and transmission line rights-of-way accounts for almost a third of the land surrounding Douglas Reservoir and almost 60 percent of the land surrounding the Nolichucky River. Early successional habitats provide habitat for a variety of bird species including eastern bluebird, northern mockingbird, eastern meadowlark, American crow, American kestrel, and red-tailed hawk. Amphibians and reptiles that use these habitats include spring peeper, chorus frog, and common garter snake.

Bird and mammal diversity greatly increases at edge habitats, especially those between forested areas bordered by early successional habitats. Birds commonly found at these edge habitats include wild turkey, great crested flycatcher, white-eyed vireo, Carolina wren, blue-gray gnatcatcher, brown thrasher, blue-winged warbler, prairie warbler, common yellowthroat, yellow-breasted chat, indigo bunting, eastern towhee, field and song sparrow, and orchard oriole. Mammals expected at edges include eastern cottontail, woodchuck, eastern harvest mouse, red fox, coyote, long-tailed weasel, and striped skunk.

Both reservoirs provide abundant open water habitats, extensive mud flats (during drawdown), and associated riparian zones that are used by a variety of wildlife. Several great blue heron colonies exist on the reservoirs as well as a number of nesting osprey. Double-crested cormorant and ring-billed and herring gulls are common throughout the reservoirs. The reservoirs are used extensively by waterfowl; mallard, wood duck, and Canada geese can be found year-round. Diversity of waterfowl species greatly increases in the fall as other species migrate into the region. The riparian corridor along the Nolichucky provides excellent habitat with a diverse array of wildlife species.

Rankin Bottoms WMA, located at the junction of the Nolichucky and French Broad rivers, provides habitat for a variety of wildlife including great blue heron, great egret, green heron, belted kingfisher, common yellowthroat, northern parula, prothonotary warbler, eastern kingbird, American goldfinch, northern rough-winged swallows, and song sparrows. Shallow embayments, especially those with emergent vegetation, provide foraging habitat for a variety of waterfowl including Canada goose, wood duck, mallard, gadwall, green-winged teal, ring-necked duck, scaup, common goldeneye, bufflehead, and hooded merganser. This area is well known for its fall aggregations of waterfowl and shorebirds including pectoral, least, spotted, stilt, semipalmated, and solitary sandpipers; killdeer; Wilson's snipe; dunlin; and greater and lesser yellowlegs. Uncommon species such as dowitchers, sanderlings, ruddy turnstone, western sandpiper, Baird's, and buff-breasted sandpipers are also attracted to the area. Local and regional birding groups regularly visit Rankin Bottoms to view the variety of birds that congregate in this area.

3.6. Endangered and Threatened Species

TVA biologists and natural resource specialists used the TVA Natural Heritage database to assess the endangered and threatened species within and around Douglas and Nolichucky reservoirs. The TVA Natural Heritage database was created to ensure that environmental compliance activities are conducted in a consistent manner across the TVA region and that these activities meet the requirements of NEPA and the ESA. Database searches are based on the following criteria: (1) distance, (2) presence/absence of suitable habitats, (3) element occurrence rank values, and (4) species or type of element present. Accordingly, plants are assessed within a 5-mile radius, aquatic species within 10 miles, and terrestrial species within 3 miles. Field surveys were conducted on tracts where impacts were likely to occur or that had not had prior planning. Records that are ranked "extirpated," or which no longer occur at the particular location of the record, were not included in this review.

Table 3.6-1 contains a list of 32 federally and state-listed species that records show could occur in the vicinity of or in the counties adjacent to Douglas and Nolichucky reservoirs. After consideration of the above criteria and evaluation of the likelihood of their occurrence, four federally listed as endangered, one federally listed as threatened, three candidates for federal listing, one federally protected, and five additional state-listed species are known to occur in the vicinity of Douglas and Nolichucky reservoirs (see Table 3.6-1).

Table 3.6-1. Federally and State-Listed Species Known to Occur Within the Douglas and Nolichucky Reservoirs Watersheds

Common Name	Scientific Name	Status ¹		Reservoir	
		State	Federal	Douglas	Noli-chucky
Plants					
Appalachian cliff fern*	<i>Woodsia appalachiana</i>	SPCO/S1,S2	--	--	X
Ash-leaved bush-pea*	<i>Thermopsis fraxinifolia</i>	THR/S3	--	--	X
Branching whitlow-wort*	<i>Draba ramosissima</i>	END/S1	--	--	X
Spreading avens	<i>Geum radiatum</i>	END/S1	END	--	--
Spreading rockcress	<i>Arabis patens</i>	THR/S1	--	X	--
Invertebrate					
Spruce-fir Moss Spider	<i>Microhexura montivaga</i>	END/S1	END	--	--
Birds					
Bald Eagle*	<i>Haliaeetus leucocephalus</i>	NMGT/S3	PROT	X	--
Piping Plover*	<i>Charadrius melodus</i>	THR/S2	THR	X	--
Swainson's Warbler*	<i>Limnothlypis swainsonii</i>	NMGT/S3	--	X	--
Mammals					
Indiana Bat*	<i>Myotis sodalis</i>	END/S1	END	X	--
Gray Bat*	<i>Myotis grisescens</i>	END/S2	END	X	X
Carolina Northern Flying Squirrel*	<i>Glaucomys sabrinus coloratus</i>	END/S1	END	--	--
Southern Bog Lemming	<i>Synaptomys cooperi</i>	NMGT/S4	--	X	X
Fish					
Blue sucker	<i>Cycleptus elongates</i>	THR/S2	--	X	X
Chucky Madtom	<i>Noturus crypticus</i>	END/S2	CAND	X	X
Highfin carpsucker	<i>Carpionodes velifer</i>	NMGT/S2,S3	--	X	X
Lake Sturgeon	<i>Acipenser fulvescens</i>	END/S1	--	X	--
Rosyface Shiner	<i>Notropis rubellus</i>	TRKD/S2	--	--	X
Snail darter	<i>Percina tanasi</i>	THR/S2,S3	THR	X	X
Tangerine darter	<i>Percina aurantiaca</i>	NMGT/S3	--	X	X
Mussels					
Birdwing pearlymussel**	<i>Lemiox rimosus</i>	END/S1	END	--	X
Cumberland Bean #	<i>Villosa trabalis</i>	END/S1	END	--	X
Fluted Kidneyshell	<i>Ptychobranthus subtentum</i>	TRKD/S2,S3	CAND	--	X
Oyster mussel	<i>Epioblasma capsaeformis</i>	END/S1	END	X	X
Pink Mucket # *	<i>Lampsilis abrupta</i>	END/S2	END	--	X
Rayed Bean #	<i>Villosa fabalis</i>	TRKD/S1	CAND	--	X
Rough Rabbitsfoot #	<i>Quadrula cylindrica strigillata</i>	END/S2	END	--	X
Slabside Pearlymussel #	<i>Lexingtonia dolabelloides</i>	TRKD/S2	CAND	--	X
Spectaclecase	<i>Cumberlandia monodonta</i>	NOST/S2,S3	CAND	X	X
Tennessee Clubshell #	<i>Pleurobema oviforme</i>	TRKD/S2,S3	--	--	X
Cumberlandian combshell #	<i>Epioblasma brevidens</i>	END/S1	END	--	--
Snail					
Spiny riversnail #	<i>Io fluviialis</i>	NOST/S2	--	X	X

= Historical record, * = Species occurs near a TVA land tract, ** = Species is believed to occur in the Nolichucky River

Federal rank abbreviations: END = Endangered; THR = Threatened; PROT = Protected; NMGT = In need of management; CAND = Candidate for listing

State status abbreviations: END = Endangered; THR = Threatened; SPCO = Special concern; TRKD = Tracked

State rank abbreviations: S1 = Critically imperiled often with five or fewer occurrences; S2 = Imperiled often with <20 occurrences; S3 = Rare or uncommon often with <80 occurrences; S4 = Uncommon but not rare

3.6.1. Plants

Field surveys and reviews of the TVA Natural Heritage database showed that no federally listed species are known to occur within 5 miles of the Douglas or Nolichucky reservoirs (Table 3.6-1). The federally listed as endangered species spreading avens is known from the Great Smoky Mountains National Park in Sevier County. However, this species is restricted to high-elevation rocky summits of the Southern Appalachians, and neither plants nor suitable habitat for this species were observed during rare plant surveys conducted in the study area during 2008. No federally listed plant species are known to occur within any of the other counties adjoining the reservoirs.

Four plant species listed in the state of Tennessee are known to occur within 5 miles of the Douglas and Nolichucky reservoirs. One state-listed as threatened species, the spreading rockcress, occurs near Douglas Reservoir. Previously undocumented populations of the state-listed as endangered branching whitlow-wort, the state-listed species of special concern Appalachian cliff fern, and the state-listed as threatened species ash-leaved bush-pea were observed on Nolichucky parcels.

3.6.2. Terrestrial Animals

Results of field surveys and reviews of the TVA Natural Heritage database indicated that three federally listed and a federally protected terrestrial animal species occur within 3 miles of the Douglas and Nolichucky reservoirs or are known from the surrounding counties (Table 3.6-1).

The federally listed as threatened piping plover has been observed at Rankin Bottoms WMA on Douglas Reservoir during the shorebird fall migration season. Observations of an individual were reported in two of the past five years. These recent observations were in September when adult males or young of the year typically migrate through this region. The piping plover is considered a casual (e.g., not regularly occurring but four or more observations in past 10 years) migrant in Tennessee by the Tennessee Ornithological Society.

The federally listed as endangered gray bat roosts in caves year-round and typically forages over open water habitats including streams, rivers, and reservoirs. One cave known to support gray bats is located approximately 5 miles east of Douglas Reservoir. A colony with more than 8,000 individuals was discovered on the Nolichucky River downstream of the impoundment in 2000. A banded gray bat was captured in the cave, and data recovered from the band indicated that the individual was originally captured in the Cherokee National Forest. A second gray bat maternity colony was found in a cave upstream of the impoundment in 2008. The presence of these colonies suggests that gray bats forage throughout the study area.

The federally listed as endangered Indiana bat roosts in caves during the winter and typically forms summer roosts under the bark of dead or dying trees (Menzel et al. 2001; Miller et al. 2002). Optimal summer roosts occur in forests with an open understory and usually near water (Romme et al. 1995). Indiana bats forage primarily in forested areas along streams or other corridors. Several caves occur near Douglas and Nolichucky reservoirs. However, Indiana bats have not been found in these caves. Suitable summer roosting habitat (e.g., trees with exfoliating bark) exists throughout the study area.

Bald eagles build nests on Douglas Reservoir and downstream of the dam. No nests are currently known on TVA lands; however, this species has nested on TVA parcels in

previous years. Bald eagles are occasionally observed along the Nolichucky River, but no nests are known in the area or near TVA-managed lands. Bald eagle numbers are increasing in east Tennessee, and several TVA parcels on Douglas Reservoir and Nolichucky River provide suitable habitat for this species. Although no longer protected by the ESA, the bald eagle is protected by the Bald and Golden Eagle Protection Act.

Two terrestrial animal species listed by the State of Tennessee are known to occur within 3 miles of the Douglas and Nolichucky reservoirs. The southern bog lemming, state-listed as in need of management, can be found in variable habitats from moist, early successional to forested sites. The species prefers habitats with a prevalence of monocots and sedges (Whitaker and Hamilton 1998). Suitable habitat for this species occurs throughout the project area, especially along the riparian corridor along the Nolichucky River. The Swainson's warbler, state-listed as in need of management, was recently identified on a Nolichucky Reservoir parcel. Habitat for this species exists throughout much of this stretch of the Nolichucky River.

The federally listed as endangered spruce-fir moss spiders and Carolina northern flying squirrels are known from the counties surrounding the reservoirs; however, they are primarily found in high elevations (greater than 5,000 feet) within spruce-fir forests and in mixed conifer-northern hardwood forests of the Blue Ridge Physiographic region. The distribution of spruce-fir moss spiders is restricted to five mountaintops. Carolina northern flying squirrels can occur in forests of varying age and understory density, though most records show a preference for old-growth forest with widely spaced, mature trees (USFWS 1990). These species do not occur on TVA lands surrounding Douglas Reservoir and the Nolichucky River.

3.6.3. Aquatic Animals

Potentially affected sensitive aquatic animals were examined using a “watershed approach.” Sensitive species were selected based upon location within the reservoir watershed and location relative to parcels on the reservoir. Additionally, barriers to aquatic animal passage such as dams and, for certain species, impounded habitat were taken into account.

A review of the TVA Natural Heritage database indicated that a total of 19 federally listed aquatic species have been reported within the watersheds of Douglas and Nolichucky reservoirs. After consideration of the above criteria and evaluation of the likelihood of their occurrence, two federally listed as endangered, one federally listed as threatened, three candidates for federal listing, and five state-listed aquatic species are known to occur near Douglas and Nolichucky reservoirs. A list of these sensitive aquatic species and the associated reservoir is located in Table 3.6-1.

Federally Listed Aquatic Species Near Douglas and Nolichucky Reservoirs

The snail darter is restricted to the upper Tennessee River system, where it occurs in parts of the main river channel and in the lower reaches of some tributaries (Etnier and Starnes 1993). In 1975, TVA transplanted 61 snail darters into a site on the Nolichucky River (River Mile 17.8) as part of the snail darter recovery effort (Biggins and Eager 1983). Recent surveys have failed to encounter any snail darters on the Nolichucky River, and they most likely no longer occur within the area. However, this species has been collected in the French Broad River, downstream from Douglas Dam, and could potentially occur near Douglas Parcel 1.

The oyster mussel is found throughout the Tennessee and Cumberland rivers systems. It prefers shallow riffles in fast current. Adults can reach 70 millimeters in length. The oyster mussel is bradyctictic (females retain parasitic larval mussels or glochidia over the winter) with several darters and the banded sculpin being identified as glochidia host (Parmalee and Bogan 1998). This species has been collected in the Nolichucky River, but not near any TVA land parcels.

The birdwing pearl mussel inhabits riffle areas of small to medium-sized rivers, with sand and gravel substrate in moderate to swift currents. The species is currently restricted to several small populations in the upper Powell and Clinch rivers in Tennessee and Virginia and in the Duck River in middle Tennessee (Parmalee and Bogan 1998). In 1982, TVA transplanted 1,000 individuals of this species into the Nolichucky River approximately 20 miles downstream from Nolichucky Dam (Jenkinson 1983). In 1995, a small birdwing pearl mussel was found at the transplant site, suggesting some reproduction. Although the mussel was not found in a 2000 mussel survey, there is good reason to believe that it still exists in the Nolichucky River below the dam (TVA 2006b).

Federally Listed Candidate Aquatic Species Near Douglas and Nolichucky Reservoirs

The spectaclecase is known to persist in the Clinch and Powell rivers, in a few scattered locations on the Tennessee River, and in other scattered locations from Minnesota and western Pennsylvania south to the Gulf of Mexico (Parmalee and Bogan 1998). This species was collected in the Nolichucky River, near Nolichucky Parcels 25 and 26 during a 1986 TVA mussel survey.

The slabside pearl mussel is known to persist in strong current with sand, fine gravel, and cobble substrate (Parmalee and Bogan 1998). This species was last collected in the Nolichucky River during a mussel survey in 1964, approximately 2 river miles downstream from Nolichucky Parcels 25 and 26.

The fluted kidneyshell inhabits sand and gravel substrate in riffles with swift current (Parmalee and Bogan 1998). This species has been collected in the Nolichucky River approximately 2 river miles downstream from Nolichucky Parcels 25 and 26.

State-Listed Aquatic Species Near Douglas and Nolichucky Reservoirs

The blue sucker inhabits relatively deep, swift waters over firm substrates in larger rivers (Etnier and Starnes 1993). Blue suckers have been collected near Nolichucky Parcels 25 and 26. Both of these sites are located downstream from Nolichucky Dam. They have been collected near Douglas Parcel 1 located downstream from Douglas Dam and above Douglas Dam in the Nolichucky River. Therefore, the species could potentially occur anywhere within the Nolichucky River below Nolichucky Dam downstream to Douglas Reservoir and below Douglas Dam.

The highfin carpsucker prefers a habitat of gravel substrate in relatively clear, medium to large rivers (Etnier and Starnes 1993). This species has been collected near Nolichucky Parcel 23, approximately 1 river mile upstream from Nolichucky Dam. However, this species has been collected in the Nolichucky River and could occur anywhere within Douglas Reservoir.

The lake sturgeon prefers large lakes and rivers, migrating up rivers to spawn over rocky reefs. This benthic species feeds primarily on crayfishes, mollusks, and insect larvae (Etnier and Starnes 1993). This species has been collected in the tailwater of Douglas Reservoir near Douglas Parcel 1.

The tangerine darter is restricted to clearer portions of large to moderate-sized headwater tributaries in the upper Tennessee River system, upstream from the Hiwassee River system (Etnier and Starnes 1993). The habitat typically occupied by this fish is deeper riffles, runs, and pools with large rubble, boulder, and bedrock substrates. Tangerine darters have been collected near Nolichucky Parcel 1, downstream from Nolichucky Dam, and likely occur near Nolichucky Parcels 25-38. In addition, they have been collected in the French Broad River and could potentially occur near Douglas Parcel 1.

The rosyface shiner commonly occurs in all upland physiographic provinces in Tennessee (Etnier and Starnes 1993). This fish prefers large creeks and small rivers with clear water and rubble, boulder, and bedrock substrates with considerable current. The rosyface shiner has been collected downstream of Nolichucky Dam and could potentially occur near Nolichucky Parcels 25 to 38 and Douglas Parcel 1.

Federally Listed Aquatic Species Historically Near Douglas and Nolichucky Reservoirs

The Cumberland bean occurs in small rivers and streams in gravel or sand substrate with fast current in riffle areas (Parmalee and Bogan 1998). It is restricted to a very few streams and rivers in the upper Cumberland River and its tributaries in Kentucky (Bogan and Parmalee 1983). This species is represented only by long-dead (relict) shells found in Lick Creek during a survey in 1967. The available information suggests that this species no longer occurs in the Nolichucky River watershed.

The pink mucket is typically a big river species, but occasionally individuals become established in small to medium-sized tributaries of large rivers. The species inhabits rocky bottoms with swift current usually in less than 3 feet of water (Parmalee and Bogan 1998). One female was collected near Nolichucky Parcels 32 and 34 in 1964. Since the pink mucket has not been collected in the area in decades (the most recent record is almost 50 years old), it is assumed that the species no longer occurs in the area.

The rough rabbitsfoot (*Quadrula cylindrica strigillata*) is known to persist in small to medium-sized rivers with clear, shallow water in sand and gravel substrate (Parmalee and Bogan 1998). This species is represented only by a subfossil shell found in Lick Creek during a survey in 1967. The available information suggests that this species no longer occurs in the Nolichucky River watershed.

Nolichucky River Unit 6 DCH for the federally listed as endangered oyster mussel and Cumberlandian combshell extends from NRM 9 (approximately 4 miles upstream of Enka Dam) to Susong Bridge in Hamblen and Cocke counties in Tennessee. The Nolichucky River currently supports a small population of oyster mussels and was historically occupied by Cumberlandian combshell.

Federally Listed Candidate Aquatic Species Historically Near Douglas and Nolichucky Reservoirs

The chucky madtom is a recently described species that is apparently closely related to members of the elegant madtom species group (*Noturus elegans*). The range of this madtom is uncertain. Within the Nolichucky River watershed, the chucky madtom is known only from Little Chucky Creek, a tributary that flows into the river at NRM 23.5. This rare madtom is unlikely to occur in habitats that could be affected by this land planning process.

The rayed bean is known to persist in sand substrate among rooted aquatic vegetation in shallow water with current (Parmalee and Bogan 1998). This species was last observed in

the Nolichucky River in 1964, approximately 2 river miles downstream from Nolichucky Parcels 25 and 26.

State-Listed Aquatic Species Historically Near Douglas and Nolichucky Reservoirs

The Tennessee clubshell occurs in the Tennessee and Cumberland rivers drainages. It prefers substrate of coarse gravel and sand in small shallow creeks and rivers with good current. It is thought to be tachytictic (parasitic larval mussels or glochidia are only found in the gills of females during the summer). Several fish species have been shown to serve as glochidia hosts (Parmalee and Bogan 1998). This species is represented only by a long-dead (relict) shell found in Little Chucky Creek in 1991. The available information suggests that this species no longer occurs in the Nolichucky River watershed.

The spiny riversnail is found in rapid, well-oxygenated waters of shoals and riffles of rivers, but not in slack water below shoals. The reservoir habitat associated with the land parcels under consideration in the DNTRLMP would not support the spiny riversnail.

3.7. Wetlands

Wetlands are defined by TVA Environmental Review Procedures (TVA 1983) as: “[T]hose areas inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, mud flats, and natural ponds.”

Wetlands are ecologically important because of their beneficial effect on water quality, their moderation of flow regimes by retaining and gradually releasing water, their value as wildlife habitat, and as areas of botanical diversity. Wetlands exist within and adjacent to TVA reservoirs, and are influenced by surface water and groundwater connections to the water levels in these reservoirs.

For the purposes of this EIS, broad estimates of wetland type and extent for each reservoir were determined using USFWS National Wetlands Inventory maps combined with data sets developed for TVA’s 2004 *Reservoir Operations Study*. These data sources are based primarily on interpretation of aerial photographs. The wetland area of each reservoir includes wetlands located along the entire reservoir shoreline as well as wetlands located adjacent to the reservoir shoreline that are within the groundwater influence area of the reservoir (TVA 2004a). The National Wetlands Inventory data include wetlands located on all land adjacent to each reservoir regardless of ownership. Wetlands associated with TVA parcels on Douglas and Nolichucky reservoirs are summarized by area and type in Table 3.7-1.

Table 3.7-1. Summary of Wetlands on Douglas and Nolichucky Reservoirs by Area and Type

Reservoir	Combined Aquatic Beds and Mud Flats (acres)	Emergent (acres)	Forested (acres)	Scrub-Shrub (acres)	All Types (acres)
Douglas	3,656	281	270	477	4,684
Nolichucky	<10	30	276	18	334
Totals	3,666	311	546	495	5,018

General data regarding wetland type, rarity, and importance can be analyzed both by ecoregion and by watershed. Both Douglas and Nolichucky reservoirs are in the Ridge and Valley ecoregion as described by Griffith et al. (1998) and are located within the French Broad River watershed. Land use/land cover data generated by USEPA in 1999 indicated wetlands comprise less than 0.2 percent of overall land use types in this region (TDEC 2008a; 2008b).

The relatively steep and rolling topography of the region affects the type, location, and extent of wetlands. In general, low-lying, poorly drained areas are confined to floodplains, and large (>10 acres) wetlands are uncommon. Wetlands on and near Douglas Reservoir are primarily riverine/floodplain forests located in the floodplains of rivers and streams. Small areas of emergent/scrub-shrub wetlands (typically less than 0.10 acre) are associated with reservoir shorelines and coves. Isolated wetlands such as bogs, seeps, and fens are relatively rare. Aquatic bed wetlands and mudflats are seasonal habitats; aquatic bed wetlands are associated with the summer growth of aquatic vegetation and are relatively uncommon on Douglas and Nolichucky reservoirs. Mudflat habitats are more common as these habitats are associated with reservoir drawdowns. Douglas Reservoir has extensive areas of mudflats in Rankin Bottoms and in the main stem of the reservoir near the Interstate-40 bridge. The data presented in Table 3.7-1 reflects this seasonality, where the large amount of aquatic bed and mudflat habitat shown for Douglas Reservoir is a function of the time of year when aerial photography was processed.

Though the Nolichucky Reservoir is much smaller in area than Douglas Reservoir, it contains wetland habitats that are larger in size and more ecologically diverse. Siltation associated with historical upstream mining activities has created extensive and unique wetland types as sediment has filled in the reservoir. These wetlands include mixes of forested areas, scrub-shrub wetlands, and emergent/herbaceous wetlands. Wetlands below Nolichucky Dam are typically more riverine and associated with islands and floodplains.

Although a few of the floodplain wetlands in the Nolichucky Reservoir area have been impacted by cattle, many of the areas are relatively undisturbed by human activity. Ecologically, these undisturbed areas represent some of the best examples of wetland communities that exist in the Tennessee River Valley (TVA 2006a).

As noted in Section 3.5.2 on invasive species, populations of the purple loosestrife have been observed in many of the wetlands around Nolichucky Reservoir and along the reservoir shoreline (TVA 2006a). This invasive plant was found in highest densities in the island and sandbar wetlands close to the dam, on tree stumps and stationary logs all around the reservoir shoreline, and in many of the floodplain wetlands. Individual plants also were seen in at least one location downstream from Nolichucky Dam. Each purple loosestrife plant produces hundreds of thousands of seeds, and the species can spread rapidly throughout a wetland or a river system. Since it arrived in North America in the early 1800s, purple loosestrife has become widespread, including many locations in the Tennessee River Valley. Once it becomes established, this plant dominates formerly diverse emergent wetlands, excluding other plant species and the variety of animal species that depend upon them (USDA 2009).

Trends for Douglas and Nolichucky Reservoirs

Large-scale analysis of land cover data and changes over time by ecoregion indicate an overall loss of forested wetland habitat in the Ridge and Valley ecoregion (Loveland and Acevedo 2006). This loss is associated primarily with urbanization and agriculture.

Emergent and scrub-shrub wetland acreage has remained relatively stable in the last 20 years, with some gain in open water/pond habitats (Dahl 2006).

Field surveys were conducted to determine types and locations of wetlands on uncommitted parcels on each reservoir. Wetland determinations were performed according to the USACE standards, which require documentation of hydrophytic (i.e., wet-site) vegetation, hydric soil, and wetland hydrology (Environmental Laboratory 1987; Reed 1997; U.S. Department of Defense and USEPA 2003). Broader definitions of wetlands, such as that used by the USFWS (Cowardin et al. 1979), and the TVA Environmental Review Procedures definition (TVA 1983) were also considered in this review. Wetlands on uncommitted parcels were also categorized according to their ecological condition. Using a TVA-developed modification of the Ohio Rapid Assessment Method (Mack 2001), known as the TVA Rapid Assessment Method (TVARAM), specific to the TVA region, selected wetlands were categorized by their functions, sensitivity to disturbance, rarity, and irreplaceability.

According to TVARAM methodology, wetlands may be classified into three categories. Category 1 wetlands are considered “limited quality waters” and represent degraded aquatic resources. Category 2 includes wetlands of moderate quality and wetlands that are degraded but have reasonable potential for restoration. Category 3 generally includes wetlands of very high quality or of regional/statewide concern, such as wetlands that provide habitat for threatened or endangered species.

On Douglas, 15 uncommitted parcels were field surveyed for wetlands. Of these 15 parcels, only three did not contain wetlands due to the steep topography or lack of hydrology. Shorelines on virtually all the parcels contain a scattered mix of scrub-shrub and emergent vegetation. High-quality Category 3 forested wetlands are present on Parcels 28 and 47; these parcels were ranked as high quality due to a mix of forested/scrub-shrub/emergent habitats and the diversity of the plant communities. Common vegetation associated with forested wetlands on Douglas Reservoir includes box elder, sycamore, silver maple, persimmon, silky dogwood, and black willow. Vegetation representative of scrub-shrub and emergent wetlands on Douglas Reservoir includes spicebush, buttonbush, rice cutgrass, soft rush, swamp rosemallow, false nettle, smartweed, and sedges. With the exception of Parcels 28 and 47 described above, the smaller, shoreline wetlands on Parcels 2, 10, 25, 37, 45, 51, and 52 were all Category 2, moderate-quality wetlands due to their small size and relative lack of habitat diversity.

Nolichucky Reservoir has 12 uncommitted parcels. Three of these parcels are above Nolichucky Dam. Field surveys indicate scattered, small Category 2 (moderate quality) emergent and scrub-shrub wetlands are present along the shoreline of Parcel 12. Nine uncommitted parcels are located below Nolichucky Dam. This section is more riverine in nature; Parcels 26, 31, 33, and 34 have a mix of Category 3 (high quality) scrub-shrub, emergent, and forested wetland habitats associated with islands and lower-lying floodplain areas. Parcels 30, 35, 36, 37, and 38 do not contain wetlands due to the steep topography. Common wetland vegetation includes sycamore, soft rush, black willow, slippery elm, cattail, silky dogwood, smartweed, river birch, jewelweed, river cane, waterwillow, and spikerush.

3.8. Floodplains

As a federal agency, TVA is subject to the requirements of EO 11988 (Floodplain Management). The objective of EO 11988 is “to avoid to the extent possible the long and

short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.” As part of the *Nolichucky Reservoir Flood Remediation Final Environmental Impact Statement* (TVA 2006a), TVA identified the boundaries of the 100-year and 500-year floodplains around Nolichucky Reservoir. The floodplain boundaries for Douglas Reservoir have not been identified. Descriptions of these floodplains are provided in the RLMPs (Volumes II-III).

3.9. Cultural Resources

The Appalachian Highland region has been inhabited for at least 12,000 years. The areas around the major waterways of the region were the focus of prehistoric habitation, resource acquisition, and ceremonial activity for all of this time. Intensification of prehistoric occupation of the Appalachian Highlands is indicated by the frequency of archaeological sites attributable to the succeeding series of temporal/cultural traditions beginning with the Paleo-Indian Stage (ca. 12000-8000 B.C.) and continuing through the Archaic (8000-1200 B.C.), the Woodland (1200 B.C.-1000 A.D.), and the Mississippian (1000-1500 A.D.) stages. Following European contact, drastic cultural changes occurred, which for explanatory purposes, have been divided into the Protohistoric-Contact Stage (1500-1750 A.D.) and the subsequent Historic era, which includes the Cherokee (1700 A.D.-present) and European- and African-American (1750 A.D.-present) occupations. The sustained presence of Native American groups in the Appalachian Highlands and their continuation of traditional religious and cultural practices are of great importance to communities of the region.

TVA is mandated under the NHPA of 1966 and the Archaeological Resources Protection Act (ARPA) of 1979, as well as other legislation, to protect historic properties located on TVA land or affected by TVA undertakings. A historic property is defined in 36 CFR § 800.16(l)(1) as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places.” In response to this mandate, TVA conducts inventories of its land to identify historic properties.

Prior to an undertaking, TVA must conduct the phased identification and evaluation procedure set forth in the 36 CFR § 800.4(b)(2) regulations of the Advisory Council on Historic Preservation and comply with Section 106 of the NHPA in order to identify, evaluate, and assess effects on historic properties and to determine the appropriate course of action. An undertaking is defined under 36 CFR § 800.16(y) as:

[A] project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval.

The area of potential effect (APE), as defined in 36 CFR § 800.16(d), is “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.” For the DNTRLMP, TVA has identified the APE as the 2,055 acres of TVA-managed land on Douglas Reservoir and the 1,136 acres of TVA-managed land on Nolichucky Reservoir, a total of 3,191 acres.

3.9.1. Archaeological Resources

To support characterization of TVA-managed lands around the Douglas and Nolichucky reservoirs, TVA conducted surveys for archaeological sites along portions of the Nolichucky

River. Additionally, TVA evaluated results of previous surveys conducted along Douglas and Nolichucky reservoirs. The TVA-managed land around the reservoirs has not been systematically and completely surveyed for cultural resources. However, a number of archaeological sites have been identified on both the Douglas and Nolichucky reservoirs. Some sites are located below the full summer pool elevation. Certain sites are eligible or potentially eligible for listing in the NRHP. Descriptions of known archaeological resources are provided in the RLMPs (Volumes II-III). As projects are proposed for the Douglas and Nolichucky reservoirs lands, TVA will consider and address the effects to archaeological sites through compliance with Section 106 of the NHPA.

3.9.2. Historic Structures

Pursuant to Section 106 of the NHPA, TVA protects important historic structures located on TVA lands or affected by its undertakings. Such structures over 50 years old (including farmhouses, communities, resorts, fortifications, churches, and cemeteries) occur on or near TVA land on the Douglas and Nolichucky reservoirs.

Initially, European settlement in the early 19th century developed into an agricultural economy with farmsteads and small towns. Transportation networks evolved along the Tennessee River and its tributaries. Towns grew and prospered, and a plantation economy developed. Towns became river ports, and many ferry crossings were established. The later development of the railroad resulted in rail lines following the river valley. The Civil War brought destruction and economic devastation to the Valley. Following this war, development was slow. Agriculture, commerce, industry, and the river and rail systems gradually expanded.

The creation of TVA and the development of the Nolichucky and Douglas reservoirs resulted in further important changes to the region. The acquisition of land for the reservoirs resulted in the removal of many structures and other man-made features on these TVA lands. Very few structures remained, though many historic structures do remain on adjacent non-TVA lands. Historic structures (and other man-made features) remain from all of these historical periods. The earliest settlements tended to be on the waterways, and many of these were lost to TVA's reservoir development. In addition, the richest farmlands and the most prosperous farms and plantations were located on the river bottoms. Many of these were also lost.

A major historical structures survey has not been conducted for Nolichucky and Douglas reservoirs. However, to the extent practicable, structures over 50 years old were identified utilizing planimetric map data. Additionally, a windshield survey was conducted for those parcels that were deemed uncommitted during the scoping and preallocation process. Results of the survey indicated no historic structures are located on uncommitted parcels. However, presence of historic structures on all Douglas-Nolichucky lands cannot be ruled out until a site visit has been conducted.

3.10. Managed Areas and Ecologically Significant Sites

This section addresses natural areas that are on, immediately adjacent to, or within 3 miles of both the Douglas and Nolichucky reservoirs. Natural areas include managed areas, ecologically significant sites, and Nationwide Rivers Inventory (NRI) streams.

Managed areas include lands held in public ownership that are managed by an entity (e.g., TVA, USDA, USFS, State of Tennessee, Greene County) to protect and maintain certain

ecological and/or recreational features. A management plan or similar document defines what types of activities are compatible with the intended use of the managed area.

Ecologically significant sites are either tracts of privately owned land that are recognized by resource biologists as having significant environmental resources or identified tracts on TVA lands that are ecologically significant but not specifically managed by TVA's Natural Areas Program.

NRI streams are free-flowing segments of rivers recognized by the National Park Service (NPS) as possessing remarkable natural or cultural values.

3.10.1. *Natural Areas on TVA Lands*

A review of the TVA Natural Heritage database indicated one natural area managed by the TVA Natural Areas Program is on the Douglas and Nolichucky reservoirs, and 11 managed areas are located on or immediately adjacent to Douglas and Nolichucky reservoirs (see Table 3.10-1), including the mapped study areas outside the boundaries of the reservoirs' proper. Descriptions of these natural areas are found in parcel descriptions in the accompanying RLMPs.

Table 3.10-1. Natural Areas on TVA Douglas and Nolichucky Reservoirs Lands

Reservoir	Natural Area	Steward	Location
Douglas	Trotter Bluff Small Wild Area	TVA-managed	Douglas Tailwater Parcel 1
	Lower French Broad and Lower Holston Rivers Nonessential Experimental Population Status	USFWS	Douglas and Cherokee Dam Tailwater, in Holston and French Broad Rivers, Parcel 1
	French Broad River Nationwide Rivers Inventory	NPS	FBRMs 0.0 to 32.0 below Douglas Dam
	Rankin Bottom State WMA	TWRA	Parcel 33
	Henderson Island Refuge	TWRA	Parcel 13
	Dandridge Municipal Park	City of Dandridge	Parcel 14
	Sevier County Park	Sevier County	Parcel 61
Nolichucky	Kinser Park	Greene County	Parcel 4
	Davy Crockett Lake Potential National Natural Landmark	NPS	Nolichucky Parcels from NRM 46.0 to Bird Bridge, NRM 50.5
	Nolichucky State WMA	TWRA	Nolichucky Parcels from NRM 46.0 to Bird Bridge, NRM 50.5
	Davy Crockett Birthplace State Park	TDEC	NRM 68.5

Douglas Reservoir

Seven managed areas are on or immediately adjacent to Douglas Reservoir and include Trotter Bluff TVA Small Wild Area (SWA), the Lower French Broad and Lower Holston River Nonessential Experimental Population Status (NEP) area, the French Broad River (one segment NRI-listed and one segment designated a State Scenic River), Rankin Bottom State WMA, Henderson Island Refuge, Dandridge Municipal Park, and Sevier County Park.

Trotter Bluff TVA SWA is the only TVA-managed natural area on Douglas and Nolichucky reservoirs lands. It is located on a portion of Parcel 1 of Douglas Reservoir and is described in Volume II, Section 4.0.

The Lower French Broad and Lower Holston Rivers NEP area extends from the base of Douglas Dam (FBRM 32.3) downstream into Knox and Sevier counties, Tennessee, to its confluence with the Holston River and then upstream as the Holston River flows through Knox, Grainger, and Jefferson counties, Tennessee, to the base of Cherokee Dam (Holston River Mile 52.3) and includes the lower 5 river miles of all tributaries that enter these river reaches. Since these river reaches are historic ranges for federally listed species (15 endangered mussels, one endangered snail, and two endangered fish species, as well as three threatened fish species), the NEP designation allows USFWS to reintroduce these species at some point in the future. To date, none of these species have been reintroduced. This area is located on Parcel 1 of Douglas Reservoir and is described in Volume II, Section 4.0.

The French Broad River, from River Mile 0.0 at the confluence with the Tennessee River to River Mile 32.0 below Douglas Dam, is NRI-listed. The NPS recognizes this stream segment for the following Outstanding Resource Values: scenic, recreational, geologic, fish, wildlife, historic, and cultural. Another approximate 30-mile segment of the French Broad, from the North Carolina state line to its confluence with Douglas Reservoir (south of Parcel 33), is designated by the State of Tennessee as a Class III (Developed River Area) State Scenic River. The Tennessee Scenic Rivers Program was established to preserve rivers or segments of rivers in their free-flowing natural or scenic conditions and to protect their water quality and adjacent lands.

The Rankin Bottom State WMA is a 1,255-acre area in Cocke County that extends north and south of Rankin Bridge; Parcel 33 is included in this WMA. It is managed by TWRA for small and large game hunting. Waterfowl hunting is allowed during deer season. Over half of this area, approximately 740 acres, is recognized by TWRA as a State Wildlife Observation Area. The mudflats, marshes, and sloughs in the area offer opportunities to view shorebirds, primarily during the fall migration from nearby roadsides, the shoreline, or on the water. No observation facilities are available.

Henderson Island Refuge, a 300-acre area in Jefferson County, is managed by TWRA. Listed as Parcel 13 in the Douglas RLMP, it is described in Volume II, Section 4.0.

Dandridge Municipal Park is listed as Parcel 14 in the Douglas RLMP and is described in Volume II, Section 4.0.

Sevier County Park is listed as Parcel 61 in the Douglas RLMP and is described in Volume II, Section 4.0.

Nolichucky Reservoir

Four managed areas are on or immediately adjacent to Nolichucky Reservoir and include Kinser Park, Davy Crockett Lake Potential National Natural Landmark (PNNL), Nolichucky State WMA, and Davy Crockett Birthplace State Park. No TVA-managed areas are located on this reservoir, and no NRI streams or Wild and Scenic Rivers are in the vicinity of Nolichucky Reservoir. Additionally, no natural areas were indicated in the vicinity of Parcels 25-38.

Kinser Park, Parcel 4 in the Nolichucky RLMP, is described in Volume III, Section 4.0.

Davy Crockett Lake PNNL, an approximate 1,000-acre area extending from Nolichucky Dam (NRM 46.0) upstream to Bird Bridge (NRM 50.5), was proposed in the mid-1980s as a

PNNL. The area was noted for the combination of wetland and floodplain communities that occur around the reservoir and the migrating waterfowl these habitats attract. The National Natural Landmark Program was established in the 1970s by the NPS to identify nationally significant examples of ecologically pristine or near-pristine landscapes. Davy Crockett Lake, while considered to meet the listing criteria, has not been registered as a National Natural Landmark.

The **Nolichucky State WMA**, with the same approximate acreage and extent as the Davy Crockett Lake PNNL described above, is managed for small game, waterfowl, and big game hunting by TWRA under a license agreement with TVA. To allow the area to function as a waterfowl refuge for a portion of the year, the area is closed to all hunting and access one week before and during the late duck season; see description of Parcel 24 in the Nolichucky RLMP, Volume III, Section 4.0.

Davy Crockett Birthplace State Park, located at approximately NRM 68.5, is a 105-acre area in Greene County that is preserved by TDEC as a historic site. The park features a museum, a cabin replica, a natural stone Crockett monument wall, recreational-vehicle and tent campground sites near the Nolichucky with water, electricity, and sewer hookups, a swimming pool, a playground, and a large picnic pavilion.

3.10.2. Additional Natural Areas Within a 3-Mile Radius of Douglas-Nolichucky Lands

No additional natural areas are within a 3-mile radius of Douglas Reservoir.

Three additional natural areas are within a 3-mile radius of Nolichucky Reservoir. These include the Tobacco University of Tennessee (UT) Agricultural Experiment Station (approximately 0.7 mile northeast of Parcel 5), the Unicoi State Bear Reserve/Cherokee (North) WMA (approximately 2.5 miles south of the Nolichucky River at NRM 70.0), and the Cherokee National Forest (approximately 2.5 miles east of the Nolichucky River at NRM 61.0).

The **Tobacco UT Agricultural Experiment Station** is a 500-acre area owned by UT. Research in burley tobacco production and beef cow and calf production is conducted on the property.

The **Unicoi State Bear Reserve** is managed by TWRA and is within that part of the North Cherokee WMA that is lying west of U.S. Highway 23 and Devils Fork Road, north of the Tennessee/North Carolina state line, east of Horse Creek Road to Highway 107 and south of Highway 107 to Erwin. Wild boar hunting with dogs and bear hunting are not permitted in this area unless a special exception is provided by proclamation.

Cherokee National Forest, a 640,000-acre forest located in eastern Tennessee along the North Carolina border, is managed by the USFS for outdoor recreation, wildlife and fish habitat, wilderness, water quality, minerals, wood products, and other uses.

3.11. Visual Resources

The physical, biological, and cultural features seen in the landscape give reservoir land its distinct visual character and sense of place. Varied combinations of these elements make the scenic resources of any portion identifiable and unique. Areas with the greatest scenic value such as islands, bluffs, wetlands, or steep forested ridges generally have the least capacity to absorb visual change without substantial devaluation. In the planning process,

comparative scenic values of reservoir land were assessed to help identify areas for scenic conservation and scenic protection. Four broad visual characteristics were evaluated. Two of these distinct but interrelated characteristics—viewing distance and human sensitivity—are commonly considered together as scenic visibility:

Scenic attractiveness is the measure of outstanding or unique natural features, scenic variety, seasonal change, and strategic location.

Scenic integrity is the measure of human modification and disturbance of the natural landscape.

Viewing distance indicates scenic importance based on how far an area can be seen by observers and the degree of visible detail.

The foreground distance is within 0.5 mile of the observer where details of objects are easily distinguished. Details are most significant in the immediate foreground from 0 to 300 feet.

Middleground is normally between 0.5 mile and 4 miles from the observer where objects may be distinguishable, but their details are weak and tend to merge into larger patterns.

Background is the landscape seen beyond 4 miles where object details and colors are not normally discernible unless they are especially large, standing alone, or provide strong contrast. Figure 3.11-1 illustrates the viewing distance parameters.

Human sensitivity is the expressed concern of people for the scenic value of the land under study. Concerns are derived or confirmed by public meetings and surveys. Sensitivity also includes considerations such as the number of viewers, frequency, and duration of views.

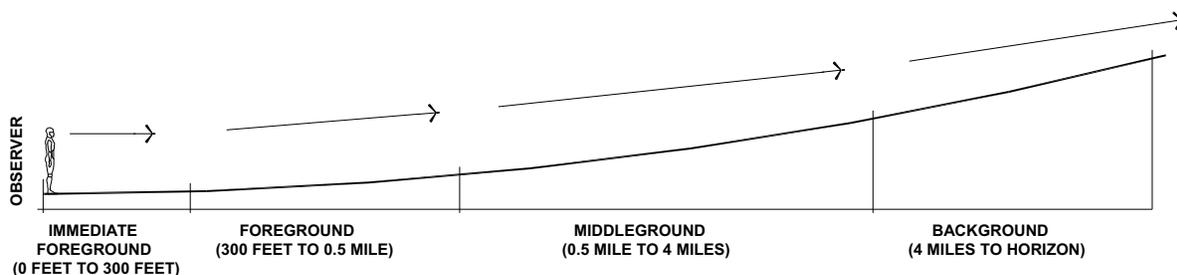


Figure 3.11-1. Viewing Distance

Where and how the reservoir landscape is viewed affects human perceptions of its aesthetic quality and sense of place. These impressions of the visual character can significantly influence how the scenic resources of public lands are appreciated, protected, and used.

Douglas and Nolichucky reservoirs include islands, secluded coves, and wetlands that are framed by high wooded ridges. Since the scenic features of the landscape are not limited by land boundaries, the attractive landscape character extends across TVA public and private land alike. The natural elements together with the communities and other cultural development provide a scenic, rural countryside.

Land uses adjacent to the reservoirs include residential development, public parks, and sporadic industrial features. The reservoirs offer abundant water-recreation opportunities along with a variety of scenery. Most creek embayments are broadly open at the mouth, and some wind over a mile to their headwaters.

Among the scenic resources of each of the reservoirs, the water body itself is the most distinct and outstanding aesthetic feature. The horizontal surface provides visual balance and contrast to the islands and wooded hillsides. The reservoirs weave around ridges and bends, changing views periodically seen from the water. The water body also links the other landscape features together. Views across the water are satisfying and peaceful to most observers.

Islands are another significant feature. The islands provide scenic accents and visual reference points throughout the reservoirs and serve as visual buffers for less desirable views. They also provide a pleasing foreground frame for the distant shoreline or background.

Other important scenic features include the secluded coves and steep, wooded ridges that occur around the reservoirs. The isolated coves with wooded shoreline provide relatively private locations for dispersed recreation activities. Significant elevation changes along some stretches of shoreline provide a dramatic contrast to the surrounding reservoir and gently sloping countryside, particularly when they are viewed from background distances.

Most shorelines upstream of the dams appear natural. Slopes and ridgelines seen from the reservoirs are generally heavily vegetated with mature hardwood and evergreen trees and provide positive visual contrast to the reservoirs. There is usually little development in the foreground distances.

3.12. Water Quality

3.12.1. General Water Quality Characteristics

Water quality in the Douglas and Nolichucky reservoirs and their tailwaters is influenced by numerous factors including the size, geology, and land use conditions in upstream drainage areas, point and nonpoint discharges of pollutants, adjacent land use activities, and the operation of the reservoir. The reservoirs are in the French Broad River watershed, which lies within two distinct ecoregions (Blue Ridge Mountains and Ridge and Valley) with different geological characteristics and land use patterns that affect water quality.

The French Broad River watershed is one of the largest watersheds in the Tennessee Valley, and about half of its watershed is in Tennessee and half is in North Carolina. The French Broad River and its two large tributaries (Nolichucky and Pigeon rivers) originate in the Blue Ridge Mountains. The Nolichucky River originates in the highlands of the Blue Ridge ecoregion in North Carolina and flows for 110 miles westward across part of the Ridge and Valley ecoregion in Tennessee to where it empties into the French Broad River. All three of these rivers merge at the upper end of Douglas Reservoir, the only sizable reservoir in the watershed.

- The Ridge and Valley ecoregion is characterized by numerous ridges and valleys underlain by sedimentary rocks. The dissolution of the limestone and dolomite that underlie much of the valleys results in naturally high concentrations of dissolved minerals in the streams. The area has a relatively large population with substantial

industrial development. The water in the French Broad River is moderately hard and generally contains high nutrients concentrations.

- The Blue Ridge ecoregion is mostly forested because of the mountainous terrain and a large proportion of land within the national forest. The geology is primarily metamorphic and igneous rocks with minor areas of sedimentary geology. Because much of the ecoregion is underlain by rocks that are relatively insoluble and surface water drainage is rapid, streams draining this area generally contain relatively low concentrations of nutrients and dissolved minerals.

Impoundments like Douglas Reservoir convert typical riverine environments into lakelike conditions, thereby effecting change to many aspects of the aquatic environment, such as water temperature, dissolved oxygen (DO), nutrient dynamics, algal productivity, and aquatic life, in the reservoirs themselves and the rivers downstream. The length of time water is retained in a reservoir (residence time) is one of the primary mechanisms influencing these changes. Table 3.12-1 gives the average annual residence time and other physical characteristics of Douglas Reservoir.

Nolichucky Dam is located at NRM 46.0, and the reservoir extends about 6 miles upstream. Nolichucky Dam was built in 1913. Because of sediment-related problems, power production has stopped, and the project does not have a flood protection purpose. The project has been used for wildlife management, recreation, and environmental education since 1972. In 1995, the gates were concreted shut and water flows unregulated over the spillway at elevation 1,240.9 feet. In 1999, when the sediment volume was last evaluated, the remaining water volume in the reservoir pool was estimated to be about 1,716 acre-feet below elevation 1,240.9 feet. This open water volume is probably maintained by continued scouring in the active river channel. The average residence time in Nolichucky Reservoir is less than one day. Table 3.12-1 gives the average annual residence time and other physical characteristics of Nolichucky Reservoir.

Table 3.12-1. Physical and Operational Characteristics of Douglas and Nolichucky Reservoirs

Reservoir	River Basin	Drainage Area (square miles)	Length of Reservoir (miles)	Mean Annual Flow (cubic feet per second) ¹	Full Pool		Mean Depth (feet) ⁴	Residence Time (days) ⁴
					Area ² (acres)	Volume ³ (10 ³ acre-feet)		
Douglas	French Broad	4,541	43.1	6,495	30,401	1,408	14.1	49
Nolichucky	Nolichucky	1,183	6.0	1,838	383	1.706	X	1

1. Mean annual flow 1990-2008 for Douglas and 1990-2007 for Nolichucky

2. Nolichucky Reservoir area at spillway elevation 1,240.9 feet

3. Nolichucky Reservoir volume below elevation 1,240.9 feet

4. Mean depth and residence time are based on average for Douglas and at elevation 1,240.9 feet for Nolichucky

Relatively little sedimentation data have been collected for the Nolichucky Reservoir over the years, but enough information is available to show that the large volume and long duration of the sediment load in the Nolichucky watershed is unique in the Tennessee River system. In recent decades, regulations affecting the sediment sources have resulted in declining sedimentation rates and improvements to water quality; however, so much sediment remains in the river channel that high sedimentation rates in parts of the Nolichucky River are likely to continue for many more years (TVA 2006a).

In 2000, the physical and chemical characteristics of the sediments in Nolichucky Reservoir were determined by analyzing core samples collected at five land-accessible sites (NRMs 46.0, 46.6, 47.7, 56.6, and 60.4). No polychlorinated biphenyls (PCBs) or pesticides were detected, and all metals concentrations were within expected background levels (TVA 2006a).

Basic water quality information was collected at NRMs 20.8, 38.5, 39.3, 41.8, 57.2, 63.0 and 66.8 by TDEC (STORET data 1999-2008) and at NRM 10.3 by TVA (TVA data 1989-2008). The maximum temperature measurement was 28.5 degrees Celsius. The pH ranged from 6.5 to 8.7, and DO concentrations ranged from 2.6 to 17.3 milligrams per liter (mg/L). DO was below 5 mg/L at NRM 20.8 during two sampling events. The water in the Nolichucky River is moderately hard, averaging about 70 mg/L, with moderate alkalinity (average total alkalinity of 68 mg/L). Average organic nitrogen (0.276 mg/L), nitrate+nitrite nitrogen (0.59 mg/L), and total phosphorus (0.070 mg/L) concentrations were in the midrange of average concentrations found at 12 TVA stream monitoring sites across the Tennessee Valley.

3.12.2. Water Quality Monitoring

Water quality in TVA reservoirs is evaluated by several programs designed to monitor the chemical and biological conditions of the aquatic environment.

State-Designated Impaired Waters

The States of Tennessee and North Carolina conduct water quality testing in accordance with requirements of the CWA. State assessment results are compiled biennially and reported to the public. The principal vehicles for this water quality assessment reporting are the state 305(b) Report and 303(d) List (North Carolina Department of Environment and Natural Resources [NCDENR] 2008; TDEC 2008c). These reports present how well waters support designated uses as well as likely causes and potential sources of impairment.

Many segments of the French Broad and Nolichucky rivers systems are listed by the States of Tennessee and North Carolina as water-quality impaired under Section 303(d) of the CWA. Impaired waters have one or more properties that violate state water quality standards. They are considered impaired by pollution and not fully meeting designated uses, such as recreation (e.g., swimming and fishing), propagation of aquatic life, or water supply. The Tennessee state-designated impaired waters include the Nolichucky Reservoir. The reason for the impaired designation is a loss of biological integrity due to siltation.

State-designated impaired waters also include other segments of the Nolichucky River and streams or segments of streams flowing into Nolichucky River. Tennessee lists 94 stream segments or about 712 stream miles in the Tennessee portion of the Nolichucky watershed as impaired or partially impaired. North Carolina lists five stream segments or approximately 43 stream miles as impaired in the Nolichucky River system. The most common reasons for a stream to be impaired are the loss of biological integrity due to siltation, followed by the presence of elevated levels of bacteria. The most common sources of stream impairment are nonpoint source pollution from agriculture (e.g., pasture grazing).

State-designated impaired waters also include streams flowing into Douglas and its tailwater. The Tennessee water quality assessment reports list about 210 stream miles as impaired or partially impaired within this watershed (i.e., Lower French Broad River Basin;

HUC 06010107). The most common reasons for a stream to be impaired are the presence of elevated levels of bacteria and loss of biological integrity due to siltation and habitat loss, followed by low pH. The most common sources of stream impairment are nonpoint source pollution from agriculture and urban runoff.

The state-designated impaired waters include the reservoir tailwater below Douglas. Reasons for the impaired designation in the tailwater include flow alteration, low DO concentrations, and thermal modification, with the source being the releases from Douglas Dam. In the reservoir, the reason for impairment is accumulated mercury in fish tissue. The fish consumption advisories issued for Douglas Reservoir are discussed below.

Fish Consumption Advisories

TVA maintains a program to examine contaminants in fish fillets from TVA reservoirs and their major tributary streams. TVA coordinates fish tissue studies in the Tennessee Valley with state agencies that are responsible for protecting public health and issuing a fish consumption advisory if warranted. TVA assists the states by collecting fish from TVA reservoirs and checking the tissue for metals, pesticides, PCBs, and other chemicals that could affect human health. Typically, channel catfish and largemouth bass are monitored.

The State of Tennessee has issued a precautionary advisory for the consumption of largemouth bass from the upper reach of Douglas Reservoir from Rankin Bridge (FBRM 71.4) to Highway 321 (FBRM 77.5) because of elevated mercury concentrations. A precautionary advisory means that pregnant women, nursing mothers, and children should not eat the fish species named. All others should limit consumption of the named species to one meal per month.

There is no State of Tennessee fish consumption advisory for the Nolichucky watershed. There is a statewide fish consumption advisory in North Carolina due to mercury concentrations. The state advises women of childbearing age (15 to 44 years), pregnant women, nursing mothers, and children under age 15 against eating largemouth bass. All others should eat no more than one meal per week of largemouth bass.

Swimming Advisories

The states evaluate water quality by performing and evaluating bacteriological (*Escherichia coli*) monitoring. When test results warrant, the states issue water contact advisories. Currently, there are no state advisories against swimming in Douglas or Nolichucky reservoirs. An advisory has been issued for Leadvale Creek in Jefferson County, which flows directly into Douglas Reservoir, and the Little Pigeon River, which is located in Sevier County and flows into the French Broad River downstream of Douglas Dam.

Reservoir Ecological Health

Since 1990, TVA has implemented the Reservoir Ecological Health Monitoring Program to determine a particular reservoir's health as compared to other reservoirs in the TVA system, to provide data for comparing future water quality conditions, and as a screening program to target needs for more detailed studies (TVA 2006b). As a part of this program, TVA developed a reservoir ecological health scoring system to aid in data evaluation and communication of monitoring results to the public. The ecological health scoring system is based upon the following five indicators, which are typically measured in the reservoir forebay area (a short distance upstream of the dam) and one or more areas farther upstream:

1. DO is necessary in respiration of most aquatic organisms. Ideally, a reservoir has enough DO throughout the water column available to fish, insects, and zooplankton for respiration. Concentrations of DO in a reservoir both control and are controlled by many physical, chemical, and biological processes (e.g., photosynthesis, respiration, oxidation-reduction reactions, bacterial decomposition, temperature) that determine the assimilative capacity of a reservoir. Assimilative capacity is a water body's ability to receive wastewaters or other materials requiring oxygen for decomposition without deleterious effects and without damage to aquatic life. If concentrations are low enough and/or low levels are sustained long enough, it can adversely affect the health and diversity of aquatic organisms. DO levels are expressed in mg/L.
2. Chlorophyll, a surrogate measure for the amount of algae (phytoplankton) in the water, is important because it provides insights into the level of primary productivity within a water body and can provide a measure of nutrient enrichment. Although some level of phytoplankton production is essential to maintain a healthy aquatic community, as concentrations increase, uses can be differentially affected. For example, fisheries such as largemouth bass in southeastern reservoirs can be enhanced as phytoplankton concentrations increase to relatively high levels. However, elevated phytoplankton concentrations are a concern because adverse ecological and use impacts could occur, such as reduced water clarity, more frequent algal blooms, higher oxygen demands and lower DO concentrations, increased periods of anoxic conditions and resultant anoxic by-products (i.e., ammonia, sulfide, and dissolved manganese), more frequent water treatment problems, and higher water treatment cost.
3. Sediment quality is a measure of the amount of PCBs, pesticides, and metals in sediment on the bottom of the reservoir. Sediments at the bottoms of reservoirs serve as a repository for a variety of materials, especially chemicals that have a low solubility in water. If contaminated, bottom sediments can have adverse impacts on bottom fauna and can often be long-term sources of toxic substances to the aquatic environment. They may impact wildlife and humans through the consumption of contaminated food or water or through direct contact. These impacts may occur even though the water above the sediments meets water quality criteria. Thus, examination of reservoir sediments is useful to determine if toxic chemicals are present and if chemical composition is changing through time.
4. Benthic macroinvertebrates (large bottom-dwelling invertebrates such as worms, snails, mussels, and crayfish) are included in aquatic monitoring programs because of their importance to the aquatic food chain, and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Data analyses that are indicative of good (and poor) water quality include the following: taxa richness, relative abundance of organisms tolerant or intolerant of poor water quality, and proportions of samples with no organisms present.
5. Fish are included because they are important to the aquatic food chain and because they have a long life cycle that allows them to reflect water quality conditions over time. Fish are also important to the public for aesthetic, recreational, and commercial reasons. Ratings are based primarily on fish community structure and function using a metric known as the Reservoir Fish Assemblage Index (RFAI). Also considered in the rating is the percentage of the sample represented by

omnivore and insectivores, overall number of fish collected, and the occurrence of fish with anomalies such as diseases, lesions, parasites, deformities, etc.

Each indicator is evaluated separately and assigned a rating of “good,” “fair,” or “poor.” Individual ratings are combined into a single, composite score for each reservoir, termed the Reservoir Ecological Health Rating.

Reservoir Ecological Health Ratings reported between 1994 and 2007 are summarized in Table 3.12-2 and provided in detail in Appendix E, Table E-5, for Douglas Reservoir; Nolichucky Reservoir was not monitored. Detailed results of ecological health monitoring for Douglas Reservoir are provided in the Douglas RLMP (Volume II).

Table 3.12-2. Typical Ratings for Dissolved Oxygen, Chlorophyll, and Sediment in Douglas Reservoir Monitored as Part of the Reservoir Ecological Health Monitoring Program, 1991-2007

Indicator	Douglas	
	Forebay	Midreservoir
Dissolved Oxygen	P	P
Chlorophyll	G/F	P
Sediment	G	G/F

Rating codes: G = Good; F = Fair; P = Poor; more than one rating code (e.g., G/F) for an indicator means that ratings have fluctuated generally between the rating categories shown.

3.12.3. Water Supply

The quality of the source water can have a direct impact on water treatment cost and how the water ultimately is used. Quality of source water may also determine the maximum amount of pollution from both point and nonpoint sources that a water body can assimilate without violating state water quality standards.

Douglas Reservoir

Numerous municipal water suppliers and industries utilize surface water from the Douglas Reservoir and its supporting watershed as their primary source of raw water. In 2005, the average daily surface water demand among these users was 99.56 millions of gallons per day (MGD) (Table 3.12-3).

Wastewater permits are issued by the states under the National Pollutant Discharge Elimination (NPDES) Program. Based on these permits, the 2005 average daily wastewater discharge was about 81.04 MGD.

Table 3.12-3. Average Daily Municipal and Industrial Water Intake From, and Wastewater Discharge to, Northeastern Tributary Reservoirs in 2005

Reservoir*	Municipal Water Intake (MGD)	Industrial Water Intake (MGD)	NPDES-Permitted Wastewater Discharge (MGD)
Douglas	47.16	52.4	81.04
Nolichucky	10.9	1.75	11.05

*includes intake from watersheds supporting each reservoir
Source: TVA's 2005 Water Use Database

Nolichucky Reservoir

No municipal water suppliers currently withdraw water from Nolichucky Reservoir. Greeneville Water and Light Commission and Jonesborough Water Department withdraw water from Nolichucky Reservoir's supporting watershed. The 2005 average daily water demand for these intakes combined was about 10.9 MGD. There are no industrial withdraws from Nolichucky Reservoir. There is one industrial withdrawal in Nolichucky Reservoir's supporting watershed. The 2005 average daily water demand for this withdrawal was 1.75 MGD (Table 3.12-3).

Wastewater permits are issued by the states under the NPDES Program. Based on these permits, the 2005 average daily wastewater discharge was about 11.05 MGD.

3.13. Aquatic Ecology

As previously mentioned, the Douglas and Nolichucky reservoirs are located in the Ridge and Valley ecoregion. Reservoir parcels lay within impounded sections of the French Broad and Nolichucky rivers in Tennessee.

The Tennessee River and all major tributaries, including the French Broad and Nolichucky rivers, have been affected by impoundments and other sources of pollution. At times, serious pollutants such as mercury and PCBs have become significant fish contaminants in some regional reservoirs (Etnier and Starnes 1993). As a result, the larger river fish faunas have fragmented distributions with several known elements to have disappeared (Etnier and Starnes 1993).

Aquatic habitat in the littoral (near-shore) zone is greatly influenced by underwater features, topography, and back-lying land use. Underwater features include the presence of woody stumps, debris, rocks, logs, or other structures. Undeveloped shoreline is mostly wooded; therefore, fallen trees and brush provide woody cover in those areas. Woody habitat is usually reduced on land where back-lying property is largely residential or agricultural. Use of the TVA-managed public land below the 1,007-foot MSC on Douglas by third parties with access rights has historically negatively influenced the amount of vegetation on some shoreline. As a result, residential development on private land adjoining TVA shoreland has resulted in a loss of riparian woody vegetation. In some cases, clearing of trees and brush may have accelerated shoreline erosion, resulting in the placement of seawalls or other shoreline stabilization. Shorelines lacking woody vegetation (where habitat would have been poor prior to development) still can provide suitable habitat; in fact, aquatic habitat can actually be improved by placement of riprap or construction of fixed docks on some of these sites. Rock is an important constituent of littoral aquatic habitat over much of the reservoir, in either the form of bedrock outcrops or a mixture of rubble and cobble on steeper shorelines or gravel along shallower shorelines. Substrate and available aquatic habitat in coves and embayments also typically correspond to shoreline topography and vegetation.

TVA developed the Ecological Health Monitoring Program to determine a particular reservoir's health as compared to other reservoirs in the TVA system, to provide data for comparing future water quality conditions, and to be a screening program for targeting more detailed studies if the need arises. As explained above, the ecological health scoring system is based on five indicators (1) DO; (2) chlorophyll, a measure of the amount of algae in the water; (3) sediment contaminants—PCBs, pesticides, and metals; (4) benthic macroinvertebrates, and (5) fish assemblage. Each indicator is evaluated separately, and then, individual ratings are combined into a single, composite score for each reservoir.

Reservoir Ecological Health Monitoring is one of five components of TVA’s overall river and reservoir monitoring effort, termed Vital Signs Monitoring. Other components of the monitoring program include: (1) examination of ecological conditions in tributary streams to the Tennessee River; (2) monitoring of toxic contaminants in fish flesh to determine their suitability for consumption; (3) evaluating the number and size of important game fish species to help ensure their populations remain abundant and robust; and (4) sampling of bacteriological concentrations at recreational areas to evaluate their suitability for water contact recreation. Douglas Reservoir was monitored on an annual basis until 1995. After 1995, TVA went to a two-year monitoring cycle. Figure 3.13-1 shows the reservoir ecological health scores for Douglas Reservoir from 1994 through 2005. Because collection methods and rating criteria for the fish and benthic communities were different prior to 1994, those results cannot be compared directly to samples taken using current methods and therefore are not presented in this document. For the past seven years, Douglas Reservoir has rated poor every year with the exception of 1994 and 2005. Sampling on Nolichucky Reservoir has not been done for Reservoir Ecological Health Ratings.

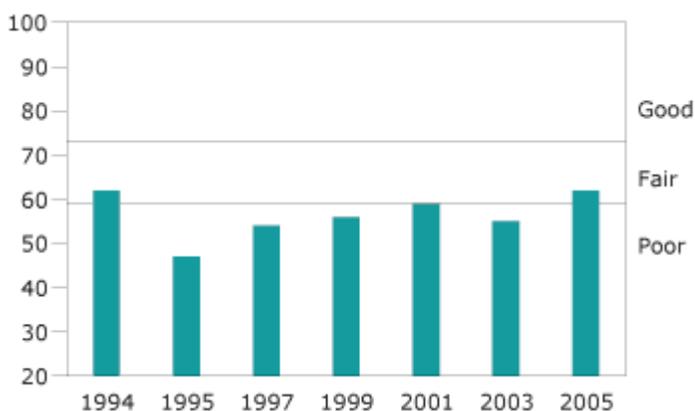


Figure 3.13-1. Douglas Reservoir Ecological Health Ratings, 1994-2005

Benthic Monitoring

Benthic macroinvertebrates include bottom-dwelling animals including readily visible insect larvae, aquatic worms, snails, crayfish, and mussels. A technique called the Benthic Index of Biotic Integrity compares specific parts of the results from a sampled site to what a site on that type of stream might produce if it were in excellent condition (Kerans and Karr 1994). Modern biologists use details in the results from studies such as this to learn more about the bottom-dwelling animal communities at different locations. Benthic macroinvertebrates are included in aquatic monitoring programs because of their importance to the aquatic food chain and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analysis that are indicative of good (and poor) water quality include total abundance of all species, except those indicative of poor water quality, and proportions of samples with no organisms present. Areas sampled on Douglas Reservoir include the forebay and midreservoir site. Benthic community scores ranged from “poor” to “fair” over the seven years sampled, most recently scoring “fair” at both sampling sites (Table 3.13-1). Benthic samples were only taken in five areas of the Nolichucky River in 2000, as part of TVA’s *Nolichucky Flood Remediation Environmental Impact Statement* (TVA 2006a). As shown in

Table 3.13-2, the bottom-dwelling community at the site in Nolichucky Reservoir (NRM 50.6) was rated “poor” while all four of the other sites were rated “fair.”

Table 3.13-1. Recent (1995-2007) Benthic Community Ratings Collected as Part of the Vital Signs Monitoring Program in Douglas Reservoir

Station	Rating
Forebay - French Broad River	P/F
Midreservoir - French Broad River	P/F

Rating codes: P = Poor (7-16); F = Fair (17-26); more than one rating code (e.g., P/F) for an indicator means that ratings have fluctuated between the rating categories shown

Table 3.13-2. Listing of Benthic Index of Biotic Integrity Ratings for Benthic Invertebrate Community Surveys in the Nolichucky River, 2000

Sample Site	Score
NRM 8.5	F
NRM 27.9	F
NRM 42.1	F
NRM 50.6	P
NRM 60.6	F

Rating codes: P = Poor (7-16); F = Fair (17-26)

Fisheries Monitoring

The Reservoir Vital Signs Monitoring Program included semiannual fish sampling on Douglas Reservoir from 1999 to 2007. A list of fish species commonly found in Douglas Reservoir can be found in Appendix E. Fish are included because they are important to the aquatic food chain and because they have a long life cycle that allows them to reflect water quality conditions over time. Fish are also important to the public for aesthetic, recreational, and commercial reasons. Ratings are based primarily on fish community structure and function using a metric known as the RFAI. Also considered in the rating is the percentage of the sample represented by omnivore and insectivores, overall number of fish collected, and the occurrence of fish with anomalies such as diseases, lesions, parasites, deformities, etc. (McDonough and Hickman 1999). Recent (1999-2007) RFAI ratings collected as part of the Vital Signs Monitoring Program indicate the fish community in Douglas Reservoir indicates a trend of improvement from “fair” to “fair/good” at the forebay site and a fluctuating score of “fair” and “good” at the midreservoir site.

Nolichucky Reservoir is not currently sampled for RFAI scores. However, samples were collected from 1990 to 2000 for Index of Biotic Integrity (IBI) scores. Under IBI protocols, all discernible habitats at a given site are sampled until no previously uncollected species are found, thus assuring a permissible sample. IBI metrics address 12 community characteristics, which are summed to produce an overall site score. Scores of 58-60 are rated excellent, 53-57 are considered good/excellent, 48-52 are considered good, 45-47 are considered fair/good, 40-44 are rated fair, 35-39 are rated fair/poor, 28-34 are poor, 23-27 are rated very poor/poor, and 12-22 are considered very poor. A backpack-electrofishing unit, a 20-foot seine, and dip nets were used to collect fish in wadable habitats, while a boat-mounted electrofishing unit was used to sample deep runs and pool

areas. IBI scores and ratings for fish community samples collected in the Nolichucky River from 1990-2000 are listed in Table 3.13-4. Overall results indicate that the Nolichucky fish assemblage has been consistently in the “good” range throughout the river.

Table 3.13-4. Index of Biotic Integrity Ratings for Fish Community Samples Collected in the Nolichucky River, 1990-2000

Sample Site	1990	1991	1992	1993	1994	1996	1997	1998	2000
NRM 8.5	F	G	F	G	G	G	G	G	G
NRM 27.9	-	-	-	-	-	-	-	-	G
NRM 42.1	-	-	-	-	-	-	-	-	G
NRM 50.6	-	-	-	-	-	-	-	-	F/P
NRM 60.5	-	-	-	-	-	-	G	-	G
NRM 89.0	-	-	-	-	-	-	F	-	G/E
NRM 97.5	G	-	-	-	-	-	-	-	-
NRM 106.8	-	-	-	-	-	-	G	-	-

IBI rating codes: F = Fair; P = Poor; G = Good; E = Excellent; more than one rating code (e.g., F/P) for an indicator means that ratings have fluctuated between the rating categories shown

12-22	23-27	28-34	35-39	40-44	45-47	48-52	53-57	58-60
Very Poor	Very Poor/ Poor	Poor	Poor/Fair	Fair	Fair/Good	Good	Good/ Excellent	Excellent

A Sport Fishing Index (SFI) has been developed to measure sport fishing quality for various species in Tennessee and Cumberland Valley reservoirs. The SFI is based on the results of fish population sampling by TVA and state resources agencies and, when available, results of angler success as measured by state resource agencies (i.e., bass tournament results and creel surveys). The SFI is calculated by comparing values for selected quantity and quality parameters from creel and population samples to expected values that would occur in a good or high-quality fishery. Point values are assigned to the parameters with higher points for higher-quality fisheries. An overall SFI is obtained by summing the point values (60 possible) that were assigned to each of the quantity and quality parameters (Hickman 2000). In 2006, Douglas Reservoir rated above the Valleywide average for black bass and smallmouth bass. It rated below the Valleywide average for largemouth bass, black crappie, crappie, walleye, and white crappie (Table 3.13-5).

Table 3.13-5. Sport Fishing Index Scores for Selected Sport Fish Species in Douglas Reservoir, 2006

Fish Species	2006 Score	2006 Valleywide Average
Black Basses	38	36
Black Crappie	28	31
Crappie	28	36
Largemouth Bass	26	33
Smallmouth Bass	32	30
Walleye	26	33
White Crappie	28	41

Nolichucky Reservoir is not sampled for an SFI score, but according to a 2007 TWRA fisheries report of the Nolichucky River between the North Carolina state line and the French Broad River, the Nolichucky River supports one of the best warm water sport fisheries in the area (Carter et al. 2007). Anglers have the opportunity to catch

muskellunge, flathead catfish, channel catfish, all species of black bass, and rock bass. In the winter when water temperatures permit, rainbow trout are stocked from the USFWS hatchery in Erwin, Tennessee. The TWRA report concluded that muskellunge should continue to be stocked as fish become available.

3.14. Air Quality

NAAQS have been established to protect the public health and welfare with respect to six pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. An area where any air quality standard is violated may be designated as a nonattainment area for that pollutant, and emissions of that pollutant from new or expanding sources are carefully controlled.

On March 12, 2008, the USEPA significantly strengthened its NAAQS for ground-level ozone. USEPA is revising the 8-hour primary ozone standard designed to protect public health to a level of 0.075 parts per million (ppm). The previous standard set in 1997 was 0.084 ppm. In addition to tightening the primary standard, USEPA is also strengthening the secondary 8-hour standard for ozone to the level of 0.075 ppm. The secondary standard is designed specifically to protect sensitive plants from damage caused by ozone exposure throughout the growing season. States must have made recommendations to USEPA no later than March 2009 for areas to be designated attainment, nonattainment, and unclassifiable. USEPA is expected to issue final designations in the near future unless there is insufficient information to make these designation decisions.

It is likely that, under these tightened ozone standards, some of the counties in which the Douglas and Nolichucky reservoirs are located may be designated nonattainment for ozone. USEPA tightened the primary fine particle standard in December 2006 and designated additional nonattainment areas in December 2008, though none of the counties covered by this DNTRLMP were designated as nonattainment for fine particulate matter. All of the counties containing the Douglas and Nolichucky reservoirs are currently in attainment of each of the NAAQS.

Prevention of significant deterioration (PSD) regulations are used to limit air pollutant emissions from new or expanding sources. Under these regulations, some national parks and wilderness areas are designated PSD Class I air quality areas and are specially protected. There are four Class I areas within 100 kilometers (62 miles) of the reservoirs, including Linville Gorge Wilderness, the Great Smoky Mountains National Park, Shining Rock Wilderness, and Joyce Kilmer/Slickrock Wilderness.

3.15. Noise

Along the Douglas and Nolichucky reservoirs, sources of noise include industrial development, project operation facilities, substations, developed recreation sites, and traffic. Noise-related effects of lands planning in the Douglas and Nolichucky reservoirs were evaluated qualitatively based upon the number of acres allocated to each zone, based upon the assumption that the potential to generate noise is greatest with industrial land uses and project operations, is moderate with developed recreation uses and shoreline access, and is least with conservation land uses.

3.16. Socioeconomics

Socioeconomics is important for understanding the relationship between economic activity and social life. It focuses on the social impact of economic change, such as might occur with a commercial or public concern (business, infrastructure, recreation), such as the

availability of employment, resources, or agreements and regulations. Social effects can be wide-ranging in their impacts to people in a small community to an entire society or one of its segments.

3.16.1. Population and Economy

The Douglas and Nolichucky reservoirs are located in northeast Tennessee. Population in the counties where these tributaries are located is estimated to be about 300,000, as of 2008 (Table 3.16-1). In three of these counties (Cocke, Greene, and Hamblen), population grew more slowly than in the nation and the state between 1980 and 2008. However, both Jefferson and Sevier counties grew much more rapidly than either the state or the nation. Projections suggest that the population of this area will reach about 376,000 by the year 2020. Sevier County is projected to continue to grow much faster than the nation and the state between now and 2020.

Overall, the rural population share in the area is well above the Tennessee average, which is somewhat higher than the national average. However, in Hamblen County, only about 25 percent of the population is considered rural, well below the state average of 36 percent but still higher than the national average of 21 percent.

Table 3.16-1. Population

Area	1980	2000	Estimate 2008	Projection 2020	Percent Increase, 1980-2008	Projected Percent Increase, 2008-2020	Percent Rural, 2000
Cocke, Tenn.	28,792	33,565	35,688	44,030	24.0	23.4	67.0
Greene, Tenn.	54,422	62,909	66,157	74,935	21.6	13.3	68.8
Hamblen, Tenn.	49,300	58,128	62,132	73,315	26.0	18.0	25.4
Jefferson, Tenn.	31,284	44,294	51,074	61,318	63.3	20.1	75.0
Sevier, Tenn.	41,418	71,170	84,835	122,526	104.8	44.4	64.9
County Total	205,216	270,066	299,886	376,124	46.1	25.4	59.2
Tennessee	4,591,023	5,689,283	6,214,888	7,195,375	35.4	15.8	36.4
U.S. (000)	226,545.8	281,421.9	304,059.7	341,387.0	34.2	12.3	21.0

Sources: Historical data and U.S. projection from U.S. Census Bureau, <http://www.census.gov>
Projections for Tennessee: The University of Tennessee-Knoxville (Undated)

Total employment in 2007 was almost 167,000 in the area counties (Table 3.16-2). Both farming and manufacturing account for a larger share of jobs than in the state and the nation. Farming is especially important to the economies of Cocke, Greene, and Jefferson counties. Manufacturing is especially important in Hamblen County and to a lesser extent in Cocke, Greene, and Jefferson counties. Retail trade is slightly more important to the region than it is statewide and nationally. This is especially true in Sevier County, due to its heavy dependence on tourism.

Table 3.16-2. Employment, 2007

Area	Total Employment	Percent of Total Employment				
		Farm	Manufac-turing	Retail Trade	Govern-ment	Other
Cocke, Tenn.	13,179	7.8	15.4	14.3	14.6	47.9
Greene, Tenn.	38,252	9.5	19.4	12.9	11.5	46.7
Hamblen, Tenn.	41,579	1.8	25.4	11.7	9.6	51.5
Jefferson, Tenn.	20,405	6.5	14.4	10.8	12.4	55.9
Sevier, Tenn.	53,330	1.7	2.8	17.4	9.0	69.0
County Total	166,745	4.6	14.7	13.9	10.6	56.3
Tennessee	3,746,010	2.5	10.5	11.2	12.0	63.8
U.S. (000)	180,943.8	1.6	8.0	10.7	13.4	66.3

Source: U.S. Bureau of Economic Analysis, Regional Economic Accounts, <http://www.bea.gov/regional/reis/>.

The unemployment rate in the area in 2008 was 7.6 percent, higher than the national and Tennessee rates (Table 3.16-3). The highest rate, 9.1 percent, was in Greene County, followed by Cocke County at 8.5. Rates in the other counties were slightly higher than the state and national levels.

The Douglas and Nolichucky Reservoirs are located in a relatively low-income area (Table 3.16-3). All of the counties in the area have per capita personal income levels below the state and national averages. Cocke County is the poorest county, with per capita income only 55 percent of the national average. Jefferson County, the second lowest, is 65 percent of the national average. The remaining counties have average income between 70 and 82 percent of the national average, still below, but much closer to, the Tennessee average.

Table 3.16-3. Unemployment and Income

Area	Unemployment Rate, 2008	Per Capita Personal Income, 2007	
		Dollars	Percent of U.S.
Cocke, Tenn.	8.5	21,414	55
Greene, Tenn.	9.1	31,490	82
Hamblen, Tenn.	7.0	27,007	70
Jefferson, Tenn.	7.0	25,200	65
Sevier, Tenn.	6.9	30,276	78
County Total	7.6	27,952	72
Tennessee	6.4	33,395	86
U.S. (000)	5.8	38,615	100

Sources: Tennessee Department of Labor and Workforce Development, Division of Employment Security; U.S. Department of Labor, Bureau of Labor Statistics; U.S. Bureau of Economic Analysis, Regional Economic Accounts, <http://www.bea.gov/regional/reis/>

3.16.2. Environmental Justice

The population of the area is predominantly non-Hispanic white, with a minority population of 8.0 percent (Table 3.16-4). The minority population share ranges from 5.3 percent in Cocke County to 17.0 percent in Hamblen County. The minority population in Hamblen County is largely white Hispanic; in the other counties, most of the minority population is nonwhite.

Table 3.16-4. Minority Population, 2008

Area	Total Population	Nonwhite Population	White Hispanic Population	Total Minority Population	Percent Minority Population
Cocke	35,688	1,424	458	1,882	5.3
Greene	66,157	2,335	1,361	3,696	5.6
Hamblen	62,132	4,098	6,455	10,553	17.0
Jefferson	51,074	2,138	1,211	3,349	6.6
Sevier	84,835	2,633	1,977	4,610	5.4
County Total	299,886	12,628	11,462	24,090	8.0
Tennessee	6,214,888	1,219,860	204,512	1,424,372	22.9
U.S. (000)	304,059.7	61,420.5	43,147.8	104,568.3	34.4

Source: U.S. Census Bureau, <http://www.census.gov/popest/race.html>

Overall, poverty levels are slightly higher than the state average (Table 3.16-5). In 2007, the poverty level in the area was 17.6 percent, while the state average was 15.8 percent and the national average was 13.0 percent. Cocke County had the highest poverty level, at 26.6 percent. The remaining counties had poverty levels ranging from 12.7 percent in Sevier County to 26.6 percent in Cocke County.

Table 3.16-5. Persons Below Poverty Level, 2007

Area	Persons Below Poverty Level (Number)	Persons Below Poverty Level (Percent)
Cocke	9,282	26.6
Greene	12,681	19.7
Hamblen	10,270	16.9
Jefferson	8,427	17.4
Sevier	10,495	12.7
County Total	51,155	17.6
Tennessee	945,263	15.8
U.S.	38,052,247	13.0

Source: U.S. Census Bureau, <http://www.census.gov/hhes/www/poverty/poverty.html>