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COMPENSATORY MITIGATION

FOR THE

PROPOSED HICKORY LOG CREEK WATER SUPPLY RESERVOIR

City of Canton
Cherokee County, Georgia

Prepared for:
City of Canton and
Cobb County-Marietta Water Authority

Prepared by:
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Appendix "A"

I. INTRODUCTION

The Applicants propose to construct a water supply reservoir on Hickory Log Creek in Cherokee County, Georgia. The proposed Hickory Log Creek reservoir is located approximately 1.5 miles northeast of the City of Canton on Hickory Log Creek. The proposed dam location is immediately downstream of an existing impoundment east of Amos Road. The reservoir would have a surface area of 369 acres at a pool elevation of 1,060 feet above mean sea level (msl).

The proposed reservoir site has historically been undeveloped or used for agricultural purposes. The steep sloping hillsides around the perimeter of the proposed reservoir pool are dominated by mid to late successional oak/hickory forests. The floodplain and associated wetland areas within the upper most portion of the reservoir, upstream and directly downstream of Fate Conn Road, have been severely altered due to previous ditching, logging, and agricultural practices. The remainder of the floodplain downstream of the ditched field at Fate Conn Road to the dam site is narrow and contains numerous small forested, scrub-shrub, and emergent vegetative wetlands. An existing 8.5 acre impoundment is located just upstream of the proposed dam location. The reservoir site is drained by Hickory Log Creek, a third order tributary of the Etowah River.

Eco-South, Inc. completed a wetland delineation of the proposed reservoir site in March and May of 1998 and October of 1999 using methods outlined in the 1987 "Corps of Engineers Wetland Delineation Manual". Proposed jurisdictional waters impacts for the Hickory Log Creek reservoir include the loss of approximately 19.27 acres of wetlands, 44,175 linear feet of stream channel, and 11.19 acres of bed-and-bank waterways in the area of proposed dam construction and impoundment. Jurisdictional waters of the U.S. impacts are approximately 30.5 acres within a normal pool elevation of 1060 msl.

Jurisdictional wetlands include approximately 12.09 acres of Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded/Saturated wetland (PF01E), and approximately 7.18 acres of Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Semipermanently Flooded wetland (PSS1F) found within the proposed reservoir pool. The shrub/herbaceous community constitutes about 37% of the wetlands, while 63% of impacted wetland consists of relatively intact bottomland hardwood forest.

II. COMPENSATORY MITIGATION

To compensate for impacts to jurisdictional waters and to protect water quality within the Etowah River watershed the Applicants propose to implement the following compensatory mitigation plan. A total of approximately 22.5 acres of wetland will be restored at two mitigation sites within the Etowah River watershed in Cherokee County. The first site, Mill Creek, combines 11 acres of wetland restoration and 8 acres of riparian enhancement along 5,500 linear feet of Mill Creek and its tributaries. The mitigation efforts at the second site, the Old Highway 5 site, will accomplish approximately 11.5 acres of wetland restoration and 6.5 acres of riparian enhancement along 4,700 linear feet of tributaries to the Etowah River.

In addition to the riparian mitigation at the wetland mitigation sites, the Applicants propose to preserve a 100-foot buffer on both banks of the Etowah River from Interstate 575 downstream to Georgia Highway 140. To protect water quality in Hickory Log Creek, above the reservoir's normal pool, a 100-foot natural buffer and a 150-foot horizontal setback from impervious surfaces on each bank shall be implemented. Setback regulations will be enforced starting at the proposed reservoir pool and extending upstream on Hickory Log Creek until designated as intermittent on a current USGS 1:24,000 quadrangle.

The Applicants propose to protect, preserve, restore, and enhance approximately 2.1 miles of Smithwick Creek and its tributaries. Smithwick and Buzzard Flapper Creeks have existing Cherokee darter populations and mitigation stream reach areas were designated from The University of Georgia, Institute of Ecology "stream buffer scores". The proposed stream/riparian mitigation areas have low (poor) to moderate buffer scores. The riparian areas will be revegetated with native trees and shrubs and the streams will have natural channel features and streambank stability restored in unstable bank reaches. Easements shall extend 100 feet (measured horizontally) on each side of the Smithwick Creek, and 100 feet on one bank of Buzzard Flapper and an unnamed tributary to Smithwick Creek, or the distance needed to provide adequate protection.

Both project impacts and compensatory mitigation sites are located in the Etowah River watershed. A more detailed wetland and stream bank mitigation plan (wetland & stream restoration design, planting design, survey plats, conservation easements, groundwater wells and vegetative monitoring locations) will be completed after necessary surveying, associated engineering, and hydrologic studies have been completed. Wetland mitigation site acreage and stream lengths are approximate and were based upon tax map aerials, soil surveys, and USGS 1:24,000 quadrangles.

III. MITIGATION SITES

III-A Mill Creek Site

The 25-acre Mill Creek mitigation site is located within the floodplain of Mill Creek, a third order tributary to the Little River in Cherokee County. The site is approximately 3.5 miles northeast of Woodstock and consists of a cleared agricultural field with approximately 1,800 feet of cleared stream bank along Mill Creek. Defining characteristics of the mitigation site include a mowed maintained pasture and several channelized first order tributaries of Mill Creek. The proposed mitigation site is generally bounded by Mill Creek to the north, Trickum Road to the west, Arnold Mill Road to the south, and Turner Hill Road to the east. The site lies in a highly urbanized and rapidly growing portion of Cherokee County. See attached location maps for reference.

Historically, forest vegetation was cleared from the mitigation area and the floodplain was ditched and converted for agricultural use. Mill Creek, an F6 stream, is an entrenched, meandering, gentle gradient stream deeply incised in cohesive sediments of silt and clay (Rosgen, 1996). Four first order tributaries of Mill Creek are channelized, entrenched, and deeply incised within the floodplain. All four tributary waterways originate off-site on adjacent side slopes and receive stormwater runoff from watersheds dominated by residential subdivisions. Flood water retention and overbank flooding of Mill Creek and associated tributaries have been reduced or eliminated as a direct result of stream downcutting, channelization, and ditching of the adjacent floodplain, resulting in an upland pasture.

The mitigation plan objective is to (1) restore the cleared agricultural field back to wetland conditions that previously existed based on hydric soils found throughout the floodplain, and (2) to revegetate the cleared riparian corridor along Mill Creek, its associated tributaries, and the wetland restoration area. The plan objective will be accomplished by restoring wetland hydrology through filling lateral ditches, checking channelized waterways, and planting native trees and shrubs. These modifications will stabilize the stream banks and restore wetland hydrologic conditions within the floodplain by promoting the retention of water for extended periods during the growing season (soil saturation within the upper 12 inches).

According to the Cherokee County soil survey, the soil series in the proposed mitigation area is comprised of the Chewacla-Cartecay complex (Chc). The Chewacla series consists of somewhat poorly-drained, strongly acid soils that have developed in recent alluvium on flood plains. The Chewacla-Cartecay complex is composed of about 40% Chewacla and 40% Cartecay. These soils are somewhat poorly-drained to moderately well-drained and occur as long narrow strips adjacent to

major creeks and rivers (Jordan, Bramblett, Gaither, Tate, Blevins, and Murphy 1973). Field investigations verified that hydric soil exists throughout the proposed wetland restoration area.

Mitigation Areas:

The proposed Mill Creek mitigation site incorporates two different categories of mitigation: 11 acres of wetland restoration and 8 acres of riparian enhancement. Approximately 1,800 linear feet of stream bank along Mill Creek and 3,700 linear feet of stream bank along four direct first order tributaries will be enhanced and preserved within the site. The mitigation area will be restored to a bottomland hardwood wetland with a mosaic of open water scrub/shrub wetland and a wooded riparian corridor along Mill Creek. Six acres of upland buffer will separate the site from the adjacent subdivision.

The wetland restoration area (11 acres) consists of a cleared agricultural field that has experienced significant hydrologic modifications through stream channelization and ditching. Due to these modifications this area no longer experiences inundation and soil saturation sufficient to support wetland hydrodynamics. The wetland restoration area is presently cleared and in agricultural use. Land use within this area includes historic conversion of the floodplain for agricultural use and livestock grazing.

Wetland hydrology will be restored in the wetland restoration area by installing rock check dams and filling of ditches. Fill material will come from small, shallow ponds located on slightly higher elevations. The exact locations and elevations of the rock checks and locations and sizes of ponds have not been established and will depend upon later soil and hydrologic studies. Several rock check dams will be installed in the deeply incised channelized tributaries to increase the height, duration and periodicity of overbank flooding.

Clay berms will be installed across small swales in the floodplain to increase the lateral distribution of water. Berms will be constructed with 3:1 side slopes, 1.5 feet high with 1.0 feet high rock lined outlets to allow water to pass through during floods. Shallow ponds with 1:20 side slopes will be excavated to provide fill material for ditch filling and berm construction. Irregular shaped ponds shall have a maximum depth of two feet deep and will add aquatic diversity as well as waterfowl and amphibian habitat.

The riparian enhancement area (8 acres) is located along the southern bank of Mill Creek. This area will be enhanced by planting native trees and shrubs and by the permanent exclusion of cultivation and grazing. This will reduce further bank erosion and provide shade to the stream in the long term. The

riparian area is an integral part of the floodplain complex and will connect the wetland areas to Mill Creek.

III-B Old Highway 5 Site

The 26-acre Old Highway 5 mitigation site is adjacent to a second order unnamed tributary of the Etowah River in Cherokee County, Georgia. The site is approximately 3 miles north of Canton and east of I-575 between the Etowah River and Highway 5. Defining characteristics of the mitigation site include a heavily grazed horse pasture, two channelized first order streams and one channelized intermittent waterway. The proposed mitigation site is within the floodplain of the Etowah River and is generally bounded by railroad tracks to the east, Highway 5 to the north, and the Etowah River to the south. See attached location maps for reference.

Historically, forest vegetation was cleared from the mitigation area and the land was converted for agricultural use. Two first order streams have been channelized through the site and converge to form a second order tributary near the southwestern property line. A channelized stream forms a portion of the northeast property line before being routed to the first order stream flowing through the center of the site. An existing sanitary sewer line traverses diagonally across the site and will remain in a maintained 20-foot wide permanent easement. No trees will be planted within the permanent easement, however, wetland hydrology will be restored to the sewer line corridor converting this limited portion of the floodplain to a herbaceous wetland.

Flood water retention and overbank flooding of the tributaries have been reduced or eliminated as a direct result of stream channelization and ditching of the adjacent floodplain, resulting in an upland pasture. The mitigation plan objective is to (1) restore the cleared agricultural field back to wetland conditions that previously existed based on hydric soils found throughout the floodplain, and (2) to revegetate both the cleared riparian corridor and wetland restoration area. The plan objective will be accomplished by restoring wetland hydrology through filling lateral ditches, checking channelized waterways, and planting native trees and shrubs. These modifications will stabilize the stream banks and restore wetland hydrologic conditions within the floodplain by promoting the retention of water for extended periods during the growing season (soil saturation within the upper 12 inches).

According to the Cherokee County soil survey, the soil series in the proposed mitigation area is comprised of the Chewacla-Cartecay complex (Chc). The Chewacla series consists of somewhat poorly-drained, strongly acid soils that have developed in recent alluvium on flood plains. The

Chewacla-Cartecay complex is composed of about 40% Chewacla and 40% Cartecay. These soils are somewhat poorly-drained to moderately well-drained and occur as long narrow strips adjacent to major creeks and rivers (Jordan, Bramblett, Gaither, Tate, Blevins, and Murphy 1973). Field investigations verified that hydric soil exists throughout the proposed wetland restoration area.

Mitigation Areas:

The proposed Old Highway 5 mitigation site incorporates two different categories of mitigation: 11.5 acres of wetland restoration and 6.5 acres of riparian enhancement. Approximately 4,000 linear feet of first order stream bank and 700 linear feet of intermittent stream bank will be enhanced and preserved within the site. The mitigation area will be restored to a bottomland hardwood wetland with a mosaic of open water scrub/shrub wetland and wooded riparian corridor. Eight acres of upland buffer will separate the site from adjacent development.

The wetland restoration area (11.5 acres) consists of a cleared agricultural field that has experienced significant hydrologic modifications through stream channelization and ditching. Due to these modifications this area no longer experiences inundation and soil saturation sufficient to support wetland hydrodynamics. The wetland restoration area is presently cleared and in agricultural use. Land use within this area includes historic conversion of the floodplain for agricultural use and livestock grazing.

Wetland hydrology will be restored in the wetland restoration area by installing rock check dams and filling of ditches. Fill material will come from small, shallow ponds located on slightly higher elevations. The exact locations and elevations of the rock checks and locations and sizes of ponds have not been established and will depend upon later soil and hydrologic studies. Several rock check dams will be installed in the channelized tributaries to increase the height, duration and periodicity of overbank flooding.

Clay berms will be installed across small swales in the floodplain to increase the lateral distribution of water. Berms will be constructed with 3:1 side slopes, 1.5 feet high with 1.0 feet high rock lined outlets to allow water to pass through during floods. Shallow ponds with 1:20 side slopes will be excavated to provide fill material for ditch filling and berm construction. Irregular shaped ponds shall have a maximum depth of two feet deep and will add aquatic diversity as well as waterfowl and amphibian habitat. Fill material for ditches will come from small, shallow ponds located on slightly higher elevations. The exact locations and sizes of ponds have not been established and will depend upon later soil and hydrologic studies.

The riparian enhancement areas (6.5 acres) are located within the cleared floodplain adjacent to the site's tributaries. These areas will be enhanced by planting native trees and by the permanent exclusion of cultivation and grazing. This will reduce further bank erosion and provide shade to the waterways in the long term. The riparian area is an integral part of the floodplain complex and will connect the wetland areas to the unnamed tributaries of the Etowah River.

III-C Smithwick Creek

Smithwick Creek is a fourth order tributary of the Etowah River and is located approximately 10 miles east to Canton. The Applicants propose to protect, preserve, restore, and enhance approximately 2.1 miles of Smithwick Creek and its tributaries north of State Routes 20 and 369. Smithwick and Buzzard Flapper Creeks have existing Cherokee darter populations and mitigation stream reach areas were designated from The University of Georgia, Institute of Ecology "stream buffer scores". The proposed stream/riparian mitigation areas have low (poor) to moderate buffer scores. The mitigation areas will be restored to wooded riparian steam corridors and fenced to exclude livestock, thereby, improving buffer scores and aquatic habitat. The objectives are to control bank erosion, restore streambank stability in unstable bank reaches, and to revegetate the riparian corridor along the creeks. This will be accomplished by constructing in-stream structures and the planting of native trees and shrubs. These modifications will stabilize streambanks, reduce further bank erosion and provide shade to the creek in the long term. In-stream structures will be designed to allow aquatic species movement and shall have locations determined by a qualified scientist(s), in coordination with the United States Fish and Wildlife Service.

The Scott tract includes approximately 2,300 linear feet of Smithwick Creek (both-banks) and 2,400 linear feet (east bank) of an unnamed second order tributary of Smithwick Creek. The Turner tract includes approximately 4,600 linear feet of Smithwick Creek (both-banks) and 2,200 of Buzzard Flapper Creek (west bank). Riparian restoration areas are presently cleared of woody vegetation, grazed by livestock and cut for hay. Streambanks have experienced a conversion of riparian woody species to a grazed grass/forb community. The existing land use is cattle and horse farming that has resulted in very little woody riparian vegetation. A few large trees are scattered along the upper portion of Smithwick Creek within the Scott tract. The lack of bank holding, deep-rooted plants, over-grazing, and hoof sheer have created unstable streambanks. Unstable banks increase shear stress on the near bank region during bankfull events increasing bank erosion rates. Water quality

downstream of these areas are affected by lowering dissolved oxygen levels, elevating water temperatures, and increased turbidity.

Native bottomland floodplain species with desirable attributes based upon forage value to native southeastern wildlife species are proposed for reforestation of the riparian corridor. Tree and shrub species will be comprised of the Native Bottomland and Streambank Species in planting list. Eighty percent of species planted will be hard mast producing oak canopy trees and 20 percent will be faster growing nurse and high forage value wildlife bottomland species. 300 stems per acre will be planted the following winter after restoration/enhancement activities have been completed and the sites fenced. No single species will comprise more than 15% of the total planted trees. Easements shall extend 100 feet (measured horizontally) on each side of the Smithwick Creek, and 100 feet on one bank of Buzzard Flapper and an unnamed tributary to Smithwick Creek, or the distance needed to provide adequate protection

IV. PLANTING

The wetland and riparian restoration areas will be revegetated by planting native bottomland trees and shrubs. Planting will begin after the hydrologic modifications have been completed to insure that species are planted in suitable hydrologic regimes. Pioneer windblown species (red maple, green ash, black willow, etc.) will not be planted in the wetland restoration area but rather allowed to regenerate naturally. After two years at least 50% vegetative cover will be achieved in the ponded areas during the growing season. Greater than 50% of the flora in the ponded areas will be comprised of plant species with a facultative or wetter wetland indicator status.

Native bottomland trees and shrubs that provide high value for wildlife will be planted in appropriate zones after hydrologic modifications. Native bottomland floodplain species with desirable attributes based upon forage value to native southeastern wildlife species and migratory birds are proposed for reforestation of the site. Planting zones are representative of natural floodplain communities and are based according to the degree of flooding and saturation.

Three planting zones are proposed for the site:

- Wet Zone: This is a very wet, frequently flooded/saturated zone planted with a mixture of overcup oak, swamp chestnut oak, cottonwood, cherrybark oak, and swamp tupelo.

- Moist Zone: This is a seasonally flooded/saturated zone planted with a mixture of swamp chestnut oak, cherrybark oak, willow oak, cottonwood, American elm, sugarberry, elderberry, and possum-haw holly.

- Well-Drained Zone: The well-drained zone consists of seasonally flooded riparian areas and will be planted with a mixture of willow oak, shumard oak, water oak, cottonwood, sugarberry, possum-haw holly, hickory's, and red mulberry.

Eighty percent of species planted will be hard mast producing oak canopy trees and 20 percent will be faster growing nurse and high forage value wildlife bottomland species. Cottonwoods will be planted in each of the zones as nurse trees for the oaks. They will provide shade and encourage site utilization by birds. Sugarberry, red mulberry, American elm, elderberry, hickory's and possum-haw holly all are important food sources for wildlife. See planting list.

1. 140 stems per acre (with tree guards) will be planted at the Mill Creek and Old Highway 5 sites in areas deemed appropriate after hydrologic modifications have been completed. An on-site meeting with agents representing the applicant and the U.S. Army Corps of Engineers will be conducted to determine planting areas. No single species will comprise more than 15% of the total planted trees. At least 50% survival of planted tree species will be achieved at the end of the 5-year monitoring period. Growth will be monitored by measuring height of volunteer and planted trees. Success is defined as a doubling of height within the 5-year monitoring period.

2. After the five-year monitoring period 200 stems per acre with at least 35% desirable hardwood species will be achieved in areas deemed suitable for planting. Natural regeneration of desirable species will be allowed to compensate for the tree planting if the planting does not meet a 50% survival rate of planted trees. In this event 400 stems per acre will be required at the end of the five-year monitoring period. It is anticipated that permanently ponded/saturated areas will not be suitable for planting.

V. MONITORING

Hydrologic monitoring at the Mill Creek and Old Highway 5 sites will begin after the hydrologic modifications have been completed. Shallow (30 inches) ground water monitoring stations will be installed to monitor hydrology on the site. Groundwater wells will consist of 2-inch pipe and slotted screen sealed with bentonite. Four monitoring wells will be placed within the wetland restoration area

at each site. Hydrologic restoration will be monitored for a period of five years to determine its success as defined by the requirements of the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. Except for the small areas of the created ponds, no open water areas will be more than 6 to 18 inches deep during the wettest part of the year.

Vegetation monitoring will document the survival of planted and volunteer species and will begin at the end of the first growing season following the completion of planting. Monitoring will consist of random 30-foot radius circular plots. One permanent plot will be randomly placed on every two acres of wetland restoration. Vegetation will be monitored for a period of 3 years to determine survival percentages.

Monitoring reports depicting groundwater monitoring well location maps and graphs will be prepared biannually the first and second years after hydrologic modifications have been completed. An annual report will follow in years 3 through 5 and will include vegetation monitoring. Photographs will be taken at established points over the 5-year period to document the vegetative growth changes.

VI. CONTINGENCY

If at the end of the 5-year monitoring period, success criteria have not been satisfied, the applicant will consult with appropriate regulatory agencies to determine what remedial action should be taken. If significant problems are identified prior to the end of the monitoring period, regulatory agency personnel will be consulted regarding corrective measures. Remedial action may include replanting, modification of hydrology, modification of in-stream structures, and continued monitoring until the 50% vegetative success and wetland hydrology criteria is met.

VII. RIPARIAN PROTECTION MEASURES

In addition to the above-mentioned mitigation sites, the Applicants propose to further mitigate for the inundation and associated construction impacts to Hickory Log Creek and its tributaries by permanently protecting riparian corridors along the Etowah River and the perennial reach of Hickory Log Creek upstream of the reservoir pool from future development. First, on the Etowah River, a minimum one hundred feet horizontal from the top of the riverbank on both sides of the river from Interstate 575 to Ga. Highway 140 will be permanently protected from future development. This encompasses approximately 17,200 linear feet of stream bank along the Etowah River through the

City of Canton. A detailed plan for preserving and enhancing the Etowah River corridor will be provided as a supplement to this plan as soon as it is available from the Applicants engineers

Second, in order to protect water quality in Hickory Log Creek, the Applicants propose to protect 100 feet horizontal from the top of the bank on both sides of Hickory Log Creek for the perennial length of stream upstream of the normal pool of the reservoir. In addition, for this reach of stream, the applicant will enforce a 150 horizontal setback from impervious surfaces. A 100-foot natural buffer along approximately 1.4 linear stream miles (7,500 feet) above the reservoir pool will be permanently protected by these protection measures. Setback regulations will be enforced starting at the proposed reservoir pool and extending upstream on Hickory Log Creek until designated as intermittent on a current USGS 1:24,000 quadrangle.

VIII. MITIGATION SUMMARY

Proposed jurisdictional waters impacts for the Hickory Log Creek reservoir include the loss of approximately 19.27 acres of wetland, 44,175 linear feet of stream channel, and 11.19 acres of bed-and-bank waterways in the area of proposed dam construction and impoundment. Jurisdictional waters of the U.S. impacts are approximately 30.5 acres within a normal pool elevation of 1060 msl.

To compensate for jurisdictional waters impacts the Applicants proposes to restore wetlands within the Mill Creek and Etowah River floodplains and protect specific reaches of the Etowah River and Hickory Log Creek from future development. Riparian protection measures will include a 100-foot buffer maintained on both sides of the Etowah River from Interstate 575 to Ga. Highway 140 and on Hickory Log Creek upstream of the proposed normal reservoir pool. No impervious surfaces shall be constructed within a 150-foot setback area on both sides of the Hickory Log Creek as measured from the stream banks. A 100-foot riparian buffer along approximately 1.4 linear stream miles (7,500') above the reservoir pool and 3.2 linear stream miles (17,200') along the Etowah River through the City of Canton will be permanently protected by these watershed protection measures.

In addition to the protected stream buffers, the Applicants propose to protect, preserve, restore, and enhance approximately 2.1 miles of Smithwick Creek and its tributaries. The riparian areas will be revegetated with native trees and shrubs and the streams will have natural channel features and streambank stability restored in unstable bank reaches. Easements shall extend 100 feet (measured horizontally) on each side of the Smithwick Creek, and 100 feet on one bank of Buzzard Flapper and an unnamed tributary to Smithwick Creek, or the distance needed to provide adequate protection.

Two proposed mitigation sites will restore wetlands and revegetate cleared stream banks within the Etowah River watershed in Cherokee County. The Mill Creek site, approximately 25-acres, combines wetland restoration, riparian enhancement, and upland buffer within the southern floodplain of Mill Creek. The site will enhance and permanently protect approximately 5,500 linear feet of stream bank within the Mill Creek drainage. The Old Highway 5 mitigation site lies within the floodplain of the Etowah River approximately three miles northeast of Canton. This 26-acre site combines wetland restoration, riparian enhancement and upland buffer adjacent to an unnamed third order tributary of the Etowah River and includes the enhancement and preservation of approximately 4,700 linear feet of stream bank. Restrictive covenants will be placed on all mitigation sites protecting them in perpetuity.

The following table summarizes the linear feet of stream bank placed under riparian protection measures, riparian enhancement (linear feet & acreage), and wetland restoration proposed for this project:

WATERWAY	RIPARIAN PRESERVATION (Linear Feet)	RIPARIAN ENHANCEMENT (Linear Feet)	RIPARIAN PLANTING ENHANCEMENT (Acres)	WETLAND RESTORATION (Acres)
Etowah River	17,200'	-	-	-
Hickory Log Creek	7,500'	-	-	-
Smithwick Creek	-	6,900	31.6 ac.	-
Unnamed Tributary to Smithwick Creek	-	2,400	5.5 ac.	-
Buzzard Flapper Creek	-	2,200	5.0 ac.	-
Mill Creek & Tributaries	-	5,500'	8.0 ac.	11 ac.
Old Highway 5 Waterways	-	4,700'	6.5 ac.	11.5 ac.
Total	**24,700 l.f.**	**21,700 l.f.**	**56.6 ac.**	**22.5 ac.**

Planting List:

Native Bottomland Oak Species:

Common Name	Scientific Name	Site Preference
Overcup oak	*Quercus lyrata*	Wet/Poorly Drained
Swamp chestnut oak	*Q. michauxii*	Wet/Moist
Cherrybark Oak	*Q. pagodaefolia*	Wet/Moist
Willow Oak	*Q. phellos*	Moist/Well Drained
Shumard Oak	*Q. shumardii*	Moist/Well Drained
Water Oak	*Q. nigra*	Moist/Well Drained

Native Bottomland Species:

Common Name	Scientific Name	Site Preference
Eastern Cottonwood	*Populus deltoides*	All Sites
Swamp tupelo	*Nyssa sylvatica* var. *biflora*	Wet
American Elm	*Ulmus americana*	Moist
Sugarberry	*Celtis laevigata*	Moist/Well Drained
Elderberry	*Sambucus canadensis*	Moist/Well Drained
Possum-haw Holly	*Ilex decidua*	Moist/Well Drained
Hickory	*Carya* spp.	Moist/Well Drained
Red Mulberry	*Morus rubra*	Well Drained

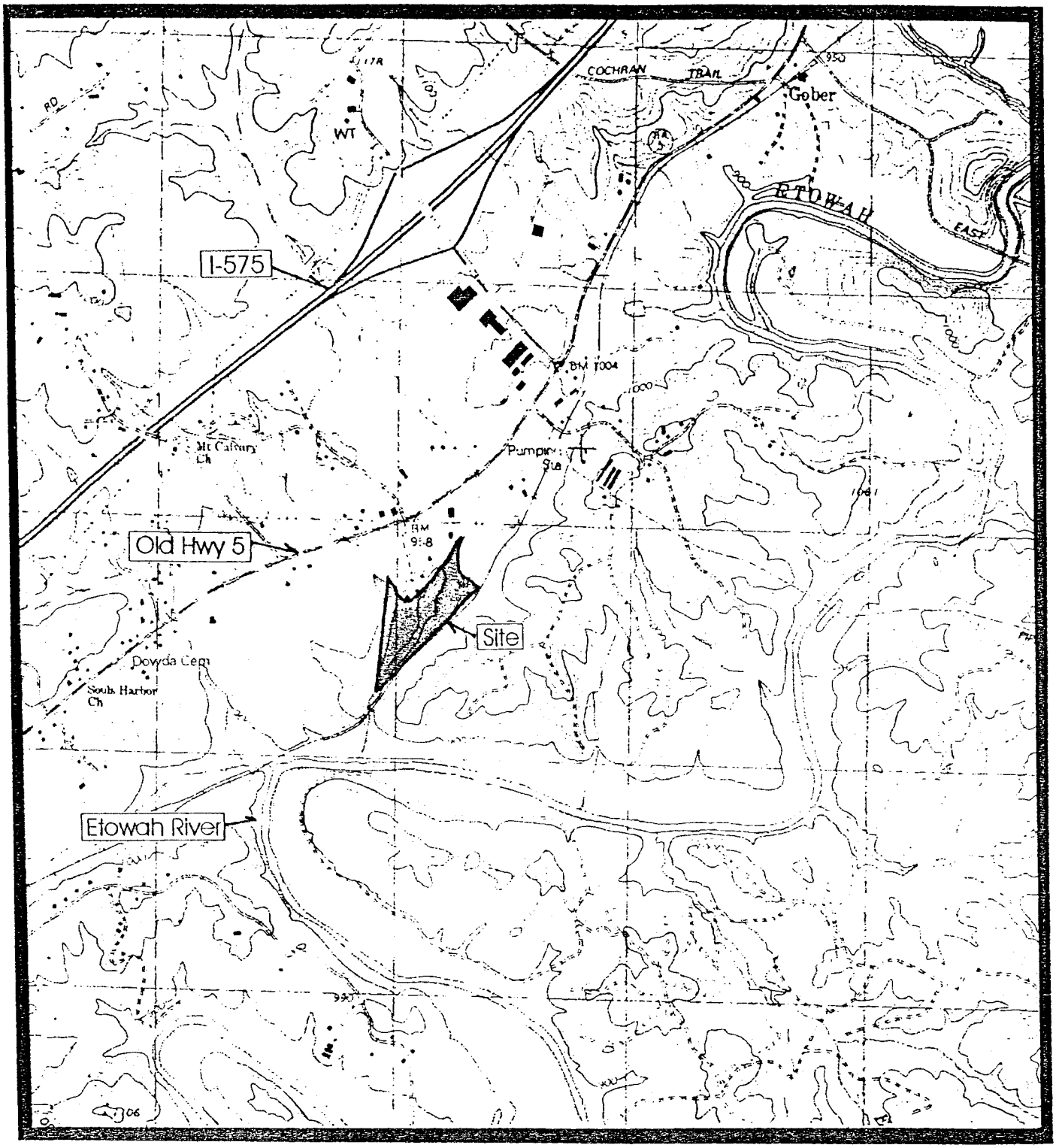
Streambank Species:

Common Name	Scientific Name
River Birch	*Betula nigra*
Red Maple	*Acer rubrum*
Green Ash	*Fraxinus pennsylvanica*
Alder	*Alnus serrulata*
Swamp Dogwood	*Cornus amomum*
Black Willow	*Salix nigra*
Swamp Azalea	*Rhododendron viscosum*
Swamp Haw	*Viburnum nudum*
Black Gum	*Nyssa sylvatica*

SITE MAPS

ECO-SOUTH, INC.

ENVIRONMENTAL CONSULTANTS



NORTH

PROJECT LOCATION MAP

OLD HIGHWAY 5 MITIGATION SITE

Cherokee County, Georgia

USGS- Ball Ground West, Georgia Quadrangle

Scale = 1:24,000 Contour Interval 20 Feet

ECO-SOUTH, INC.

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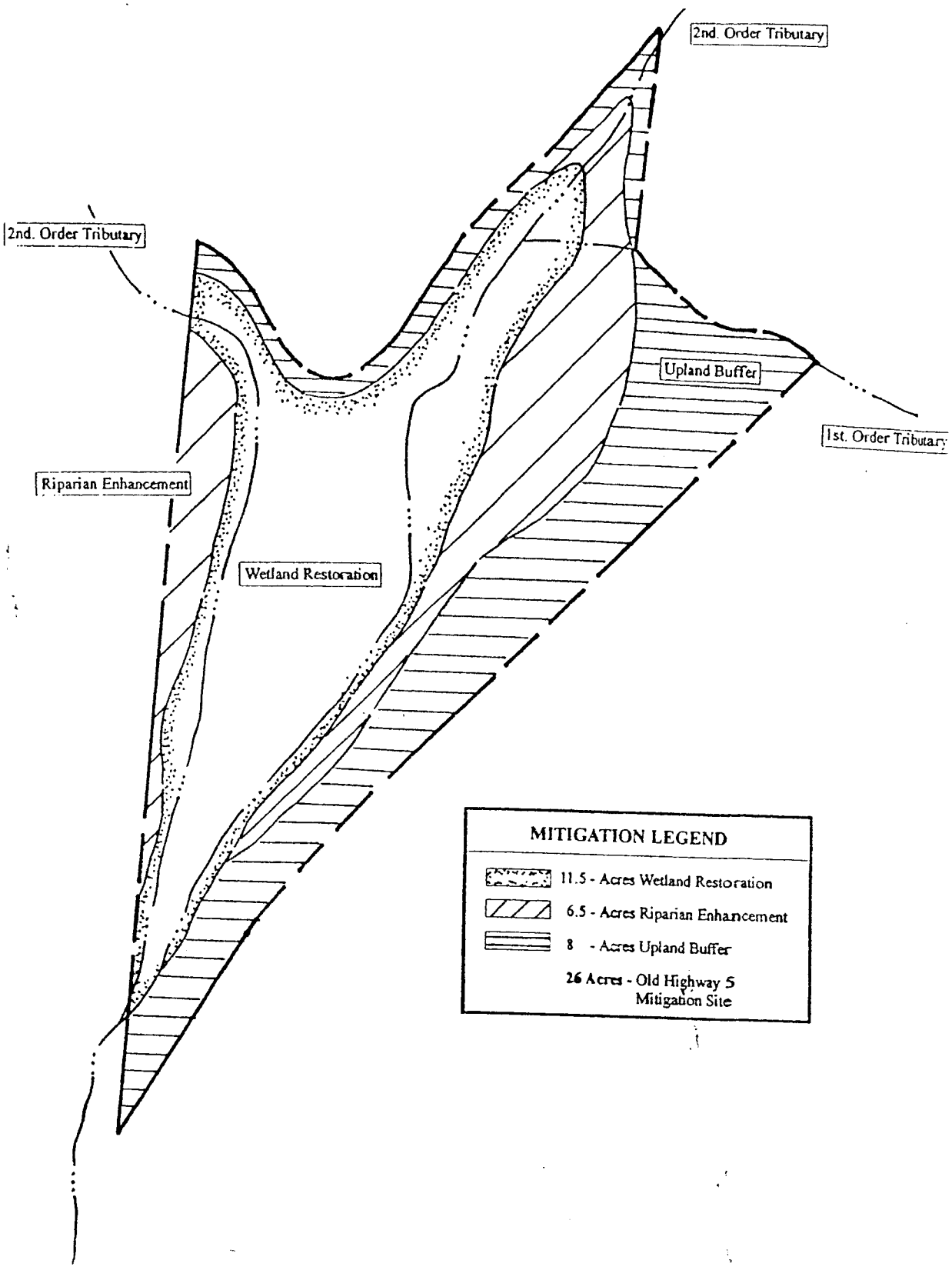
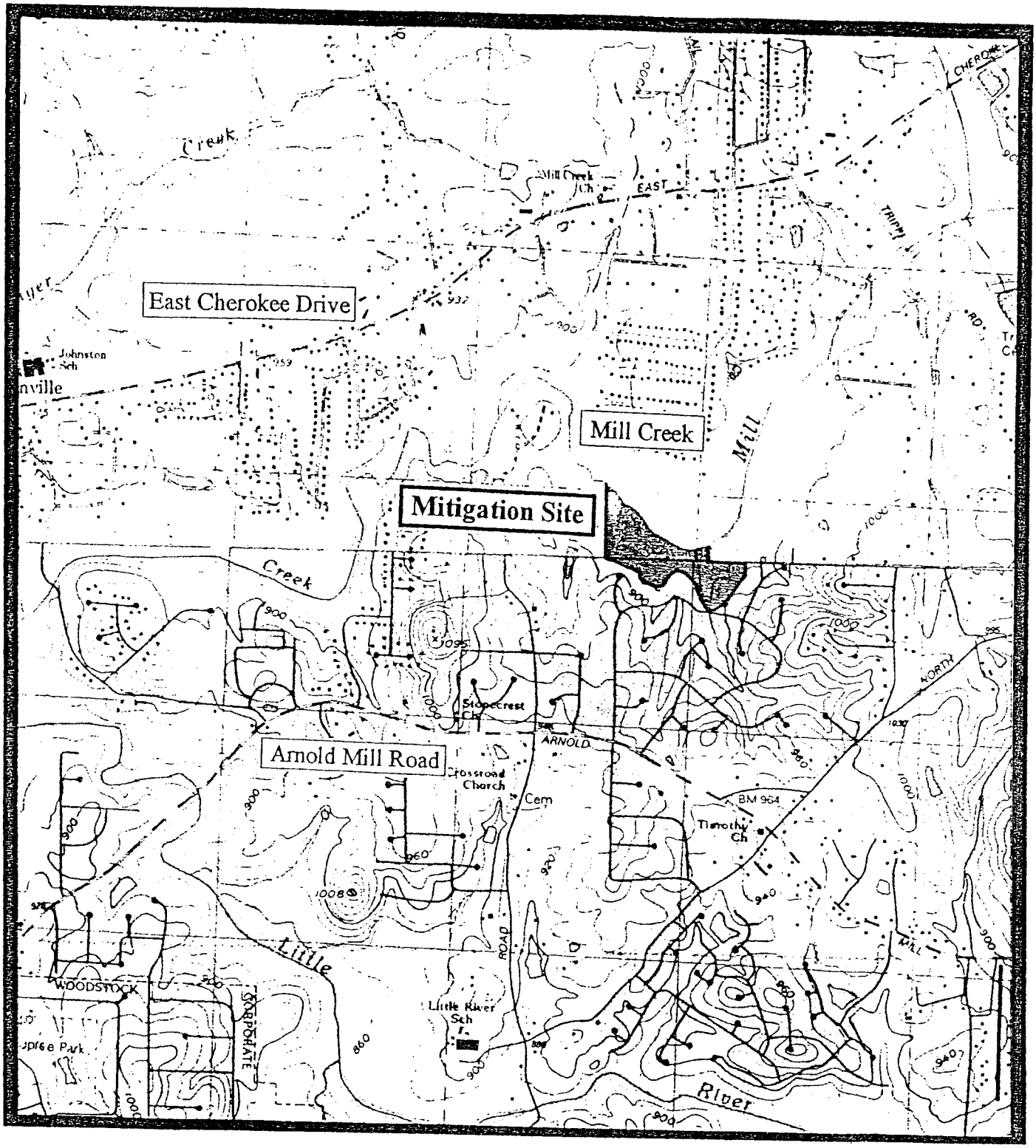


NORTH

MITIGATION SITE MAP
OLD HIGHWAY 5 MITIGATION SITE
Cherokee County, Georgia
Not to Scale

ECO-SOUTH, INC.
ENVIRONMENTAL CONSULTANTS



NORTH

PROJECT LOCATION MAP

MILL CREEK MITIGATION SITE

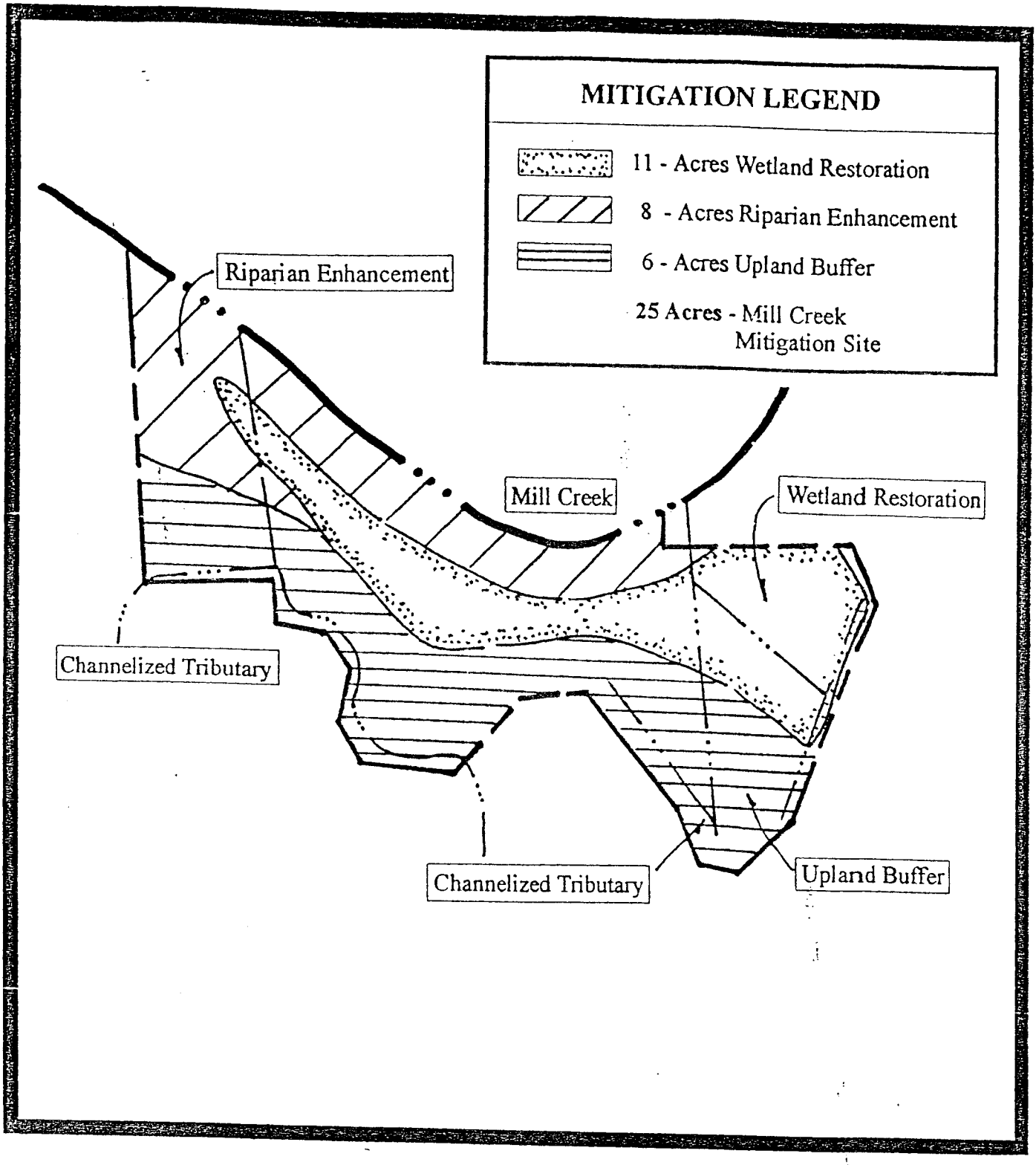
Cherokee County, Georgia

USGS - Canton & Mountain Park, Georgia Quadrangles

Scale = 1:24,000 Contour Interval 20 Feet

ECO-SOUTH, INC.

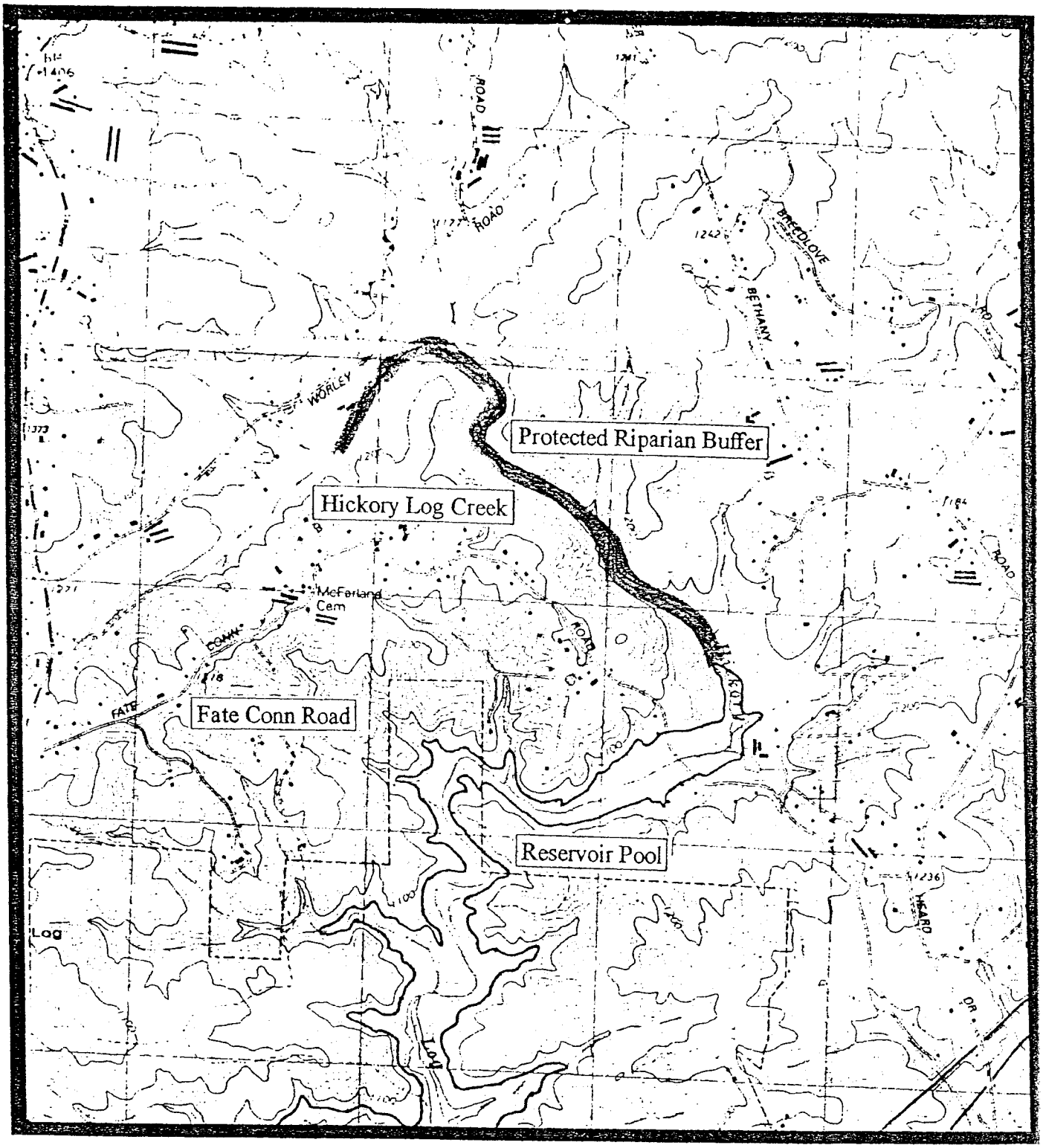
ENVIRONMENTAL CONSULTANTS



NORTH

MITIGATION SITE MAP
MILL CREEK MITIGATION SITE
Cherokee County, Georgia
Scale : 1"=400'

ECO-SOUTH, INC.
ENVIRONMENTAL CONSULTANTS



NORTH

PROJECT LOCATION MAP

HICKORY LOG CREEK MITIGATION SITE

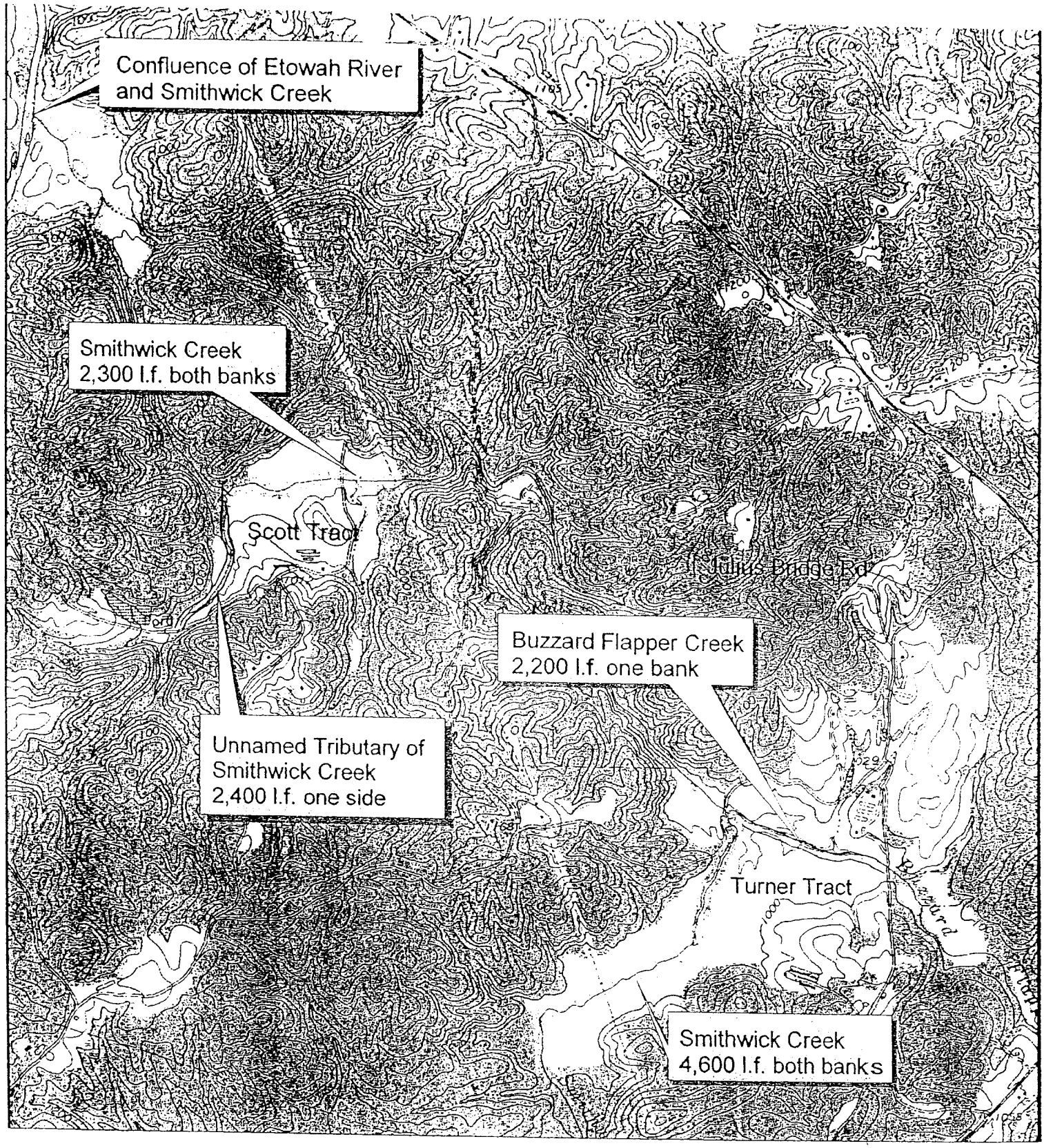
Cherokee County, Georgia

USGS - Ball Ground West, Georgia Quadrangles

Scale = 1:24,000 Contour Interval 20 Feet

ECO-SOUTH, INC.

ENVIRONMENTAL CONSULTANTS



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STREAM MITIGATION LOCATION MAP

HICKORY LOG CREEK RESERVOIR

Cherokee County, Georgia

Ball Ground East, 7.5 minute USGS Quadrangle

400 0 400 800 Meters

ECO-SOUTH, INC.

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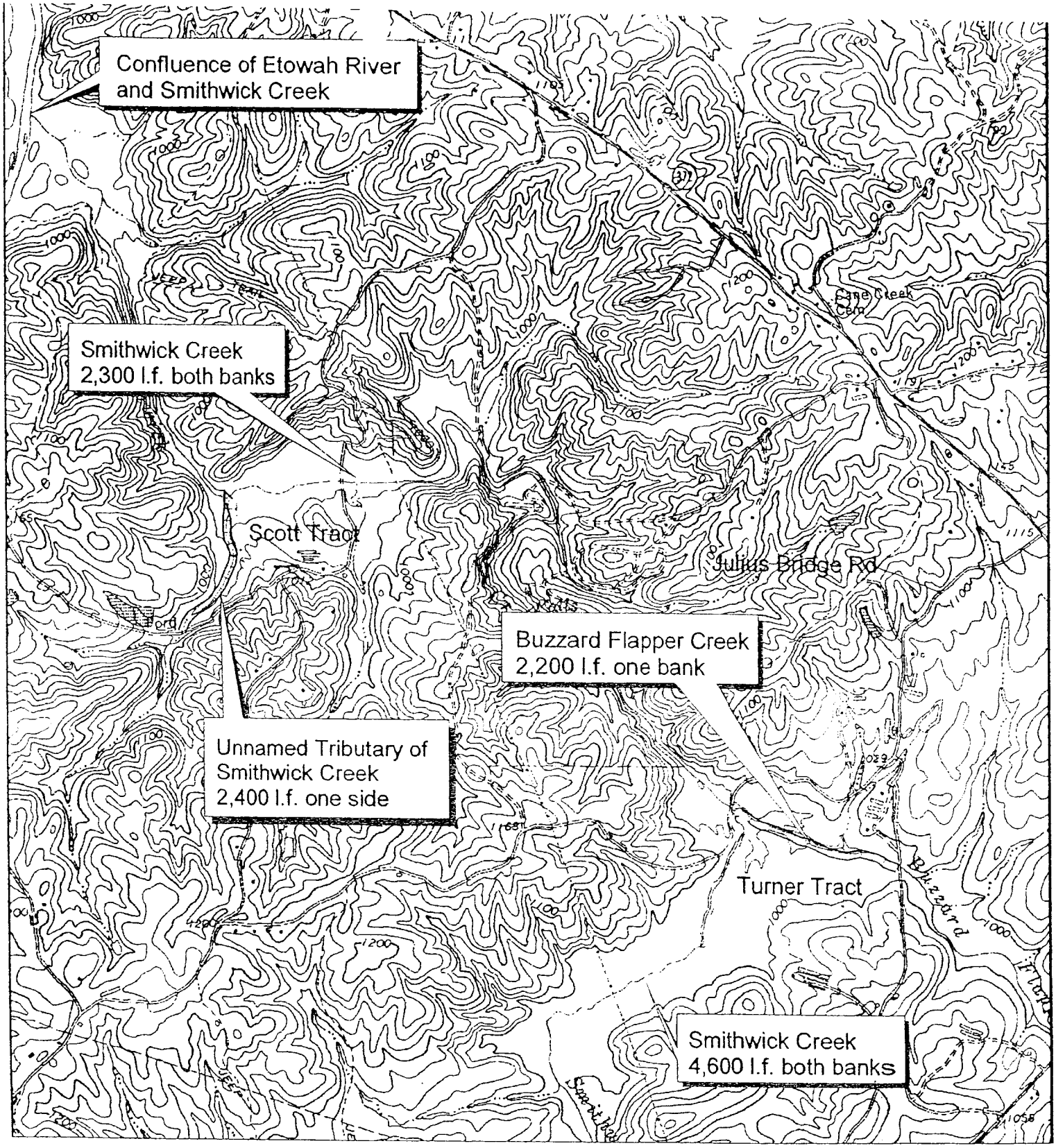

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Environmental Consultants

Georgia Department of Natural Resources
205 Butler Street, S.E., East Floyd Tower, Atlanta, Georgia 30334
Lonice C. Barrett, Commissioner
Harold F. Reheis, Director
Environmental Protection Division

November 20, 2000

Mr. Edward D. Johnson, Jr., Chief
U.S. Army Corps of Engineers
Savannah District, North Area Section
The Plaza, Suite 130
1590 Adamson Parkway
Morrow, GA 30260-1763

Mr. Cecil Pruett, Mayor
City of Canton
687 Marietta Highway
Canton, GA 30114

Mr. Roy Fowler, General Manager
Cobb County-Marietta Water Authority
1660 Barnes Mill Road
Marietta, GA 30062-1520

Re: Proposed Hickory Log Creek Reservoir
City of Canton
Cherokee County, Georgia

Dear Gentlemen:

The Environmental Protection Division ("EPD") of the Georgia Department of Natural Resources has been asked by the City of Canton and the Cobb County-Marietta Water Authority (collectively, the "Applicants") to review submitted and other available population and water demand projections in the support of a proposed regional reservoir on Hickory Log Creek in the City of Canton, Cherokee County, Georgia (the "Project"). The Project contemplates pumped storage from the Etowah River and a safe, sustainable yield of 45 MGD.

EPD concurs with the population growth and water demand projections employed to justify need for the Project. In addition, we approve and accept the following: (1) the Applicants have appropriately adopted a 50-year planning horizon, and (2) the Applicants have successfully demonstrated future water demand for service delivery areas for which they bear service

responsibility under intergovernmental agreements executed pursuant to House Bill 489 (Official Code of Georgia Annotated § 36-70-1 et seq.) [Georgia's Growth Strategies legislation], copies of these agreements being on file and of record with EPD.

In conclusion, the proposed reservoir on Hickory Log Creek is consistent with the State's long-range water supply plan for the Peidmont region of the State and is expected to meet 45 MGD of forecasted need. EPD has long encouraged a multi-jurisdictional approach to water supply planning and supports this current effort by these partners.

It is our understanding that the Applicants have applied to the U.S. Army Corps of Engineers (the "Corps") for a Section 404 Permit under the Clean Water Act for the proposed Hickory Log Creek reservoir. EPD supports this effort and stands ready to assist the Applicants and the Corps in whatever manner you deem appropriate.

Sincerely,

Nolton G. Johnson, P.E., Chief
Water Resources Branch

cc: Harold Reheis
Keith Parsons
Tommy Craig
Nap Caldwell

ALLATOONA DAM AND RESERVOIR
ETOWAH RIVER, GEORGIA

ALLATOONA POWER BENEFITS FOREGONE ASSOCIATED WITH THE CONSTRUCTION OF THE HICKORY LOG CREEK PROJECT

March 2004

Prepared For
U.S. Army Corps of Engineers
Mobile District
Mobile, Alabama

Prepared By
Hydropower Analysis Center
Northwestern Division
Corps of Engineers

1.0 INTRODUCTION

1.1 Purpose and Scope

The City of Canton and the Cobb County-Marietta Water Authority (CCMWA), both located in Georgia, are evaluating several alternatives for meeting the expected increase in the water supply needs of their customers in the future. Each alternative would involve the construction of a 175-foot high dam on Hickory Log Creek, to be located 1.5 miles northeast of the City of Canton. Flows from Hickory Log Creek enter the Etowah River upstream of the Allatoona Reservoir. Each alternative would also include the Canton Pump Station, to be located on the Etowah River upstream of its confluence with Hickory Log Creek. Canton Pump Station would pump water from the Etowah River into the Hickory Log Creek Reservoir, to be released later as needed to meet water supply demands.

One condition that the City of Canton and the CCMWA must meet before they can begin construction on the Hickory Log Creek Dam and Canton Pump Station is to procure of a Department of the Army (DA) permit under Section 404 of the Clean Water Act. They have filed a permit application with the Corps of Engineers Savannah District (which reviews permit applications for proposed projects in Georgia), and the District is in the process of evaluating the application. Before Savannah District can make a decision on whether to issue a DA permit for the Hickory Log Creek project, it must consider the purpose and the impacts of the proposed project.

One of the impacts of the Hickory Log Creek project would be the withdrawal of water from Hickory Log Creek and the Etowah River for future increased water supply demands, water that would otherwise flow into the Allatoona Reservoir. The purpose of this economic analysis is to assess the economic impact that the Hickory Log Creek project would have on Allatoona's hydropower generation.

The economic analysis presented in this report is limited to a determination of the Allatoona power benefits foregone that would result from the increased water supply withdrawals taking place under each Hickory Log Creek alternative. If the Corps issues a DA permit for the Hickory Log Creek project and the City of Canton and the CCMWA decide to implement either of these alternatives, then a more comprehensive water supply storage reallocation study may need to be conducted to determine the economic impact of the Allatoona hydropower losses under the implemented alternative.

1.2 Project Description

The Allatoona project is located on the Etowah River in northern Georgia, approximately 40 miles northwest of Atlanta and 4 miles south of Cartersville. Construction on the storage project was completed in 1955. The primary purposes of the project include flood control, navigation, hydropower, recreation, water-quality and

water supply. The reservoir at the project has a total storage capacity of 670,050 acre-feet (AF), of which 302,580 to 489,060 AF (varies seasonally) is available for flood control.

The project has a powerhouse that contains three Francis-type generating units, two large units and a single small unit. [1] The two large units (Units 1-2) are primarily used for peaking. The available storage allows for shaping of the flow to permit the units to operate at high output during peak-demand hours and shutting the units down during off-peak hours. As a result of project minimum flow requirements for water quality and environmental purposes, the operation of the small unit (Unit 4) is continuous throughout the year except for maintenance outages. Typically, each large unit delivers 40 MW at maximum capacity, while the small unit delivers 3 MW at maximum capacity, so that the maximum output of the project is approximately 83 MW.

The *Allatoona Major Rehabilitation Evaluation Report* was completed in March 2000, which recommended rehabilitating the turbine runners on both large units and including environmental measures for increasing the dissolved oxygen level downstream of the project. With turbine runner rehabilitation, the maximum capacity of each large unit would increase from 40 MW to 50 MW. The Allatoona powerhouse major rehabilitation has not been funded for construction, and funds for rehabilitation are not expected to be appropriated before the project online date of the Hickory Log Creek project. Therefore, this analysis assumes that the Allatoona powerhouse units are in their existing condition.

1.3 Alternatives Examined

Three Hickory Log Creek alternatives were analyzed in this study, in addition to the existing or base condition. The Hickory Log Creek alternatives are those being evaluated by the City of Canton and the CCMWA for meeting the expected increase in the water supply needs of their customers in the future. The existing condition is used as a baseline against which the three remaining alternatives are compared. Each study alternative is summarized below.

Alternative HLEXIST: Existing or base condition. The existing condition alternative is the alternative without the Hickory Log Creek project. This future without project condition assumes that the project will continue to be operated consistent with existing practices based on 1990 Alabama-Coosa-Tallapoosa – Apalachicola-Chattahoochee-Flint (ACT-ACF) water demands and the 1993 ACT Water Control Plan. Three with project alternative palns will be compared to this future without project plan to measure the economic impact the Hickory Log Creek project would have on Allatoona's hydropower generation.

Alternative HLYTAF1: With Hickory Log Creek project. This alternative

[1] The project was constructed so as to allow for the future addition of a third large unit. Due to downstream flow restrictions, the third large unit has never been installed.

represents the operation of the Hickory Log Creek project as ultimately planned by the City of Canton and the CCMWA. This future with project alternative is based on .1990 Alabama-Coosa-Tallapoosa – Apalachicola-Chattahoochee-Flint (ACT-ACF) water demands, the 1993 ACT Water Control Plan plus these additional demands:

- Up to 39 MGD above minimum flow (250 cfs) at Canton Pump Station to be pumped into the Hickory Log Creek Reservoir
- 11 MGD City of Canton annual average additional withdrawal from the Etowah River below Hickory Log Creek
- 34 MGD CCMWA annual average additional withdrawal from the Allatoona Reservoir.
- The Hickory Log Creek project will be operated to maintain the lesser of 250 cfs minimum flow or natural streamflow in the Etowah River below the City of Canton

Alternative HLYTAF1B: With Hickory Log Creek project. This future with project alternative is the same as Alternative HLYTAF1 with the exception of the following operational change:

- Allatoona's firm energy commitment is reduced to 85% of that for Alternative HLYTAF1 in order to ensure that the project's pool does not draw down any further than that occurring under Alternative HLEXIST (existing condition)

Alternative HLYTAF2: With Hickory Log Creek project. Unlike Alternatives HLYTAF1 and HLYTAF1B, this alternative does not include withdrawals from the Allatoona Reservoir. This future with project alternative is based on 1990 Alabama-Coosa-Tallapoosa – Apalachicola-Chattahoochee-Flint (ACT-ACF) water demands, the 1993 ACT Water Control Plan plus these additional demands:

- Up to 39 MGD above minimum flow (250 cfs) at Canton Pump Station to be pumped into the Hickory Log Creek Reservoir
- 35 MGD (11 MGD to the City of Canton and 24 MGD to the CCMWA) annual average additional withdrawal from the Etowah River below Hickory Log Creek
- The Hickory Log Creek project will be operated to maintain the lesser of 250 cfs minimum flow or natural streamflow in the Etowah River below the City of Canton

1.4 Procedure

The development of Allatoona foregone power benefits for the Hickory Log Creek study included the following steps:

For Energy Benefits:

- Run the HEC-5 model to obtain a sequential streamflow regulation for each study alternative, under the assumption that both large units at Allatoona are available
- Utilize output from HEC-5 to estimate the project average annual energy for each study alternative
- Determine the levelized energy value using energy value output from the PROSYM production cost model
- Using average annual energy and levelized energy value as input, determine annual energy benefits for each study alternative
- For each of the three proposed Hickory Log Creek alternatives, determine the Allatoona annual foregone energy benefits
- For each of the three proposed Hickory Log Creek alternatives, determine the Allatoona life-cycle economic impacts resulting from foregone energy benefits

For Capacity Benefits:

- Run the HEC-5 model to obtain a sequential streamflow regulation for each study alternative, under the assumption that both large units at Allatoona are available
- Utilize output from HEC-5 to estimate the project peak demand period energy and capacity for each study alternative
- Utilize the average availability method to determine the project dependable capacity for each study alternative
- Utilize Allatoona historical hourly generation data to develop an annual generation-duration curve
- Utilize FERC procedures to develop the adjusted capacity value for each thermal alternative
- Utilize the Allatoona annual generation-duration curve to determine the

adjusted capacity value for the most likely, least-cost thermal alternative

- Using dependable capacity and adjusted capacity value as input, determine annual capacity benefits for each study alternative

- For each of the three proposed Hickory Log Creek alternatives, determine the Allatoona annual foregone capacity benefits

- For each of the three proposed Hickory Log Creek alternatives, determine the Allatoona life-cycle economic impacts resulting from foregone capacity benefits

The steps above that involve running the HEC-5 model were performed by a consultant hired by the City of Canton and the CCMWA, with the model input and output being verified as reasonable by Mobile District. The steps above that involve determining the Allatoona life-cycle economic impacts were performed by Mobile District.

1.5 Input Assumptions

a. Period of Analysis

The period of analysis begins in the year 2007, which is the year when operation of the Hickory Log Creek project is expected to begin. It extends from that point through a 50-year period, which is the period of analysis often utilized in a water supply withdrawal study.

b. Discount Rate

The interest rate used in this study is the Fiscal Year 2004 Federal interest rate of 5.625 percent.

c. Price Levels

The unit capacity values and the fuel prices used in determining the unit energy values are based on August 2003 price levels. In accordance with ER 1105-2-100, *Principles and Guidelines* (April 2000), real fuel cost escalation and inflation were not utilized in developing levelized energy values. The August 2003 level fuel prices were assumed to apply over the entire period of analysis.

d. Rounding and Totals

Some parts of the study analysis were performed using spreadsheet software. Arithmetic operations and totals were taken to full decimal accuracy within the spreadsheet. Tables found within this report have been rounded to a specified level of accuracy after the mathematical computations have been performed; therefore,

rounded totals may not equal the summation of rounded values.

2.0 ENERGY OUTPUT AND DEPENDABLE CAPACITY

2.1 HEC-5 Model and Studies

The energy and capacity output from Allatoona, under the existing condition and each of the three Hickory Log Creek alternatives, was developed utilizing output from an HEC-5 system operation study. The Hydrologic Engineering Center Model HEC-5, *Simulation of Flood Control and Conservation Systems*, was used to simulate (using a daily routing interval) the operation of the Alabama-Coosa Rivers system of reservoirs, including the Allatoona Reservoir, over the 63-year hydrologic period of record from 1939 through 2001. The existing condition simulation HLEXIST utilized the ACT Comprehensive Study "Existing Conditions" HEC-5 model TEA08017 and assumed 1990 ACT-ACF water demands and the 1993 ACT Water Control Plan. The existing conditions model was modified as needed to simulate the operation of each of the three Hickory Log Creek alternatives (HLYTAF1, HLYTAF1B and HLYTAF2). The HEC-5 model modifications and the running of the four model simulations were performed by a consultant hired by the City of Canton and the CCMWA. The HEC-5 model input and output for the four study alternatives was provided to Mobile District, which reviewed it before it was provided to HAC for the Allatoona power impacts analysis.

In each HEC-5 simulation, all three Allatoona generating units were assumed to be available, with the small unit operating continuously to provide a minimum release for water quality and environmental purposes. [2] Since the planned powerhouse major rehabilitation has not been funded for construction, and funds for rehabilitation are not expected to be appropriated before the Hickory Log Creek project is placed in operation, each HEC-5 simulation assumed the Allatoona large units to be in existing condition. In addition, the large units were modeled assuming best efficiency operation, since the Southeastern Power Administration believes there likely will be the need in the near future for the units to operate most of the time at best efficiency in order to maximize project energy.

Allatoona period of record daily energy and capacity output from the four HEC-5 simulations were utilized in order to estimate the project average annual energy and dependable capacity under the existing condition and each of the three Hickory Log Creek alternatives. A summary of the estimates that were obtained is presented in the remaining sections.

2.2 Annual Energy Results

Table 1 summarizes, for the existing condition and each of the three Hickory Log Creek alternatives, the Allatoona average annual energy estimates that were

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[2] The continuous operation of the small unit was modeled in HEC-5 as a leakage of 250 cfs, and the model output for Allatoona consisted of the daily energy and capacity contributed by the two large units.

developed from the HEC-5 daily energy output. The last column of the table summarizes the estimate of average annual energy foregone under each Hickory Log Creek alternative. The largest negative impact on Allatoona average annual energy takes place under Alternative HLYTAF1, the alternative that represents the operation of the Hickory Log Creek project as ultimately planned by the City of Canton and the CCMWA.

Table 1
Annual Generation by Alternative

Alternative	Plant Capacity (MW)	Avg. Annual Energy (MWh)	Annual Energy Loss Relative to HLEXIST (MWh)
HLEXIST	80.0	128.242	—
HLYTAF1	80.0	122.002	6.240
HLYTAF1B	80.0	122.053	6.189
HLYTAF2	80.0	123.419	4.823

2.3 Dependable Capacity Results

Allatoona dependable capacity was computed for each study alternative using the average availability method. This method, which is described in Section 6-7g of EM 1110-2-1701, *Hydropower Engineering and Design* (31 Dec 1985), is the most appropriate method for a hydropower project which is operated in a thermal-based power system such as the Southern subregion of the Southeastern Electric Reliability Council (SERC) power system.

Under the average availability method, dependable capacity is defined as the average supportable capacity for the peak demand weeks over the available hydrologic period of record. For the area that includes Allatoona, the peak demand weeks are 23 through 35, which correspond to the months June through August. Weekly data on the energy and capacity output contributed by Units 1-2 was developed from the results of the 63-year HEC-5 system operation study described in Section 2.1.

The average availability method was used to calculate the supportable capacity for each year in the period of record, for each of the four study alternatives. For each alternative, the supportable capacity results over the 63-year period of record were averaged in order to compute the dependable capacity for that alternative.

Table 2 summarizes, for the existing condition and each of the three Hickory Log Creek alternatives, the Allatoona dependable capacity estimates that were developed

from the HEC-5 daily energy and capacity output. The last column of the table summarizes the estimate of dependable capacity foregone under each Hickory Log Creek alternative. The largest negative impact on Allatoona dependable capacity takes place under Alternative HLYTAF1B, the alternative that reduces Allatoona's firm energy commitment to 85% of that for Alternative HLYTAF1 in order to ensure that the project's pool does not draw down any further than that occurring under Alternative HLEXIST (existing condition).

Table 2
Dependable Capacity by Alternative

Alternative	Plant Capacity (MW)	Dependable Capacity (MW)	Dependable Capacity Loss Relative to HLEXIST (MW)
HLEXIST	80.0	76.9	----
HLYTAF1	80.0	75.7	1.2
HLYTAF1B	80.0	75.0	1.9
HLYTAF2	80.0	76.0	0.9

3.0 ENERGY AND CAPACITY VALUES

3.1 Energy Value Development and Results

The energy benefits attributable to a hydro project are based on the system cost of producing the same amount of energy as the hydro project. To obtain a unit energy value for the hydro project, a system analysis is performed in which the area power system is modeled under two different conditions: one that includes the hydro project in the power system, and one that excludes the hydro project from the power system. The unit energy value is then determined by dividing the difference in system operating costs for the two conditions by the hydro project's annual energy output.

The energy values for Allatoona were developed using the PROSYM production cost model, a chronological hourly production cost model that was developed and is maintained by Henwood Energy Services of Sacramento, California. PROSYM dispatches system generating resources to meet hourly system loads thereby developing system operating costs for the specified load and resource conditions. In PROSYM, one load year is analyzed at a time, with the model economically dispatching resources hour-by-hour over one-week periods. Unit energy values were developed for five representative load years: 2005, 2010, 2015, 2020, and 2025. Values between these years were interpolated. The value for year 2025 was assumed to be representative of the value for unsimulated years beyond 2025.

The basic PROSYM data set utilized for this analysis was based on Henwood's NERC database (version 6_8_1). The area evaluated included the Southern Company Transmission area in Alabama and Georgia. Data utilized from Henwood's database included system loads, resources, fixed operating costs, and variable operating costs. For each load year modeled in PROSYM, using the Capacity Expansion Module provided by Henwood, generic thermal resources were added to the system as needed to insure that resources were balanced to the load with a 12 percent peak load reserve margin.

Hydropower input data for Allatoona included monthly energy output and minimum and maximum capacity for the two large units. The energy output was the long term average from the HEC-5 study which was done as part of the *Allatoona MRER*. Hydropower input data for the remaining hydropower plants in the system were obtained from Henwood's NERC database. For determination of energy values, Allatoona was modeled as a peaking hydropower plant. Two sets of hydropower input data were assembled, one including Allatoona, and one without Allatoona. The latter input data set simply removed the Allatoona contribution to the hydropower energy and capacity of the system. The same hydropower data was used for all load year simulations.

Once the yearly energy values were developed utilizing output from PROSYM, they

were present-worthed to the beginning of the period of analysis and then levelized over the project economic life by applying the appropriate amortization factor to develop the levelized unit energy value. For this analysis, the period of analysis begins in the year 2007, which is the year when operation of the Hickory Log Creek project is expected to begin. The project economic life is assumed to be 50 years, which is the period often utilized in a water supply withdrawal study.

Table 3 summarizes the unit energy value in $/MWh for each year in the period of analysis. The shaded values in the third column of the table are those that were developed using the PROSYM model. The shaded value, $38.63/MWh, at the bottom right corner of the table is the levelized unit energy value. This is the value that was utilized for the computation of Allatoona energy benefits.

3.2 Capacity Value Development and Results

The capacity benefits attributable to a hydro project are based on the least-cost mix of thermal resources that would most likely replace the project capacity if it were not available. Capacity benefits are computed as the product of the dependable capacity of the hydro project and a unit capacity value.

The types of thermal resources that are normally considered when developing the unit capacity value are coal-fired steam (used for meeting base loads), gas-fired combined cycle (used for meeting base and intermediate loads) and gas-fired combustion turbine (used for meeting peak loads). Unit capacity values for these three thermal resource types were developed using procedures developed by the Federal Energy Regulatory Commission (FERC). The adjusted FERC capacity value (CV_{FERC}) incorporates the unadjusted capacity value (CV), the ratio of availability (HMA/TMA) and the flexibility adjustment (1+F), as shown in the equation below. The ratio of availability accounts for the relative mechanical/electrical reliability of hydropower compared to the thermal alternative, while the flexibility adjustment accounts for the added operational flexibility of hydropower compared to the thermal alternative.

$$CV_{FERC} = (CV)\left(\frac{HMA}{TMA}\right)(1+F)$$

Table 4 summarizes the adjusted and unadjusted unit capacity values that were developed using the FERC procedures, along with the three factors (HMA, TMA and F) that FERC includes when developing the adjusted unit capacity values. The unit capacity values shown in the table are based on a Federal interest rate of 5.625 percent and August 2003 price levels.

Table 3
Levelized Energy Value Computation [3]

Interest Rate: 5.625
HLC Operation Start Date: 2007
End of Economic Life: 2056

Year	Present Worth Factor	Energy Value ($/MWh)	PW Energy Value
2004	1.0000	----	----
2005	1.0000	38.57	----
2006	1.0000	37.99	----
2007	0.9467	37.42	35.43
2008	0.8963	36.84	33.02
2009	0.8486	36.27	30.78
2010	0.8034	35.69	28.67
2011	0.7606	36.17	27.51
2012	0.7201	36.65	26.39
2013	0.6818	37.13	25.31
2014	0.6455	37.61	24.28
2015	0.6111	38.09	23.28
2016	0.5785	38.40	22.21
2017	0.5477	38.71	21.20
2018	0.5186	39.01	20.23
2019	0.4909	39.32	19.30
2020	0.4648	39.63	18.42
2021	0.4400	39.77	17.50
2022	0.4166	39.91	16.63
2023	0.3944	40.04	15.79
2024	0.3734	40.18	15.00
2025	0.3535	40.32	14.25
To 2056	0.0648	40.32	206.96
Total			642.17
Period of Analysis (Yrs)			50
Levelized Energy Value ($/MWh)			38.63

[3] Energy values for 2005, 2010, 2015, 2020 and 2025 obtained from PROSYM studies; values for intermediate years obtained by linear interpolation; the year 2025 value assumed to be representative of remaining years.

Table 4
Unit Capacity Values

Thermal Alternative Plant Type	Adjusted Capacity Value ($/kW-yr)	FERC Adjustments			Unadjusted Capacity Value ($/kW-yr)
		HMA	TMA	F	
Coal-Fired Steam	209.64	0.98	0.85	0.050	173.17
Combined Cycle	116.45	0.98	0.90	0.025	104.34
Combustion Turbine	62.13	0.98	0.90	0.025	55.67

The least-cost thermal alternative to the Allatoona large units was determined by utilizing the annual generation-duration curve for the Allatoona project appearing in Appendix E-III (Hydropower Benefit Calculations), Figure E-III-2 of the *Allatoona MRER*. This annual generation-duration curve is based on historical hourly generation data for 1995, the first calendar year after the rewind of Units 1-2. This particular year was selected since it is considered to be a representative year of project operation in terms of both power generation and river flows.

Based on the characteristic shape of the year 1995 annual generation-duration curve, which represents typical project operation, HAC determined that the least-cost mix of thermal resources that would most likely be displaced by the Allatoona large units would be gas-fired combined cycle (CC) and, to a lesser extent, gas-fired combustion turbine (CT). The least-cost thermal alternative assumed in the Hickory Log Creek analysis consists of a mix of 2/3 CC and 1/3 CT. The unit capacity value corresponding to this mix was determined by weighting the adjusted capacity values for CC and CT in Table 4. The unit capacity value computation is shown below.

For CC: Adjusted CV = $116.45/kW-yr

For CT: Adjusted CV = $62.13/kW-yr

For a mix of 2/3 CC and 1/3 CT: Adjusted CV = (2/3 * 116.45) + (1/3 * 62.13)

= $98.34/kW-yr

The unit capacity value $98.34/kW-yr was utilized in the computation of Allatoona capacity benefits.

4.0 HYDROPOWER BENEFITS AND BENEFITS FOREGONE

4.1 Procedure

Annual energy benefits for each of the four study alternatives were computed by applying the levelized unit energy value ($38.63/MWh) from Section 3.1, Table 3 to the average annual energy estimates summarized in Section 2.2, Table 1. The equation below was utilized in this process. The annual energy benefits for each Hickory Log Creek alternative were then subtracted from the annual energy benefits for the existing condition in order to obtain the Allatoona annual energy benefits forgone under each Hickory Log Creek alternative.

$$Annual\ Energy\ Benefits = EV_{Lev.} * AAE$$

Annual capacity benefits for each of the four study alternatives were computed by applying the adjusted unit capacity value ($98.34/kW-yr) from Section 3.2 to the dependable capacity estimates summarized in Section 2.3, Table 2. The equation below was utilized in this process. The annual capacity benefits for each Hickory Log Creek alternative were then subtracted from the annual capacity benefits for the existing condition in order to obtain the Allatoona annual capacity benefits foregone under each Hickory Log Creek alternative.

$$Annual\ Capacity\ Benefits = CV_{Adj.} * DC$$

Annual power benefits for each of the four study alternatives were computed by summing the corresponding annual energy benefits and annual capacity benefits. The annual power benefits for each Hickory Log Creek alternative were then subtracted from the annual power benefits for the existing condition in order to obtain the Allatoona annual power benefits foregone under each Hickory Log Creek alternative.

4.2 Hydropower Benefits and Benefits Foregone Results

Tables 5, 6 and 7 summarize, respectively, the annual energy benefits, annual capacity benefits and annual power benefits that were obtained for each study alternative when the procedure outlined in the previous section was carried out. The last column of the tables summarize the Allatoona annual energy benefits foregone, annual capacity benefits foregone and annual power benefits foregone under each Hickory Log Creek alternative. The largest negative impact on Allatoona annual power benefits takes place under Alternative HLYTAF1B, the alternative that reduces Allatoona's firm energy commitment to 85% of that for Alternative HLYTAF1 in order to ensure that the project's pool does not draw down any further than that occurring under Alternative HLEXIST (existing condition). The larger negative impact on Allatoona annual power benefits that takes place under alternative HLYTAF1B is the result of the corresponding larger negative impact this alternative has on the project's dependable capacity (see Section 2.3, Table 2).

Table 5
Annual Energy Benefits by Alternative

Alternative	Avg. Annual Energy (MWh)	Levelized Energy Value ($/MWh)	Annual Energy Benefits ($1,000)	Energy Benefit Loss Relative to HLEXIST ($1,000)
HLEXIST	128.242	38.63	4.954.0	----
HLYTAF1	122.002	38.63	4.712.9	241.1
HLYTAF1B	122.053	38.63	4.714.9	239.1
HLYTAF2	123.419	38.63	4.767.7	186.3

Table 6
Annual Capacity Benefits by Alternative

Alternative	Dependable Capacity (MW)	Adjusted Capacity Value ($/kW-yr)	Annual Capacity Benefits ($1,000)	Capacity Benefit Loss Relative to HLEXIST ($1,000)
HLEXIST	76.9	98.34	7.562.4	----
HLYTAF1	75.7	98.34	7.444.4	118.0
HLYTAF1B	75.0	98.34	7.375.5	186.9
HLYTAF2	76.0	98.34	7.473.9	88.5

Table 7
Annual Hydropower Benefits by Alternative

Alternative	Energy Benefits ($1,000)	Capacity Benefits ($1,000)	Total Hydropower Benefits ($1,000)	Hydropower Benefit Loss Relative to HLEXIST ($1,000)
HLEXIST	4.954.0	7.562.4	12.516.4	-----
HLYTAF1	4.712.9	7.444.4	12.157.3	359.1
HLYTAF1B	4.714.9	7.375.5	12.090.4	426.0
HLYTAF2	4.767.7	7.473.9	12.241.6	274.8

LAKE ALLATOONA
BOATER BASED RECREATION IMPACTS

1.0. INTRODUCTION

1.1. Purpose and Scope

The City of Canton and the Cobb County-Marietta Water Authority (CCMWA), both located in Georgia, are evaluating several alternatives for meeting the expected future increase in the water supply needs of their customers. Each alternative would involve the construction of a 175-foot high dam on Hickory Log Creek, to be located 1.5 miles northeast of the City of Canton. Flows from Hickory Log Creek enter the Etowah River upstream of the Allatoona Reservoir. Each alternative would also include the Canton Pump Station, to be located on the Etowah River upstream of its confluence with Hickory Log Creek. The Canton Pump Station would pump water from the Etowah River into the Hickory Log Creek Reservoir, to be released later as needed to meet water supply demands.

One condition that the City of Canton and the CCMWA must meet before they can begin construction on the Hickory Log Creek Dam and Canton Pump Station is to procure of a Department of the Army (DA) permit under Section 404 of the Clean Water Act. They have filed a permit application with the Corps of Engineers Savannah District (which reviews permit applications for proposed projects in Georgia), and the District is in the process of evaluating the application. Before Savannah District can make a decision on whether to issue a DA permit for the Hickory Log Creek project, it must consider the purpose and the impacts of the proposed project.

One of the impacts of the proposed project would be the withdrawal of water from Hickory Log Creek and the Etowah River for future increased water supply demands, water that would otherwise flow into the Allatoona Reservoir. The purpose of this economic analysis is to assess the economic impact that lower reservoir levels resulting from water withdrawals would have on boater-based recreation on Lake Allatoona. One of the proposed alternatives (HLYTAF1) requires withdrawal directly from Lake Allatoona. Tentative plans are for the Allatoona withdrawals to be supported directly from releases from Hickory Log Creek reservoir storage, in lieu of reallocating storage at the Allatoona project. If it is determined that the Hickory Log Creek project has inadequate storage to support the projected withdrawals from Allatoona, then a more comprehensive water supply storage reallocation study may need to be conducted to determine the economic impact of the boater-based recreation losses under the implemented alternative.

1.2. Alternatives Examined

The future without and with project conditions were evaluated for the period of record (1939-2001) and for the decade (1980's) that included two drought years (1986 and

1988). The difference between the two conditions (i.e., for the same analysis period) will determine the economic impacts of the alternatives being evaluated.

1.3. Analysis Limitations

This analysis was performed at a reconnaissance level of detail using readily available information. As such, the survey population and study area result in estimates that apply only to a sub-set of all recreation users. Thus, recreation impacts have been underestimated being limited to boater based activities and 1995 recreation users. Population growth occurring since that time has not been captured and its effects on boater-based recreation have not been estimated. Additional impacts not estimated include both regional and indirect impacts. The Corps' Value to the Nation website (http://www.corpsresults.us/default.htm) provides a general description of the project's features and an estimate of its impact on the local economy. Based upon 1999/2000 data (source of which is provided below), there are an estimated 5.7 million visits to the lake each year. Within 30 miles of the lake, there was approximately $94.46 million in visitor spending, 67% of which was captured by the local economy as direct sales effects. With multiplier effects considered, visitor trip spending resulted in the following: $99.06 million in total sales; $57.69 million in total income; and 2,081 jobs in the local community surrounding the lake. Note, these estimates are based upon visitor, trip spending within 30 miles of the lake only and do not include purchases of durable goods.

The aforementioned visitation data (i.e., provided at the Value to the Nation website) was derived from the National Recreation Management System (NRMS); the spending profiles were estimated from a national visitor spending survey that was conducted in 1999/2000. The Impact Analysis for Planning (IMPLAN) system was utilized to estimate capture rates and economic multipliers. IMPLAN is a microcomputer based input-output (I-O) modeling system maintained by the Minnesota IMPLAN Group Inc. Spending averages were computed and multiplied by visitation statistics to estimate total annual visitor spending. Generalized spending profiles were then developed for two sets of visitor segments: (1) campers, other overnight visitors, and day users, and (2) boaters and non-boaters. These profiles were applied to recreation use data gathered from the 1999/2000 survey and from the NRMS to estimate total spending by each segment for each of the 456 Corps projects.

2.0. BACKGROUND

2.1. Data Sources

Data that was analyzed in the following recreation assessment was acquired from the Recreation Demand Element report for the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint (ACT and ACF) Comprehensive Study. Recreation use data was obtained through a two-phase recreation survey administered to registered boat owners in the 101 counties in the ACT and ACF basins. The Phase I survey consisted of a telephone survey that was administered to collect information on

recreational use at each of the ACT and ACF project sites, including Lake Allatoona, during the 1995-recreation year. The Phase II survey was a contingent use survey that queried respondents on how their recreation use at one of six impact projects would change as the result of low water conditions.

The six impact projects were a subset of the ACT and ACF water resource projects evaluated in the Recreation Demand Element report. The six impact projects were selected based upon their representativeness of the entire range of project characteristics in the basins. The six impact projects consist of the following: the Alabama River Lakes, Lake Allatoona, Lake Walter F. George, Lake Sidney Lanier, Lake Martin, and the Apalachicola River.

The initial survey sample size consisted of 2,000 completed interviews for the Phase I survey and 100 completed Phase II interviews for each of the six impact projects. A stratified design was used to assure an appropriate distribution of the sample for representing all boats in the population and maximizing the precision of estimates. The following table presents the strata that were used for Phase I of the study. All strata were defined by proximity to water projects targeted for Phase II and to other projects within the basins. For projecting to the total population of registered boats in the eleven strata, sample data from Phase I were weighted by the inverse of the sampling fraction in each stratum. The weighting factors for each stratum are shown in Table 1.

Table 1
Weighting Scheme

Strata	Number of Registered Boaters	Number of Completed Interviews	Sample Allocation (%)	Weights
Alabama Lakes	13,666	205	10.00	66.66
Lake Allatoona	27,276	198	10.00	137.76
Apalachicola River	10,797	203	10.00	53.19
Lake George (AL)	7,337	185	8.50	39.66
Lake George (GA)	789	36	1.50	21.92
Lake Lanier	33,112	206	10.00	160.74
Lake Martin	8,253	213	10.00	38.75
Counties with other projects (AL)	34,277	279	13.85	122.86
Counties with other projects (GA)	19,488	105	5.05	185.60
Counties without other projects (AL)	27,652	141	6.85	196.11
Counties without other projects (GA)	76,629	296	14.25	258.88

2.1.1. Phase I Survey – Visitation

Estimates of water-based boater recreation use under current conditions were developed from the results of the Phase I survey that measured recreation use for the 1995 recreation year. Estimates that were collected include the number of recreation

trips and the recreation activities that respondents engaged in. The number of recreation trips made during the 1995 evaluation period was grouped by the following recreation seasons:

- Winter — December 1994 - February 1995
- Spring — March - May 1995
- Summer — June - August 1995
- Fall — September - November 1995

The reported number of seasonal visits was based upon respondent recall. As shown in the table, the total number of seasonal trips (i.e., Total Trips) is less than the total trips reported (i.e., sum of columns 2 thru 5). This variance is due to respondents remembering the total number of trips they made to a project, but not the exact amount by season. In addition to the number of annual and seasonal trips, estimates were also developed for the number of days spent on typical boating trips and the number of people who went on the boating trips. Table 2 displays the Lake Allatoona visitation for registered boat owners during the 1995-recreation year. As shown, the summer months have the highest visitation with 193,808 trips, followed by the spring months with 182,144 trips.

Table 2
Lake Allatoona Visitation for Registered Boat Owners

Trips					Days on Typical Trip	Persons on Typical Trip
Total	Winter	Spring	Summer	Fall		
482,489	59,072	182,144	193,808	47,466	1.3	2.9

2.1.1.1. Pool Levels. The average 1995 seasonal pool levels for Lake Allatoona are shown in Table 3. These seasonal water levels were typical of those present during the project visitation reported in Table 2.

Table 3
Average Seasonal Pool Levels

Season	Feet (NGVD)[1]
Winter	829.73
Spring	838.40
Summer	837.62
Fall	832.51

[1] NGVD: National Geodetic Vertical Datum

2.1.1.2. Recreation Activity Participation. As shown in Table 4, fishing from a boat had the highest recorded recreation activity participation rate, with participation by 73 percent of those surveyed. The activities that survey respondents reported

participating in least were scuba diving and hunting. Since respondents were asked which activities they participated in on a typical trip and activities were not mutually exclusive, reported activity participation per trip sums to more than 100 percent.

Table 4
Activity Participation

Activity	Participation
Fishing: shore	16%
Fishing: boat	73%
Pleasure Boating	64%
Water Skiing	38%
Jet Skiing	9%
Scuba Diving	0%
Swimming	58%
Camping	30%
Pick-nicking	49%
Hunting	2%

2.1.1.3. Expenditures. Spending estimates were obtained from the Phase I survey. Estimates consisted of those one-time expenditures made for items consumed on a typical trip to the project that the respondent visited most often. There were two types of expenditures reported:

- those made inside a thirty-mile radius of the project, and
- those made outside a thirty-mile radius of the project.

Note, a thirty-mile radius is typically used in economic impact analysis to define a local economic region. Table 5 displays the 1995 expenditure data for Lake Allatoona.

Table 5
Site Expenditures

	Within Thirty Miles	Outside Thirty Miles
	(dollars)	
Annual Total	10,856,003	44,630,233
Mean/Trip	22.50	92.50
Standard Error	3.4	17.2

2.1.2. Phase II Survey – Impacts

As previously mentioned, the Phase II survey was designed to ascertain how respondents' use of one of six impact projects would change as a result of low water conditions. The survey consisted of a mail-back instrument that included two scenarios, one of navigation hazards and the other of recreation facilities. Each depicted and described problems faced by recreational boaters at two specified low water elevations. The survey instrument was sent to project users identified during the Phase I survey. In addition to the survey instrument, the respondents were provided with the number of trips that they had previously indicated taking to the project during the 1995 recreation year (i.e., in the Phase I survey). The respondent was asked to refer to the number of trips that they had taken during a typical recreation year and indicate how their project use would change due to the low water conditions shown.

2.1.3. Value Functions – Development

Seasonal value functions were developed for each recreation project. The water level/trip visitation value functions provide estimates of the number of recreation trips boaters would make at any specific pool level within a range of water levels.

2.1.3.1. Pool Levels. A maximum of five pool levels were used in determining the water level/recreation visitation relationship. The following is a list of the pool levels and definitions:

- Maximum - point (pool level) at which the first boat ramp is closed due to high water levels;
- Average - 1995 seasonal average pool level;
- First Impact Level - point at which low water first begins to impact recreation use;
- Second Impact Level - point at which low water problems become so serious that users must decide whether to continue to use the project; and
- Minimum - point at which the last project boat ramp is closed.

The maximum and minimum water levels were defined to incorporate the widest range of pool levels for the evaluation of alternatives. The maximum, first and second impact levels, and minimum pool levels were identified by recreation experts at the respective projects. The Water Management Office of the U.S. Army Corps of Engineers, Mobile District provided the average 1995 seasonal water levels. Table 6 displays the range of pool levels used to evaluate changes in recreation use and define the value functions for Lake Allatoona.

Table 6
Impact Pool Levels

Maximum	1st Impact	2nd Impact	Minimum
(feet NGVD)			
842.0	837.0	835.0	819.0

2.1.3.2. Visitation. Recreation visits (trips) were associated with the pool levels identified above. Trips associated with the maximum water level were assigned the same value as those at the average seasonal pool level. The assumption was made that recreation use at a project reaches capacity at normal pool (seasonal average pool was used as a surrogate for normal pool) and remains that way until high water impacts begin to limit accessibility. Trips associated with the minimum pool levels were set at zero (0) under the assumption that recreation use ends when all facilities are unusable due to low water conditions. This assumption was made despite the fact that some boaters will still be able to access a project from private boat docks, ramps, etc. The number of trips made during average pool levels came directly from the Phase I use estimates.

The number of trips made at first and second impact levels was derived from the Phase I and Phase II survey estimates. To determine these impact level use estimates, the percent change coefficient was calculated from data obtained in the Phase II survey. For each impact project, the percent change in visitation between 1995 and impact level use was calculated using the following formula:

$$(\text{Impact Level}_i \text{ Trips} - 1995 \text{ Trips}) / 1995 \text{ Trips}$$

The percent change coefficients calculated above were then applied to the Phase I baseline seasonal use estimates to produce the number of trips associated with the first and second impact levels for each impact project. This was accomplished by multiplying the impact project's seasonal baseline trips by the percent change coefficients:

$$\text{Baseline Trips}_{\text{season } n} - (\text{Baseline Trips}_{\text{season } n} * \text{Percent Change}_{\text{impact level } i})$$

Table 7 displays the percent change coefficients and the first and second impact level recreation trip estimates for Lake Allatoona, as described below.

Table 7
Impact Level Percent Change Coefficients

Baseline Trips	First Impact Level		Second Impact Level	
	Trip Change	Percent Change	Trip Change	Percent Change
2,090	1,324	0.6335	1,713	0.8196

Value functions were then developed by fitting a series of trend lines between adjacent pairs of data points: maximum level to average level, average level to first impact level, first impact level to second impact level, and second impact level to minimum level. The origin and slope of each line were then used to produce trip estimates for intervening water levels. The following table contains the line segment equations used to estimate the value functions for Lake Allatoona.

Table 8
Lake Allatoona
Equations for Value Function Line Segments

Season	Line Segment	Equation
Winter	819 ft. to 830 ft. Avg. below 2nd impact	-4398178.909 + 5370.182 (Levels) No equation fitted
Spring	819 ft. to 835 ft. 835 ft. to 837 ft. 837 ft. to 838 ft.	-1681958.801 + 2053.674 (Levels) -14119138.720 + 16948.500 (Levels) -96513184.360 + 115388.220 (Levels)
Summer	819 ft. to 835 ft. 835 ft. to 837 ft. 837 ft. to 838 ft.	-1789666.515 + 2185.185 (Levels) -15023289.270 + 18033.835 (Levels) -102693628.10 + 122777.37 (Levels)
Fall	819 ft. to 833 ft. Avg. below 2nd impact	-12958218.000 + 15822.000 (Levels) No equation fitted

2.1.4. National Economic Development (NED) Boater Benefit Estimates

NED benefits are estimates of the value of recreation opportunities created by water resource projects. The estimates developed below, when applied to the value functions for Lake Allatoona, provide an assessment of the project's value as a recreation site. The NED benefit estimates were developed by applying a boater-specific regional demand model from a sample of boaters who use the U.S. Army Corps of Engineers reservoirs in the states of Tennessee and Arkansas.

The following discussion of the development of the NED benefit estimates will refer to two previous studies that were used in the database development and model estimation. The first is titled "Regional Recreation Demand Models for Large Reservoirs: Database Development, Model Estimation, and Management Applications," by Frank Ward, Brian Roach, John Loomis, Richard Ready, and Jim Henderson. This March 1995 study developed recreation demand models for all visitors to U.S. Army Corps of Engineers reservoirs located in the Little Rock, Arkansas; Nashville, Tennessee; and Sacramento, California Districts. In the discussion that follows, this report will be referred to as the RRDM report. The second study is titled "Estimation of Boating Visitor Economic Benefits for U.S. Army Corps of Engineers Projects in the Little Rock and Nashville Districts," by Brian Roach. This July 1995 study, which will be referred to as the Boater Model (BM), developed similar recreation demand models but was limited to boating visitors.

2.1.4.1. Previous Work. The data collection and analysis for several recreation demand models were summarized in the RRDM. Since multiple sites were included in

the models, the impact of site characteristics on visitation rates was statistically estimated. One purpose of the RRDM report was to estimate the validity of model transferability. To determine whether demand equations (coefficients) were similar across different Corps districts, statistical tests were conducted. The results of these tests suggested that transfers would not be valid. However, one explanation for this poor transferability was that the models were aggregated for a combination of project users. For example, day users were grouped together without regard to recreation activity.

The BM was developed to focus on boating visitors. Due to the anticipated application of the model to the ACT and ACF sites as well as geographic proximity to the basins, only the Little Rock and Nashville Districts were included in the BM. The BM attempted to duplicate the RRDM modeling process.

2.1.4.2. Database Development for Application of the BM to ACT Sites. A database was developed for each of the project sites. Variables included in the database were the following: travel costs, demographic variables and site characteristics. Since data for site characteristics of several of the sites were not available, several data assumptions were made. The database development and assumptions regarding missing data are discussed in the following paragraphs.

2.1.4.2.1. Travel Costs. The approximate market area for each project was identified. The market area included all counties within a 200-mile radius of each project. The largest city in each potential origin county was then identified from U.S. Census data. The respective cities were used as the common origin for all visitors from that county. Next, towns nearest to the sites were identified from detailed area maps. Due to varying project size, several towns were often identified for larger sites. The model then assumed that people from a given zone would travel to the nearest access point to visit a site.

After these origin and destination towns were identified, travel distances and times were calculated using the computer program PCMiler. For projects with multiple nearby towns, the shortest distance from an origin to the site was chosen. All distances less than 200 miles were then considered for the database, which resulted in a data set of 4,442 observations for both ACT and ACF projects. One-third the average county wage rate was then used to value travel costs.

2.1.4.2.2. Demographic Variables. Demographic data collected for each county in the data set included the following: population, average per capita income, average wage rate, percent non-white population in the county, and population percent over age 65. All demographic variables were independent in nature with the exception of wage rate, which was used to estimate the value of travel time in calculating travel costs.

2.1.4.2.3. Site Characteristics. Site characteristic variables included the surface acres of the site, the number of shoreline miles, the number of parking spaces, and the average MEI. MEI is a measure of the fish productivity of the site. MEI is defined as the average total dissolved solids (TDS) divided by the average water depth. Estimates of the MEI were produced using data for average project depth and TDS. Average depth for each reservoir was given as capacity (in acre-feet) divided by the surface acreage. Annual TDS data was available from data published by the U.S. Geological Survey. A search through these published records produced average TDS for eight of the ACT and ACF projects being evaluated, including Lake Allatoona.

The final independent variable in the BM was the substitute index. Previous simulations of the model had shown that using an average index value for all observations instead of using the calculated index would not bias benefit estimates by more than 10 percent in either direction. Since the average substitute index for the Nashville District was 12,426 and 14,673 for the Little Rock District (as reported in the RRDM report), a midpoint value of 13,550 was used for all origins in the application.

2.1.4.3. Model Application. Once the data set of independent variables was completed, the BM was applied to the ACT projects. Each independent variable was multiplied by its appropriate coefficient; the data for Lake Allatoona is provided in the table below.

Table 9
Boater Model Data

Surface Acres	Shore Miles	Parking Spaces	MEI
12,010	270	8,021	1.67

Using OLS in double-log form, an unadjusted visit prediction was obtained for each county-site combination. The per-visit benefit formula was then used to determine the average per visit benefits for each project. Total benefits per project were then calculated by multiplying the per-visit boater benefits by the average number of people per boating trip by the total boat trip estimates. The following table presents the NED benefit estimates for Lake Allatoona.

Table 10
NED Estimates

NED Estimates/Boater	$14.42[1]
Average Number Of People/ Boat	2.9
NED Estimates/Boating Trip	$41.82
Annual Number Of Boating Trips	378,297
NED Benefits	$15,820,381

[1]**NED estimates are in 1995 dollars.**

2.1.5. Value Functions – Application

The following table provides the seasonal value functions for Lake Allatoona. The table includes the value functions for each pool level defined between the project maximum and minimum operating water level discussed previously in this text. The direct economic impacts for Lake Allatoona, for the given season and water level, are determined by multiplying the NED boater trip estimates in Table 10 by the value function.

Table 12
Seasonal Water Levels and
Boater Trips Value Functions

Water Levels	Trips			
	Winter	Spring	Summer	Fall
819	0	0	0	0
820	5370	2054	2185	3390
821	10740	4107	4370	6781
822	16111	6161	6556	10171
823	21481	8215	8741	13562
824	26851	10268	10926	16952
825	32221	12322	13111	20343
826	37591	14376	15296	23733
827	42961	16429	17481	27123
828	48332	18483	19667	30514
829	53702	20537	21852	33904
830	59072	22590	24037	37295
831	59072	24644	26222	40685
832	59072	26698	28407	44076
833	59072	28751	30593	47466
834	59072	30805	32778	47466
835	59072	32859	34963	47466
836	59072	49807	52997	47466
837	59072	66756	71031	47466
838	59072	182144	193808	47466
839	59072	182144	193808	47466
840	59072	182144	193808	47466
841	59072	182144	193808	47466
842	59072	182144	193808	47466

3.0. DIRECT ECONOMIC IMPACTS

The following is a discussion of the development of the direct economic impacts estimated for this study effort.

3.1. Alternative Modeling

The HEC-5, Simulation of Flood Control and Conservation Systems, model developed for the ACT-ACF Comprehensive Study was used to model the current flow release operations for Lake Allatoona (i.e., Without Project Condition) and for the CCMWA alternatives (i.e., With Project Condition). The Indicators of Hydrologic Alteration (IHA) model was used to analyze the HEC-5 output data and provide meaningful statistics for the output parameters based on the modeled period 1939 - 2001.

3.1.1. Alternative - HLEXIST

The future without project condition assumes that the project will continue to be operated consistent with existing practices, based on 1990 ACT-ACF water demands and the 1993 ACT Water Control Plan. Two with-project alternative plans will be compared to this future without project plan to measure the economic impact the Hickory Log Creek project would have on boater-based recreation at Lake Allatoona.

3.1.2. Alternative - HLYTAF1

This alternative represents the operation of the Hickory Log Creek project as ultimately planned by the City of Canton and the CCMWA. This future with-project alternative is based on 1990 ACT-ACF water demands, the 1993 ACT Water Control Plan, and the additional demands proposed as part of the Hickory Log Creek project:

- Up to 39 million gallons/day (MGD) above minimum flow (250 cubic feet/second (cfs) at Canton Pump Station to be pumped into the Hickory Log Creek Reservoir;
- 1 MGD City of Canton annual average additional withdrawal from the Etowah River below Hickory Log Creek;
- 34 MGD CCMWA annual average additional withdrawal from the Allatoona Reservoir; and
- The Hickory Log Creek project will be operated to maintain the lesser of 250 cfs minimum flow or natural streamflow in the Etowah River below the City of Canton.

3.1.3. Alternative - HLYTAF2

This future with-project alternative is based on 1990 ACT-ACF water demands, the 1993 ACT Water Control Plan, and the additional demands proposed as part of the Hickory Log Creek project. However, unlike Alternative HLYTAF1, this alternative does not include withdrawals from the Allatoona Reservoir:

- Up to 39 MGD above minimum flow (250 cfs) at Canton Pump Station to be pumped into the Hickory Log Creek Reservoir;
- 35 MGD (11 MGD to the City of Canton and 24 MGD to the CCMWA) annual average additional withdrawal from the Etowah River below Hickory Log Creek; and
- The Hickory Log Creek project will be operated to maintain the lesser of 250 cfs minimum flow or natural streamflow in the Etowah River below the City of Canton.

3.2. Direct Economic Impact Evaluation

IHA output files were used to determine the direct economic impacts to recreation resulting from the proposed changes. Percentile values (10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th}) were calculated for the future without and with project conditions. For each of the percentiles, a monthly average reservoir value was determined. Sample output is shown in the following tables.

Table 12
Without Project Condition
Percentile Statistics

Month	10%	25%	50%	75%	90%
September	832.33	834.89	836.88	838.36	839.41
October	830.41	833.65	835.54	836.93	838.46
November	828.13	829.44	831.23	832.96	834.43
December	822.43	823.23	824.61	826.97	831.31
January	821.90	822.85	823.92	830.06	843.46
February	824.24	826.67	830.29	838.43	849.98
March	830.63	832.61	837.94	847.19	856.59
April	835.01	837.44	840.38	853.03	860.00
May	837.58	839.50	840.83	843.75	855.00
June	837.85	839.08	840.10	840.76	841.00
July	836.76	838.02	838.97	840.19	840.90
August	834.77	836.91	838.23	839.47	840.50

Table 13
Alternative HLYTAF1
Percentile Statistics

Month	10%	25%	50%	75%	90%
September	830.87	833.85	836.15	837.92	839.12
October	828.45	832.44	834.67	836.53	838.17
November	826.86	828.84	830.78	832.54	834.21
December	822.06	823.05	824.55	826.80	831.03
January	821.61	822.69	823.83	829.75	843.19
February	823.73	826.40	830.14	838.14	849.71
March	830.31	832.36	837.56	846.80	856.30
April	834.54	837.29	840.24	852.62	860.00
May	837.03	839.30	840.77	842.98	854.93
June	837.39	838.83	839.88	840.66	841.00
July	835.85	837.56	838.64	839.91	840.84
August	833.80	836.12	837.77	839.14	840.37

Table 14
Alternative HLYTAF2
Percentile Statistics

Month	10%	25%	50%	75%	90%
September	831.32	834.14	836.32	838.02	839.17
October	829.07	832.78	834.89	836.60	838.24
November	827.23	829.00	830.89	832.66	834.27
December	822.16	823.06	824.55	826.84	831.03
January	821.63	822.69	823.85	829.78	843.22
February	823.83	826.46	830.16	838.20	849.76
March	830.37	832.45	837.60	846.88	856.39
April	834.69	837.34	840.29	852.73	860.00
May	837.18	839.36	840.79	843.14	854.94
June	837.54	838.90	839.95	840.69	841.00
July	836.11	837.69	838.73	839.99	840.85
August	834.03	836.33	837.88	839.21	840.40

Since the data in the Recreation Demand Element final draft report produced output on a seasonal basis, the percentile data was averaged by season for Lake Allatoona, for each operating scenario. For example, the fall season consisted of the months of September, October, and November. For each of the percentile statistics shown above, these three months were averaged to produce one percentile statistic for the season for each percentile value. An example of the process is shown in the following table.

Table 15
Without Listing Condition
Average Fall Percentile Statistics

Month	10%	25%	50%	75%	90%
September	832.33	834.89	836.88	838.36	839.41
October	830.41	833.65	835.54	836.93	838.46
November	828.13	829.44	831.23	832.96	834.43
TOTAL	**2490.87**	**2497.99**	**2503.65**	**2508.25**	**2512.30**
AVERAGE	**830.29**	**832.66**	**834.55**	**836.08**	**837.43**

Averaging the monthly percentile statistics for Lake Allatoona produced the following data for each operating scenario (Table 16). However, to fully evaluate the direct economic impacts, the extreme conditions also had to be identified. To ascertain the minimum extreme case, IHA output providing daily reservoir levels for the period of record, operating scenario, season, and analysis year was analyzed to find the lowest reservoir level. This reservoir level was then identified as the minimum extreme condition. The maximum extreme case or the 100% condition was identified as the highest reservoir level evaluated for the Recreation Demand Element reservoir level/boater trip value functions. These values were included with the percentile statistics to produce the following evaluation parameters.

Table 15
Evaluation Parameters

Scenario	Season	Minimum	Percentile Statistics					Maximum
			10%	25%	50%	75%	90%	
Without Project Condition								
	Fall	817.80	830.29	832.66	834.55	836.08	837.43	842.00
	Winter	818.57	822.86	824.25	826.27	831.82	841.59	842.00
	Spring	822.36	834.41	836.52	839.72	847.99[1]	857.20	842.00
	Summer	819.70	836.46	838.00	839.10	840.14	840.80	842.00
Alternative HLYTAF1								
	Fall	813.14	828.73	831.71	833.87	835.66	837.17	842.00
	Winter	816.14	822.47	824.05	826.17	831.56	841.31	842.00
	Spring	821.66	833.96	836.32	839.52	847.47	857.08	842.00
	Summer	816.77	835.68	837.50	838.76	839.90	840.74	842.00
Alternative HLYTAF2								
	Fall	816.18	829.21	831.97	834.03	835.76	837.23	842.00
	Winter	816.48	822.54	824.07	826.19	831.61	841.34	842.00
	Spring	821.81	834.08	836.38	839.56	847.58	857.11	842.00
	Summer	818.71	835.89	837.64	838.85	839.96	840.75	842.00

[1]As previously mentioned, the Recreation Demand Element study utilized 842.0 feet-NGVD as the maximum pool elevation. As such, boater based recreation participation was not surveyed for higher pools. Therefore, this analysis utilized data for the maximum surveyed pool elevation (842.0 feet-NGVD) for pools in this analysis which exceeded this elevation.

For the Without Project condition, the table above is read, "Ten percent of the time, in the fall season, the Lake Allatoona reservoir would be below 830.29 feet-NGVD. Twenty-five percent of the time, it would be below 832.66 feet-NGVD," and so on.

To determine the value of boater recreation, the following process was used. For each lake level identified from the percentile statistics, the corresponding value function was paired. As shown in Table 11, the corresponding value function for a Fall Lake Allatoona reservoir level of 830 feet-NGVD (830.29 rounded) is 37295, and so on. The value function for each lake level was then multiplied by the NED boater trip estimate for Lake Allatoona to yield the value of boater recreation for that lake level, $1,883,025 at a lake level of 830 feet-NGVD. Note, the 1995 NED estimate per boating trip ($41.82) was updated to 2004 dollars ($50.49) for use in this study effort. Unless otherwise noted, all costs shown in this document reflect this update.

The average value for boater recreation for the interval between the 10% and 25% frequency is $2,139,791. This value was determined by taking the average of the 10% and 25% boater recreation values (($1,883,025 +$2,396,558)/2). The frequency of the interval, 15 %, was determined by subtracting the lower frequency from the higher frequency (25% - 10%). In the case of the minimum and 10% frequencies, this method was not applied. Since the tail of the distribution needed to be captured, the frequency of the interval below 10% was set at 10%. The value of boater recreation for each

interval was then determined by multiplying the average value in the interval by the frequency of the interval. After each value was calculated, the annual value of boater recreation for each alternative, analysis year, and season was determined by summing the values calculated for the respective season.

Table 16
Fall Season - Boater Based Recreation

WITHOUT PROJECT CONDITION

Frequency	Min.		10%		25%		50%		75%		90%		100%	Annual
Lake Level	817.80		830.29		832.66		834.55		836.08		837.43		842.00	
Value Function	0		37295		47466		47466		47466		47466		47466	
Corresponding Value	$ -		$1,883,025		$2,396,558		$2,396,558		$2,396,558		$2,396,558		$2,396,558	
Average Value In Interval		$941,512		$2,139,791		$2,396,558		$2,396,558		$2,396,558		$2,396,558		
Frequency Of Interval		10%		15%		25%		25%		15%		10%		
Corresponding Value		**$94,151**		**$320,969**		**$599,140**		**$599,140**		**$359,484**		**$239,656**		**$2,212,53**

ALTERNATIVE HLYTAF1

Frequency	Min.		10%		25%		50%		75%		90%		100%	Annual
Lake Level	813.14		828.73		831.71		833.87		835.66		837.17		842.00	
Value Function	0		33904		44076		47466		47466		47466		47466	
Corresponding Value	$ -		$1,711,813		$2,225,397		$2,396,558		$2,396,558		$2,396,558		$2,396,558	
Average Value In Interval		$855,906		$1,968,605		$2,310,978		$2,396,558		$2,396,558		$2,396,558		
Frequency Of Interval		10%		15%		25%		25%		15%		10%		
Corresponding Value		**$85,591**		**$295,291**		**$577,744**		**$599,140**		**$359,484**		**$239,656**		**$2,156,90**

ALTERNATIVE HLYTAF2

Frequency	Min.		10%		25%		50%		75%		90%		100%	Annual
Lake Level	816.18		829.21		831.97		834.03		835.76		837.23		842.00	
Value Function	0		33904		44076		47466		47466		47466		47466	
Corresponding Value	$ -		$1,711,813		$2,225,397		$2,396,558		$2,396,558		$2,396,558		$2,396,558	
Average Value In Interval		$855,906		$1,968,605		$2,310,978		$2,396,558		$2,396,558		$2,396,558		
Frequency Of Interval		10%		15%		25%		25%		15%		10%		
Corresponding Value		**$85,591**		**$295,291**		**$577,744**		**$599,140**		**$359,484**		**$239,656**		**$2,156,90**

3.2.1. Boater-Based Recreation Impacts – Period of Record

The direct economic impacts to recreation at Lake Allatoona (i.e., for the period of record) were then determined by taking the difference between the Without Project and the With Project respective seasonal values. The estimated impacts are displayed in the following table.

Table 17
Direct Economic Impacts
Period of Record

Season	Without Project Condition	Alternative HLYTAF1		Alternative HLYTAF2	
	Recreation Value	Recreation Value	Annual Impacts	Recreation Value	Annual Impacts
	(dollars)				
Fall	2,212,500	2,156,900	$ (55,600)	2,156,900	$ (5,600)
Winter	1,999,700	1,965,800	$ (33,900)	1,999,700	$ -
Spring	6,631,900	6,460,700	$ (171,200)	6,460,700	$ (171,200)
Summer	8,412,900	8,407,400	$ (5,500)	8,407,400	$ (5,500)
TOTAL	$19,257,000	$18,990,800	$ (266,200)	$19,024,700	$ (232,300)

3.2.2. Boater-Based Recreation Impacts – Drought Conditions

The same methodology was used to determine the economic impacts to boater-based recreation during the decade of the 1980's. The purpose of this analysis was to estimate the economic impacts during drought conditions, similar to that experienced in 1986 and 1988. To provide meaningful statistics, the entire decade was utilized for data analysis. The following table provides results of this analysis.

Table 18
Direct Economic Impacts
Drought Conditions

Season	Without Project Condition	Alternative HLYTAF1		Alternative HLYTAF2	
	Recreation Value	Recreation Value	Annual Impacts	Recreation Value	Annual Impacts
	(dollars)				
Fall	1,857,330	1,724,668	$ (132,662)	1,801,697	$ (55,634)
Winter	1,809,862	1,721,744	$ (88,118)	1,721,744	$ (88,118)
Spring	4,713,828	4,700,865	$ (12,963)	4,713,828	$ -
Summer	6,753,070	6,515,803	$ (237,268)	6,551,657	$(201,413)
TOTAL	$ 15,134,091	$14,663,080	$ (471,011)	$14,788,926	$(345,165)

Georgia Department of Natural Resources
2 M.L.K. Jr. Drive, S.E., Suite 1058 East Tower, Atlanta, Georgia 30334-4100
Lonice C. Barrett, Commissioner
Harold F. Reheis, Director
(404) 656-3094

August 2, 2002

AUG - 7 2002

Mr. Roy Fowler, General Manager
Cobb County– Marietta Water Authority
1660 Barnes Mill Road
Marietta, Georgia 30062-7535

Re: 401 Water Quality Certification
Public Notice No. 200006560
Hickory Log Creek Reservoir
Coosa River Basin
Cherokee County

Dear Mr. Fowler:

This is per the Cobb–Marietta Water Authority's (CCMWA) and the City of Canton's (City) joint application for a Federal permit (404) to conduct activity in, on or adjacent to waters of the State of Georgia. The proposed activity being to construct a dam on Hickory Log Creek to create a 370 acre pump-storage water supply reservoir to provide water for the service areas of the City and the CCMWA.

Pursuant to Section 401 of the Federal Clean Water Act, the State of Georgia issues this Water Quality Certification jointly to the CCMWA and the City this proposed activity.

This certification follows the EPD's review of required documentation submitted with the joint application and comments on the proposed activity by Georgia's Wildlife Resources Division, the U.S. Environmental Protection Agency, the U.S. Fish & Wildlife Service and other agencies and organizations. This review has led EPD to the following conclusions:

1) That there are reasonable assurances that the activity will comply with state water quality standards to protect designated uses, meet criteria and comply with anti-degradation policy. However, to the extent that the change resulting from the construction and operation of the reservoir is construed as degradation, EPD has determined that this change is justifiable to provide necessary social or economic development.

2) That the joint applicants' proposed water service area and assessment of long term need for that area is appropriate. That the applicants need the amount of water that the reservoir would provide to meet long term (2050) demands even with projected demand reductions via future opportunities with water conservation, wastewater re-use and groundwater supply contributions.

Appendix "E"

3) That the joint applicants' alternatives analysis was comprehensive and that the applicants' preferred alternative is acceptable to EPD.

The State of Georgia certifies that there is no applicable provision of Section 301; no limitation under Section 302; no standard under Section 306; and no standard under Section 307, for the applicant's activity. The State of Georgia certifies that the applicant's activity will comply with all applicable provisions of Section 303.

This certification is contingent upon the following conditions:

-All work performed during construction will be done in a manner so as not to violate applicable water quality standards.
-No oils, grease, materials or other pollutants will be discharged from the construction activities to reach public waters.

This certification does not relieve the applicant of any obligation or responsibility for providing acceptable mitigation for unavoidable impacts to waters of the State or for complying with the provisions of any other laws or regulations of other federal, state or local authorities.

It is your responsibility to submit this certification to the appropriate federal agency.

Please note that the respective water withdrawal permits which are pending for this project will contain a number of special conditions related to the protection of water quality standards via extensive monitoring and appropriate operation of the project.

I appreciate the work that the CCMWA has done to date regarding this important project. I look forward to continued dialogue with the CCMWA and the City in the future as we strive to meet growing water demands in the area while at the same time protecting the quality of Georgia's water resources. Please contact Mr. Kevin Farrell (404 656-3103) with any questions regarding this certification.

Sincerely,

Harold F. Reheis
Director

cc: Mr. Tommy Craig
Mr. John Biagi
Ms. Sandra Tucker
Mr. Nick Ogden
Mr. Ronald J. Mikulak

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
247 South Milledge Avenue
Athens, Georgia 30605

West Georgia Sub Office
P.O. Box 52560
Ft. Benning, Georgia 31995-2560

Coastal Sub Office
4270 Norwich Street
Brunswick, Georgia 31520

COPY

6/28/02

Mr. Edward B. Johnson
Chief, North Area Section
Corps of Engineers
1590 Adamson Parkway, Suite 130
Morrow, Georgia 30260-1763
ATTN: Mr. Gary Craig

RE: FWS Log NG-01-95-Cher

Dear Mr. Johnson:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed Hickory Log Creek Reservoir and its effects on the threatened Cherokee darter (*Etheostoma scotti*), endangered Etowah darter (*E. etowahae*), and endangered amber darter (*Percina antesella*), in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended, (16 U.S.C. 1531 et seq.). Your request for formal consultation was received, and consultation was initiated, on January 28, 2002.

This biological opinion is based on the April 28, 2000, Section 404 permit application; the December 27, 2000, Joint Public Notice; a March 21, 2000 site visit; five meetings with the applicants about the project; July 9, 2001, and May 8, 2002, letters from the applicants' consultants responding to agency comments and questions; the January 14, 2002, biological assessment; the February 2002 revised compensatory mitigation plan; and other sources of information. A complete administrative record of the consultation is on file in the Athens office.

The proposed action is not likely to adversely affect other federally-listed species under the Service's purview. No further action for these species is required under section 7 of the Act. This document does not address requirements of other environmental statutes, such as the National Environmental Policy Act.

CONSULTATION HISTORY

February 10, 2000: The Service met with personnel from the Law Offices of William Thomas Craig, personnel from Eco-South, Inc., and Dr. Byron J. Freeman, University of Georgia, Institute of Ecology, to discuss proposed reservoir impacts on listed species. Dr. Freeman, one of the recognized experts on Cherokee darters, estimated that reservoir construction and inundation would take 1000-10,000 individuals. The Service indicated that formal consultation under the Act would be needed.

Appendix "F"

March 15, 2000: The applicants' consultants presented an overview of the proposed reservoir project to the Corps of Engineers (Corps), Environmental Protection Agency (EPA), Georgia Environmental Protection Division (GAEPD), and Service. The Service recommended formal consultation under the Act.

March 21, 2000: The Service participated in a site visit of the proposed reservoir footprint.

April 28, 2000: The applicants met with the Corps, EPA, GAEPD, and Service and provided a detailed description of the project, including a copy of the Clean Water Act permit application. The Service recommended formal consultation under the Act.

December 27, 2000: The Corps issued the Joint Public Notice for the project. On February 28, 2001, the Service provided Fish and Wildlife Coordination Act comments to the Corps, including a recommendation that the Corps deny permit issuance. The Service recommended formal consultation under the Act.

August 30, 2001: The Service met with Eco-South, Inc. to discuss minimization of impacts to protected species.

December 11, 2001: The Law Offices of William Thomas Craig provided the Service with a biological assessment of project impacts on listed species. A later draft of the assessment was provided to the Service and Corps on January 14, 2002.

January 20, 2002: The Corps requested the Service review the applicants' biological assessment. On January 25, 2002, the Service recommended formal consultation under the Act on reservoir impacts to listed species.

January 28, 2002: The Corps requested, and the Service initiated, formal consultation on project impacts on listed species, in accordance with section 7(a)(2) of the Act.

May 8, 2002: The Law Offices of William Thomas Craig provided the Service with the applicants' evaluation of how reservoir operation would affect flows in Hickory Log Creek below the dam and in the Etowah River below the confluence with Hickory Log Creek.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The Cobb County Marietta Water Authority (CCMWA) and the City of Canton propose to dam Hickory Log Creek, a third order tributary of the Etowah River, to create a 370-acre pump-storage water supply reservoir (Fig. 1). The purpose of the reservoir, as stated in the Section 404 permit application, is to meet projected water demands, based on population projections, in the CCMWA and City of Canton's service area (Fig. 2). Storage will be augmented by water pumped from the Etowah River. The proposed dam would be located in Cherokee County about 1.5 miles upstream of the confluence of Hickory Log Creek with the Etowah River.

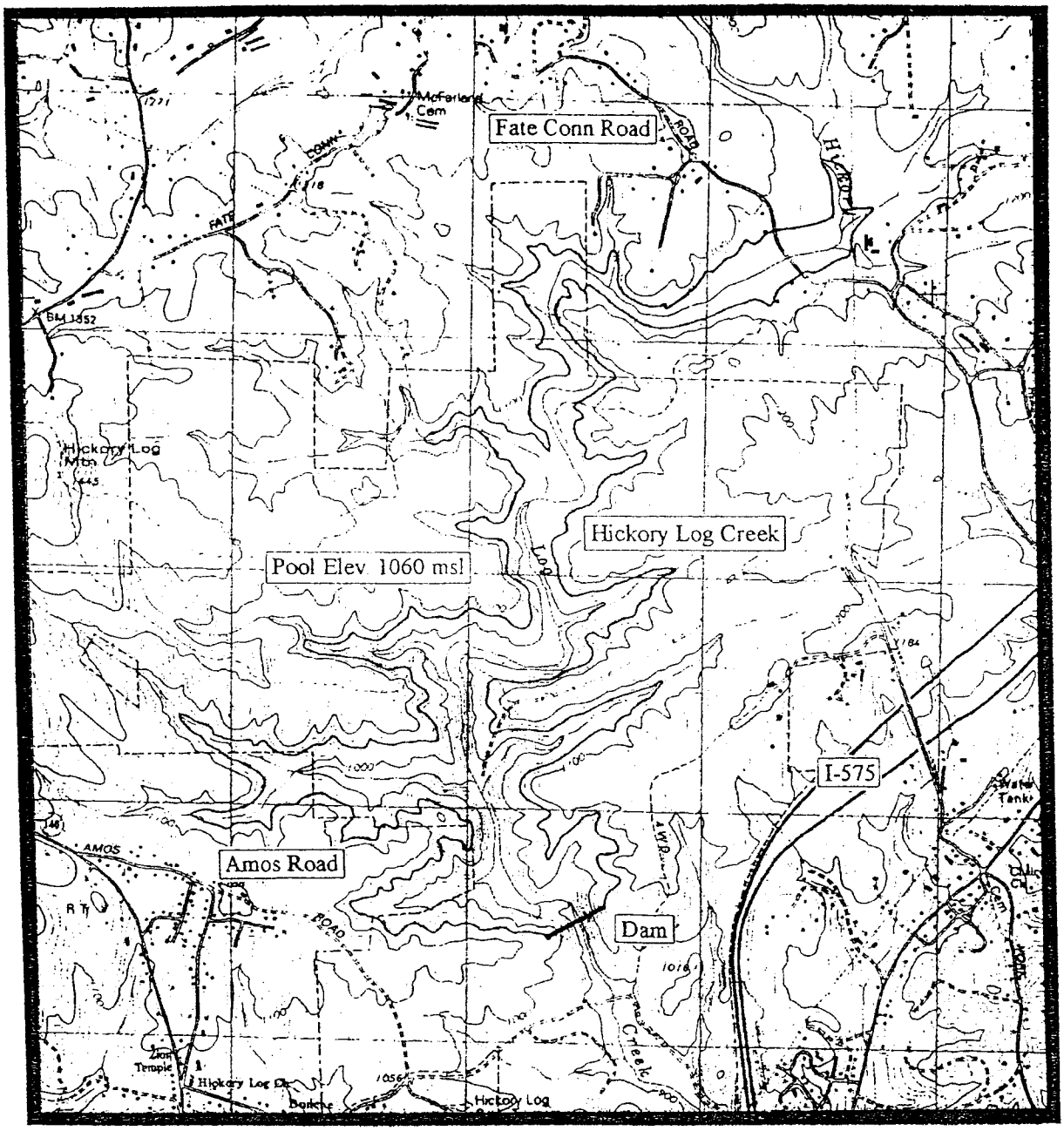

Fig. 1. Location of the proposed Hickory Log Creek Reservoir, Cherokee County.

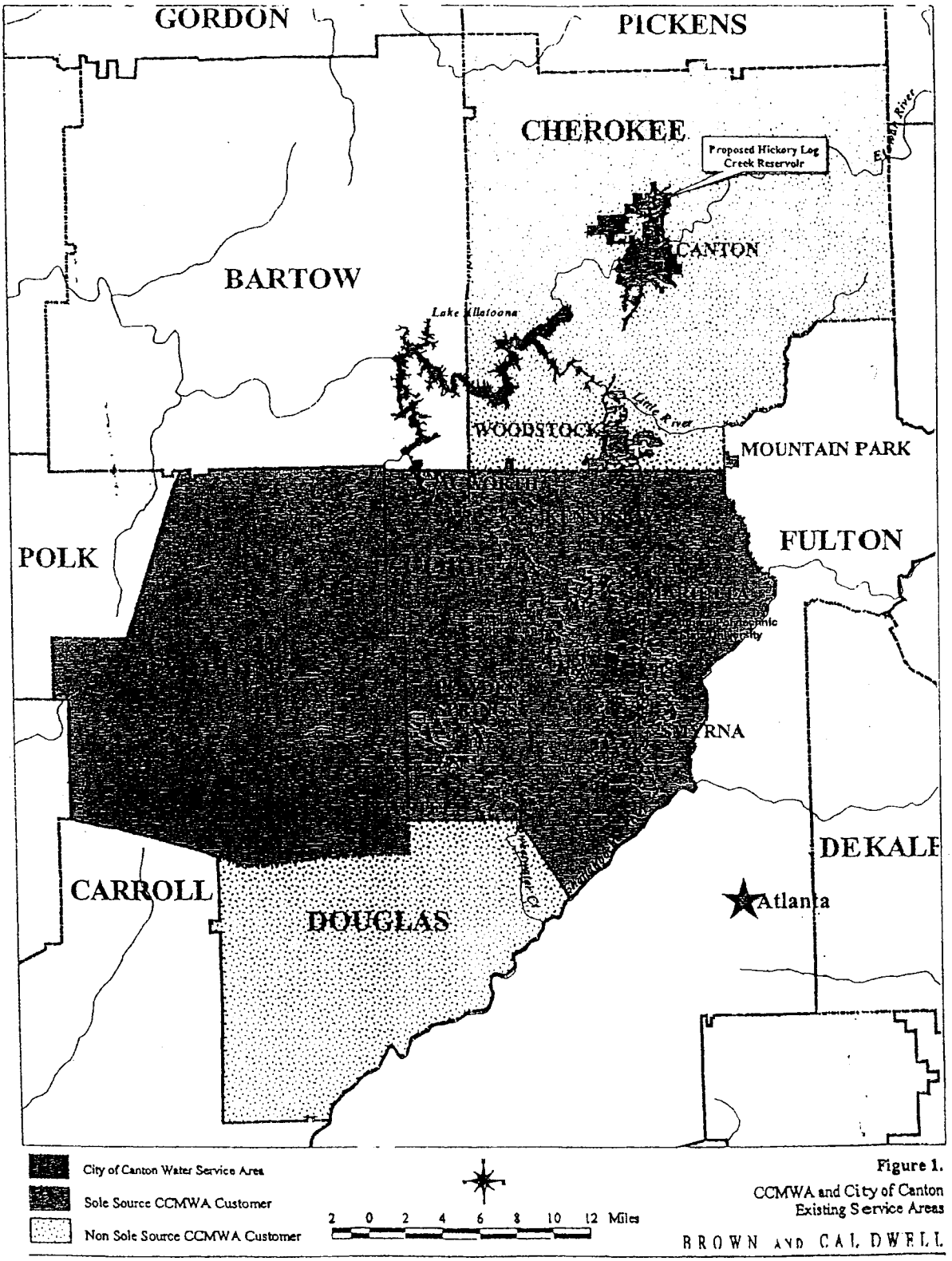

Fig. 2. Hickory Log Creek Reservoir proposed service area.

The project would inundate 19.27 acres of wetlands and 8.3 miles of Hickory Log Creek and its tributaries at a pool elevation of 1060 feet MSL. A pump station and 7000-foot water main would be constructed to connect the proposed facility with the Etowah River (Fig. 3). Water would be discharged from the reservoir to augment (1) seasonal low flows in the Etowah River, where the City of Canton has an existing water intake 1.5 miles downstream of the Hickory Log Creek confluence, and (2) storage in Lake Allatoona that is available to CCMWA. Releases from the reservoir will equal the applicants' withdrawals. The water yield for the project would be 45 million gallons per day (mgd) based on 7Q10 releases into Hickory Log Creek below the dam. The 7Q10 flow in Hickory Log Creek at the dam site is higher than the 25% average annual flow (AAF) (Table 1). The applicants' consultants stated in a May 8, 2002, letter that the 25% AAF could be maintained in the Etowah River below the reservoir intake by using larger pumps, if the Service determined flows larger than the 7Q10 in this reach would be in the best interest of the system.

Table 1. 7Q10 and 25% average annual flows in Hickory Log Creek and the Etowah River.

Location	7Q10	AAF
Hickory Log Creek at dam site	3.6 cfs	3.3 cfs
Etowah River at reservoir intake	250 cfs	292 cfs

In their May 8, 2002, letter, the applicants' consultants provided the Service with operational simulation of altered flows in Hickory Log Creek and the Etowah River. Simulations used a minimum 7Q10 flow in Hickory Log Creek below the reservoir and 25% AAF in the Etowah River below the reservoir intake. Results from these simulations, based on historic flows and anticipated water demand in an average rainfall year, dry year, and 3-year drought indicate:

- **Average Rainfall Year** (based on 1969 flow data; Figs. 4 and 5): Releases from the reservoir will not be needed to augment flows in the Etowah River to meet the applicants' water supply needs (45 mgd), nor will pumping of water from the Etowah River be required to fill the reservoir. There is sufficient flow in Hickory Log Creek to maintain a full reservoir, although releases of water from the reservoir into Hickory Log Creek are likely to be slightly lower than normal flows in the summer due to evaporation of reservoir waters.
- **Dry Year** (based on 1947 flow data; Figs. 6 and 7): Flow patterns in Hickory Log Creek in a dry year (75 percentile year) would be similar to those in an average rainfall year (1969 flow data) during the early summer. However, in late August, releases from the reservoir would be required to augment Etowah River flows and meet the applicants' water supply needs. These releases, which, in the simulations modeled by the applicants, occurred from late August to mid-October, would increase flows in Hickory Log Creek below the dam from about 5 cfs to 50-60 cfs; augmented flows could last for several weeks at a time and would account for up to 23% of the water in the Etowah River below the Hickory Log Creek confluence. The simulations indicate that high releases from the reservoir would be followed by a month of 7Q10 flows in Hickory Log Creek as the reservoir is refilled from upstream Hickory Log Creek flows and pumping of water from the Etowah River.

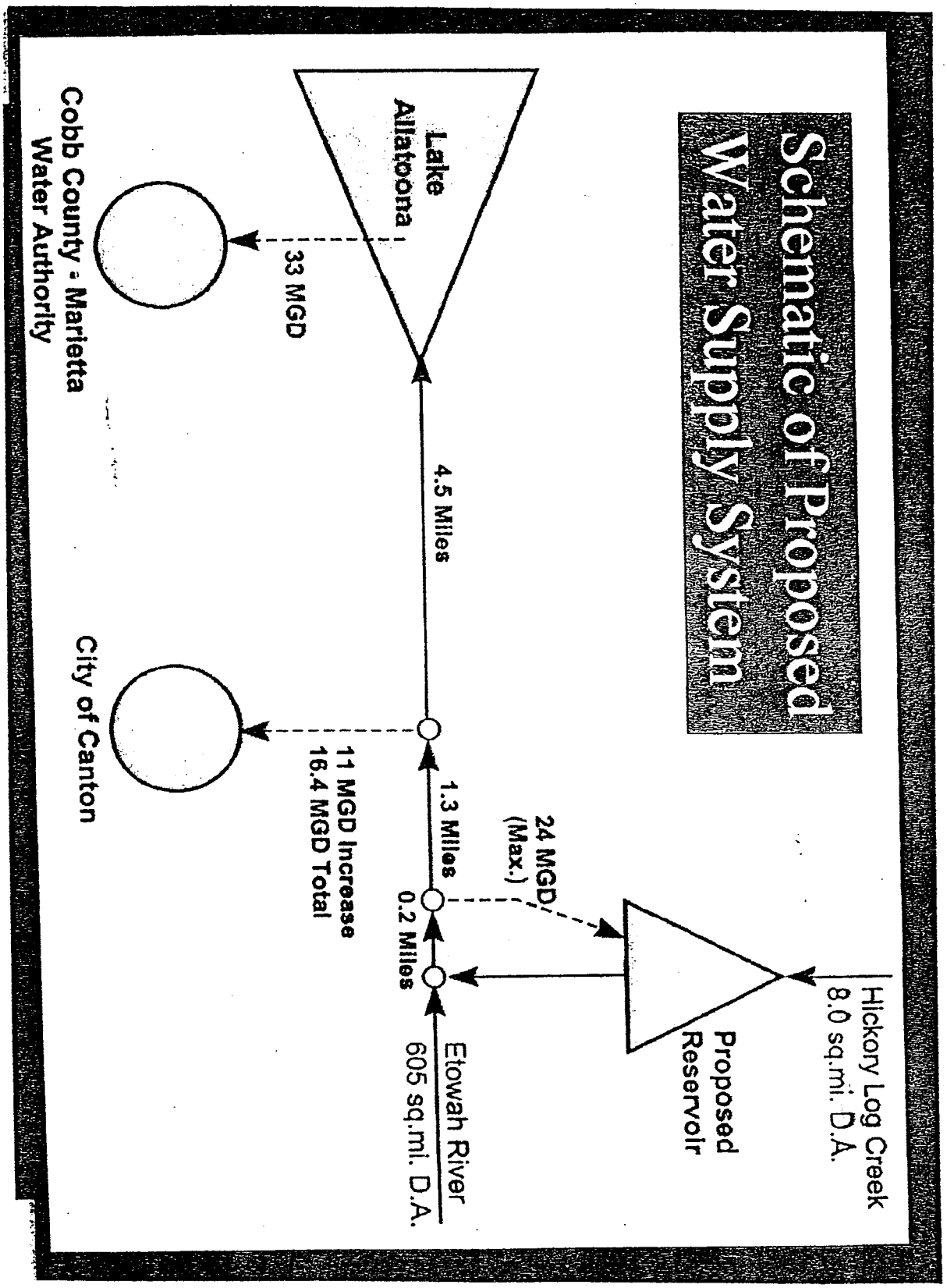

Fig. 3. Schematic of proposed water supply system, Hickory Log Creek Reservoir.

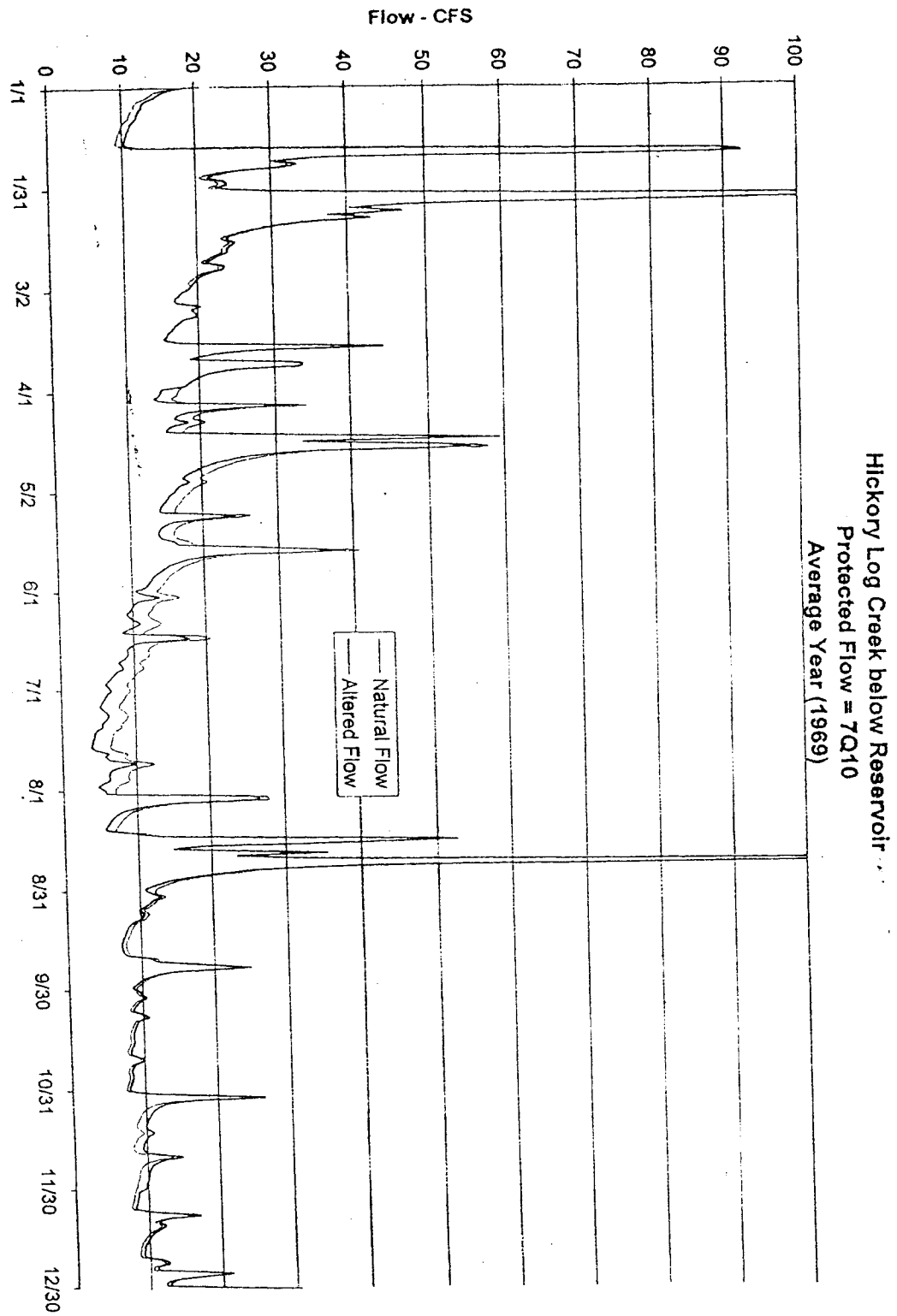

Fig. 4. Flow simulation in Hickory Log Creek in an average rainfall year.

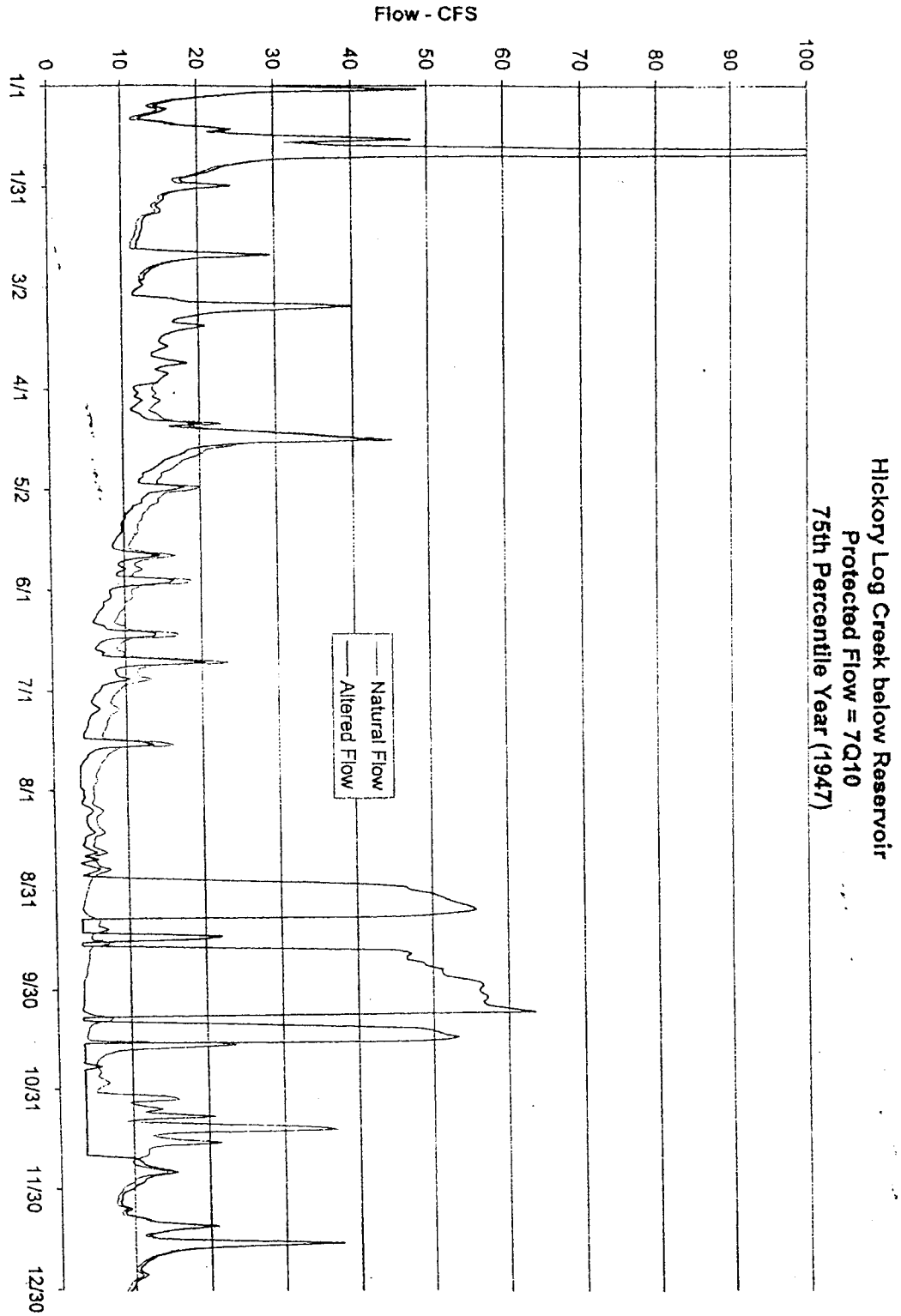

Fig. 6. Flow simulation in Hickory Log Creek in a dry year.

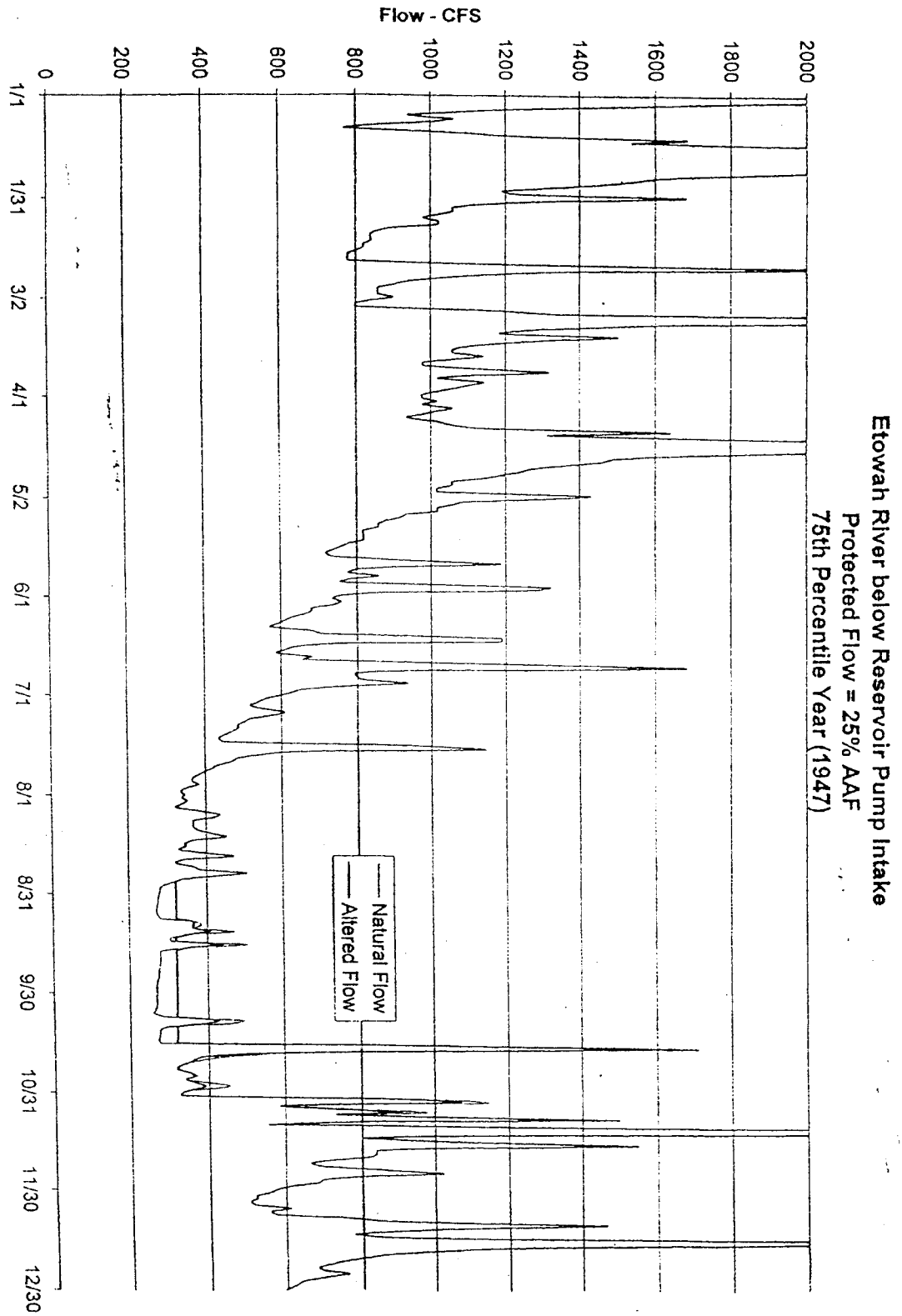

Fig. 7. Flow simulation in the Etowah River in a dry year.

Withdrawals from the Etowah River to fill the reservoir during dry years, if flows are maintained at the 25% AAF (293 cfs), would result in up to a 14% reduction in Etowah River flows below the intake structures. Historic flow data indicate that flows below the 25% AAF occur in the Etowah River in this reach during dry years, although under natural conditions, these low flows are more variable and of shorter duration than the simulated flow regime.

- **Extreme Drought** (based on 1986-1988 flows; Figs. 8 and 9): Projections using flow data from the 1986-1988 drought indicate that flows in Hickory Log Creek downstream of the dam would be significantly altered during drought years, with extreme high flows released during periods when normal flows are low and extended 7Q10 flows when flows typically are variable. During the driest parts of the drought, flows in the Etowah River downstream of Hickory Log Creek are projected to be up to 35% higher than normal due to water releases from the reservoir. During the wetter parts of a drought cycle, Etowah River flows could be reduced up to 14.6% when waters are withdrawn to refill the reservoir. Historic flow data indicate that flows below the 25% AAF occur frequently and for long periods in the Etowah River in this reach during drought years, although under natural conditions, these low flows are more variable than the simulated flow regime.

CONSERVATION MEASURES PROPOSED BY THE APPLICANTS

In the January 14, 2002, biological assessment and February 2002 revised mitigation plan, the applicants listed the following measures that will be implemented to enhance survival and recovery of federally-listed fish in the Etowah River basin:

- Protection of a Cherokee darter stream (CDS). Within one year of permit issuance, the status of the Cherokee darter within the CDS will be determined by qualified scientists, and stream reaches will be prioritized based on habitat and pending threats to this habitat. A written report of status and priority reaches will be submitted to the Corps and Service. A 50-200-foot perpetual conservation easement will be established on both banks of a 3.5- to 5.0- mile corridor of the CDS. At least 40% of the corridor will be acquired and protected before Hickory Log Creek Reservoir is impounded, and 75% will be acquired and protected within 5 years after impoundment begins. A second survey of Cherokee darters will be conducted in the CDS at this time. Other important reaches to protect and recover Cherokee darters may be substituted for easements in the CDS on a case-by-case basis.
- Contribution of $50,000 to fund development of a management plan for the Cherokee darter.
- Contribution of $50,000 to fund a genetic study of the Cherokee darter.
- Collection of Cherokee darters in Hickory Log Creek before the reservoir is inundated for scientific purposes or transplanting to appropriate sites, as identified by the management plan.
- Operation of the reservoir to protect water quality and maintain optimal stream habitat conditions in the Etowah River. Releases from the reservoir will not cause a four-hour average water temperature difference of more than two degrees Celsius in the Etowah River at the confluence of Hickory Log Creek, as compared to temperatures above the confluence (although this requirement may not be met in fall with unusually cold temperatures).

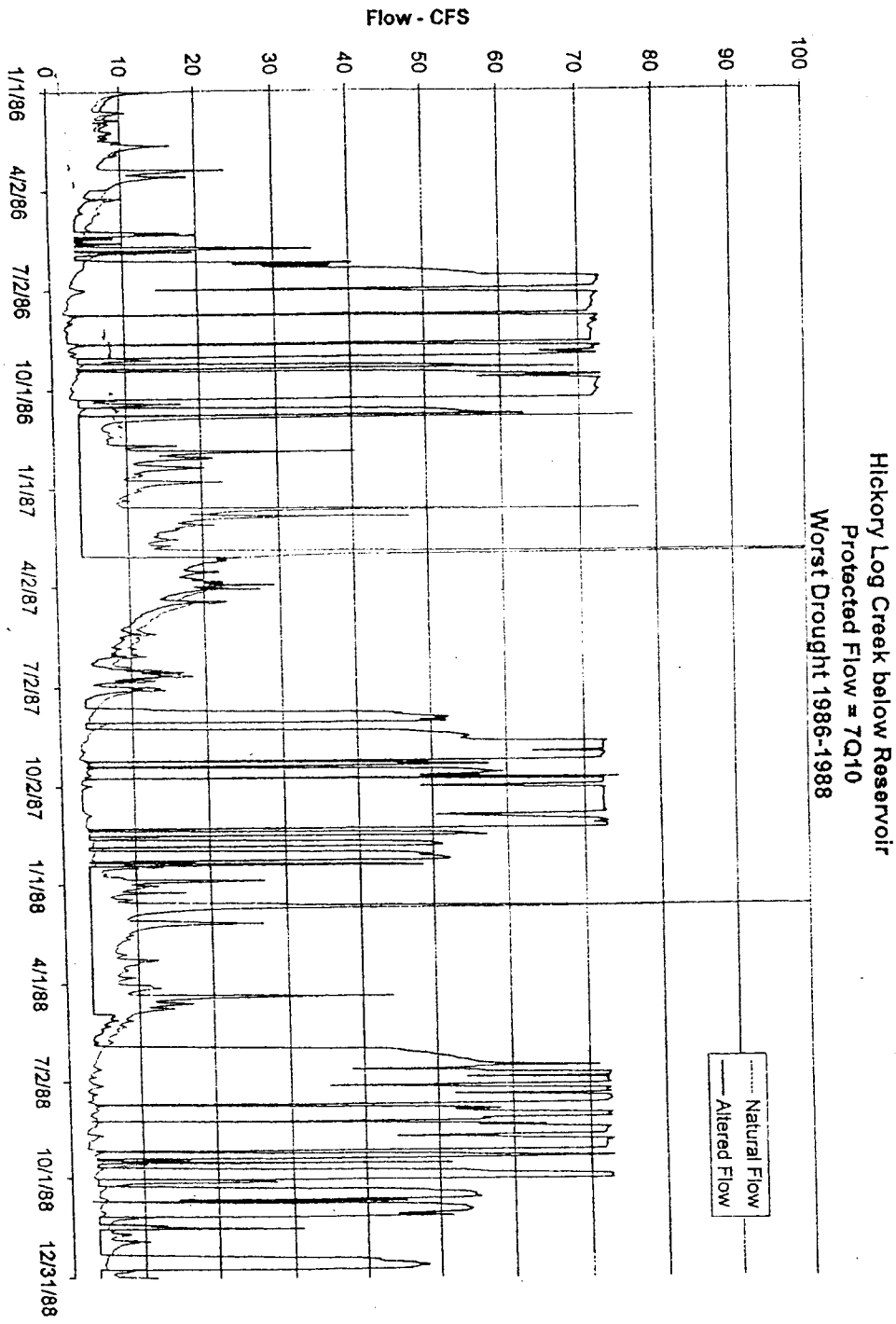

Fig. 8. Flow simulation in Hickory Log Creek during drought.

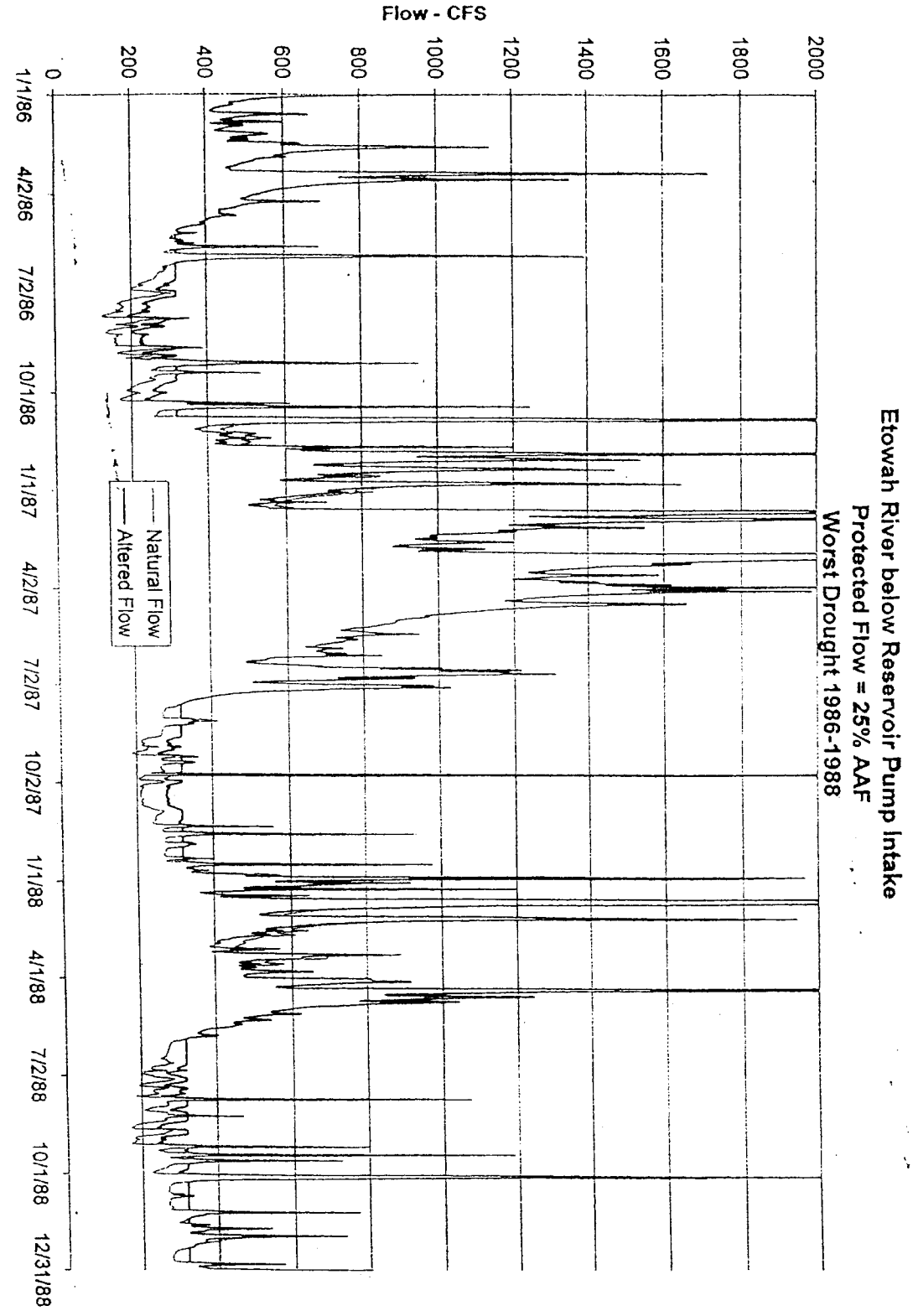

Fig. 9. Flow simulation in the Etowah River during drought.

- Establishment of three continuous monitoring gauge stations that record discharge, pH, temperature, specific conductivity, dissolved oxygen, turbidity, and nutrient levels on Hickory Log Creek and the Etowah River. The Hickory Log Creek gauge will be located downstream of the reservoir dam. Gauges on the Etowah River will be located upstream and downstream of the City of Canton's intake point. The gauges will be established, and weekly sampling will be initiated, within six months of permit issuance.
- Establishment of a minimum of three biological monitoring stations for each of the three flow/water quality gauges (minimum nine biological monitoring stations) to measure stream geomorphology, periphyton, fishes, and aquatic macroinvertebrates. Sampling will be initiated within six months of permit issuance. Samples will be collected quarterly for the first three years, then biannually thereafter. Data from gauges and biological monitoring stations will be reported to the State of Georgia, Corps, and EPA annually, with an analysis of the data provided at minimum five-year increments.
- Restoration of 150-600-foot riparian buffers on the south side of a 5500-feet reach of Mill Creek and its tributaries (Little River system) and 25-250-foot riparian buffers on both sides of a 4700-foot reach of an unnamed tributary to the Etowah River.
- Preservation of a minimum 100-foot buffer on both banks of the Etowah River from I 575 downstream to GA 140 (approximately 3.2 linear miles; 17,200 linear feet).
- Implementation of a 100-foot buffer on both banks of Hickory Log Creek above the reservoir's normal pool upstream 1.4 linear miles (7,500 linear feet) to the site where the Creek is designated as intermittent on a USGS 1:24,000 quadrangle.
- Employment of measures that meet or exceed state erosion and sedimentation requirements during all construction phases of the reservoir.

The Service considered these measures in evaluating whether the project would the jeopardize continued existence of the three listed fish in this basin. Where applicable, the measures are included in the Terms and Conditions section of this opinion.

For the purpose of consultation under section 7 of the Act, the "action area" is defined at 50 CFR 402 to mean "all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The Hickory Log Creek Reservoir will provide drinking water to the City of Canton, Cherokee County, Cobb County, and Paulding County. Therefore, the Service has defined the action area as the service areas for the reservoir that lies within the Etowah Basin (Fig. 2).

STATUS OF THE SPECIES

The Cherokee and Etowah darters were listed as threatened and endangered, respectively on December 20, 1994. The amber darter was listed as endangered on August 5, 1985. The primary factors affecting these species are habitat loss associated with:

- Impoundments, including Allatoona Reservoir and numerous small ponds throughout the species' range. Impoundments destroy important stream habitat and block genetic interchange by fragmenting habitat and isolating populations. Impoundments also alter the thermal and chemical regimen of stream sections immediately below the dam and cause community shifts favoring centrarchid fishes (Brim 1991), which may prey on darters.

- Erosion that results in siltation of stream bottoms and increased levels of suspended sediment. Sources of increased sediment loads include timber clearcutting, clearing of riparian vegetation, urbanization, road construction, and other practices that allow bare earth to enter streams. Light to moderate levels of siltation are ubiquitous in many streams of the Etowah River system with Cherokee darters; however, siltation problems are severe in many tributaries where these fish have been extirpated. Excessive sedimentation and suspended sediment cause multiple adverse effects on fishes including increased predation and parasitism, reduced availability of prey/feeding rates, reduced reproductive success, and increased physiological stress.
- Increased point source and nonpoint source pollution associated with urban development, road development, landfills, agricultural practices, and other sources. Toxic chemicals, such as many petroleum products, detergents, industrial and domestic wastes, herbicides, fungicides, insecticides, and other pesticides, can affect stream water quality. Large spills of these pollutants can kill aquatic organisms in areas well downstream of the spill. Even small amounts of these toxic chemicals, if continually released over time into streams, can act cumulatively to seriously affect the ability of some aquatic organisms to maintain healthy populations. Nutrients from excessive fertilizer use, animal waste, household and industrial detergents, and septic tank leakage also can affect streams. These nutrients, particularly nitrogen and phosphorus, increase plant productivity and, in excess quantities, can lead to algae blooms on stream bottoms that limit foraging and reproduction by benthic organisms.

Cherokee Darter

The Cherokee darter, a small percid fish, is subcylindrical in shape and has a relatively blunt snout with a subterminal mouth. The body shade is white to pale yellow. The side of adults is pigmented with usually eight small dark olive-black blotches that develop into vertically-elongate, slightly oblique bars in breeding adults, especially in males. The back usually has eight small dark saddles and intervening pale areas. The spinous dorsal fin of nuptial males has a dark olive black band at the base of the fin and nearly uniform russet orange red on the remaining fin, except for a blue margin. The Cherokee darter has proven to be distinct from the Coosa darter (*E. coosae*), a species with which it was previously confused, by peak nuptial males never having five discrete color bands in the spinous dorsal fin (Bauer et al. 1995).

The Cherokee darter is endemic to the Etowah River system in north Georgia and, historically, is thought to have occurred in most of the system's tributaries (U. S. Fish and Wildlife Service 2000). Currently, the darter exhibits a disjunct and discontinuous distribution pattern, associated to a large degree with construction of the Allatoona Reservoir in the middle Etowah River system. Most Cherokee darter populations occur upstream of Lake Allatoona in tributaries of the Etowah River that drain the Piedmont physiographic province (e.g., 43 of 49 populations, as identified by Bauer et al. 1995). Populations downstream of Allatoona Dam are geographically and genetically isolated from other populations in the Etowah River basin. These southern tributary systems tend to drain areas exhibiting less relief and, on average, are much more degraded than streams above the Reservoir (U. S. Fish and Wildlife Service 1994).

The species usually occurs in shallow water (e.g., 4 - 20 inches) and in sections of reduced current, typically in runs above and below riffles and at the ecotones of riffles and backwaters

(Bauer et al. 1995). It generally does not occur in the Etowah River itself, although the mainstem may provide marginal habitat that allows movement between streams and genetic exchange between some populations (Dr. B. Freeman, pers. comm., 1998). The Cherokee darter is associated with large gravel, cobble, and small boulder substrates, but is uncommonly or rarely found over extensive areas of bedrock, fine gravel, or sand. It is most abundant in sections of smaller streams with relatively clear water and clean substrates with little silt deposition. The Cherokee darter is relatively intolerant of moderate to heavy silt deposition and to impoundment (Bauer et al. 1995).

The life history of the Cherokee darter has not been studied. However, research on other members of the darter subgenus *Ulocentra*, in which this species is placed, provide general life history information that may pertain to the Cherokee darter. Spawning takes place in the spring. *Ulocentra* darters generally display some sort of courtship behavior (e.g., flashing colorful fins, posturing) before the female deposits eggs separately on the side or under a large rock. After fertilization, the male may defend the eggs, which generally number in the low hundreds. Sexual maturity is usually reached after the first year of a typically three-year life span. Like most darters, *Ulocentra* usually eat a variety of insect larvae, particularly midges and blackflies, and microcrustacea.

Etowah Darter

The Etowah darter is a small-sized percid fish that is moderately compressed laterally and has a moderately pointed snout with a terminal, obliquely angled mouth. The body ground shade is medium brown or grayish-olive. The lower opercle and branchiostegal rays have a pale bluish-green wash with is intensified in nuptial males. The side is usually pigmented with 13 or 14 small dark blotches just below the lateral line. The breast in nuptial males is dark greenish-blue. The spinous dorsal fin is suffused dusky black olive with a red margin. The soft dorsal and caudal fin have four bands. The pelvic fins are clear to dusky black with a pale green blue wash; pectoral fins are dusky black. The Etowah darter has proven distinct from the greenbreast darter (*E. jordani*), a species with which it has previously been confused, by the absence of red marks on the sides and anal fins of male specimens (Wood and Mayden 1993).

The Etowah darter is endemic to the upper Etowah River system in north Georgia, although historically it may have occurred further downstream in the Etowah River mainstem. This darter has one of the most restricted distributions in the southeast for a fish that occurs in moderate to large creeks or small rivers (Lee et al. 1980); it currently is found only in the upper Etowah River mainstem and in Amicalola, Shoal (Dawson County), Long Swamp, and Smithwick Creek. This distribution suggests habitat specialization, since all streams inhabited by this species are geographically adjacent in the most upland portion of the river system (U.S. Fish and Wildlife Service 1994).

The Etowah darter lives in warm and cool, medium and large creeks or small rivers approximately 50-100 feet wide of moderate or high gradient with rocky bottoms. Etowah darters inhabit relatively shallow riffles (6-18 inches), with large gravel, cobble, and small boulder substrates. The fish typically is associated with the swiftest portions of shallow riffles, but occasionally adults are taken at the tails of riffles. Sites with the greatest abundance of

Etowah darters had clear water and relatively little silt in the riffles. The darter is intolerant of impoundments and is not found in pool habitats (U.S. Fish and Wildlife Service 1994).

The life history of the Etowah darter has not been determined. A related species, the greenbreast darter (*Etheostoma jordani*), a species with which the Etowah darter was long confused, spawns in the spring in sand and gravel riffles. The female selects the spawning site, buries herself with only her head and caudal fin exposed, and is mounted by the male. Females generally deposit 100 to 200 eggs in the substrate. Sexual maturity is usually reached after the first year of a typically three-year life span. The greenbreast darter (and probably the Etowah darter) eats a variety of insect larvae, particularly midges, and water mites.

Amber Darter

The amber darter is a small slender fish rarely exceeding 2.5 inches in length (Williams and Etnier 1977). The fish's upper body is golden brown with four dark saddles, and its belly is yellow to cream in color. The spinous dorsal fin is clear, with a vague gray-black basal and marginal band. The soft dorsal, caudal, and pectoral fin rays have clusters of dark chromatophores, while their membranes are unpigmented. The anal and pelvic fins are unpigmented except for a few clusters of dark chromatophores.

The amber darter is endemic to the Coosa River basin. This fish is found only in a 33-mile reach of the Conasauga River, a 26-mile reach of the Etowah River, and the lower portions of two Etowah River tributaries, Shoal and Sharp Mountain Creeks in Cherokee County.

Habitat use by the amber darter in the Conasauga River watershed was described by Freeman and Freeman (1994). Amber darters occurred in relatively low densities in stream riffles that generally supported large populations of other species of small benthic fish. Individuals usually were observed over cobble, gravel, or sand, and occasionally moved under small cobbles or river weed for short (<1 minute) periods. Amber darters never were observed in habitat characterized by slow current and extensive silt substrates. Freeman and Freeman (1994) suggested the following as criteria for suitable amber darter habitat: depth > 7.9 in (20 cm), velocity near the substrate >0-51 cy/sec (0-39 cm/sec), average velocity = 13-103 cy/sec (10-79 cm/sec), and substrate dominated by gravel or cobble.

Individual darters observed by Freeman and Freeman (1994) tended to remain within relatively small areas, covering an average of 50.6 ft^2 (4.7 m^2) during observations of at least 30 minutes; fish commonly retraced movements as they foraged. Prey items of adults included mostly gastropods (snails and limpets) and insects (primarily Trichoptera and Ephemeriptera, occasionally Coleoptera, Diptera, and Plecoptera) (Freeman 1983). Prey of larvae and juveniles is unknown.

Spawning may occur from late fall to early spring. Freeman (1983) collected gravid individuals in October, March, April and May. Ripest females were collected during late April and early May, and courting males and females were observed in May. Starnes (1977), however, collected ripe males in November, suggesting either a protracted spawning season, or a spawning season heavily influenced by seasonal events (Freeman 1983).

Recent Impacts to Species:

Since December 1998, the Service has provided non-jeopardy biological opinions on 14 projects in waters of the United States that were likely to adversely affect Cherokee, Etowah, and/or amber darter populations in the Etowah River watershed. Two of these projects, the Bluff Parkway and Great Skys Subdivision, also impact stream habitat in the Hickory Log Creek catchment; the action areas considered in these biological opinions overlap the action area for the Hickory Log Creek biological opinion.

Since December 1998, the Service also has reported to Law Enforcement four projects in Cherokee and Paulding Counties that either killed Cherokee darters or resulted in significant loss of known occupied habitat due to increased sedimentation, improper use of chemicals, and illegal piping and/or filling of streams with Cherokee darter populations. These impacts, combined with impacts to water quality caused by extensive upland development within the watershed, pose an increasing threat to listed fish populations.

ENVIRONMENTAL BASELINE

Until recently, the action area covered by this biological opinion was largely rural with low human population densities. Land use practices included forestry, grazing, poultry production, and hay and small scale row-crop agriculture (Freeman 1993). Rapid urbanization of much of the action area, however, has occurred in the past several decades, due in large part to the basin's close proximity to the rapidly expanding Atlanta metropolitan area.

Both the Cherokee and Etowah darter are endemic to the Etowah River system. Cherokee darter populations are known from small stream systems throughout the action area (Fig. 10). Amber darters and Etowah darters occur in the Etowah River mainstem and several large tributaries (Figs. 11 and 12). The amber darter is known to occur in the Etowah River at its confluence with Hickory Log Creek; suitable habitat exists for Etowah darters in this reach, but none have been located in recent surveys. Much of the known habitat for Etowah darters, as well as the reach of the Etowah River with the largest known numbers of amber darters, occurs outside of the action area for this biological opinion. The Etowah River in Cherokee County also provides habitat for two species listed by the State of Georgia as endangered: the freckled darter (*Percina lenticula*) and the frecklebelly madtom (*Noturus munitus*).

The Hickory Log Creek watershed, where the reservoir will be constructed, historically has been a mix of undeveloped and agricultural lands. The steep, sloping hillsides around the perimeter of the proposed reservoir are dominated by mid- to late-successional oak/hickory (*Quercus* spp./*Carya* spp.) forests. The floodplain and associated wetland areas within the upper portion of the proposed reservoir have been altered by ditching, logging and agriculture. The lower portion of the basin downstream to the proposed dam site is narrow and contains numerous small forested, scrub-shrub, and emergent wetlands. Hickory Log Creek near its confluence with the Etowah River flows through a highly urbanized area.

Survey data indicate that Cherokee darters occur throughout Hickory Log Creek and in many of its small tributaries. The most recent survey in the mainstem of Hickory Log Creek, conducted by Dr. B. Freeman in July and August 1998, found Cherokee darters at sites above and below the current dam (Fig. 13, Sites 4 and 6). Cherokee darters also were collected in Hickory Log Creek by various researchers in 1993 and 1995 (Fig. 13, Sites 2, 5, and 7) and in several tributaries in 1994 and 2000 (Fig. 13, Site 8; Fig. 14). These survey data and discussion with Dr. B. Freeman, one of the recognized experts on Cherokee darters, indicate that the Cherokee darter population in Hickory Log Creek is large and apparently stable. Dr. Freeman estimated that inundation of Hickory Log Creek could take 1,000 to 10,000 Cherokee darters (Pers. comm., Feb. 10, 2000).

An existing 8.5-acre impoundment is located on Hickory Log Creek just upstream of the proposed reservoir dam (Fig. 1). The existing dam effectively isolates Cherokee darter populations above the dam from other populations in Hickory Log Creek and the Etowah basin (Dr. B. Freeman, pers. comm., 2000).

Two projects recently authorized by the Savannah District, Corps, also will affect aquatic habitat in Hickory Log Creek. Construction of the proposed Bluffs Parkway, a new 2.92-mile road in the City of Canton, will require piping of 300 feet of Hickory Log Creek downstream of the proposed Hickory Log Creek Reservoir dam and 1190 feet of perennial and intermittent stream on five tributaries to Hickory Log Creek. Construction of the proposed Great Sky Subdivision on a 915-acre property in the City of Canton will require piping of 740 feet of Hickory Log Creek tributaries upstream of the reservoir footprint. The Service anticipated project construction and maintenance of these projects would take all Cherokee darters:

- in the Hickory Log Creek watershed from the most upstream tributary the Bluffs Parkway will cross downstream to Hickory Log Creek's confluence with the Etowah River;
- in Hickory Log Creek tributaries that flow from the Great Sky property downstream to their confluences with Hickory Log Creek, and
- a one-mile reach of Hickory Log Creek downstream of these the Great Sky property.

Most of this area overlaps the reach of Hickory Log Creek and its tributaries that would be flooded following dam construction or that would be affected by altered flow regimes. Some fish included in this baseline may have been killed, stressed, suffered degradation of habitat, or otherwise taken if the reservoir is constructed after these other projects on Hickory Log Creek are completed.

Other fish species collected in reaches of the Hickory Log Creek system where Cherokee darters were located included southern brook lamprey (*Ichthyomyzon gagei*), largescale stoneroller (*Campostoma oligolepis*), Alabama shiner (*Cyprinella callistia*), tricolor shiner (*C. trichroistia*), bluehead chub (*Nocomis leptocephalus*), silverstripe shiner (*Notropis stilbius*), Coosa shiner (*N. xaenocephalus*), creek chub (*Semotilus atromaculatus*), Alabama hog sucker (*Hypentelium etowamum*), snail bullhead (*Ameiurus brunneus*), speckled madtom (*Noturus leptacanthus*), sculpins (*Cottus* spp.), redeye bass (*Micropterus coosae*), spotted bass (*M. punctulatus*) largemouth bass (*M. salmoides*), redbreast sunfish (*Lepomis auritus*), bluegill (*L. macrochirus*), blackbanded darter (*Percina nigrofasciata*), bronze darter (*P. palmaris*), and mobile logperch (*P. kathae*).

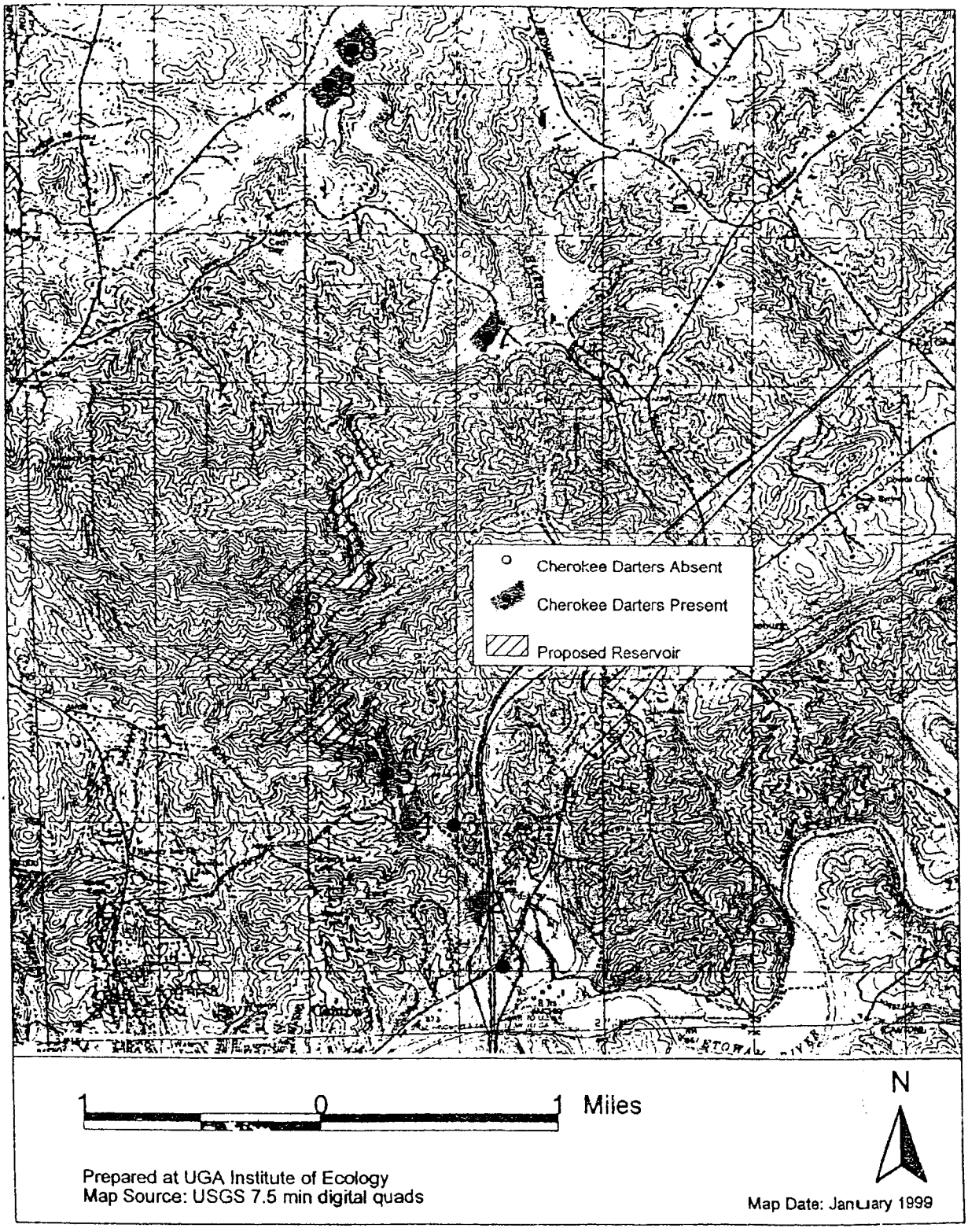

Fig. 13. Results of Cherokee darter surveys on Hickory Log Creek.

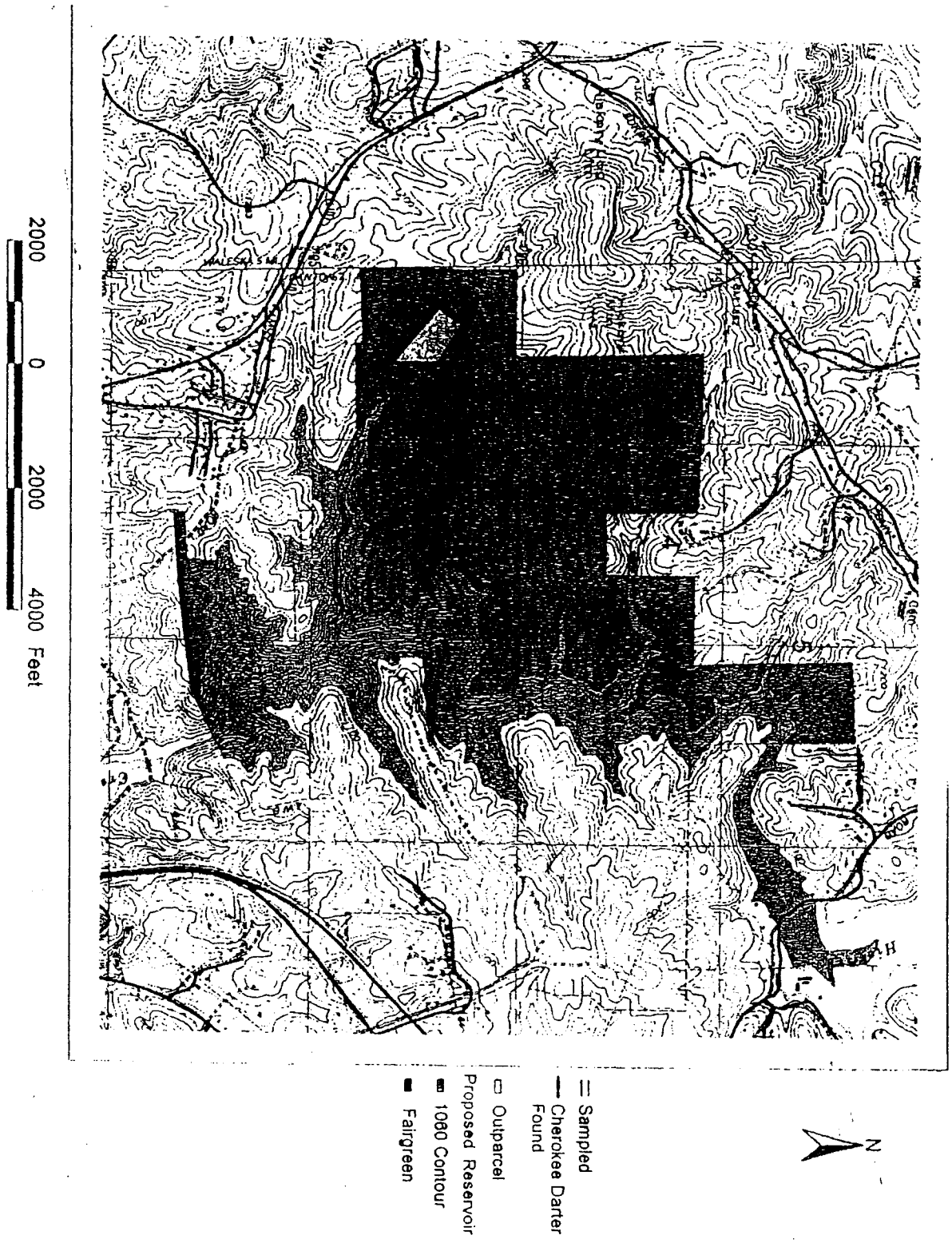

Fig. 14 — Cherokee darter survey results

EFFECTS OF THE ACTION

Direct Effects

1. **Cherokee Darter Habitat Loss:** The proposed reservoir will flood 8.3 miles of Hickory Log Creek and its tributaries, including 5 miles of streams that provide habitat for a large, apparently stable population of Cherokee darters. Inundation will change the stream from a lotic to a lentic habitat, an action that will significantly modify Cherokee darter habitat within the reservoir footprint by changing flow characteristics, channel substrates, and aquatic communities. Cherokee darters are obligate benthic riverine fishes and will not survive in the reservoir. Little data exist on the distance Cherokee darters will disperse to avoid unsuitable habitat; however, studies on other species of small darters indicate home ranges are small, and large-scale movement in response to degraded habitat may be limited (Dr. Mary Freeman, USGS-Biological Resources Division, and Dr. B. Freeman, pers.comm., December 1999). Based on this information, we anticipate that habitat changes associated with inundation are likely to result in death of the majority of Cherokee darters in the inundated area by significantly impairing spawning, foraging, and sheltering.

2. **Fragmentation of Cherokee Darter Habitat and Isolation of Populations**: Dam construction and inundation will block fish movement and genetically isolate Cherokee darter populations that might remain downstream of the dam and in the headwaters of Hickory Log Creek and its tributaries after the reservoir is flooded. The majority of these remnant populations are likely to be relatively small and therefore more susceptible to genetic drift, or random changes in gene frequencies independent of mutation, recombination, and natural selection. Major impacts of genetic drift include a loss of genetic variation within populations, genetic divergence between populations, and loss of population viability.

3. **Downstream Sedimentation during Dam and Reservoir Construction:** Land-clearing operations and other activities during dam and reservoir construction are likely to increase sediment loads in Hickory Log Creek and the Etowah River. Excessive sedimentation and suspended sediment in aquatic systems can cause multiple adverse effects on benthic fish, including loss of stream habitat essential for foraging and spawning; increased mortality of eggs, larvae, juveniles, and adults; increased predation on eggs by sediment-dwelling invertebrates; increased vulnerability of adults to predation; reduced reproductive success; induced physiological stress; reduced feeding and weight loss; reduced availability of prey; increased parasitism; simplification of community structure; and hypertrophy/necrosis of gill epitheliums (Newcombe and Jensen 1996).

4. **Other**: Movement of heavy machinery and placement of fill dirt in Hickory Log Creek during dam construction may crush Cherokee darters that occur within the dam area. Pumps that move water from the Etowah River to fill the reservoir could entrain and kill Etowah and amber darters. Lands that currently are in agriculture, or that have significant commercial and residential development, could affect the quality of reservoir waters if these lands, when flooded, release high levels of fertilizers, pesticides, nutrients, or other chemicals.

Indirect effects

Dams change the physical environment of a stream system, altering the variation and cycles of flow that occur daily, seasonally, and annually; changing stream temperature and other water quality parameters; and modifying sediment transport in the system. We anticipate indirect impacts associated with construction and operation of the reservoir will include:

1. **Changes in flow patterns in Hickory Log Creek downstream of the dam that affect Cherokee darter survival and habitat:** Lowered spring flows may limit recruitment of juveniles into the Cherokee darter population downstream of the dam. Cherokee darters are thought to deposit eggs on the sides or under large rocks; like many riverine species, relatively swift currents may be needed to keep nests and eggs well oxygenated and free of smothering silt (EPA/FWS 1999). Continued low flows and slower water movement during the Cherokee darter spawning period is likely to increase deposition of suspended sediment and reduce dissolved oxygen levels in spawning areas, as well as increase water temperatures that affect incubation, survival, and emergence of fry in Hickory Log Creek downstream of the dam. Low flows may also increase predation and affect spawning behavior (Mr. John Biagi and Dr. Chris Skelton, GADNR, pers. comm., April 2002). Repeated and/or extended high flows at any period may flush larval, juvenile, and adult Cherokee darters into the Etowah River, where they are unlikely to survive, and/or scour the larger channel substrates that provide darter habitat (Mr. John Biagi and Dr. Chris Skelton, GADNR, pers. comm., April 2002).

2. **Changes in stream geomorphology in Hickory Log Creek downstream of the dam that affect Cherokee darter habitat by altering the size, distribution, or condition of stream habitat:** Large dams are effective sediment traps, commonly retaining over 99% of the sediment flowing into a reservoir (Williams and Wolman 1984). Curtailment of sediment supply, particularly in combination with repeated long-duration releases of reservoir water, typically results in a lowering of the mean bed level (with associated increased sedimentation) downstream from the dam unless the substrate is dominated by very coarse material or bedrock. The resulting entrenched stream often then begins to widen within the newly established channel, causing increased bank erosion and downstream sedimentation.

3. **Changes in water temperature downstream of the dam in Hickory Log Creek and the Etowah River that stresses or kills Cherokee, Etowah, and amber darters:** In many reservoirs, solar energy heating causes temperature stratification of stored water. Stratification is the layering of a reservoir into an upper, warm layer, called the epilimnion; a mid-depth transitional layer, the metalimnion; and a lower, dark, cold, and unproductive layer, the hypolimnion. These layers are separated by a thermocline in the metalimnion, a sharp transition in water temperature between upper warm water and lower cold water. This stratification varies seasonally, being most pronounced in the summer and absent in the winter. Between these extremes are periods of less pronounced stratification and spring and fall overturns, when the entire waterbody mixes together.

The extent of changes in water temperature downstream of a dam due to reservoir releases depends on the retention time of water in the reservoir and the withdrawal depth of releases from the reservoir. The Service has no information on reservoir depths from which water will be withdrawn for release from the Hickory Log Creek Reservoir. However, withdrawals from a single strata within the reservoir could result in water releases warmer or colder than normal water temperatures. Fish can generally function in a wide range of temperatures but have an optimum range, as well as lower and upper lethal temperatures for various activities. Changes in water temperature, in addition to directly affecting listed darter health and survival, may also have negative effects on invertebrate populations and other food sources.

4. **Significantly reduced dissolved oxygen levels and/or high concentrations of anoxic products in water released into Hickory Log Creek and the Etowah River that stresses or kills Cherokee, Etowah, and amber darters:** Dissolved oxygen levels in many reservoirs are tied to the overturn, mixing, and stratification processes. The epilimnion tends to be enriched with oxygen from the atmosphere and photosynthesis. Dissolved oxygen, however, tends to become depleted in the hypolimnion due to decomposition of organic substances, algal respiration, and nitrification. Little new oxygen is introduced into this lower layer by wind mixing, algae photosynthesis, or other sources. The Service has no information on reservoir depths from which water will be withdrawn for release from the Hickory Log Creek Reservoir. However, withdrawals from the hypolimnion could result in low downstream dissolved oxygen levels that fail to support aquatic life, including listed darters, in the basin.

   Anoxic conditions in the hypolimnion, in addition, may stimulate the formation of reduced species of iron, manganese, sulfur, and nitrogen. Chemical cycling of these elements occurs when they change from one state to another (e.g., from solid to dissolved). Many chemicals enter a reservoir attached to sediment particles or quickly become attached to sediment. Many of these chemicals are not toxic as solids to many organisms. Some, however, are easily reduced under anoxic conditions and become soluble. The reduced, soluble forms of these chemicals may be toxic to many aquatic organisms at relatively low concentrations. We have no data on toxicity of these chemicals to listed darters in the Etowah.

Reductions or increases of instream flows in the Etowah River below the intake structures may alter water temperatures and channel morphology in this reach of the River. Changes in flow timing and duration, in addition, may alter the condition or availability of important habitat types during various life stages of the Etowah and amber darter. However, we do not have sufficient data on flow requirements of the Etowah and amber darter, or on how altered flows affect these species' life history or habitat, to assess indirect impacts to these fish associated with altered flow in the Etowah River. Changes in stream geomorphology in the Etowah River due to altered flows in Hickory Log Creek below the reservoir are likely to be minimal (Dr. B. Freeman, pers. comm., April 28, 2000).

Many stream fish populations vary from year to year under natural conditions; therefore, it may be difficult to conclusively tie any of the anticipated impacts described below to observed population fluctuations within these species.

INTERRELATED AND INDEPENDENT ACTIONS AND CUMULATIVE EFFECTS

Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions are actions having no independent utility apart from the proposed action. Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Reasonably certain to occur means that permits, grants, contracts, authority, obligations of expenditures, etc. have been initiated. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Etowah River basin, until recently, was largely rural with low human population densities. Land use practices included forestry, grazing, poultry production, and hay and small scale row-crop agriculture (Freeman 1993). These activities may have degraded some stream reaches within the basin, but probably did not have a major effect on aquatic systems due to low human density.

This situation is rapidly changing. Aquatic diversity is threatened by increased development due in large part to the basin's close proximity to the rapidly expanding Atlanta metropolitan area. Agricultural lands and forests are being converted to subdivisions, industrial parks, recreational facilities, and other developments at an accelerated rate. Riparian vegetation that stabilizes stream banks and moderates water quality is being cleared, runoff from upland areas with large expanses of impervious surfaces has increased and is of poorer quality, and stream geomorphology is being altered by fill, piping, channelization, flashy stream flows, and other modifications. These changes in land use frequently cause accelerated erosion that silts in stream bottoms and reduces foraging and spawning success and/or increases point source and nonpoint source pollution in streams.

The purpose of the reservoir, as stated in the Section 404 permit application, is to meet projected water demands, based on population projections, in the CCMWA and City of Canton's service area (Fig. 2). The City of Canton's service area includes only city residents; however, the CCMWA's service area includes both Cobb and Paulding Counties as sole source customers and Douglas and Cherokee Counties as non-sole source customers (Fig. 2). These service areas lie within the majority of the Cherokee darter's range, and a portion of the Etowah and amber darters' ranges. Population in the primary service area that will be served by this reservoir (Cobb, Douglas, Cherokee, and Paulding Counties) is projected to more than double from 767,050 individuals in 1995 (known population) to 1,940,000 individuals in 2050. A reliable supply of water is likely to facilitate continued residential and commercial growth in the basin; however, the Service is unable to determine if growth in the action area would occur, or would occur as rapidly, without construction of the Hickory Log Creek Reservoir.

Some of the future growth in this basin will directly impact stream systems with listed fish (i.e., stream culverting, fill, and inundation) and will require separate consultation pursuant to section 7 of the Act. Other actions either will not result in take or will require a section 10 permit under the Act. The Service, with its partners, currently is developing a Habitat Conservation Plan that will minimize and mitigate for non-Federal, activities in the basin that will take listed aquatic species. Take associated with population growth and associated urbanization of this basin is not covered under the Incidental Take Statement below.

CONCLUSION

After reviewing the current status of the Cherokee, Etowah, and amber darter; the environmental baseline for the action area; the effects of the proposed actions; and the cumulative effects, it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for Cherokee, amber, or Etowah darters in the Etowah River watershed.

We reached this opinion based on:

- Cherokee darters:
  a. The existing 8.5-acre impoundment on Hickory Log Creek just upstream of the proposed reservoir dam (Fig. 1) effectively isolates Cherokee darter populations above this dam from other populations in Hickory Log Creek and the Etowah basin (Dr. B. Freeman, pers. comm., 2000).
  b. Bauer et al. (1995) reported the occurrence of at least 49 populations of Cherokee darters in the Etowah basin, and Dr. B. Freeman has identified additional populations not in Bauer et. al's paper. Although several Cherokee darter populations are or have been impacted directly and indirectly by sedimentation, chemical contamination, fill and piping of suitable darter habitat, and upland development within portions of the watershed, many areas within the Etowah River watershed are relatively undisturbed with diverse aquatic faunas, including healthy populations of Cherokee darters. Bauer et al. (1995) stated Cherokee darters have been extirpated from only six stream systems since 1948, primarily due to inundation associated with construction of Lake Allatoona.

- Etowah and amber darters: Freeman and Wenger (2000) identified protection of the upper Etowah River mainstem and its tributaries in Dawson County as essential for long-term health of these two species and the entire unique Etowah River fish assemblage. This reach of the river is not within the action area.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the Corps so that they become binding conditions of any grant or permit issued to the applicants, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the applicants to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the applicants must report the progress of the action and its impact on listed species to the Service as specified in the Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE

During reservoir construction and operation, the Service anticipates take of all Cherokee darters in Hickory Log Creek and all Etowah and amber darters in the six-mile reach of the Etowah River between its confluence with Hickory Log Creek and Lake Allatoona. The incidental take is anticipated to be in the form of

- Habitat modification or degradation of 5 miles of occupied stream habitat, such that Cherokee darters are unable to breed, feed, or shelter.
- Death of or harm to Cherokee darters, including larvae or eggs, crushed or injured when the dam is constructed.
- Death or harm to listed fish, including larvae or eggs, due to short-term increases in water turbidity during and immediately after dam construction.
- Death or harm to Cherokee darters, including larvae or eggs, due to altered flows (particularly low spring flows and high flows) in Hickory Log Creek below the dam.
- Death or harm to listed fish, including larvae or eggs, due to changes in water temperatures, changes in dissolved oxygen levels, or contaminants/excess nutrients in water released from the reservoir.

- Loss of stream habitat in Hickory Log Creek downstream of the dam due to geomorphic changes in stream pattern, profile, and dimension associated with altered flows/sediment transport in the lower portion of Hickory Log Creek.
- Changes in gene diversity in Cherokee darter populations above and below the reservoir due to restricted fish movement and fragmented populations.
- Death or harm to Etowah and amber darters, including larvae or eggs, due to entrainment at the pump in the Etowah River.

Although we anticipate take of all listed fish in Hickory Log Creek and in the six-mile reach of the Etowah River below the confluence due to construction and operation of the reservoir, quantifying the extent of take is problematic. Estimates of Cherokee darters within the Hickory Log Creek system range from 1000 to 10,000 individuals; the total number of Etowah and amber darters in the Etowah River below the confluence with Hickory Log Creek is not known. Collection of darters killed as the reservoir fills, during high or low flow events, or due to other causes listed above will be difficult due to the fishes' small sizes and rapid decomposition of carcasses.

Though we anticipate all Cherokee, Etowah, and amber darters will be incidentally taken, we do not anticipate the immediate death of all individuals. Evaluating the extent of take that will occur after the reservoir is filled is difficult due to the limited information on darter home ranges, movement patterns, minimum flow/water quality requirements, and genetic diversity. Some Cherokee darters within the reservoir footprint may disperse to suitable habitat outside the reservoir footprint as the reservoir fills. Cherokee darters in Hickory Log Creek and its tributaries above and below the reservoir will not be directly impacted by reservoir filling, but remnant populations are likely to be small and isolated; small, isolated populations are highly vulnerable to the affects of genetic drift, which causes loss of genetic variability within populations and increased genetic variability between populations. Cherokee, Etowah, and amber darters below the dam, in addition, may be impacted by modified flows and altered water quality associated with the new reservoir water release regime. All Cherokee darter populations that remain in Hickory Log Creek and its tributaries after the reservoir is filled will be more subject to extirpation, since reproductive failure or high mortality due to drought or other factors is less likely to be counterbalanced by recolonization from other populations.

EFFECT OF THE TAKE

In the accompanying opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of Cherokee, Etowah, and amber darters:

1. Minimize changes in water quality in Hickory Log Creek and the Etowah River below the confluence during reservoir construction and in water releases from the reservoir.

2. Operate the dam such that downstream changes in stream channel morphology and impacts to aquatic communities will be minimized.

3. Minimize fish impingement at the Etowah River intake structures.

TERMS AND CONDITIONS

In order to be exempt from prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. The January 14, 2002, biological assessment and February 2002 revised mitigation plan listed a number of conservation measures that the applicants would implement to minimize project impacts on listed darters. These conservation measures are incorporated, where appropriate, as terms and conditions below.

1. Water Quality
   a. Design the dam to release waters at temperatures suitable for survival of Cherokee, Etowah, and amber darters (i.e., no more than a four-hour average water temperature difference of more than two degrees Celsius in the Etowah River at the confluence of Hickory Log Creek, as compared to temperatures above the confluence). Potential measures to control temperatures of water released from the reservoir include fixed and adjustable surface outlets that allow water to be drawn from different depths of the reservoir, surface pumps or draft tube mixers that pump or guide warm surface water to intake structures at the bottom, and submerged curtains of flexible rubber fabric that surround the existing outlet and extend upward to draw water from the surface.
   b. Install an oxygen diffuser to ensure dissolved oxygen concentrations in water released from the reservoir are similar to those in the Etowah River at the confluence of Hickory Log Creek.
   c. Establish three continuous monitoring gauge stations that record discharge, pH, temperature, specific conductivity, dissolved oxygen, turbidity, and nutrient levels on Hickory Log Creek and the Etowah River. The two gauges on the Etowah River should be placed above and below the confluence of Hickory Log Creek to monitor water quality parameters. Contingency plans will be developed to modify dam operation procedures if water released from the dam causes a four-hour average water temperature difference of more than 2°C in the Etowah River at the confluence of Hickory Log Creek, as compared to temperatures above the confluence, or if dissolved oxygen levels, as measured at the gauge downstream of the reservoir dam, fall below critical levels.

d. Establish a minimum of three biological monitoring stations for each of the three flow/water quality gauges to measure stream geomorphology, periphyton, fishes, and aquatic macroinvertebrates.
e. Report data from gauges and biological monitoring stations to the Service, as well as the State of Georgia, Corps, and EPA, annually, with an analysis of the data provided at minimum five-year increments.
f. Implement a 100-foot buffer on both banks of Hickory Log Creek above the reservoir's normal pool upstream until the creek is designated as intermittent on a USGS 1:24,000 quadrangle. This buffer will support undisturbed native vegetation; no construction, land clearing, or vegetation removal (including mowing or hand clearing) will be permitted.
g. Ensure proper closure and/or removal of existing septic systems, close all petroleum tanks, and allow agricultural land in the proposed reservoir footprint to lie fallow for two years prior to impoundment of the reservoir.
h. At a minimum, implement BMPs endorsed by the State of Georgia for erosion and sediment control during land clearing and construction activities. The applicants will submit to the Service before construction operations begin
   1. a copy of the primary permittee's Notice of Intent for use of the State of Georgia General NPDES Permit for Storm Water Discharges from Construction Activities (General NPDES Permit),
   2. a copy of the certified Erosion, Sedimentation, and Pollution Control Plan, as required under Part IV of the General NPDES Permit, and
   3. a copy of the Comprehensive Monitoring Program under the General NPDES Permit. Monthly monitoring reports, as described in Part V of the General NPDES Permit, will be provided to the Service by the fifteenth day of the month following the reporting period.
i. Submit to the Service a copy of the primary permittee's Notice of Termination under the General NPDES Permit when activities authorized by the General NPDES Permit have ceased.
j. To the maximum extent practicable, limit land clearing activities and dam construction to times outside of the suspected spawning period of the Cherokee darter (April 1 to June 15).

2. Dam Operation
   a. Maintain 7Q10 flows in Hickory Log Creek below the reservoir.
   b. Adopt one of the Georgia Department of Natural Resources (GADNR) April 1, 2001, interim minimum flow protection requirements for flows in the Etowah River below the reservoir intake. A copy of these requirements is enclosed.
   c. Release waters from the dam such that maximum releases do not exceed peak flows that would have occurred in Hickory Log Creek prior to dam construction in an average rainfall year. Preferably, during periods when extended, high flows are released from the Reservoir (e.g., Aug. 25-October 15 in Fig. 6; summer to late fall in Fig. 8), route flows above 7Q10 through the reservoir intake pipes, rather than down Hickory Log Creek, if engineering analyses show this is feasible. Repeated and/or extended high flows at any period may flush larval, juvenile, and adult Cherokee darters into the Etowah River, where they are unlikely to survive, and/or scour the larger channel substrates that provide darter habitat.

3. Fish Impingement
   a. Utilize best available technology to minimize fish impingement at structures in the Etowah River where water is withdrawn to fill the reservoir.

4. If a dead, injured, or stressed Cherokee, Etowah, or amber darter is located, the finder must immediately notify the Georgia Field Office (706-613-9493). Care should be taken in handling specimens to ensure effective treatment or to preserve biological materials to analyze cause of death. The finder is responsible for ensuring evidence intrinsic to the specimen is not unnecessarily disturbed.

During reservoir construction and operation, the Service anticipates take of all Cherokee darters in Hickory Log Creek and all Etowah and amber darters in the six-mile reach of the Etowah River between its confluence with Hickory Log Creek and Lake Allatoona. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. Considering that all listed darters are expected to be taken during the course of the action, the level of incidental take is exceeded only if the scope of the action increases to include other darter streams. Such a change in the proposed action would represent new information requiring reinitiation of consultation. Additionally, if in the course of project implementation the reasonable and prudent measures cannot be carried out as described, the Corps must immediately provide an explanation and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We make the following conservation recommendations for this project:

- The CDS will be located in a catchment identified by Freeman and Wenger (2000) as of high or medium priority to Cherokee darters, unless selection of a lower priority stream is justified and approved by the Service.
- Funding for Cherokee darter management plan development and Cherokee darter genetic study will be provided to qualified scientists within six months of permit issuance. The management plan should be developed in close coordination with Service and Georgia Department of Natural Resources personnel. The proposal for the genetic study must be approved by the Service prior to commencement of research activities.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the biological assessment. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the Corps' action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the Corps' action is modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (4) conservation measures, as described on Page 4 of this opinion are not implemented; or (5) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The above findings and recommendations constitute the report of the Department of the Interior. Please contact staff biologist Robin Goodloe at 706-613-9493 x21 if you require additional information.

Sincerely,

Sandra S. Tucker

Sandra S. Tucker
Field Supervisor

Enclosure

cc: K. Parsons, GAEPD, Atlanta, GA
B. Lord, EPA, Atlanta, GA
M. Harris, GADNR, Social Circle, GA
J. Johnston, FWS, RO, Atlanta, GA
P. DeGarmo, FWS. Ft. Benning
file

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DEPARTMENT OF THE ARMY
SAVANNAH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 889
SAVANNAH, GEORGIA 31402

MEMORANDUM OF AGREEMENT AMONG THE US ARMY CORPS OF ENGINEERS, SAVANNAH DISTRICT, THE GEORGIA STATE HISTORIC PRESERVATION OFFICER, THE CITY OF CANTON, CHEROKEE COUNTY, GEORGIA, AND THE COBB COUNTY – MARIETTA WATER AUTHORITY

SUBMITTED TO THE ADVISORY COUNCIL ON HISTORIC PRESERVATION IN ACCORDANCE WITH SECTION 36 CFR 800.6(c)

SUBJECT: Treatment of Historic Properties, Specifically Prehistoric Archaeological Site 9CK1073, Cherokee County, Georgia, Proposed Hickory Log Creek Water Supply Reservoir, City of Canton, Cherokee County, Georgia, DA Permit Application No. 200006560

1. WHEREAS, the US Army Corps of Engineers (USACE), Savannah District, has determined that the proposed construction of a dam on Hickory Log Creek, City of Canton, Cherokee County and the impoundment of a portion of the Hickory Log Creek drainage will have an effect upon prehistoric archaeological site 9CK1073, a single–component Late Archaic site, a property determined eligible for inclusion in the National Register of Historic Places at a local level of significance, and has consulted with the Georgia State Historic Preservation Officer (GASHPO) pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f); and

2. WHEREAS, the construction of the proposed dam and the impoundment of water require a permit authorization under the US Army Corps of Engineers' permitting authority in accordance with Section 404 of the Clean Water Act;

3. WHEREAS, the City of Canton, Cherokee County, Georgia, and the Cobb County – Marietta Water Authority, as the permit applicants, and proponents of the project, participated in the consultation and has been invited to concur in this Memorandum of Agreement (MOA); and

4. WHEREAS, the definitions given in Enclosure 1, attached hereto and incorporated herein by reference, are applicable throughout this Agreement;

5. NOW, therefore, the USACE, Savannah District, the GASHPO, the City of Canton, Cherokee County, Georgia, and the Cobb County – Marietta Water Authority agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

Appendix "G"

SUBJECT: Treatment of Historic Properties, Archaeological Site 9CK1073, Hickory Log Creek Water Supply Reservoir, Cherokee County, DA Permit Application No. 200006560

STIPULATIONS

6. The USACE, Savannah District will ensure that the following measures are carried out:

a. Mitigation through Data Recovery Excavations. The adverse effects to archeological Site 9CK1073 that will result from the construction of the proposed Hickory Log Creek Water Supply Reservoir will be mitigated through data recovery archaeological excavations. Mitigation through in-place preservation was considered, but determined not to be feasible. The data recovery archaeological investigations will be conducted in accordance with the following stipulations:

1. Research Design and Fieldwork. A research design and attendant scope of work for the archaeological mitigation of site 9CK1073 shall be developed by the applicant, or by the applicant's consultant. The research design and scope of work shall be provided to the USACE, Savannah District and the GASHPO for review and comment. The research design and scope of work, as implemented in the field and attendant laboratory work, shall be implemented in accordance with its specifications, except as modified by comments for the GASHPO and USACE, Savannah District. The research design and scope of work shall be developed in accordance with the *Secretary of the Interior's Standards and Guidelines for Archeological Documentation* (FR48, 190:44734-77, September 29, 1983), the Advisory Council on Historic Preservation's *Treatment of Archeological Properties* (1980) and appropriate monographs of the Georgia Department of Natural Resources/Historic Preservation Division/University of Georgia Department of Anthropology, Laboratory of Archaeology Research Design Series. Proposed changes to the scope of work will be coordinated through the USACE, Savannah District, with the GASHPO. The USACE Savannah District will consult GASHPO concerning the appropriateness and adequacy of the proposed changes and shall inform the archaeological consultant concerning their approval.

2. The research design, fieldwork and laboratory analyses shall incorporate provision for such specialized archeological analyses as might be reasonably foreseen, namely paleoethnobotanical analyses, zooarcheological analyses, radiocarbon analyses, etc., and shall implement these as necessary and applicable.

3. The USACE, Savannah District shall provide the applicant notification to proceed prior to the implementation of the data recovery program. No mitigation data recovery excavations shall be implemented prior to the execution of this Agreement and notification to the applicant to proceed from the USACE, Savannah District.

4. Report of Completion of Fieldwork. Upon the completion of the requisite fieldwork necessary to fulfill the requirements of the research design, the applicant, or the applicant's

consultant, shall submit to the USACE, Savannah District and the GASHPO a report concerning the completion of the fieldwork portion of the data recovery program. The report of completion of fieldwork shall include a description of what fieldwork was done, the locations of excavations and collection areas, the methods of excavation, and a preliminary description and quantification of what sorts of data were recovered. The work accomplished should be consistent with that required by the research design/scope of work and the relevant research questions to which the data may be applied. The report should include an assessment of whether or not intact portions of the site still remain after completion of the fieldwork, and the location and approximate areal extent of such areas.

5. No construction will be allowed within the physical limits of archaeological site 9CK1073 until the report of the completion of fieldwork has been reviewed and accepted by the GASHPO and the USACE, Savannah District. The USACE, Savannah District shall consult the GASHPO and receive their approval prior to giving the applicant, the City of Canton and the Cobb County - Marietta Water Authority notification that they can proceed with construction activities within the limits of archaeological site 9CK1073.

6. Personnel. The overall development and implementation of the research design will be overseen by a Principal Investigator(s) that meet the Secretary of the Interior's Professional Qualifications Standards (Federal Register, Vol. 62, No. 119, pp. 33708-33723, June 20, 1997, hereinafter Qualifications Standards) particularly for those for prehistoric archeologists. Other key personnel, as defined in Enclosure 1 of this Agreement, and those responsible for conducting specialized analyses shall also meet the Qualification Standards, or other relevant professional standards, as necessary and appropriate.

b. Reports of Data Recovery Fieldwork, Analyses, and Interpretation. The results of the data recovery mitigation excavations will be submitted in a report that meets the requirements of the Secretary of the Interior's Standards for archaeological documentation (referenced above).

1. Draft Reports. A draft of the mitigation report will be submitted to the USACE, Savannah District and the GASHPO for review and comment. Reviewing agencies shall have 45 days to review and comment on draft reports submitted to them, from the date of their receipt.

2. Final Report. Review comments shall be incorporated into a final mitigation report, as appropriate. A minimum of five copies of the final (revised) draft report will be submitted to the GASHPO and the USACE. The USACE, Savannah District shall consult with the GASHPO and receive their comments on the final draft of the report prior to accepting it. The USACE, Savannah District shall provide written notification to the City of Canton and the Cobb County – Marietta Water Authority that the report is acceptable.

3. Popular Summary. At the discretion of the USACE, in consultation with the GASHPO, the Applicant (the City of Canton and the Cobb County - Marietta Water Authority), and the Principal Investigator, the archaeological consultant under the direct supervision of the Principal Investigator will prepare a brief, popular summary report describing the mitigation project and its results. Such popular summaries may be in written form, or in other types of information media.

4. Curation. All artifacts, field notes, maps, drawings, and data resulting from the data recovery mitigative excavations at Site 9CK1073 will be curated at an institution meeting the standards of 36 C.F.R. 79, *Curation of Federally Owned and Administered Collections.*

5. Human Remains and Unmarked Graves. If unmarked burials or graves are encountered during the course of the data recovery mitigative excavations, the Principal Investigator shall cease excavation in the immediate area of the excavations and notify the USACE, Savannah District, the GASHPO, the Applicant, and the City of Canton of such discovery (ies) in a timely and expeditious manner.

a. Any human remains, burial grounds, or cemeteries encountered during the course of his project shall be treated in accordance with the Official Code of Georgia Annotated, 36-72-1 through 36-72-16, *Abandoned Cemeteries and Burial Grounds,* as applicable.

b. In the event that any such burial or burials are Native American prehistoric or protohistoric in age, the GASHPO shall be notified and a determination made concerning consultation with appropriate Native American representatives. Such consultation shall be made through either the Georgia Department of Natural Resources Council on American Indian Concerns, or with official representatives of an appropriate Native American ethnic group, should it be possible to reasonably ascribe such burials to a particular group.

c. Dispute Resolution. Should any party to this Agreement object within 30 days to any actions proposed pursuant to the Agreement, the USACE, Savannah District shall consult with the objecting party to resolve the objection. If the USACE, Savannah District determines that the objection cannot be resolved, the USACE, Savannah District shall request the comments of the Council pursuant to Section 36 CFR 800.6(b)(v). Any Council comment provided in response to such a request will be taken into account by the USACE, Savannah District in accordance with 36 CFR 800.6(c) with reference only to the subject of the dispute; the agency's responsibility to carry out all actions under this Agreement that are not the subjects of the dispute will remain unchanged.

7. Execution of this Memorandum of Agreement by the US Army Corps of Engineers, Savannah District, the Georgia Historic Preservation Officer, the City of Canton, Cherokee County, the Cobb County – Marietta Water Authority and its subsequent submission to the Council, and implementation of its terms, evidence that the USACE has afforded the Council an opportunity

SUBJECT: Treatment of Historic Properties, Archaeological Site 9CK1073, Hickory Log Creek Water Supply Reservoir, Cherokee County, DA Permit Application No. 200006560

to comment on the Proposed Hickory Log Creek Water Supply Reservoir Project and its effects on historic properties, and that the USACE has taken into account the effects of the undertaking on historic properties.

US ARMY CORPS OF ENGINEERS,
SAVANNAH DISTRICT

By: Roger A. Gerber

Roger A. Gerber
Colonel, US Army
District Engineer

Date: 18 Dec 2002

GEORGIA DEPARTMENT OF
NATURAL RESOURCES

By: W. Ray Luce

Ray Luce
Director Historic Preservation Division
Deputy SHPO

Date: 1/13/03

CITY OF CANTON

By: [signature]
(Name and Title of signer)

Date: April 12, 2004

COBB COUNTY – MARIETTA
WATER AUTHORITY

By: [signature]

Date: April 12, 2004

ENCLOSURE 1
DEFINITIONS AND REFERENCES

MEMORANDUM OF AGREEMENT
For the
PROPOSED HICKORY LOG CREEK WATER SUPPLY RESERVOIR
CITY OF CANTON, CHEROKEE COUNTY, GEORGIA

DA Permit Application No. 200006560

The following references, and the definitions, terms and specifications given therein, apply throughout this Memorandum of Agreement.

REFERENCES

1. Official Code of Georgia Annotated, Chapter 72, "Abandoned Cemeteries and Burial Grounds." Sections 36-72-1 through 36-72-16.

2. National Historic Preservation Act, as amended (1992) (16 U.S.C. 470)

3. 36 CFR 800: Protection of Historic Properties: Final Rule. Published in the Federal Register September 26, 1986 (51 FR31115). These regulations govern the Section 106 review process established by the National Historic Preservation Act of 1966, as amended 1992.

4. 36 CFR 800: Protection of Historic Properties: Final Rule, Revision of Current Regulations. Published in the Federal Register Vol. 64, No. 95:27044-2727084, May 18, 1999, Effective June 17, 1999.Protection of Historic Properties: Recommended Approach for Consultation on Recovery of Significant Information for Archaeological Sites

5. Treatment of Archaeological Properties: A Handbook. Council on Historic Preservation. Washington, D.C. February 1981. 39 pp.

6. Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines: National Park Services's Guidelines published in the Federal Register September 29, 1983 (Vol. 48, No. 190, pp. 44716-44742), including:
Secretary of the Interior's Standards for Historical Documentation
Secretary or the Interior's Guidelines for Historical Documentation
Secretary of the Interior's Standards for Archeological Documentation
Secretary of the Interior's Guidelines for Archeological Documentation

7. Secretary of the Interior's Historic Preservation Professional Qualifications Standards: Notice. Published in the Federal Register Vol. 62, No. 119:33708-33723, Friday June 20, 1997.

8. Guidelines for Applying the Historic Preservation Professional Qualification Standards. Draft 1996. U.S. Department of the Interior, National Park Service.

DEFINITIONS

1. Research Design: def., A statement of proposed identification, documentation, investigation, or other treatment of a historic property that identifies the project's goals, methods and techniques, expected results, the context within which or against which the archaeological data to be retrieved is to be evaluated and analyzed, and the relationship of the expected results to other proposed activities or treatments.

2. Principal Investigator: def., the chief professional person in charge of a project, who is responsible for the formulation of the project research design, goals, strategy, analytical techniques and interpretations of analyses, and field and laboratory methods, who is responsible for staffing the project with the appropriate qualified personnel and overseeing the general and specific progress of the project from initiation through completion, and for insuring the accuracy and adequacy of all written reports resulting from the project, as well as the appropriate disposition of the artifacts and materials resulting from the project (curation). The principal investigator may or may not serve as the field and/or lab director, as circumstances allow or dictate.

3. Field Director: def., the principal professional (archaeologist) directing the day-to-day field operations and data collection during the field portion of a project. Responsible for the appropriate keeping of records, daily logs and notes, and directing the methods of excavation/recovery to be used.

4. Laboratory Director: def., the principal professional person in charge of directing the day-to-day methods of handling, sorting, categorizing, analyzing the data and artifacts returned to the lab from the field, and for providing specialized data sets to such specialized consultants as may be required, such as zooarchaeologists, paleoethnobotanists, or radiometric dating specialists, and for coordinating the completion of all required lab analyses and organizing the same into a retrievable form.

5. Key Personnel: def., all personnel for whom it is prerequisite that they meet the Secretary of the Interior's Professional Qualifications Standards: including, but not limited to, the Principal Investigator, the Field Director, the Lab Director, the principal (responsible) zooarchaeologist, and the principal (responsible) paleoethnobotanist.

6. Shovel Test: For the purposes of this Agreement a "shovel test" is defined as a square or rectangular excavation unit smaller than 1m x 1m square, but at least 0.3m x0.4m in size, excavated using a flat-bladed shovel, spade, and/or pointed mason's trowel (standard archaeological trowels), with the soil matrix screened through a sieve or sieves with mesh size not to exceed ¼-inch square. For the purposes of this Agreement, the term "shovel test" specifically is <u>not meant</u> to include what are sometimes referred to as "rapid shovel tests," which are round or roundish posthole-like tests excavated by pointed

shovel, post hole diggers, manual or motorized screw-type augers, or other such equipment.

Test Excavation Unit (Trench): A smaller- to medium-sized discrete excavation unit of at least 1m x 1m square, but usually not more than 2m wide in its smaller dimension, nor more than 3m-4m long in its larger dimension, not physically contiguous with any other such unit, used for the purposes of making exploratory observations before deciding where, how, and how large an Excavation area to open for the purpose of data recovery mitigation.

Core Type Auger Test: A tube-type auger test of 1-inch diameter or greater that extracts intact a core from the existing soil profile at the point of the test, such that the retrieved core, when examined, shows the depth and relationship of any discernible strata. Used primarily for discerning the likely stratigraphy of a particular location, the likely existence of features, etc., or both. Not used for the retrieval of more artifact specimens.

Screw Type Auger Test: An auger test using a screw type auger, which discharges the excavated soil matrix as it penetrates, such that it does not produce an intact soil core.

Rapid Shovel Test/Post Hole Test: A roughly round, quickly, vertically excavated test hole excavated by using a pointed shovel or post hole digger, generally used to determine the presence, or likely presence, of artifacts (and sites) in areas that are heavily covered with ground vegetation and lacking surface visibility, or in which there has been the relatively recent accretion (deposition) of soil or soil constituents. Not normally used as an appropriate archaeological mitigation program data recovery technique.

Block Excavation: A large, square, rectangular, or irregularly shaped polygon excavation of a contiguous (and continuous) area using a square grid system for horizontal provenience, and control pedestals and/or transit/level and stadia rod, or line level, as appropriate, for vertical provenience, excavated in a manner that allows three-dimensional vertical profiling, either by hand techniques, or mechanical techniques.

Specialized Analyses: Any laboratory or field assay, analysis, or test requiring sufficiently specialized knowledge to require being overseen by a specialist in the subject area of analysis. The specialized areas of analysis listed below are those that might be most likely employed in a data recovery mitigation program such as the present one, but others might be considered, if conditions warrant.

Paleoethnobotany: The study of the interrelationships between human populations and the plant world through the archaeological record (Pearsall, Paleoethnobotany: A Handbook of Procedures, Academic Press, 1989:ix), having two principal components, an archaeological approach, and an ecological one.

Zooarchaeology: The qualitative, quantitative, and taphonomic study (analysis) of animal remains (usually bones), and primarily but not exclusively vertebrates, from archaeological contexts.

Absolute Dating Techniques: Any dating technique that can produce results within specified limits of accuracy in absolute years before present, such as radiocarbon dating, or dendrochronology

Radiocarbon Dating: An absolute dating technique relying on certain basic universal facts and assumptions, based on the existence of multiple isotopes of the element carbon, a known rate of the decay of the radioactive carbon isotope to the non-radioactive one, and a relatively constant ratio of one to the other. Although this technique may be usable, or even appropriate to some components/occupations of the site, if the right materials present themselves, it is likely inappropriate for much of the protohistoric period occupation and is inappropriate for the historic period, because of the upper limits of its accuracy range, which does not include dates newer than about 400-300 years old, and the existence of other more accurate forms of dating, including written records.

Proton Magnetometer/Metal Detector Surveys: Remote sensing surveys using metal detectors/proton magnetometers on a grid system in order to define areas of concentration of metals and map activity areas across a site. Useful on historic sites, particularly, for locating structures via patterning of nails, hinges and other primarily iron or steel metals, but (proton magnetometers) may also be employed for locating fire hearths on prehistoric sites. If such techniques are employed during data recovery operations under the this Agreement, they should be conducted systematically, with the results mapped out and analyzed. They should not be used in a simple random walk (in the non-statistical sense) manner.

Phosphate Analysis: Phosphate Analysis surveys attempt to define areas of phosphate concentration across the area of an archaeological site, which are thought to be the areas of highest use and activity, corresponding to food preparation, food disposal, and the processing of animal products for human use as tools, clothing, etc.

DETERMINATION OF ADVERSE EFFECT ON THE HISTORIC PROPERTY DESIGNATED 9CK1073, A PREHISTORIC ARCHAEOLOGICAL SITE RESULTING FROM THE CONSTRUCTION OF THE HICKORY LOG CREEK RESERVOIR CHEROKEE COUNTY, GEORGIA

Department of the Army Permit Application No. 200006560

I. Introduction: Project Location and Description

The city of Canton, Cherokee County, Georgia, proposes to construct a dam and impound water for a water supply reservoir on Hickory Log Creek, a tributary of the Etowah River, northeast of the city of Canton, in northwestern Georgia. The proposed water impoundment is designed to flood (normal pool) a portion of the Hickory Log Creek drainage to an elevation of 1,060 feet above mean sea level (c.323m AMSL), forming a long, narrow, "finger lake," along the creek, and the lower reaches of some lower order tributaries to it. The area of potential effect for the proposed reservoir includes the reservoir itself, and a buffer zone around its periphery extending c. 150, horizontal distance (c. 46m), from the edge of the normal pool impoundment.

The proposed project is located in the central portion of Cherokee County, Georgia, and is shown on the U.S.G.S. 7.5-minute Ballground West quadrangle map (see attached, derived from Figure 1.1 of the January 2000 R.S. Webb and Associates cultural resources survey report for the project, referenced below. The project area is located in the Cherokee Upland District of the Southern Piedmont Section of the Piedmont Physiographic province. The project area is composed mostly of steep-sided valley slopes with limited areas of narrow, relatively level alluvial bottomlands. An artifical lake has already been created and exists in the southernmost portion of the reservoir site. Hickory Log Creek joins the Etowah River approximately 3.0 km below (southeast) of the project area.

The area is underlain by a variety of metamorphic rocks, including mica schists, biotite gniesses, metagraywacke, amphibolites and other schistose mafic rocks. Soils are cobbly sandy loams to loams. At the time of the R.S. Webb cultural resources survey, the ridges and ridge slopes of the area are described as having been vegetated with pine and hardwoods, while the creek bottoms were characterized as being densely covered with water tolerant species of hardwoods and grasses, with the wider areas of floodplain in pasture. According to the U.S.G.S. map provided of the area as Figure 1.1 (Ballground West Quadrangle), dated 1992), the area appears to be rural, with a low-density, dispersed population. If the map is reflective of current, CY 2002, conditions, there are no buildings or structures within the proposed projects area of potential effects, nor any paved roads. The project tract is approximately 346 acres (140 hectares in size).

SUBJECT: Determination of Adverse Effect to Historic Properties, Proposed Hickory Log Creek Water Supply Reservoir, City of Canton, Cherokee County, Georgia, DA Permit Application No. 200006560

II. Description of Efforts Taken to Identify Historic Properties

In order to assist the USACE, Savannah District fulfill its responsibilities to consider the effects of its issuance of permits on historic properties under its regulations and Section 106 of the National Historic Preservation Act (NHPA), the city of Canton, Cherokee County, Georgia, undertook a cultural resources (historic sites) identification survey through the consulting firm of R.S. Webb and Associates via their representative, Mr. William Thomas Craig, attorney. The results of the R.S. Webb survey are contained in the following report:

Vehling, Marcia and Robert S. Webb
2000 "Cultural Resources Survey of the Proposed Hickory Log Creek Reservoir Site, Cherokee County , Georgia," dated January 18, 2000, Prepared by R.S. Webb and Associates for the Law Offices of Mr. Wm. Thomas Craig and the City of Canton, Georgia. Report submitted to the US Army Corps of Engineers, Savannah District and the Georgia State Historic Preservation Officer.

The USACE, Savannah District reviewed the R.S. Webb report in April 2001, and coordinated it with the GASHPO, requesting their comments on the National Register of Historic Places eligibility status of the properties identified in the survey report. Additional information was requested, and additional fieldwork conducted at two sites identified in the area surveyed. This work was also conducted by R.S. Webb and Associates, and an addendum to the original report was submitted regarding this additional work. Additional information was also requested regarding the proposed reservoir's viewshed, and potential effects to an unincorporated community and historic district that was not included in the originally defined area of potential effect for the proposed reservoir. All of the additional studies and information was reviewed by the USACE, Savannah District and coordinated with the GASHPO, whose comments were sought regarding the information supplied. The relevant correspondence, reports, and communications are enumerated, below.

As a result of the above-described efforts, one prehistoric archaeological site, designated as site 9CK1073 was identified within the proposed reservoir's area of potential effects. It is considered National Register eligible by consensus between the USACE, Savannah District and The Georgia State Historic Preservation Office (Historic Preservation Division, Georgia Department of Natural Resources), in accordance with 36 CFR 800.4(c)(2). It is located in the northern extreme of the proposed normal flood pool, to the left (bank) of the existing creek, closer to the proposed shoreline than to the center of the flood pool at that point.

SUBJECT: Determination of Adverse Effect to Historic Properties, Proposed Hickory Log Creek Water Supply Reservoir, City of Canton, Cherokee County, Georgia, DA Permit Application No. 200006560

III. Description of Affected Historic Properties

The only historic property, for purposes of Section 106 compliance, i.e., the only property determined to be National Register eligible under the criteria of eligibility found at 36 CFR 60.4, within the proposed reservoir's area of potential effects is prehistoric archaeological site 9CK1073.

Site 9CK1073

Archaeological site 9CK1073 is described as a prehistoric lithic scatter comprised of quartz and chert debitage in the original cultural resources survey report. At the time of the initial survey and collection of the site, no temporally diagnostic materials were recovered from or observed on the site. Five shovel tests dug at 15m intervals, however, yielded artifacts to depths of up to 60cm below surface, a possible fire-cracked rock feature at 55cm below surface, and relatively deep topsoils. The site is described as located on a floodplain between the base of a ridge slope and a branch of Hickory Log Creek, and approximately 45m x 30m in size. The site is covered mainly with grass.

Subsequent to the initial survey of the site some limited additional testing was undertaken. This included "close order shovel testing" at 15m intervals, and the excavation of two formal 2m x 2m test units. The testing program indicated that the site was contained largely in the vertical levels between 20cm below ground surface and 60cm below ground surface, and that the site had a moderate density of lithic artifacts of a variety of kinds, but primarily debitage with more limited numbers of tools, an expectable distribution. The testing also indicated that the site appeared to be a single component, earlier Late Archaic (pre-ceramic Late Archaic). On the basis of the testing results, and the fact that it appears to be a single component (occupation) site, the consultant recommended the site eligible for inclusion in the National Register. The US Army Corps of Engineers, Savannah District, and the GASHPO agreed.

IV. Description of the Undertaking's Effects to Historic Resources

According to the information presented in the January 2000 R.S. Webb cultural resources survey for the Hickory Log Creek project, Site 9CK1073 is located at about 320m AMSL, approximately 3m below the design normal flood pool for the proposed reservoir. The impoundment of water in the reservoir will adversely affect the site, by making it relatively inaccessible, and making it water-saturated. Also, the site is be situated relatively near the northern margin of the flood pool, such that a drop in water level for from 2m-4m would likely

accelerate erosion of the site through wave action, and gullying, sheet erosion and human activities if it to remain above the water level of the reservoir for a prolonged period of time.

V. Description of Alternatives To Avoid Adverse Effects to Historic Properties

An alternatives analysis has been conducted for the City of Canton and the Cobb County-Marietta Water Authority for the purposes of best meeting the needs and purposes prompting the proposed reservoir project. The goal of the project is to provide a multi-jurisdictional water supply system in the region and its purpose is to provide, in part, for future growth in the region; the Cobb County-Marietta Water Authority's proposed goal is to provide a long term plan to supply a projected peak demand of 289 million gallons per day (current capacity 136 mgd) in design year A.D. 2050. The proposed Hickory Log Creek is calculated to be able to provide 33 mgd, if built, or approximately 11.4% of the projected peak water demand.

The alternatives that were considered included: 1) the 'No Action' alternative; 2) water conservation methods; 3) the recycling and use of wastewater; 4) groundwater alternative(s); 5) construction of a traditional reservoir without pumped storage; 6) the construction of several reservoirs (several alternative locations or combination of alternatives were considered; 7) river or stream intake system with no storage reservoir, and 7) a river or stream intake with one storage reservoir.

The 'no action,' water conservation, and the recycling alternatives would have no adverse effects on National Register eligible site 9CK1073, but none of these alternatives, even in combination would meet the proposed project's need and purpose. The use of groundwater (alternative #4) might conceivably affect unknown archaeological sites of National Register significance, but it is likely that this alternative could be designed to avoid any eligible properties if it were viable and chosen. However, this alternative has been calculated to be of too little yield to be viable, even in concert with portions of other alternatives.

The construction of traditional, no pumped storage, reservoir was considered, but it's nature would require it to be much larger than the reservoir proposed and would likely affect other historic properties. It would also likely involve potential other environmental issues in terms of negative water quality issues (e.g., low dissolved oxygen, both upstream and downstream of the dam. This alternative was eliminated from further review because of projected higher environmental impacts, and higher costs.

The construction of several reservoirs was considered, but this alternative would allow the City of Canton and the Cobb County-Marietta Water Authority (and each of their customers) to construct their own reservoirs. While this would perhaps result in lesser environmental impacts

per reservoir, the cumulative impacts would be substantially greater, it is estimated. It would also far exceed the proposed, multi-jurisdictional, alternative in costs. Aside from other, physical, chemical, biological, and water-related environmental impacts, this alternative would likely also have greater, though at this point unspecified, effects on historic properties.

The construction of a stream intake with no associated storage reservoir was discounted because of the unreliability of the amount of water it would be able to supply.

The proposed alternative is the construction of a river or stream intake with one associated storage reservoir. Aside from the Hickory Log Creek location, possible reservoir sites on Settingdown Creek, Long Swamp Creek, Sharp Mountain Creek, Shoal Creek, and Pumpkinvine Creek were considered, and participation in the West Georgia Regional Water Authority dam and reservoir project. The applicant, the city of Canton (and the Cobb County-Marietta Water Authority, concluded concluded that the Hickory Log Creek location was the largest off-line storage reservoir of sufficient size to serve both the Authority and the city of Canton. For further documentation on the alternatives considered, the alternatives analysis contained in the Environmental Assessment for the proposed project should be consulted.

The affected National Register eligible archaeological site, site 9CK1073, is located along the left bank of Hickory Log Creek, in the upper (northern) reaches of the reservoir. According to the maps provided, it is located at approximately 320m AMSL, on average, about 3 meters lower than the design pool of the reservoir (323m AMSL, or 1060' AMSL). The site would thus be subject to wave action and erosional effects when the lake level fluctuated, say, between 1.5 and 3 or more meters below the design elevation. Some form of erosional control, such as a woven erosion "blanket" might be able to retard erosion of the site, but it would not stop it entirely. Also, the saturation of the site, particularly if it is not constant, e.g., because of prolonged drying intervals caused by extended periods of lower pool elevations, would likely lead to accelerated rates of mechanical and chemical decomposition of artifacts and any faunal material present. Given the nature of the project design, it would be expected that the actual pool elevation might vary frequently from the design elevation, if the state of existing reservoirs in North Georgia is any indication.

Therefore, the two options available to mitigate, or minimize harm, to site 9CK1073 are preservation and stabilization in place, through the use of geotextile erosion blankets, or mitigation through data recovery excavations. The former option, though it may be partially effective, will not be fully effective, and would require periodic inspection and maintenance that it might or might not receive during the reservoir's existence, and will not compensate for the saturation and drying cycles that might occur. The latter option, mitigation through archaeological data recovery excavations, would be as effective as the data recovery efforts,

would ultimately destroy the site except for its recordation through the retrieval of artifacts and documentary records, and is labor intensive. The costs of the latter, however, would be a one-time expense, while some of the costs of the former would be recurring, assuming that a proper preservation management plan was developed and implemented. Given the size of the site (est. 45m x 30m), and its relative importance, e.g., its local level of significance, mitigation through data recovery excavations would seem to be, in the long run, less encumbering, and more cost

effective. The second option, mitigation through data recovery excavations, is the recommended option.

VI. Supporting Documentation

Reports

Vehling, Marcia and Robert S. Webb
2000 "Cultural Resources Survey of the Proposed Hickory Log Creek Reservoir Site, Cherokee County , Georgia," dated January 18, 2000, Prepared by R.S. Webb and Associates for the Law Offices of Mr. Wm. Thomas Craig and the City of Canton, Georgia. Report submitted to the US Army Corps of Engineers, Savannah District and the Georgia State Historic Preservation Officer.

Correspondence

1. 23 March 2001 Memorandum from Mr. Gary Craig, Project Manager, USACE, Savannah District North Area Section, to Mr. Dave Crampton, Archaeologist, USACE, Savannah District Regulatory Branch, requesting a review of the R.S. Webb cultural resources survey report for the above project.

2. 5 April 2001 USACE, Savannah District Regulatory Branch review comments on the report entitled "Cultural Resources Survey of the Proposed Hickory Log Creek Reservoir, Cherokee County, Georgia," prepared by R.S. Webb and Associates.

3. 7 February 2002 Facsimile transmission from USACE, Savannah District Regulatory Branch, Mr. Dave Crampton, to Ms. Beth Gantt, Principal Archaeologist, R.S. Webb and Associates, transmitting comments on the original cultural resources survey report for the Hickory Log Creek Reservoir project.

4. 8 February 2002 Letter from Ms. Beth Gantt, Principal Archaeologist, R.S. Webb and Associates to Mr. Gary Craig, Project Manager, USACE, Savannah District Regulatory

Branch North Area Section, indicating that they intented to conduct additional limited Archaeological testing on the two sites.

5. 27 February 2002 Letter from Mr. Richard Cloues, Deputy SHPO, to Mr. Gary Craig, Project Manager, US Army Corps of Engineers, Regulatory Branch North Area Section, commenting on the initial RS Webb cultural resources survey report, and indicating that there was a potential historic district close to or within the proposed project's area of potential effects. The GASHPO letter indicated that archaeological sites 9CK1073 and 9CK1074 should be considered "potentially" National Register eligible, pending limited additional fieldwork. It also indicated that the Stafford home place should be considered National Register eligible, both on historic architectural and archaeological grounds.

6. 18 March 2002 Memorandum from Mr. Richard Cloues, Deputy SHPO to Mr. Dave Crampton, Regulatory Branch, US Army Corps of Engineers, Savannah District, transmitting information on the Hickory Log Creek community Historic District, which had not been included in the initial R.S. Webb report or addendum.

7. 30 May 2002 Letter from Mr. Richard Cloues, Deputy State Historic Preservation Officer, to Mr. Dave Crampton, Archaeologist, Regulatory Branch, US Army Corps of Engineers, Savannah District, commenting on the addendum to the Phase I Cultural Resources Survey report, and that although the Hickory Log Creek Community Historic District should be considered National Register eligible, the proposed project would not have an effect on it.

Cumulative Impact Report
Proposed Hickory Log Creek Reservoir
October 20, 2003

I. INTRODUCTION

According to Title 40 Code of Federal Regulation Part 1508.7, cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

The USACE is considering issuing the City of Canton and the Cobb County-Marietta Water Authority (CCMWA), a CWA Section 404 permit for the construction of a 369-acre pump-storage public water supply reservoir, raw water intake, and raw water pump station on the Etowah River with an estimated reliable yield of 44 MGD.

The study area is comprised of the Etowah watershed above Lake Allatoona. The reservoir affects (1) Hickory Log Creek from the impoundment expansion to the confluence with the Etowah River and (2) the Etowah River from the pumped diversion until it enters Lake Allatoona, six river-miles downstream.

a. PREVIOUSLY PERMITTED PROJECTS

One water supply reservoir has been permitted in the Etowah Basin

1. Department of the Army (DOA) Permit 7201- Issued to Cherokee County Water and Sewage Authority for a 334-acre pumped storage reservoir on Yellow Creek with a reliable yield of 40 MGD.[1]

b. REASONABLY FORESEEABLE PROJECTS

i. RESERVOIR PROJECTS

There was no data provided indicating that any reservoir projects are in the preliminary planning stages within the Study Area.

ii. OTHER PROJECTS

There are currently 21 other pending projects within the study area. These projects will have to be analyzed individually to assess the possible affects on streams and wetlands prior to approval. These projects and their proposed impacts are illustrated in Table 1.[2]

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[1] The information provided by EPD is combined data from the GAEPD surface withdrawal permit and the Etowah River

[2] The proposed mitigation was not provided.

Appendix H.

Table 1

STREAM & WETLAND IMPACTS FOR PENDING PROJECTS IN THE STUDY AREA[3]

Project #	Stream Impacts (linear feet)	Stream Mitigation	Wetland Impacts (acres)	Wetland Mitigation
200311350-0	128		0	
200311420-0	0		1.1	
200311430-0	0		0.81	
200015310-0	1,576		0.31	
200207900-0	1,745		0	
200208840-0	200		0	
200312360-0	0		0.14	
200312380-0	0		0.52	
200311260-0	75		0.01	
200310210-0	284		0	
200309570-0	0		0.13	
200309790-0	100		0	
200305970-0	99		0	
200312620-0	0		0.12	
200312350-0	196		0.19	
200210410-0	3,368		3.2	
200215760-0	738		1.72	
20010240-0	360		1.7	
200111910-0	2,100		3.39	
200309290-0	0		0.002	
200307710-0	858		0	

The Northern Arc, a highway project, has been in regional planning discussions for more than twenty years. A recent decision modified the plan from 200 to 59 miles that would consist of a four-lane roadway extending from US 41 in Bartow County to Alcovy Road in Gwinnett County. The current plan passes through the counties of Bartow, Cherokee, Forsyth, and Gwinnett. Geologically, the path runs through the headwaters of the Etowah River and across the watershed of the Chattahoochee. The project has been removed from the short term regional transportation plan. If and when this project ever comes to fruition, its construction will have impacts on the basins through which it proposes to pass, however the extent of its potential impacts cannot be predicted at this time. The project has been studied in an MIS and EIS.

[3] Mitigation information was not provided.

c. CONTEXT

i. WITHIN GEORGIA

NEPA requires that the significance of an action be analyzed in the proper context. The context within which water resource issues in Georgia occur at this time is one of great change, confusion, and controversy. There is competition for water resources between the agricultural areas and the Atlanta metropolitan urban areas, between those who want to see economic growth and those who want to see preservation of natural aquatic resources, between those who use the rivers for water supply and those who would use them for recreation, and between upstream and downstream users. The most important issue for the State of Georgia at this time may be how to manage the state's surface and ground water resources to satisfy the need for adequate water supply by the competing users.

Over the past few years, numerous local water authorities have applied to the Corps of Engineers for permits authorizing discharge of fill into waters of the United States for the purpose of constructing water supply reservoirs. Although county water authorities are encouraged to coordinate with adjacent counties and municipalities to consider regional approaches to water supply (as is the case for the Hickory Log Creek Project), they are not compelled to do so by federal law, state law, or by regulation. The result of the fragmentation of applications for CWA Section 404 permits is permitting on a "first come, first serve" basis and a race for permits by those counties in north Georgia that have not yet received permits allowing construction of reservoirs.

The Corps of Engineers, Savannah District, maintains a spread sheet of Section 404 permit applications that presently indicates no fewer than 42 reservoir actions in Georgia either permitted, pending, in the pre-application stage or temporarily withdrawn due to insufficient data. Table 2 shows these projects. The present policy of GADNR is to strongly advocate that the USACE issue permits to those counties/municipalities that presently can demonstrate the greatest growth or projected growth in population. The USACE does not consider any application for a proposed reservoir complete until the applicant submits a letter from GADNR stating that the department concurs with the applicant's stated need and population analysis. Although the CWA and regulations would generally limit the scope of consideration of environmental impacts to the immediate area of the proposed Hickory Log Creek reservoir, NEPA requires a broader consideration of the secondary and cumulative impacts.

ii. WITHIN THE ACT BASIN

At the heart of the water resource controversy is the Alabama-Coosa-Tallapoosa Compact (ACT Compact). The area covered by the Compact originates in north Georgia and Alabama and terminates in Mobile Bay. It extends approximately 320 miles and encompasses an area of approximately 22,800 square miles. A Comprehensive Study was undertaken by Alabama, Florida, Georgia and the Corps for the ACT basin with the purpose to determine the capabilities of the water resources of the basins, to describe the water resource demands of the basins, and to evaluate alternatives which utilize the water resources to benefit all user groups within the basins.[4] Article VII of the Compact requires the Federal Commissioner to the ACT Basin Commission to concur or not concur with the water allocation formula as developed by the State

[4] Water Allocation for the Alabama-Coosa-Tallapoosa (ACT) River Basin Draft Environmental Impact Statement

Commissioners. The draft Environmental Impact Statement (EIS) serves as the baseline document to assist the Corps in making future reservoir management decisions in the basin, and as an information base to assist federal agencies in managing their programs in the basin. This proposed reservoir evaluated the potential changes in stream flows associated with the water allocation over the planning period (1995 to 2050) to address water management alternatives while considering future demands on water resources within the basin as required by the EIS.

The Coosa River Basin is part of the Alabama-Coosa-Tallapossa River Basin Compact which requires written notification to the parties of the Compact in the event any person increases the withdrawal, diversion or consumption of specific water resources by more than 10 million gallons per day on an average annual daily basis, or in the event any person, who was not withdrawing, diverting or consuming any water resources from the Basin, seeks to withdraw, divert or consume more than one million gallons per day on an average annual daily basis. The Hickory Log Creek reservoir is located within the Coosa River Basin, and is subject to the ACT Compact. Notice was provided to the ACT Federal and state commissioners, September 19, 2000.

d. ECONOMIC IMPACTS

Demand for water supply has grown faster than the ability to find new water sources. Atlanta and the surrounding counties have experienced unprecedented growth. The USACE does not require cost-benefit reports in consideration of CWA permits for local water supply reservoirs. Water allocation determinations in non-Federal water supply reservoirs are made by GADNR. However, the USACE is required to balance all the public interest factors in its consideration. The use of water increasingly involves complex tradeoffs among biophysical, economic, ecological and societal values.

Map Key	File #	Project Manager	Applicant (City or County)	Status	County Where Located	Basin	Stream	YIELD	Size Acres	Wetland Impacts Acres	Stream Impacts Feet
13	60251		Lumpkin	Issued 11/30/92	Lumpkin	Chattahoochee	Yahoola Creek	25.5	132	30	
9	199100469	Morgan	Carroll	Issued 7/8/94	Carroll	Chattahoochee	Snake Creek	13	650	33.2	
8	6495		Heard	Issued IP 04/07088	Heard	Chattahoochee	Sharp Creek				
1	6498		Douglas	Issued IP09/12/88	Douglas	Chattahoochee	Dog River	15.89	260	?	?
2	200104600 Mod to 6498	Dills	Douglas	Pending IP	Douglas	Chattahoochee	Dog River	7.11	?	10.5	4,860
7	200102890	Fischer	Heard	Pre-App	Heard	Chattahoochee	1 Pink Creek or 2 Taylor Creek		?		
11	199100031		Hogansville	Pre-App	Troup	Chattahoochee	Unnamed				
12	200007430		Carrolton	Pre-App	Carroll	Chattahoochee	Whooping Creek			13	31,000
14	200005900	Craig	Lumpkin	Pre-App	Lumpkin	Chattahoochee	Yahoola Creek				
3	980001740			Pre-App	Douglas	Chattahoochee	Dog River		(withdrawn)		
4	No Number			Proposed?	Hall	Chattahoochee	Flat Creek				
5	No Number			Proposed?	Troup	Chattahoochee	Hagansville Creek				
6	No Number			Proposed?	Habersham	Chattahoochee	Nancy Town Creek				
10	200006290	Craig	Habersham	Withdrawn	Habersham	Chattahoochee	Tugaloo		32	1.08	3,730
16	6911	Morgan	Dalton	Issued 4/16/92	Whitfield	Coosa	Conasauga River	18	118	0.5	
17	60234	Morgan	Dalton	Issued 5/18/93	Whitfield	Coosa	Haig Mill Creek	5	200	27.8	
19	7201	Morgan	Cherokee	Issued 9/23/94	Cherokee	Coosa	Yellow Creek	?	334	14	730
18	200006560	Craig	Cherokee	Pending IP	Cherokee	Coosa	Hickory Log Creek	44	369	19.27	44,175
15	No Number			Proposed?	Floyd	Flint	Aemuchee Creek				
22	199100096		Manchester	Issued 12/14/91	Talbot	Flint	Rush Creek	?	?	0.5	?
20	60246	Morgan	Fayette	Issued 12/23/92	Fayette	Flint	Horton Creek	?	770	319	34,000
23	60216	Morgan	Clayton	Isued 4/16/92	Clayton	Flint	Shoal Creek	8.4	400	134	8,500
24	980001900	Miller	Griffin	Issued IP 2001	Spalding	Flint	Still Branch	35	476	46	24,000
21	No Number			Proposed?	Fayette	Flint	Line Creek				
43	6312		McDonough	Issued	Henry	Ocmulgee	Walnut Creek	2.4	108	?	9,000
44	6225		Walton	Issued	Walton	Ocmulgee	Beaverdam Creek	6.4	110	?	?
26	930010500 Mod to 6744	Johnson	Walton	Issued 04/02/97	Walton	Ocmulgee	Beaverdam Creek	6.4	113	38	?
28	6972		Newton	Issued 08/16/89	Newton	Ocmulgee	Cornish Creek	24	820	255	30,096
29	970013470 Mod to 6744	Johnson	Henry	Issued 09/24/97	Henry	Ocmulgee	Towaliga River	10	418	126	?
27	199100788	Morgan	Rockdale	Issued 10/02/92	Rockdale	Ocmulgee	Big Haynes Creek	33	654	183	
22	200012080	Miller	Henry	Issued 10/23/2002	Butts	Ocmulgee	Tussahaw Creek	23.6	1,477	252	90,200
32	7238	Morgan	Bibb	Issued 10/30/91	Bibb	Ocmulgee	Town Creek	63			
30	960015220 Mod 6744	Johnson	Henry	Issued 11/12/92	Henry	Ocmulgee	Towaliga River	0	0	0	0
31	6744	Morgan	Henry	Issued 11/12/92	Henry	Ocmulgee	Towaliga River	10.6	575	352	49,100
25	200003600	Miller	Newton	Withdrawn	Newton	Ocmulgee	Bear Creek	28MGD	12500	121	72,641
35	930006540		Jackson	Issued 07/20/96	Jackson	Ocmulgee	Bear Creek	25	505	12.7	23,232
36	970012360	Johnson	Hall	Issued 11/16/98	Hall	Oconee	Cedar Stream	??	143	8.6	
37	990012220	Miller	Walton	Pending IP	Walton	Oconee	Hard Labor Creek	41.8	1370	49	91,000
34	No Number			Proposed?	Oconee	Oconee	Apalachee River				
38	No Number			Proposed?	Jackson	Oconee	North Oconee River				
39	920012220		Hall	Withdrawn	Hall	Oconee	Oconee River				
41	990010820	Morgan	Haralson	Pre-App	Haralson	Tallapoosa	Tallapoosa		3,500	650	
40	No Number			Proposed?	Paulding	Tallapoosa	Richland Creek				
42	200013720	Craig	Dade	Withdrawn	Dade	Tallapoosa					

Shaded = Issued Permits

e. GEOGRAPHIC SCOPE

NEPA requires that the impacts of each reservoir proposal be considered within the appropriate geographical area. The geographic area for purposes of consideration of the present proposal is the portion of the Coosa River Basin in Etowah River watershed upstream of the Lake Allatoona dam. The Coosa River Basin or watershed, comprising all land areas draining into the river above the confluence with the Tallapoosa River near Wetumpka, Alabama occupies a total area of about 10,059 miles, of which 4,579 square miles (46%) lie in Georgia.

The United States Geological Service has divided the Coosa Basin into 5 sub-basins, or Hydrologic Unit Codes (HUCs). The Etowah River basin drains an area of 1,860 square miles, all in Georgia. The Etowah River begins in the Blue Ridge Mountains near Dahlonega, GA, and flows about 150 miles in a southwesterly direction to its confluence with the Oostanaula River at Rome, Georgia to form the Coosa River. There is one dam on the Etowah River, Allatoona Dam, which is about 48 miles above Rome near Cartersville, GA.[5] The drainage area above the dam is 1,119 square miles. As shown herein, the adverse impacts below this point are negligible. Therefore the study area for this report is limited to the Etowah River Basin above the Lake Allatoona dam.

Within this study area the HEC 5 modeling was performed by George McMann and provided the USACE the downstream flows above the Allatoona dam. The Biological Opinion offered by the Fish and Wildlife Service (FWS) evaluated the impact to aquatic resources within and around the Study Area.

f. EVALUATION CRITERIA

In previously permitted reservoir projects, the USACE identified target resources for evaluation based on public and agency comments. Target resources are defined as important resources that could be cumulatively affected by development activities in the basin. The USACE identified the following target resources because of their regional importance: 1) streams, 2) wetlands, 3) water quantity 4) water quality 5) aquatic species.

The following pages assess the cumulative impacts of the proposed project on these resources. In performing these assessments, we considered the impacts of this project and past projects, as well as all reasonably foreseeable impacts in the Etowah Basin and the other basins as appropriate.

II. STREAM IMPACTS

a. STREAM IMPACTS FROM HICKORY LOG CREEK PROPOSAL

i. IMPACTS TO HICKORY LOG CREEK

The proposed Hickory Log Creek reservoir project would impact 44,175 linear feet of stream within the Hickory Log Creek watershed. To place the proposed project in perspective, one must consider that the proposed dam site is approximately 1.5 miles upstream of Hickory Log Creek's confluence with the Etowah River that then continues six river-miles to the headwaters of Lake Allatoona. The potential for the proposed reservoir to cause substantial downstream impacts to Hickory Log Creek is limited due to the previous impacts of an existing impoundment and dam east of Amos Road. The existing impoundment has already resulted in localized habitat

[5] ACT-EIS: citing Corps, 1997

degradation and stream fragmentation within the system.

The total length of Hickory Log Creek is approximately 36,590 linear feet. The length of Hickory Log Creek stream channel directly impacted by the reservoir is approximately 18,480 feet or 50%[6] of Hickory Log Creek (incorporating the stream channel currently impounded by the existing dam). The portion of the Hickory Log Creek watershed that would be directly impacted by the impoundment is 3.6%.[7] If looked at from a basin wide prospective, Hickory Log Creek's total watershed of 9.06 square miles represents only 0.4%[8] of the Etowah River Basin and 0.8%[9] of the study area. The proposed reservoir will not fragment the Hickory Log Creek watershed further, but merely expand upon the existing impoundment.

ii. IMPACTS TO THE ETOWAH RIVER

The Etowah River begins in the Blue Ridge Mountains near Dahlonega, Georgia, and flows about 150 miles in a southwesterly direction to its confluence with the Oostanaula River at Rome. The basin drains an area of 1,860 square miles in Georgia. From its source, the Etowah River falls at a rate of about 45 feet per mile to the vicinity of Dawsonville. Then it falls 4.5 feet per mile for the next 43 miles to the reservoir of Allatoona Dam. The Allatoona Dam is located on the Etowah River, about 48 miles above the mouth of the river near Cartersville, Georgia. The Study Area is 1,119 square miles. The Allatoona project has an operating head of about 150 feet. Bankfull discharge is approximately 800 cfs at Dawsonville, approximately 3,500 cfs at Canton, approximately 9,200 cfs near Cartersville and approximately 10,000 cfs at Rome. The principal streams contributing to the Etowah River in the study area are the Little River of Georgia which drains a 210-square-mile area, and Euharlee, and Allatoona Creeks.

Hickory Log Creek is a tributary to the Etowah River. The proposed project includes a pumped diversion from the Etowah River for storage in the Hickory Log Creek reservoir. A pump station and 7000-foot water main will be constructed to connect the Etowah River to the proposed facility. Releases from the reservoir will be made to augment flow in the Etowah River to permit withdrawal for water supply while maintaining downstream flows. The proposed maximum pumping from the Etowah River is 44 million gallons per day (mgd) for water supply and 39 mgd diversion for storage in the reservoir. The proposed pumped-diversion intake is sited at the Northwest quadrant of the I-575 and GA 5 interchange.

The length of river flows indirectly impacted by pumped-diversion is 3.86%[10] of the Etowah River. If looked at from a basin wide perspective, the Etowah River's total watershed (1,860 square miles) represents only 18.4%[11] of the Coosa River Basin. The Study Area represents 60.1%[12] of the Etowah River Basin and 11.1%[13] of the Coosa River Basin.

b. STREAM IMPACTS FROM PAST, PENDING AND PROPOSED PROJECTS

To determine the past impacts to streams in the Study Area, the applicants reviewed data for the 8 counties in the basin from (1) the National Dams Inventory (NDI) and (2) the USACE's Regulatory Analysis and Management System (RAMS). For RAMS data, the data was totaled

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[6] 18,480 feet ÷ 36,590 feet = 0.50 or 50%
[7] 369 acres ÷ 5,801 acres= .036 or 3.6%
[8] 9.06 sq. mi. ÷ 1,860 sq. mil = .004 or .4%
[9] 9.06 sq. mi. ÷1,119 sq. mi. = .008 or .8%
[10] 5.8 miles ÷ 150 = .0386 or 3.86%
[11] 1,860 miles ÷ 10,059 miles = .184 or 18.4%
[12] 1,119 mi. ÷ 1860 mi = .601 or 60.1%
[13] 1,119 mi ÷ 10,059 mi = .111 or 11.1%

for each of the eight counties and multiplied by the ratio of the county area with the study area to the total area to find the approximate applicable impact for that particular county in the Study Area.

i. IMPACTS IN THE ETOWAH BASIN

National Dam Inventory Data. The NDI data provides the surface area of a total of 180 dams within the study area. Using the NDI data it was estimated that 14,983.3 acres had been inundated, which would have impacted approximately 1,793,732.5 linear feet of stream.[14]
RAMS. RAMS data provides the stream impacts and stream mitigation provided for projects constructed for which data was recorded. RAMS currently only tracks stream impacts for Nationwide Permits. The USACE's RAMS database indicates that 14,456 linear feet of stream have been impacted by USACE permit actions.[15]
Other. The USACE reports that the 1949 construction of Lake Allatoona inundated 12,010 acres. Based upon the Hickory Log Creek project that project would have inundated 1,437,782.5[16] feet of stream.
Mitigation. Within the Study Area, RAMS indicates 9,512 linear feet of mitigation has been provided by the permittees for 14,456 linear feet of impacts.
Pending. RAMS data indicates that the USACE currently has 21 applications pending (for a variety of project types other than the Hickory Log Creek proposal) in the Study Area (Table 1). The estimated stream impacts from these projects are 11,827 linear feet. The USACE likely will require at least 6,110 feet of stream mitigation for these proposed projects.[17] Adverse stream impacts due to the proposed Northern Arc have not been calculated. If the State DOT proceeds with this project, it will be forced to avoid and minimize impacts to streams. Until a final route has been determined the extent of any adverse impacts cannot be determined.

c. UNDOCUMENTED IMPACTS

Each year there are other impacts to streams that do not require permits from the USACE. These impacts are normally associated with agricultural activities, such as irrigation ponds and canals, or silvicultural activities, both of which are exempted from Section 404 of the Clean Water Act. Such impacts are greater below the fall line where silviculture and farming are practiced in a more commercial manner; however any attempt to estimate the undocumented impacts would be pure speculation. However, these impacts have been reduced in recent years due to efforts from various administrative agencies. Furthermore, the NDI data does not include impoundments that have existed prior to USACE permitting.

d. SUMMARY AND CONCLUSION

The impacts associated with the Hickory Log Creek project will be partially offset by the applicants proposed mitigation plan. For this project, the proposed 44,880[18] linear feet of mitigation lies entirely within the Etowah Basin. Therefore, the Hickory Log Creek Project, with

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[14] 44,175 feet of Hickory Log Creek Stream Impact ÷369 acres (acres inundated by the Hickory Log Project) x 14,983.3 acres (acres of inundation from other projects) = 1,793,732.5 linear feet of stream

[16] 44,175 feet ÷ 369 acres x 12,010 acres = 1,437,782.5 feet of stream

[17] This is the same percentage of stream impacts vs. mitigation as required in past projects in the study area. (9,512 ÷ 14,456 = .657 or 66%) Therefore 11,827 x .657 = 7,770

[18] 8.5miles x 5280 = 44,880 linear feet

the proposed mitigation, would not significantly impact stream habitat in the Study Area when considered alone or in concert with the other past and future projects.

III. WETLAND IMPACTS

a. WETLAND IMPACTS FROM HICKORY LOG CREEK PROPOSAL

The proposed Hickory Log Creek reservoir would impact 19.23 acres of wetlands. The applicant proposes to restore 22.5 acres of wetlands. There were 2,826.4 acres[19] of wetlands in the study area as of 1988-1990 based on data in a 1996 document titled, "State of Georgia Landcover Statistics by County, Project Report 26" published by the Georgia Department of Natural Resources. Since that time the USACE have records of impacts to 553 acres of wetlands for which 1,178 acres of mitigation was provided. Therefore without the mitigation, after permitted and potential impacts to wetlands, there should be at least 2,273.4 acres of wetlands remaining in the study area.[20] Due to these activities in the Study Area there has been a 19.5% loss of wetlands.[21] With the proposed 19.23 acre impact from Hickory Log Creek, the result is a 20.2 %[22] loss of wetland in the Area (discounting wetlands mitigation to be provided for by the project).

b. WETLAND IMPACTS FROM PAST, PENDING AND PROPOSED PROJECTS

National Dams Inventory. Using the US Geological Survey National Hydrography Dataset it was estimated that 14,983.3 acres have been inundated resulting in impacts to 783.7 acres of wetlands.

RAMS. The USACE's RAMS database indicates that 553 acres were impacted by USACE's permit actions.

Other. The USACE reports that the 1949 construction of Lake Allatoona inundated 12,010 acres. Based on the Hickory Log Creek project, that project would have inundated 628.2[23]acres of wetlands.

Mitigation. Within the Study Area, RAMS indicates that 1,178 acres of mitigation have been provided by the permittees.

Pending. RAMS indicates that the USACE currently has 21 applications pending (for a variety of project types other than the Hickory Log Creek proposal) in the Study Area. (Table 3) The estimated wetland impacts from these projects is 13.73 acres. The USACE will likely require at least 29.24 acres of mitigation for these proposed projects.[24]

Based upon NDI and RAMS data, it is estimated that 14,983.3 acres have been inundated in the Study Area. If these projects had similar impacts to the Hickory Log Creek project, 783.7[25] acres of wetland impact may have resulted. Most of this impact was likely not mitigated since

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[19] Data derived form the eight counties partially within the study area. The total for each county was multiplied by the fraction of the part of the county within the study area compared to the total county area.

[20] 2,826.4 – 553 = 2,273.4 acres remaining

[21] 553 ÷ 2,826.4 = .195 or 19.5%

[22] (553+19.23) ÷2,826.4 = .202 or 20.2%

[23] 19.3 acres ÷ 369 acres x 12,010 acres = 628.2 acres

[24] This is the same percentage of wetland impacts with known mitigation for past projects in the study area. (1,178 ÷ 553 x 13.73= 29.2 acres)

[25] 19.3 acres ÷ 369 acres x 14,983.3 acres = 783.7 acres

construction was completed prior to the Clean Water Act permit regulation. A large portion of impact resulted from the 1949 construction of the largest reservoir, Lake Allatoona (12,010 acres).[26]

c. UNDOCUMENTED IMPACTS

Each year there are other impacts to wetlands that do not require permits from the USACE. These impacts are normally associated with agricultural activities, such as irrigation ponds and canals, or silvicultural activities, all of which are exempted from Section 404 of the Clean Water Act. Such impacts are greater below the fall line where silviculture and farming are practiced in a more commercial manner; however any attempt to estimate undocumented impacts would be pure speculation. Farming and silvicultural activities cannot convert a wetland to a non-wetland without prior authorization; however conversion of these lands sometimes occurs without authorization. Farm ponds convert wetland areas from vegetated wetlands to open water habitat and fragment the stream, if they are constructed on a stream. However, these impacts have been reduced in recent years due to the swampbuster and wetland conservation/restoration provisions of the US Department of Agricultures Farm Bill and efforts of the Georgia Forestry Commission. Furthermore, the NDI data does not include impoundments that have existed prior to USACE permitting.

SUMMARY AND CONCLUSION

When considering the above impacts, the proposed 19.23 acres of wetlands would have only a minor impact to wetland habitat in the portion of the Etowah watershed above the Allatoona Dam and a negligible impact on the basins further downstream. In addition, this impact is reduced by the current applicants' proposed mitigation plan and the mitigation required for the other projects permitted in the Study Area. The mitigation proposed by the Applicants is to restore wetlands in existing farm fields that are not presently considered wetlands. Therefore, the Hickory Log Creek Project, with the proposed mitigation, would not increase the cumulative impacts in the basin when considered alone or in concert with the other past and reasonably foreseeable future projects.

IV. WATER QUANTITY

Water in the Etowah watershed supports many uses including municipal drinking water, industrial water supply, agricultural irrigation, recreation, waste assimilation and habitat for aquatic life. Water withdrawals from surface and ground water sources have increased substantially in the last quarter of the century, resulting in greater demands on what are essentially finite supplies. This trend is expected to continue, with municipal and industrial demands projected to increase in the Study Area. The Applicants propose to construct a larger impoundment on Hickory Log Creek to impound a 369-acre reservoir. At the request of FWS the Applicants will release a minimum of the higher of the 7Q10 or 25% AAF value or inflow. The project includes pump-diversion from the Etowah River to the proposed reservoir. The maximum pumping capacity proposed is 39 mgd. The minimum non-depleatable flow at the diversion point on the Etowah River is 25% of AAF (292 cfs).

[26] http://www.georgialakeinfo.com/altoona/info.shtml

a. ANALYSIS OF FLOWS

i. DOWNSTREAM FLOWS IN HICKORY LOG CREEK

As discussed throughout this document, the dam for this project would be located approximately 1.5 miles upstream of the confluence of Hickory Log Creek and the Etowah River.

The published 7Q10 value for Hickory Log Creek at the dam site (3.6 cfs) is greater than the 25% of the Average Annual Flow (AAF) value of 3.3 cfs. Using the higher of the two values has a negligible impact on the proposed project's reliable yield. Any minor impact on yield can be compensated for by increasing the capacity of the pumps in the Etowah River diverting water to the proposed reservoir. The higher 7Q10 value was applied in all modeling results, consistent with a "let by" from the proposed reservoir to Hickory Log Creek of the higher 7Q10 value.

The operation of the proposed reservoir was evaluated using the 7Q10 amount for Hickory Log Creek. The system was evaluated during an average year (1969), a dry year (the year in which the average annual flow for the year is exceeded 75% of the time, (1947) and the drought of record (1986-89). The results are as follows:

Average year - 1969. In an average year, there is enough flow in Hickory Log Creek to maintain a full reservoir by replacing the storage lost to evaporation and to maintain minimum downstream flows. The flow in the Etowah River is sufficient as to not require augmentation flows from the reservoir. This is demonstrated graphically in Figure 1.

Dry year - 1947. During a dry year, there is enough flow in Hickory Log Creek to maintain a full reservoir by replacing the storage lost to evaporation and to maintain a minimum downstream flow of 7Q10. In a dry year, the Etowah River has sufficient flows to accommodate water supply use of 44 MGD and 25% of AAF without augmentation by the reservoir until August. In August, the reservoir is utilized for water supply increasing flows in Hickory Log Creek from about 5 cfs to around 50 cfs. Once sufficient flows return to the Etowah River in October, Hickory Log Creek is utilized to refill the reservoir through November. This is demonstrated graphically in Figure 2.

Drought years of 1986-1989. During the drought of record, flows in Hickory Log Creek vary widely. Only in early 1986 and the spring/early summer of 1987 do flows approximate pre-project flows. The remainder of this period is spent at the 7Q10 flow of 3.6 cfs during reservoir refilling or near 70 cfs when the reservoir is used to augment low flows in the Etowah River. This is demonstrated graphically below in Figures 3 through 6.

Figure 1

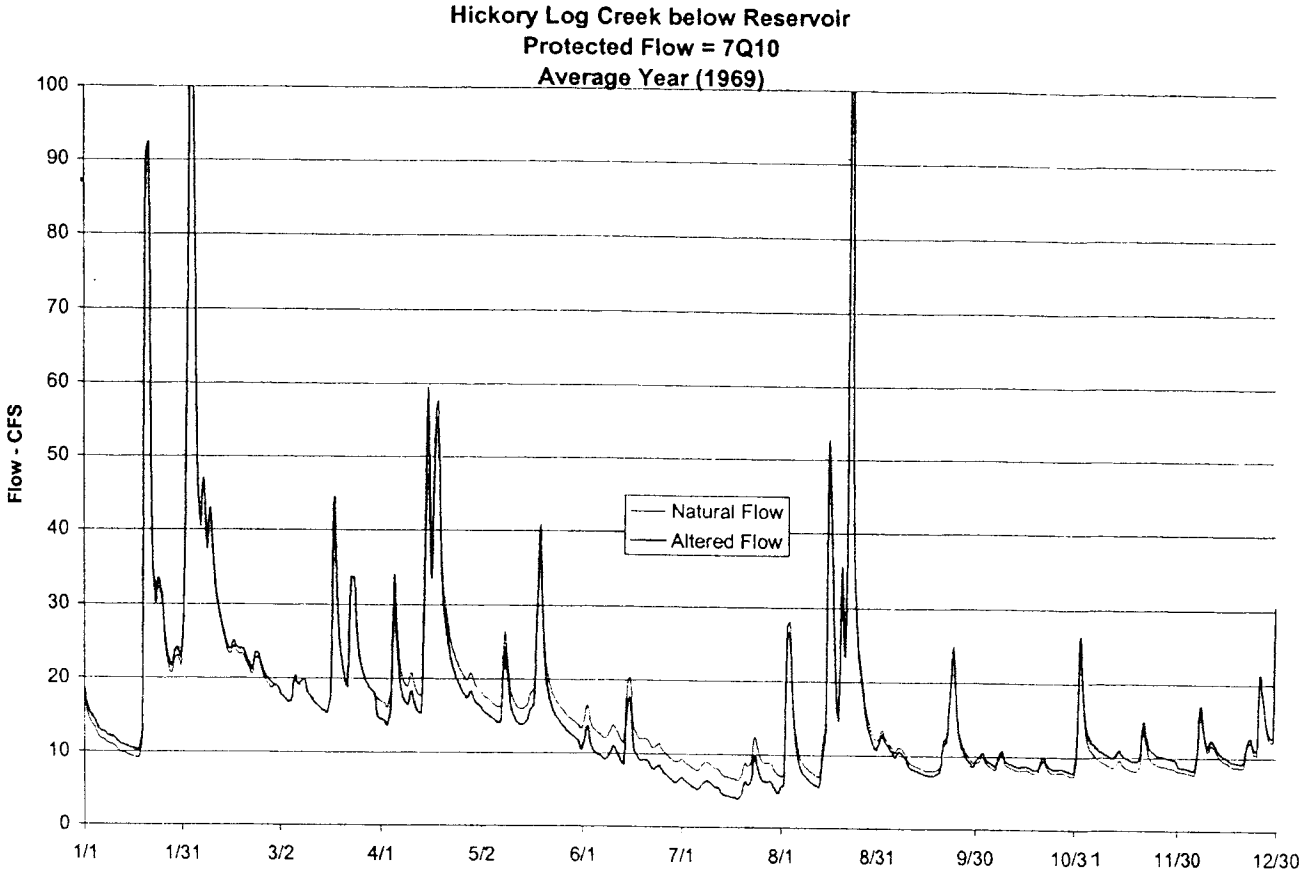
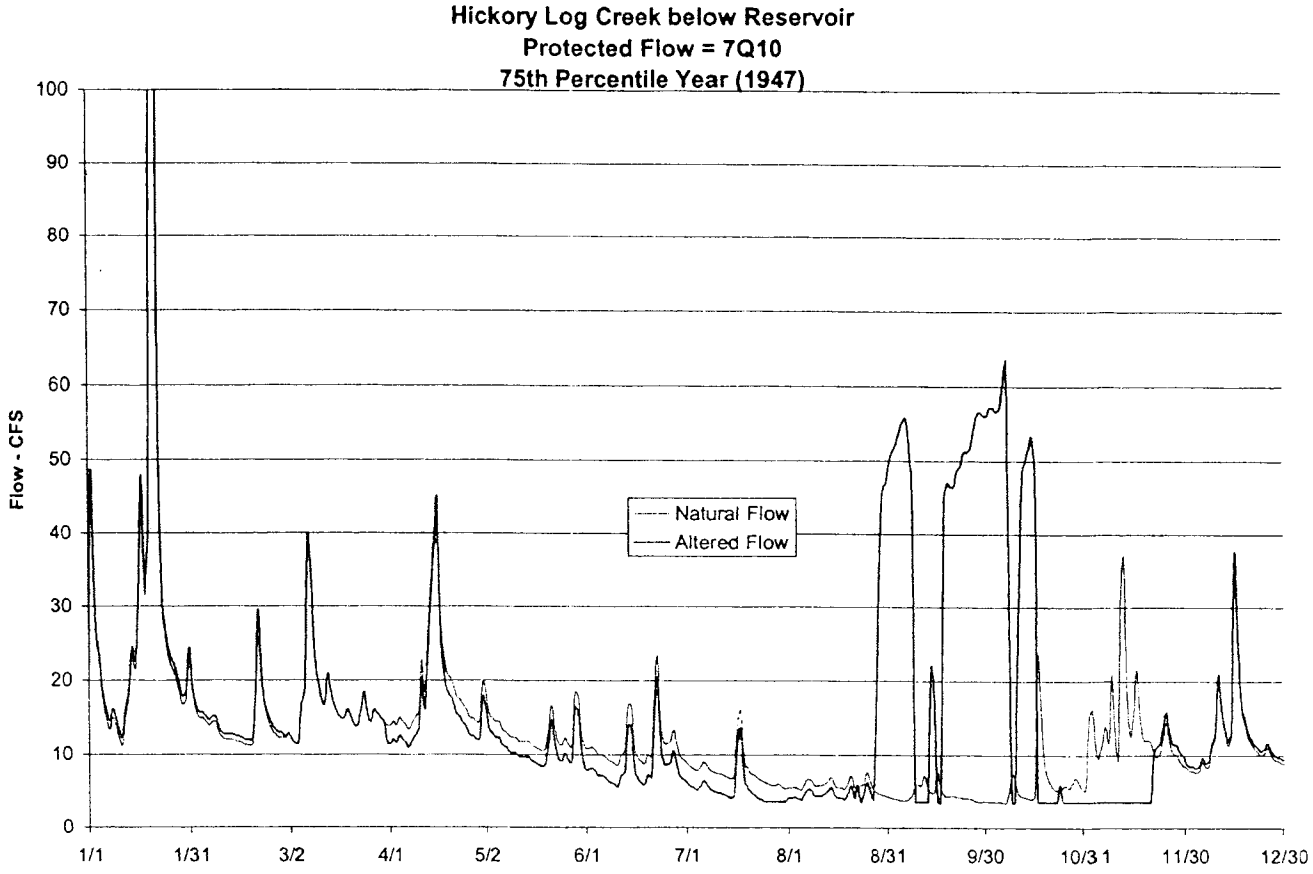

Hickory Log Creek below Reservoir
Protected Flow = 7Q10
Average Year (1969)
Flow - CFS
100
90
80
70
60
50
40
30
20
10
0
1/1
1/31
3/2
4/1
5/2
6/1
7/1
8/1
8/31
9/30
10/31
11/30
12/30
Natural Flow
Altered Flow

Figure 2


Hickory Log Creek below Reservoir
Protected Flow = 7Q10
75th Percentile Year (1947)
Flow - CFS
100
90
80
70
60
50
40
30
20
10
0
1/1
1/31
3/2
4/1
5/2
6/1
7/1
8/1
8/31
9/30
10/31
11/30
12/30
Natural Flow
Altered Flow

The results of the modeling show that the flows in Hickory Log Creek post-project will approximate natural flows well over 75% of the time. However, during periods of reservoir releases, the flow in the creek will swell from the natural flow of 3 to 6 cfs to 50 cfs during a dry year and to over 70 cfs during drought years. While the flows are not unusual during heavy rain events, their duration during reservoir operation will be lengthened. For this reason, if practical from a design and operation perspective, the Applicants propose to utilize the pipeline carrying water from the River to the reservoir to release water from the reservoir to the River when augmenting the flows in the River. Utilizing this proposal, post-project flows in Hickory Log Creek will approximate pre-project flows except during reservoir refilling.

1. FLOWS IN THE ETOWAH RIVER ABOVE THE WATER SUPPLY INTAKE

The results of the modeling of the Etowah River at the location of the reservoir's pumped diversion intake revealed a 7Q10 value of 250 cfs. Using the published criteria, the 25% AAF value is 292 cfs. At the request of the FWS, the Applicant increased its proposal from 250 cfs to 292 cfs or inflow, whichever is less. This required an increase in the maximum pumping rate from the Etowah River to 39 mgd from 24 mgd.

Using 292 cfs or as inflow as the minimum flow, the Applicants evaluated the effects of the reservoir's proposed operation on the flows in the Etowah River. The system was evaluated during an average year (1969), a dry year (the year in which the average annual flow for the year is exceeded 75% of the time), (1947) and the drought of record (1986-89). The results are as follows:

Average Year 1969. During an average year, Hickory Log Creek has sufficient flows as to not require pumping from the River to maintain a full reservoir. This is demonstrated graphically in Figure 7.

Dry Year 1947. From late August to mid-October, the proposed reservoir is needed to augment the flows in the River for downstream water supply. At no point do the additional flows account for more than 23% of the flow in the River (October 7, 1947). From that point to mid-November, water is being pumped from the River to the reservoir. At a proposed maximum pumping rate of 39 MGD (60 cfs), the water withdrawn to refill the reservoir results in no more than a 14% reduction in flow in the River (October 29, 1947). This is demonstrated graphically in Figure 8.

Drought of Record 1986-1989. During this severe drought the reservoir is needed to augment low River flows 407 days (27.8%). At the worst point in the drought, when natural flows were below 200 cfs in the River, reservoir water accounts for more than 35% of the River flow (67 days). When the reservoir is being refilled, post-project flows vary more than 1% from pre-project flows for only 331 days (22.7%). During this period the reduction in flows is more than 10% of pre-project flows for only 137 days with the maximum reduction in flows being 14.65%. This is demonstrated graphically by Figures 9 through 12.

Figure 3

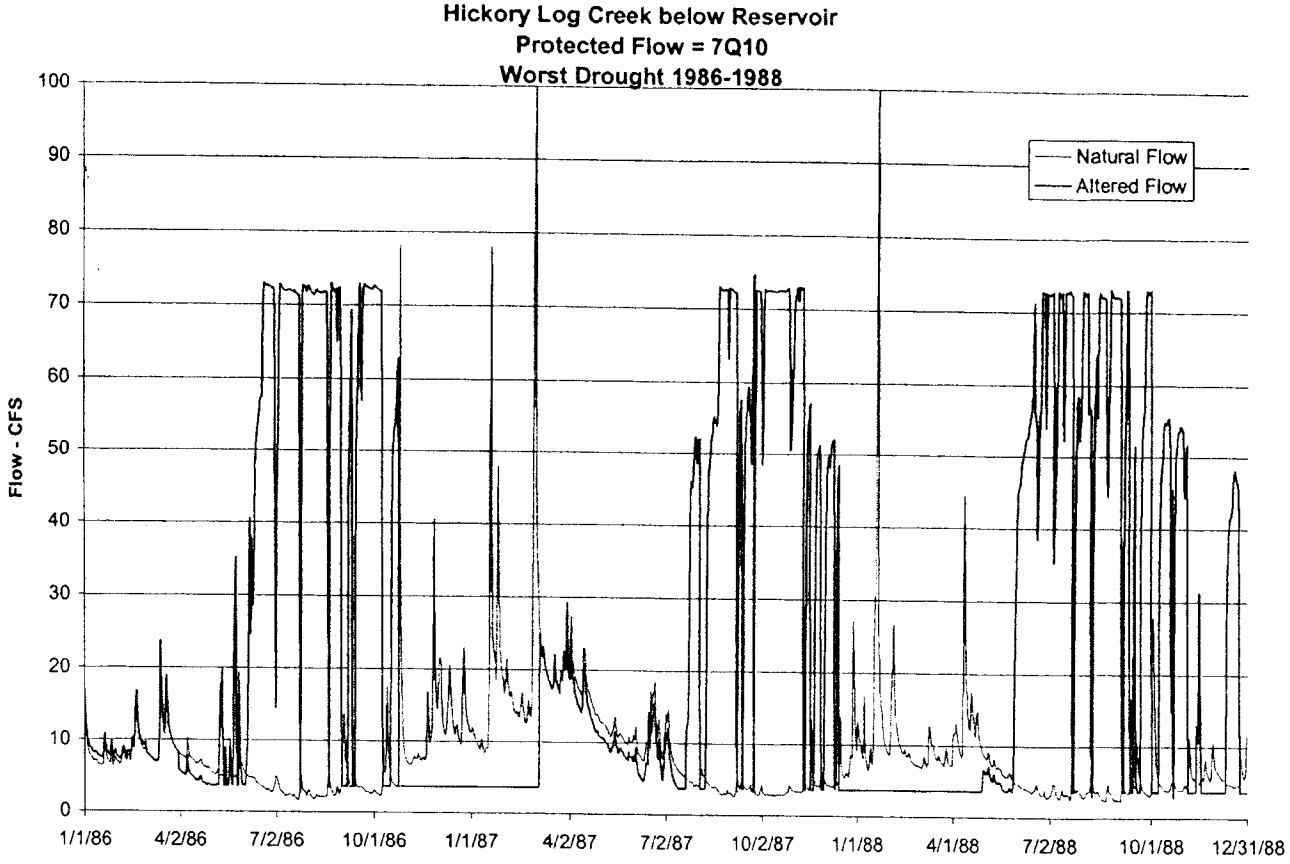

Hickory Log Creek below Reservoir
Protected Flow = 7Q10
Worst Drought 1986-1988
Natural Flow
Altered Flow
Flow - CFS
100
90
80
70
60
50
40
30
20
10
0
1/1/86
4/2/86
7/2/86
10/1/86
1/1/87
4/2/87
7/2/87
10/2/87
1/1/88
4/1/88
7/2/88
10/1/88
12/31/88

Figure 4

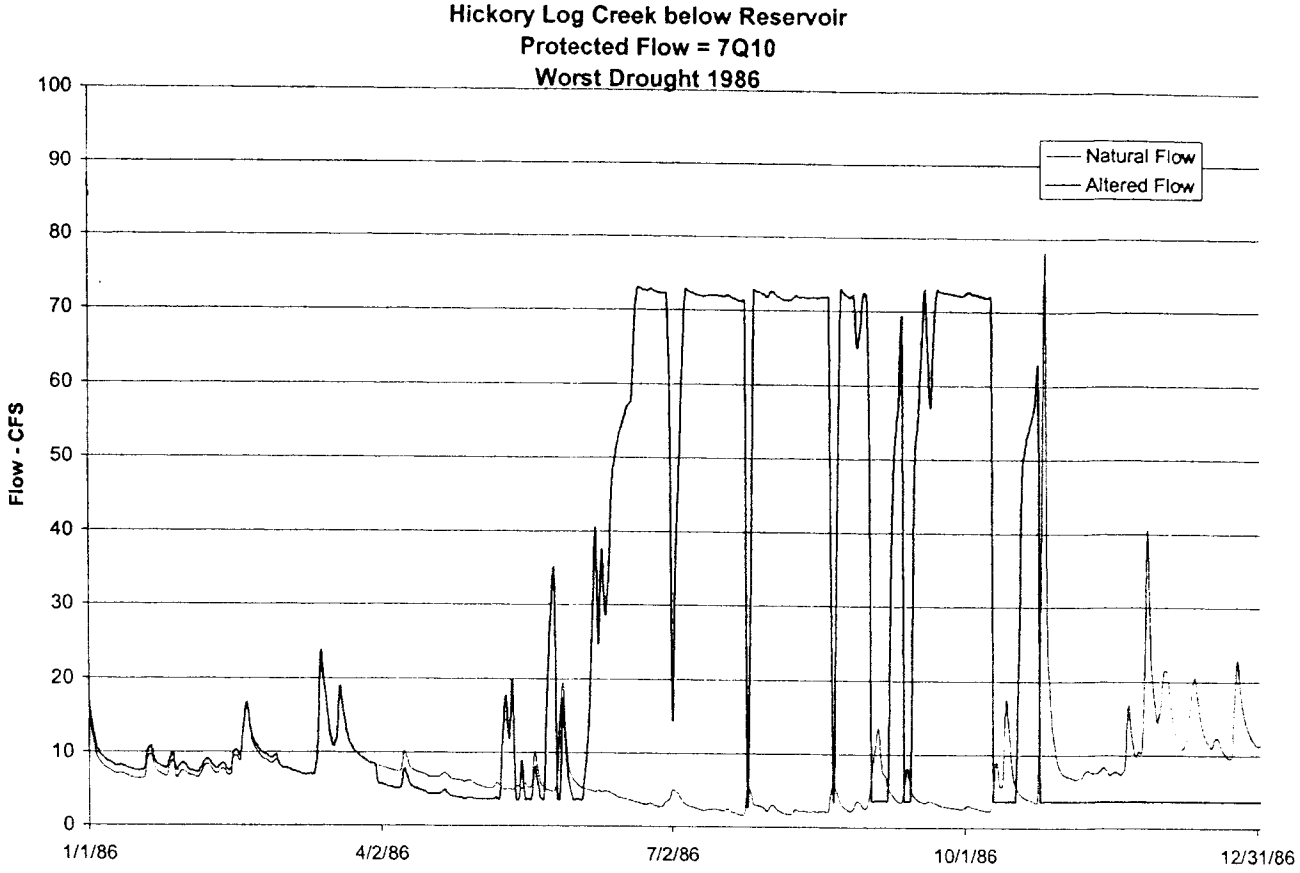

Hickory Log Creek below Reservoir
Protected Flow = 7Q10
Worst Drought 1986
Natural Flow
Altered Flow
Flow - CFS
100
90
80
70
60
50
40
30
20
10
0
1/1/86
4/2/86
7/2/86
10/1/86
12/31/86

Figure 5

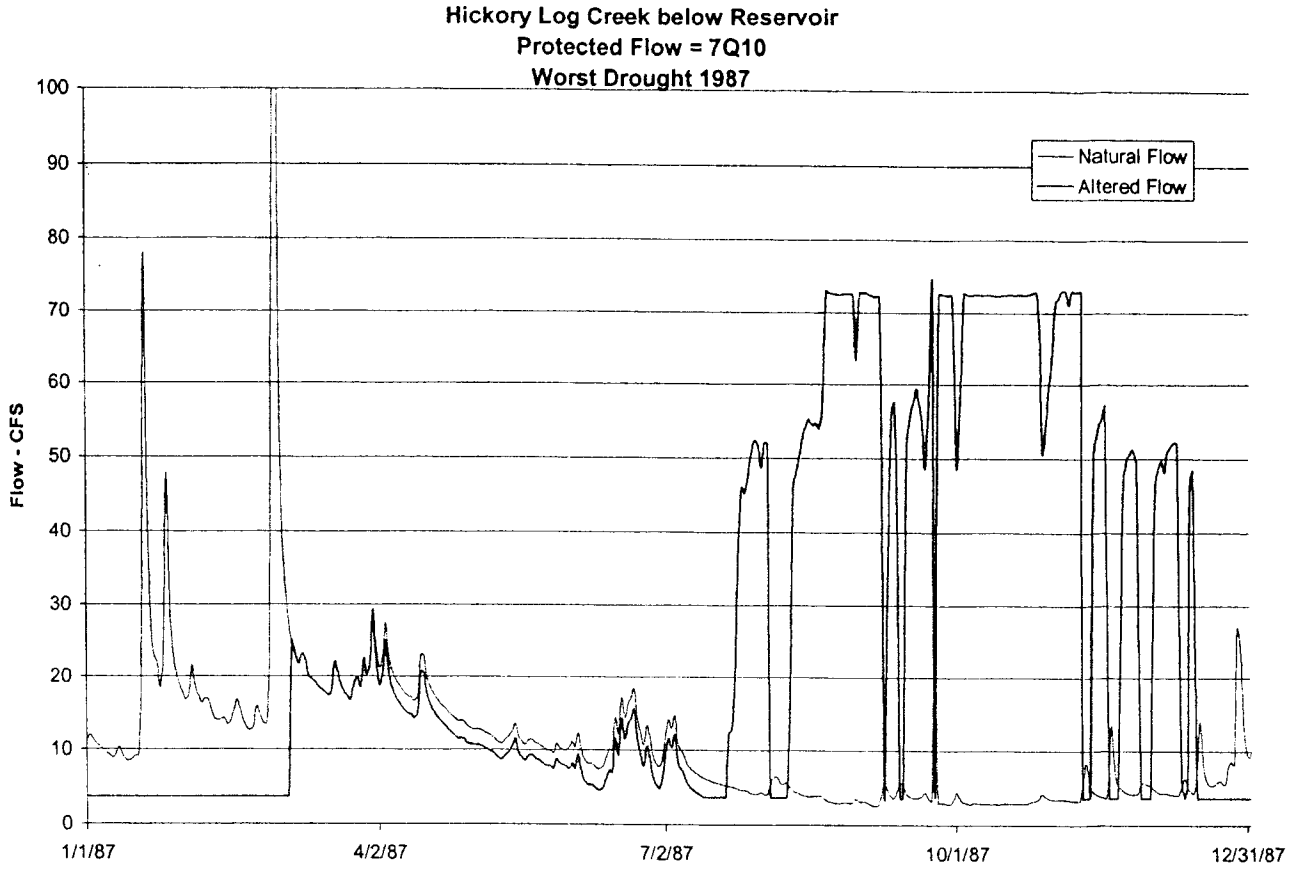

Hickory Log Creek below Reservoir
Protected Flow = 7Q10
Worst Drought 1987
Natural Flow
Altered Flow
Flow - CFS
100
90
80
70
60
50
40
30
20
10
0
1/1/87
4/2/87
7/2/87
10/1/87
12/31/87

Figure 6

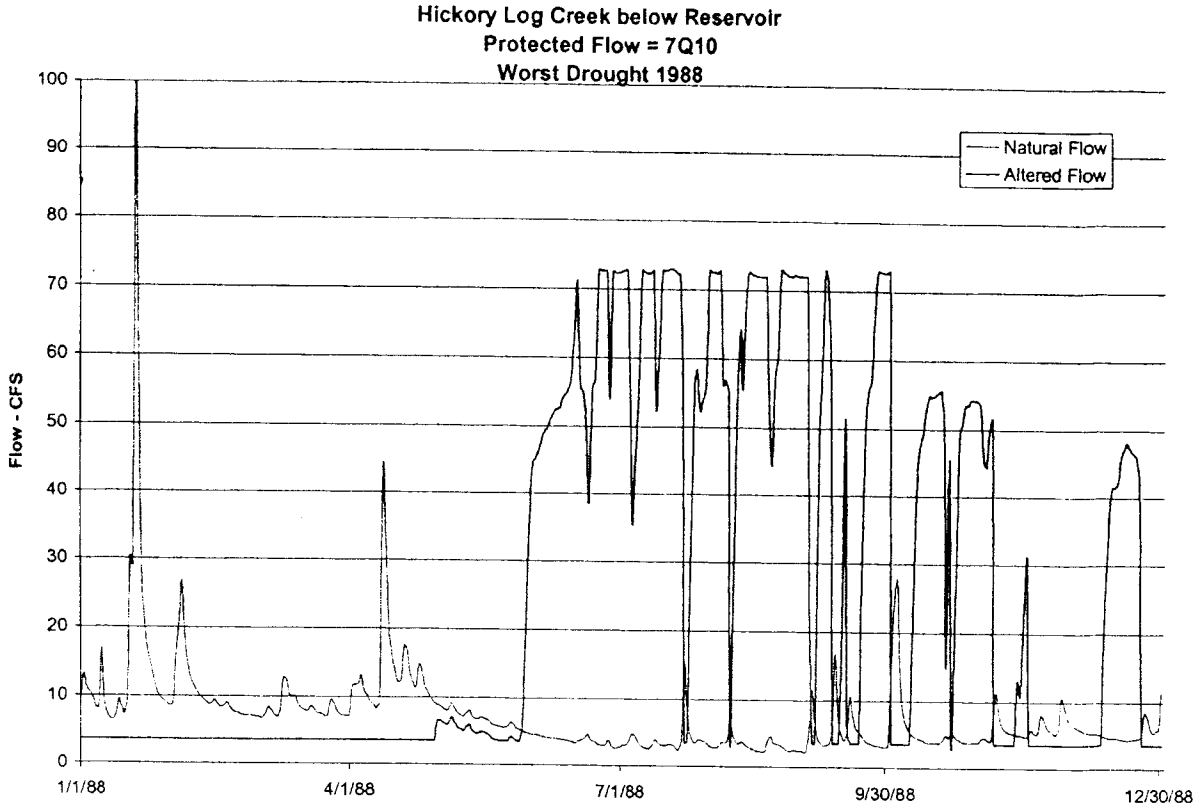

Hickory Log Creek below Reservoir
Protected Flow = 7Q10
Worst Drought 1988
Natural Flow
Altered Flow
Flow - CFS
100
90
80
70
60
50
40
30
20
10
0
1/1/88
4/1/88
7/1/88
9/30/88
12/30/88

Figure 7

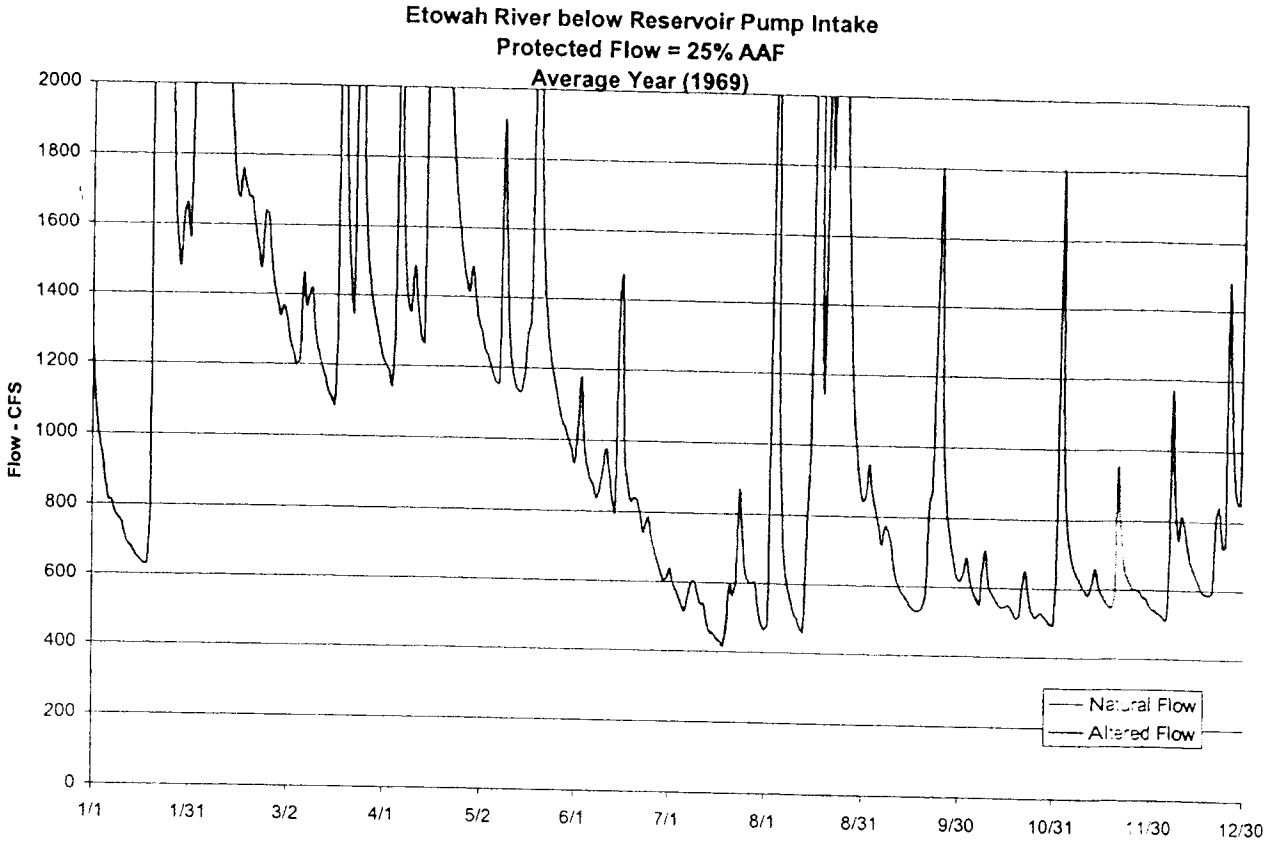
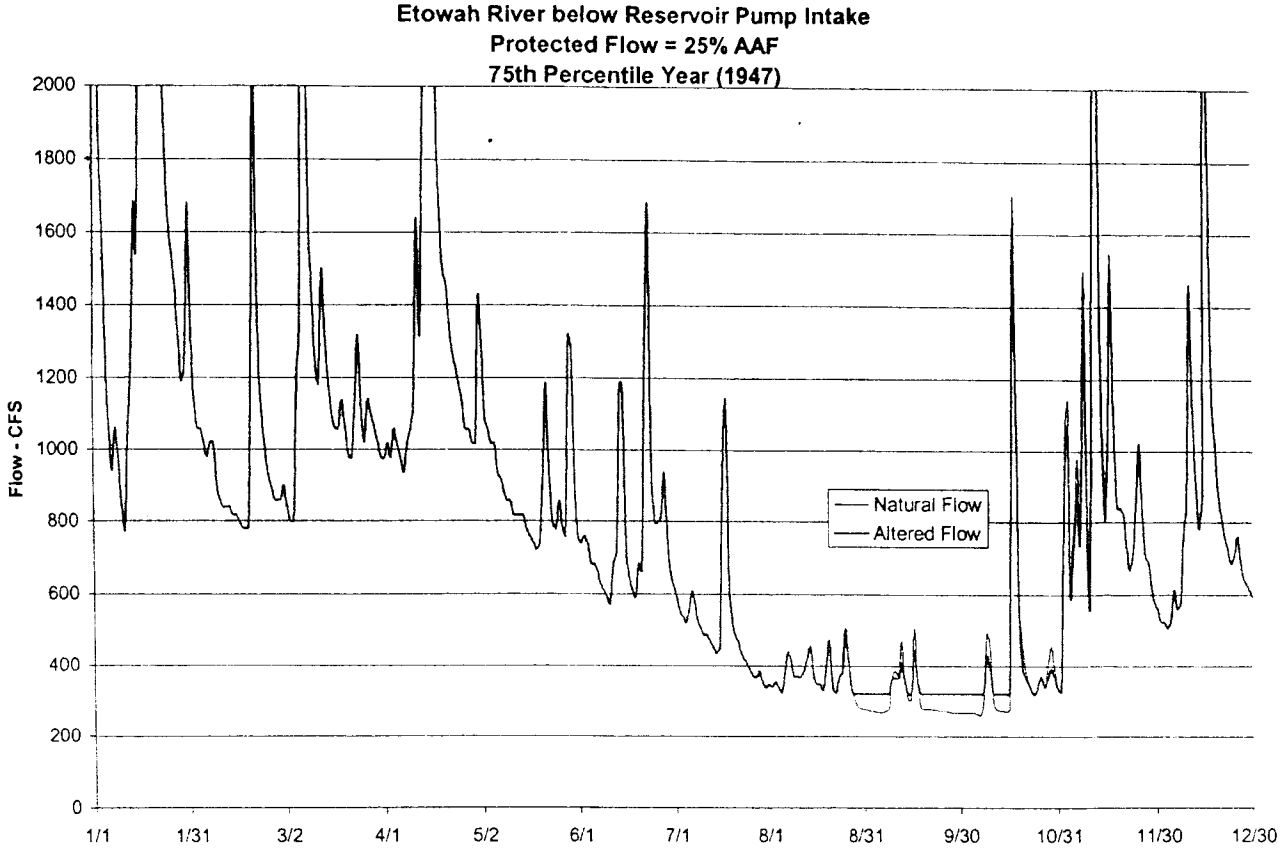

Etowah River below Reservoir Pump Intake
Protected Flow = 25% AAF
Average Year (1969)
Flow - CFS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1
1/31
3/2
4/1
5/2
6/1
7/1
8/1
8/31
9/30
10/31
11/30
12/30
Natural Flow
Altered Flow

Figure 8


Etowah River below Reservoir Pump Intake
Protected Flow = 25% AAF
75th Percentile Year (1947)
Flow - CFS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1
1/31
3/2
4/1
5/2
6/1
7/1
8/1
8/31
9/30
10/31
11/30
12/30
Natural Flow
Altered Flow

In the Etowah River even during the worst drought of record, 1986-1989, post-project flows are within one percent of natural flows for 50% of the time. During the dry year modeled, 1947, post-project flows were within one percent of natural flows for over 80% of the time. Therefore, while the duration of low flows (less than 320 cfs) during dry periods will be minimized, the flows in the River will closely approximate the natural flows well over 75% of the time. Even during reservoir operation, the "peaks and valleys" of the low flows are maintained on a regular basis.

ii. FLOWS IN THE ETOWAH RIVER BELOW THE WATER SUPPLY INTAKE

The Applicants currently propose to withdraw all 44 mgd of the projects water supply yield at the City of Canton's current water supply withdrawal site. The average annual stream flow value of the Etowah River at this point is 1168 cfs. The Etowah River was evaluated during the same average year (1969), a dry year (1947) and the drought of record (1986-89).

Average year (1969) – During an average year there is sufficient flow in the Etowah River to satisfy the Applicants water supply withdrawals and minimum instream flow requirements. Since there are also sufficient flows in Hickory Log Creek to replace evaporation losses and minimum flow requirements, there is no pump-diversion from the River.

Dry Year (1947) – During this dry year, from late August to mid October the reservoir project is needed to augment flows in the River to meet water supply withdrawal and minimum flow requirements. Downstream of the water supply intake, this results in only minimal flows during this period except for rain events. The maximum reduction of flows in the Etowah River until (44 mgd withdrawal + 39 mgd pump-diversion = 83 mgd) occurs during refilling of the reservoir is complete in mid-October.

Drought of Record (1986-1989) – During this severe drought below the water supply withdrawal, under this proposal, low flows will be virtual identical pre- and post-project. Maximum impact to flows (83 mgd) will occur during the refilling of the Hickory Log Creek reservoir with high flows from the Etowah River. However, as demonstrated by Figure 15, these flows closely mimic natural flows in both value and variability.

The potential for the diversion and water supply withdrawal to cause substantial downstream impacts to the Etowah River is significantly reduced by the addition of flows from the Canton Wastewater Treatment Plant, Canton and Puckett Creeks downstream of the water supply intake. As discussed below, further potential for the diversion to cause substantial downstream impacts is terminated by Lake Allatoona.

Figure 9

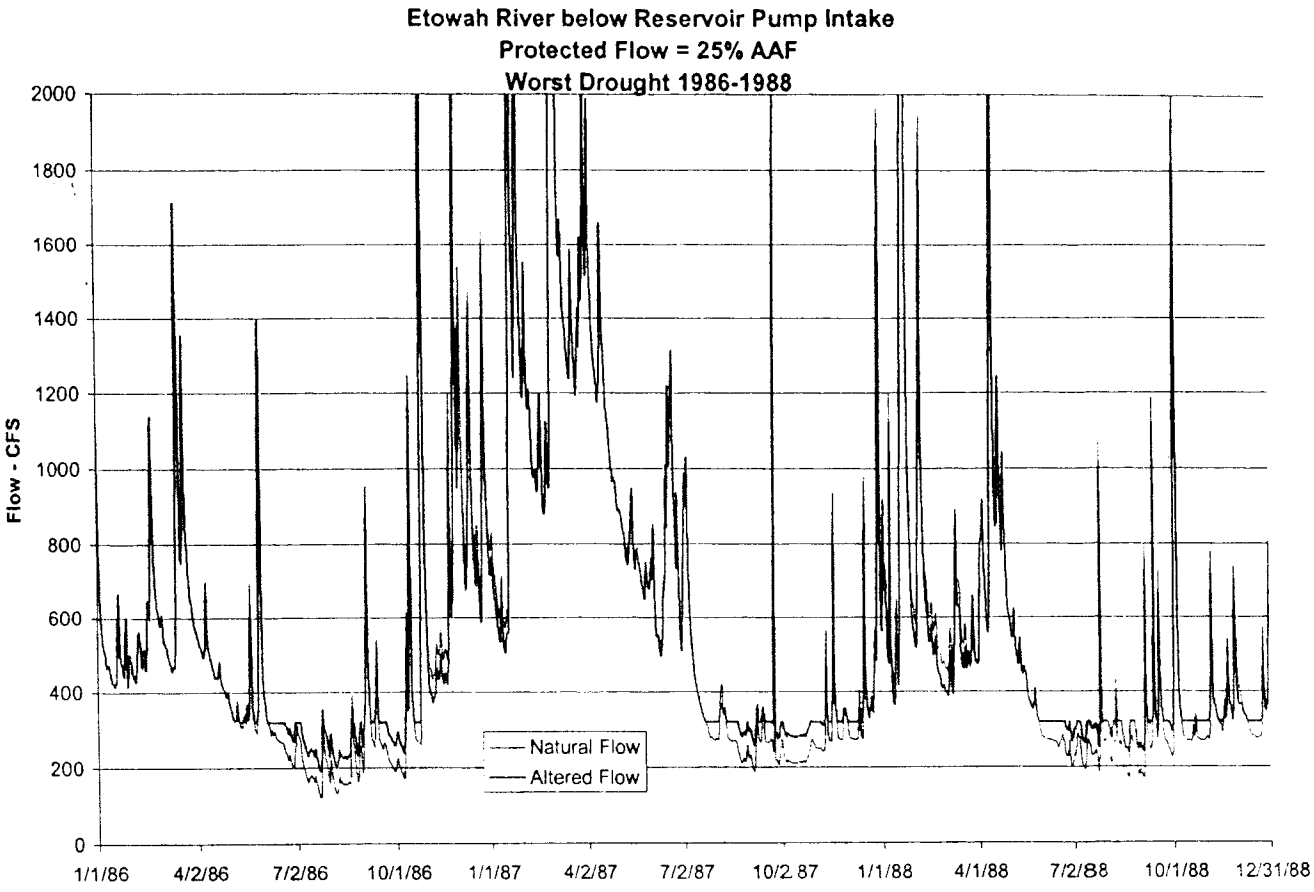

Etowah River below Reservoir Pump Intake
Protected Flow = 25% AAF
Worst Drought 1986-1988
Flow - CFS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Natural Flow
Altered Flow
1/1/86
4/2/86
7/2/86
10/1/86
1/1/87
4/2/87
7/2/87
10/2 87
1/1/88
4/1/88
7/2/88
10/1/88
12/31/88

Figure 10

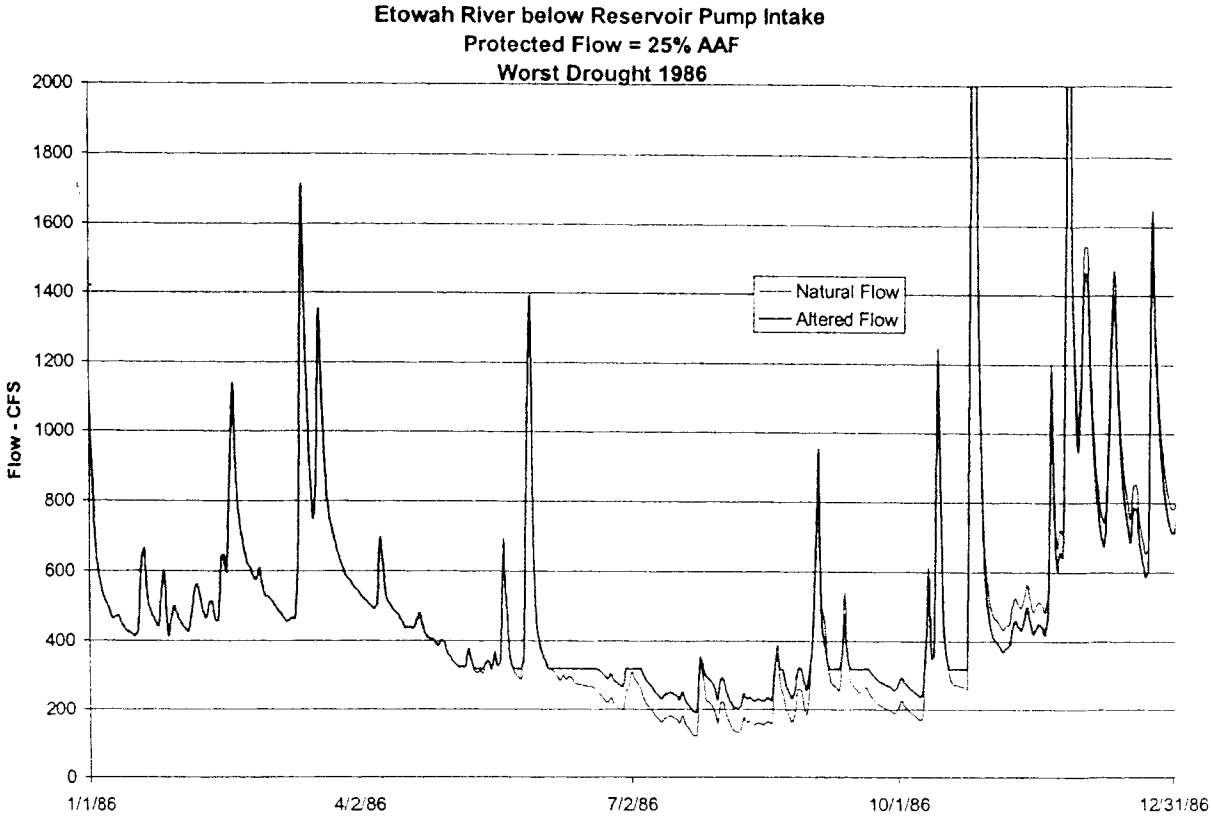

Etowah River below Reservoir Pump Intake
Protected Flow = 25% AAF
Worst Drought 1986
Flow - CFS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Natural Flow
Altered Flow
1/1/86
4/2/86
7/2/86
10/1/86
12/31/86

Figure 11

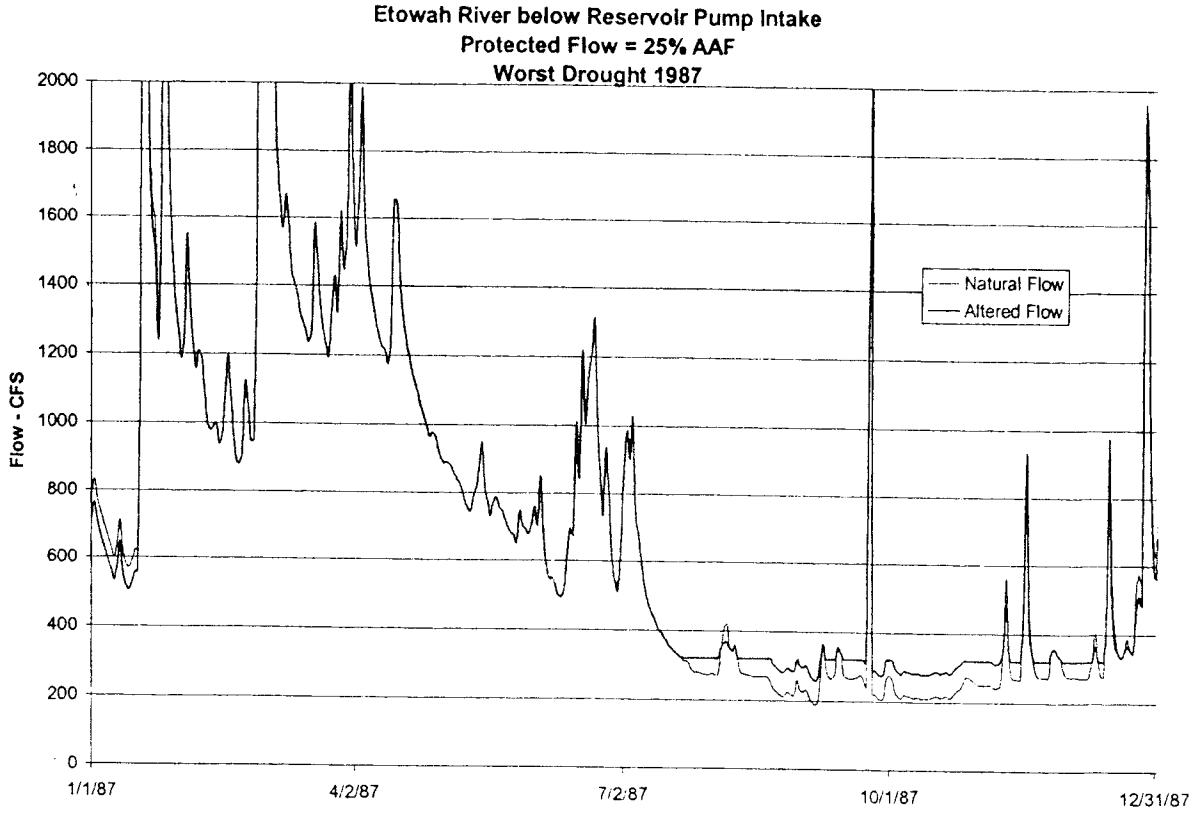

Etowah River below Reservoir Pump Intake
Protected Flow = 25% AAF
Worst Drought 1987
Flow - CFS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1/87
4/2/87
7/2/87
10/1/87
12/31/87
Natural Flow
Altered Flow

Figure 12

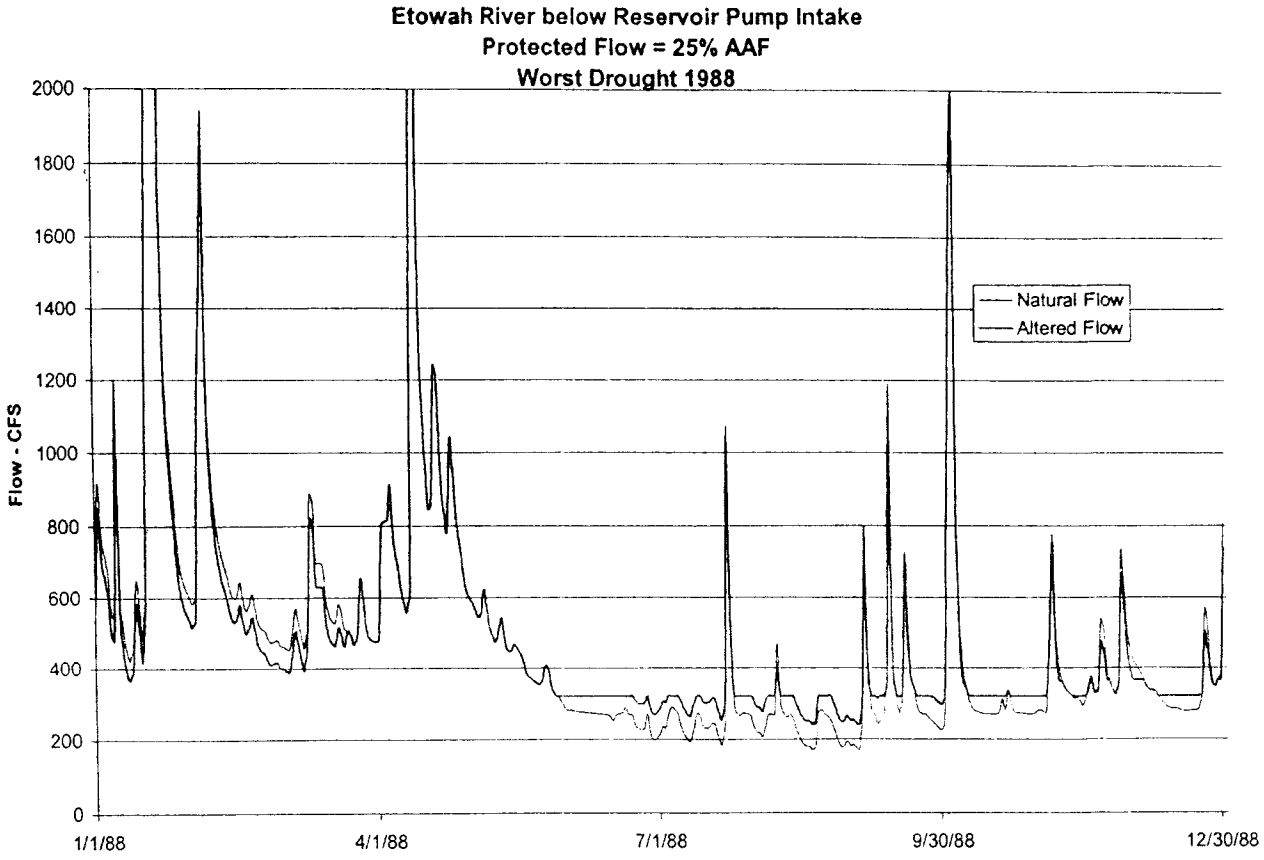

Etowah River below Reservoir Pump Intake
Protected Flow = 25% AAF
Worst Drought 1988
Flow - CFS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1/88
4/1/88
7/1/88
9/30/88
12/30/88
Natural Flow
Altered Flow

Figure 13

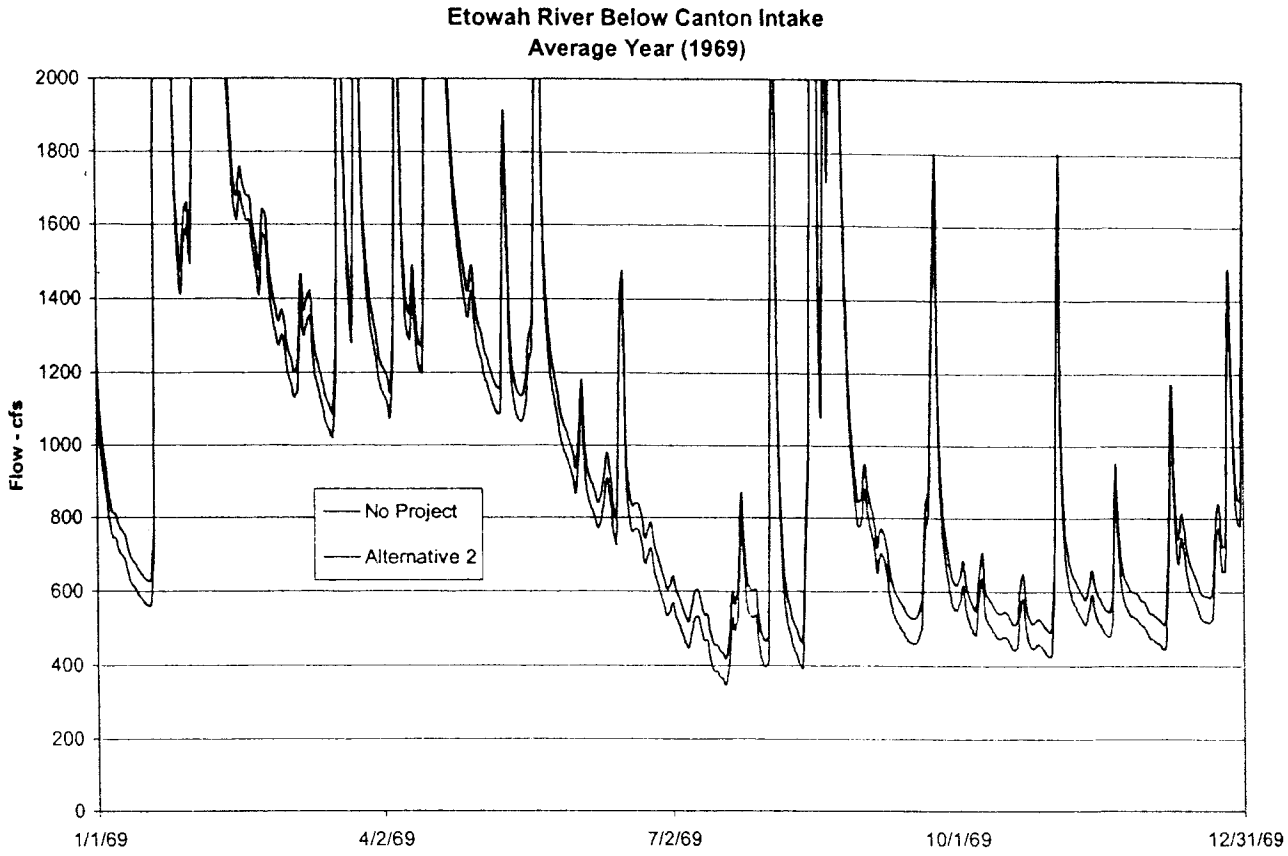

Etowah River Below Canton Intake
Average Year (1969)
Flow - cfs
2000
1800
1600
1400
1200
1000
800
600
400
200
0
No Project
Alternative 2
1/1/69
4/2/69
7/2/69
10/1/69
12/31/69

Figure 14

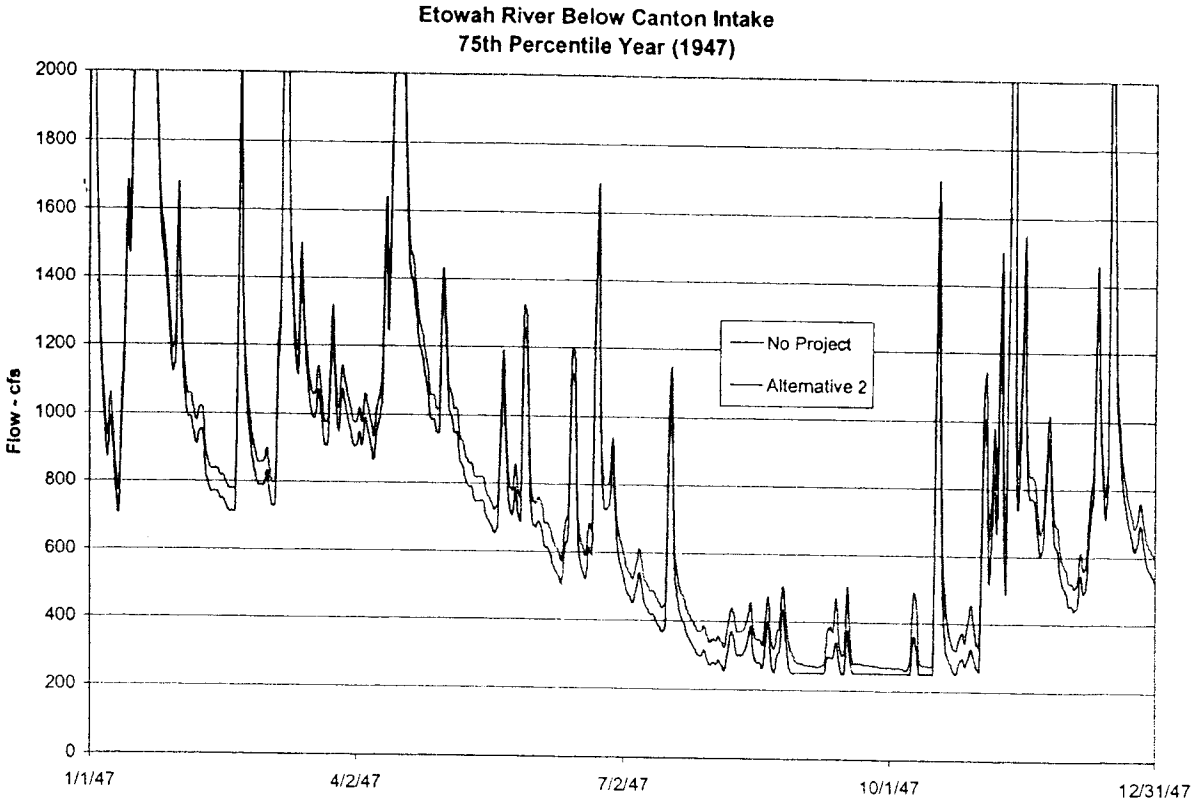
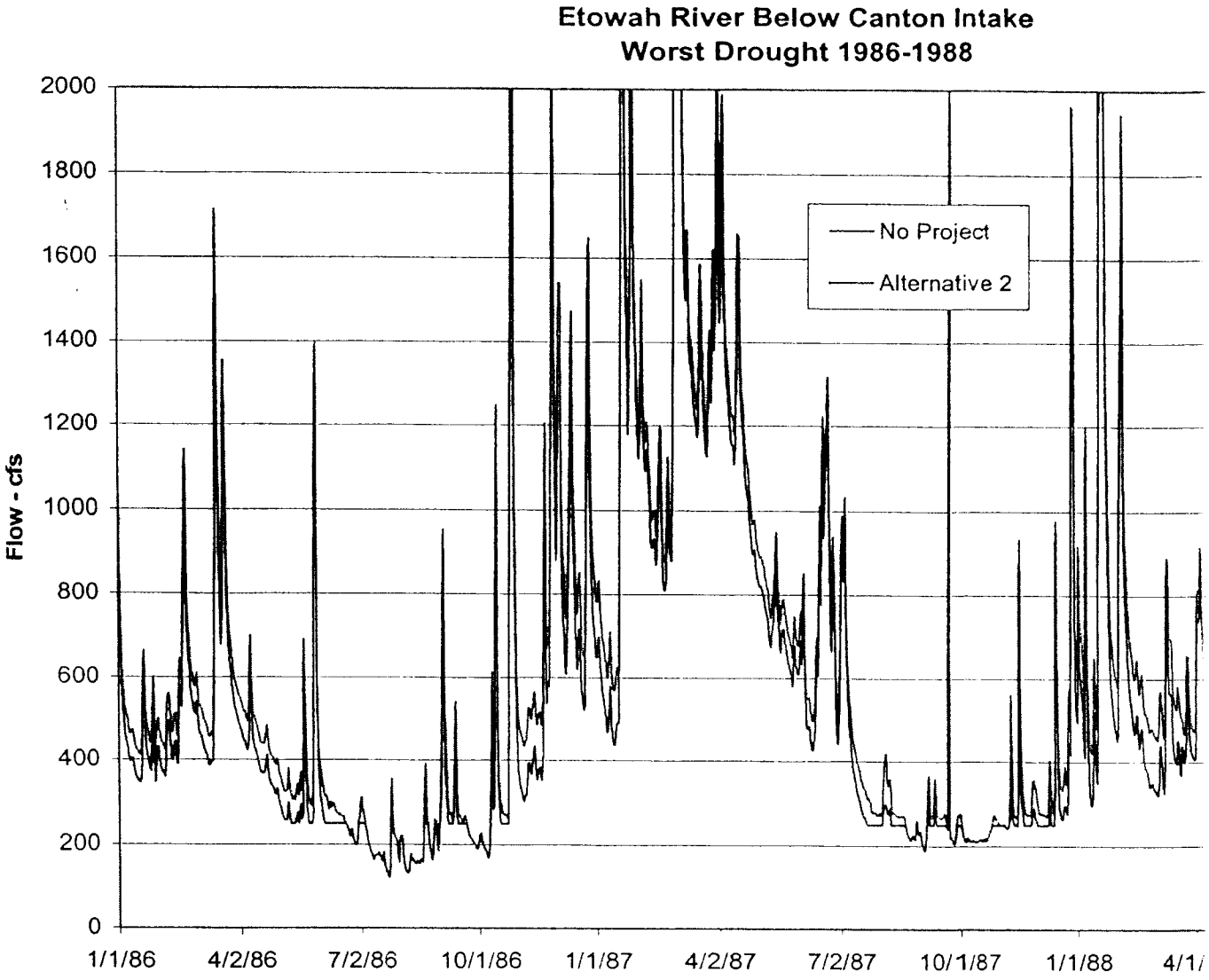

Etowah River Below Canton Intake
75th Percentile Year (1947)
Flow - cfs
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1/47
4/2/47
7/2/47
10/1/47
12/31/47
No Project
Alternative 2

Figure 15



iii. FLOWS IN THE ETOWAH RIVER DOWNSTREAM OF LAKE ALLATOONA

The Etowah River enters Lake Allatoona approximately six river-miles downstream from the pumped-diversion intake site. A tremendous amount of stream flow re-regulation occurs as flows transit into and through this reservoir. In addition, the large surface area of this lake minimizes the affects of normal stream flow variations and, therefore, the downstream terminus of any measurable impact from the Hickory Log Creek project is effectively terminated as flows enter Lake Allatoona. Flows from Allatoona Dam are primarily driven by minimum releases and hydropower generation schedules for supply of electricity during peak demand times. The annual mean stream flow of the Etowah River over the last 63 years is 1876 cfs at the Allatoona Dam.[27] The reservoir created by Allatoona Dam, Lake Allatoona, serves purposes such as water supply, water quality, and fish and wildlife enhancement in addition to hydropower generation. The major withdrawals from, and releases to, this reservoir are made by the Cartersville (18

[27] http://waterdata.usgs.gov/ga/nwis/annual/?site_no=02394000&agency_cd=USGS. There is never less than 250 cfs passing the dam.

mgd) and Cobb County-Marietta Water Systems (78 mgd).[28] The Northwest Cobb Water Pollution Control Plant (Georgia Permit GA0046761) also discharges into Lake Allatoona. The dams drainage area is 1,119 square miles.[29]

The Allatoona Dam releases a continuous minimum flow of 250 cfs, which generates power while providing a constant flow to the Etowah River downstream. Allatoona Dam operates in a peaking mode, generating power between 2 and 6 hours during normal operations each weekday. Weekend generation may occur if required to meet customer needs. The period of power generation is related to the stage of conservation pool drawdown. Generally, only the 250 cfs minimum flow is released on the weekends.

The following three figures graphically represent the impact the proposed project will have on releases from the Allatoona dam. Based upon this information, the AAF of the Etowah River below the Allatoona dam, the maximum impact to the Etowah River from the project, and the results of the HEC 5 study prepared utilizing the same baseline data used for the ACT Draft EIS, the USACE concludes there is negligible impact from the project on water quantity downstream of Lake Allatoona and no impact on the other studies parameters.

Figure 16 illustrates the monthly releases from the dam over the record period. It shows slight decreases in high flows with little or no change during low flow conditions. The project would have no impact on the occurrence of bank full discharges below the dam.

[28] EPD Permitting information

[29] http://waterdata.usgs.gov/ga/nwis/annual/?site_no=02394000&agency_cd=USGS.

Figure 16

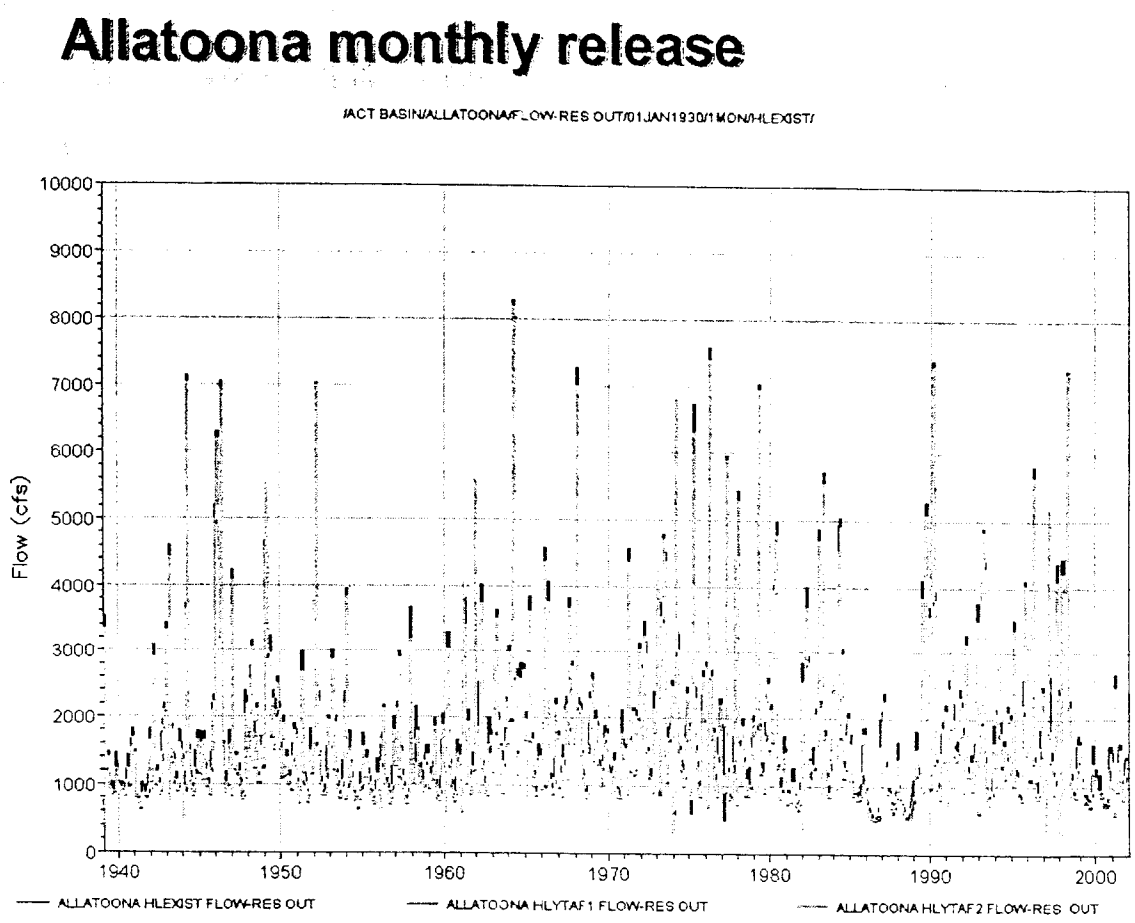

Allatoona monthly release
/ACT BASIN/ALLATOONA/FLOW-RES OUT/01JAN1930/1MON/HLEXIST/
Flow (cfs)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1940
1950
1960
1970
1980
1990
2000
ALLATOONA HLEXIST FLOW-RES OUT
ALLATOONA HLYTAF1 FLOW-RES OUT
ALLATOONA HLYTAF2 FLOW-RES OUT

Figure 17 is the flow duration curve for the period of record pre- and post- project. Given the low occurrence interval of the proposed project's impacts on high flows and the minimum releases required, there is no distinguishable impact below 10% or above 70%. The approximate bankfull discharge at Cartersville is 9,200 cfs. As demonstrated below, this project would not have any measurable effect at these flow volumes. Likewise, the flow below the dam would remain greater than 1000 cfs for over 60% of the period of record and at the minimum of 250 cfs for the same 30% pre- and post-project.

Figure 18 shows the negligible impact the project would have on average monthly flows. The average flow remains greater than 900 cfs in all months and greater than 1500 cfs in all but the typical-low flow months of July through October.

b. IMPACT OF RETURN FLOWS

At this time, it is not possible to accurately project specific return flow distribution within the basin for apportioning return flows from the utilization of this project's water supply to Hickory Log Creek or to the Etowah River. Therefore, return flows were not incorporated into the pre- and post-project stream flow analyses that were submitted as a part of this project's application, and the resulting stream impacts are therefore somewhat overstated. Downstream from the pump-diversion intake point on the Etowah River the Canton Wastewater Treatment Plant is currently permitted to discharge 1.98 mgd of effluent with return flows estimated at 60% of withdrawals it is expected that the City's discharge would increase to 8.58 mgd as result of this project.[30] CCMWA's returns would be outside of the Study Area.

c. OTHER PROJECTS

GAEPD issued a Public Notice on October 5, 2003, indicating applications have been submitted to the GAEPD for an additional 3.7 mgd of monthly average withdrawals in the Study Area (Table 4). The GAEPD has not yet made decisions on these applications but, even if issued, these 2 projects would not significantly further impact water quantity.

Currently there are no additional reservoirs in the preliminary planning process within the Study Area. The twenty-one projects pending with the USACE as proposed would not have an impact on water quantity.

d. SUMMARY AND CONCLUSION

The above analysis demonstrates that any impacts that may result from the Hickory Log Creek Reservoir are confined to the 6 mile reach between the intake point on the Etowah River and Lake Allatoona.

The downstream impacts to the Etowah River are reduced due the addition of flows from the Canton Wastewater Treatment Plant, Canton Creek and Puckett Creek.

[30] 60% of 11mgd + 1.98 mgd (permitted) = 8.58 mgd

Figure 17

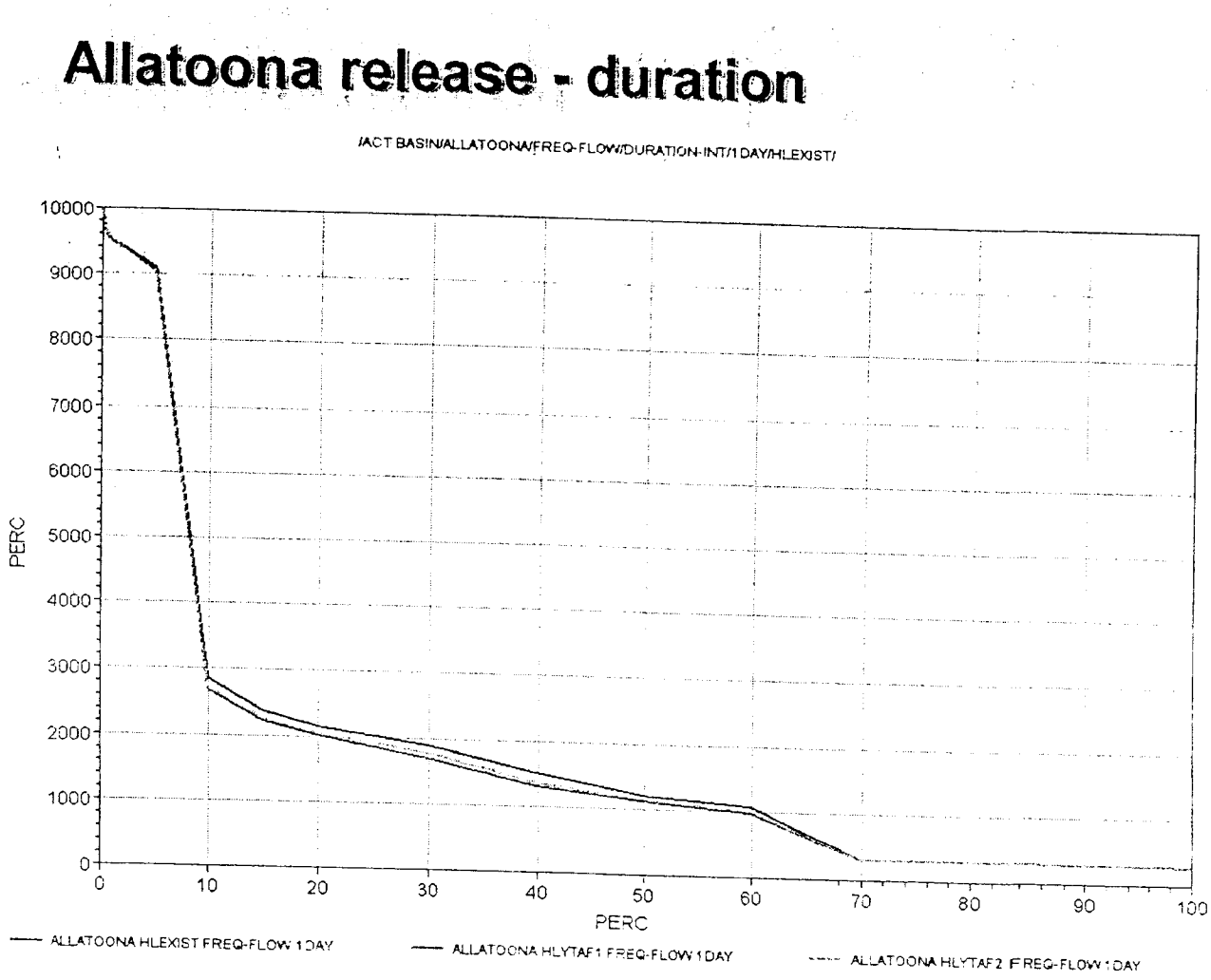

Allatoona release - duration
/ACT BASIN/ALLATOONA/FREQ-FLOW/DURATION-INT/1 DAY/HLEXIST/
PERC
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
PERC
ALLATOONA HLEXIST FREQ-FLOW 1 DAY
ALLATOONA HLYTAF1 FREQ-FLOW 1 DAY
ALLATOONA HLYTAF2 FREQ-FLOW 1 DAY

Figure 18

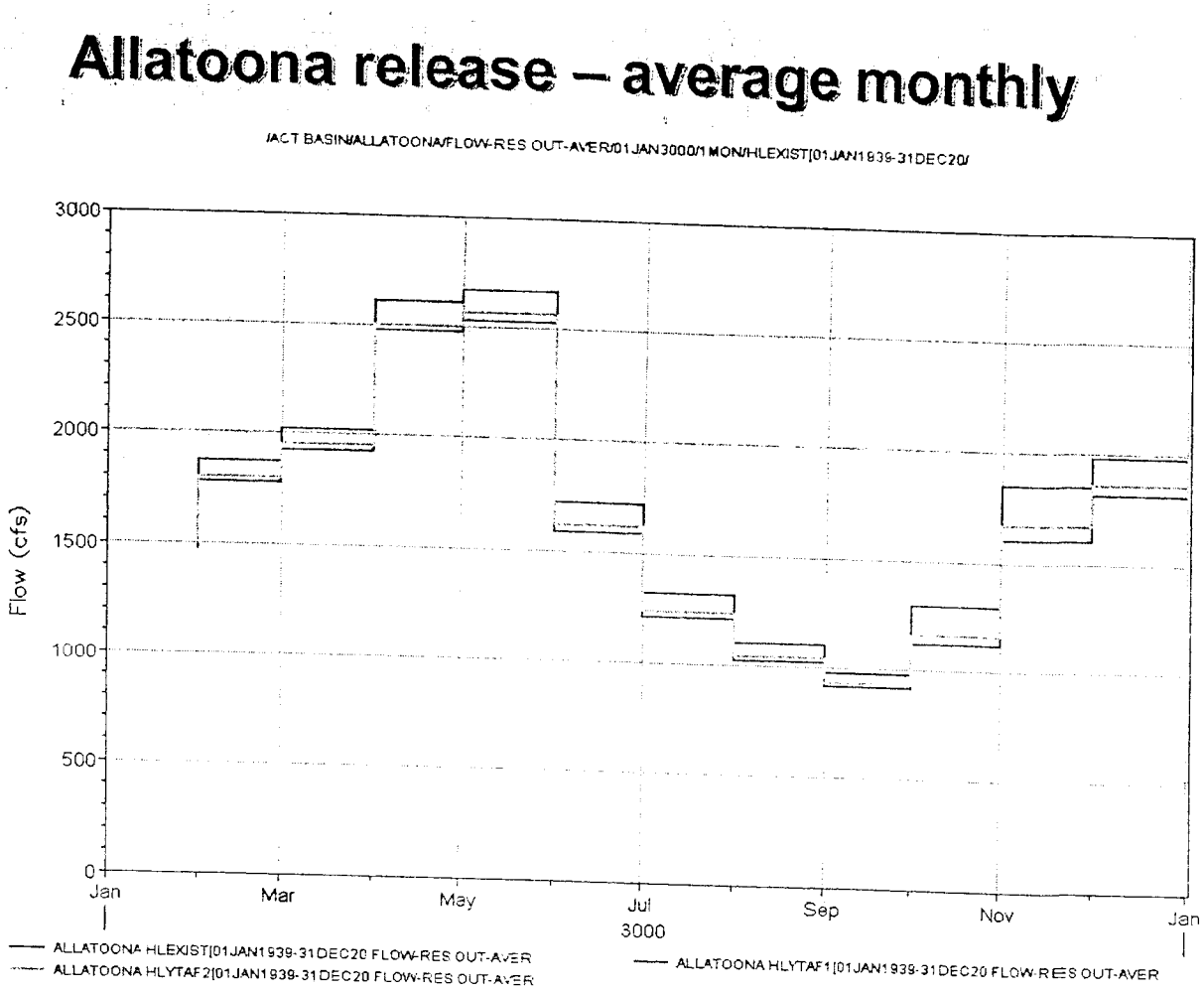

Allatoona release – average monthly
/ACT BASIN/ALLATOONA/FLOW-RES OUT-AVER/01JAN3000/1 MON/HLEXIST[01JAN1939-31DEC20/
Flow (cfs)
3000
2500
2000
1500
1000
500
0
Jan
Mar
May
Jul
3000
Sep
Nov
Jan
ALLATOONA HLEXIST[01JAN1939-31DEC20 FLOW-RES OUT-AVER
ALLATOONA HLYTAF2[01JAN1939-31DEC20 FLOW-RES OUT-AVER
ALLATOONA HLYTAF1[01JAN1939-31DEC20 FLOW-RES OUT-AVER

Table 4

Applicant	Purpose	Associate	Source	Date Posted	Permit Limits in Million gallons per day (max 24 hour/mo avg)	
					Original	Proposed
City of Cartersville P.O. Box 1390 Cartersville, GA 30120	Mun	Bill Jackson 404-656-3094	Lake Allatoona	4/5/00	21.42/18.0	26.5/20.8
Etowah W&SA 1162 Highway 53 East Dawsonville, GA 30534	Mun	Bill Jackson 404-656-3094	Etowah River	10/5/03	3.0/3.0	3.9/3.9

STUDY AREA

Finally, considering a watershed-wide approach, as demonstrated above, the diversion from the Etowah River results in negligible impacts at and downstream of Lake Allatoona due to highly regulated flows through Allatoona dam, the consistent release of water, and the large drainage area contributing to it.

Based on the foregoing, the proposed project will not propel a significant cumulative impact on water quantity in Hickory Log Creek or the Etowah River, and any impact to the Etowah River terminates at the Allatoona Dam.

V. WATER QUALITY

Water quality is affected by changes to the environment (referred to as stressors) that adversely affect aquatic life or impair human uses of a water body. Point sources are municipal and industrial wastewater discharges. Non-point sources consist of sediment, litter, bacteria, pesticides, fertilizers, metals, oils, grease, and a variety of other pollutants that are washed from rural and urban lands by storm water. Expected growth in population and employment in the Study Area may mean more potential stress from non-point source loading. This project, as well as all other existing and proposed water supply projects in the Study Area, would have impacts on water quality due to runoff during construction, and changes in flows in creeks or rivers.

e. IMPACTS FROM DAMS

The existing dams and impoundments located in the Study Area have impacted water quality in areas downstream of the dams. In addition to impacts resulting from a decrease in water quantity dams have impacts due to the release of low oxygen water, and elevated nutrient levels. The older dams likely have greater impacts on water quality since there were few regulatory controls during the time of their construction. More recently constructed facilities are likely required to consider water quality impacts in their design.

The proposed dam location decreases the cumulative impact of the proposed project on water quality by being just 1.5 miles upstream of the confluence of Hickory Log Creek and the Etowah River and six river-miles from the headwaters of Lake Allatoona. The dam's design will incorporate measures to increase dissolved oxygen and decrease elevated nutrient levels released into the system. The dam will also attempt to mimic natural temperature levels to the extent possible.

f. IMPACTS FROM WASTEWATER, AGRICULTURAL AND INDUSTRIAL DISCHARGES

The other major factors that have impacted water quality in the basin are wastewater, agricultural, and industrial discharges. Impacts from such facilities were greater prior to the 1970's, but these discharges still introduce pollutants, which when considered cumulatively, lowers water quality. A review of the impaired water list for the Etowah Basin (303(d) list) indicates that 28 waterways are listed as impaired. The major contaminate problem is fecal coliform (23). These impacts are generally caused by urban runoff and nonpoint sources. Three streams are impacted by PCB's, three by sediment, three by biota, and one by Cholorphyll a. Fish Consumption Advisories are active on six streams and a commercial fishing ban is on one stream. This data is illustrated in Table 5.

g. WATERSHED MANAGEMENT PLAN

The applicant reviewed a copy of the 1998 study prepared by the Georgia Department of Natural Resources, Environmental Protection Division titled, "Coosa River Basin Management Plan." The study found that the major problems with water quality in this area were nutrient loading, oxygen depletion, metals, fecal coliform, synthetic organic chemicals, flow and temperature modification, sediment, and habitat degradation and loss. These problems appear to be related to municipal and industrial discharges, agricultural runoff, and urban runoff. There are several general strategies that address both point and nonpoint source controls. Adoption of GADNR recommendations will minimize future water quality degradation.[31] Additionally, operation of potable water systems requires diligence in protecting water quality. Water system operators are often responsible for watchdog operations that lead to the identification and elimination of pollutant sources in watersheds contributing to their potable water supplies.

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[31] The Coosa River Basin Plan thoroughly discusses a variety of implementation strategies within the Basin. See the Coosa River Basin Plan for all proposed actions.

h. OTHER PROJECTS

GAEPD issued a Public Notice on October 5, 2003, indicating applications have been submitted to the GAEPD for an additional 3.7 mgd of monthly average withdrawals in the Study Area. The GAEPD has not yet made decisions on these applications but, if issued, these projects would not have any significant impact on water quality.

i. SUMMARY AND CONCLUSION

Water quantity may directly affect water quality. Hickory Log Creek is not as greatly affected due to the already existing impoundment and dam. On the Etowah River, the effect of water quantity on water quality is lessened by inflows from the Canton Wastewater Treatment Plant, unregulated inflows from Canton and Puckett Creeks and ultimately the Lake Allatoona dam.

In view of the above, it is the USACE's contention the proposed project, with its proposed conditions, would not have a significant impact on water quality when considered alone or in concert with the other past and reasonably foreseeable future projects in the watershed.

Table 5

Data Source	Criterion Violated	Potential Cause(s)
Acworth Creek	Fecal Coliform Bacteria	Urban Runoff
Butler Creek	Fecal Coliform Bacteria	Urban Runoff
Connesenna Creek	Commercial Fishing Ban	Residual from Industrial Source
Etowah River (Lake Allatoona to Richland Creek)	Fecal Coliform Bacteria, Fish Consumption Guidance	Nonpoint Source
Little Noonday Creek	Fecal Coliform Bacteria	Urban Runoff
Owl Creek	Fecal Coliform	Urban Runoff
Procter Creek	Fecal Coliform Bacteria	Urban Runoff
Rowland Springs Branch	Fecal Coliform Bacteria	Nonpoint Source
Rubes Creek	Fecal Coliform Bacteria	Urban Runoff
Stamp Creek	Fecal Coliform Bacteria	Nonpoint Source
Tanyard Creek	Fecal Coliform Bacteria	Urban Runoff
Tributary to Allatoona Creek	Fecal Coliform Bacteria	Urban Runoff
Allatoona Creek	Fecal Coliform Bacteria	Urban Runoff
Amicalola Creek	Fecal Coliform Bacteria	Nonpoint Source
Etowah River (Clear Creek to Forsyth Co. Line)	Fecal Coliform Bacteria, Fish Consumption Guide	Nonpoint Source
Etowah River (Settingdown Creek to Long Swamp Creek)	Fecal Coliform Bacteria	Nonpoint Source
Little Allatoona Creek	Fecal Coliform Bacteria	Urban Runoff
Long Swamp Creek	Fecal Coliform Bacteria	Nonpoint Source
Rocky Creek	Fecal Coliform Bacteria	Urban Runoff
Sharp Mountain Creek	Fecal Coliform Bacteria	Nonpoint Source
Canton Creek	Biota, Habitat	------
Settingdown Creek	Biota, Habitat	------
Bannister Creek	Biota, Habitat	------
Acworth Lake	Fecal Coliform Bacteria	Urban Runoff
Lake Allatoona (Cherokee, Cobb, & Bartow Counties)	Fish Consumption Guide	Urban Runoff, Nonpoint Source
Lake Allatoona (Tanyard Creek Embayment)	Fish Consumption Guide, PCB's, Fecal Coliform Bacteria	Urban Runoff
Lake Allatoona (Little River Embayment)	Fish Consumption Guide, PCB's, Fecal Coliform Bacteria, Cholorophyll a	Nonpoint Source, Urban Runoff
Lake Allatoona (Carters Creek Embayment)	Fish Consumption Guide, PCBs, Fecal Coliform Bacteria	Urban Runoff

V. AQUATIC SPECIES

The Biological Opinion thoroughly examined impacts from the proposed Hickory Log Creek reservoir in conjunction with past and other probable actions within the Study Area. The Cherokee darter, being the most sensitive of the species within the affected area is treated throughout the analysis as an indicator species for the cumulative impacts in the Study Area.

a. SPECIES OF SPECIAL CONCERN

The Cherokee and Etowah darters were listed as threatened and endangered, respectively on December 20, 1994. The amber darter was listed as endangered on August 5, 1985. The primary factors affecting these species are habitat loss associated with impoundments, including Allatoona Reservoir and numerous small ponds throughout the species' range. Impoundments destroy important stream habitat and block genetic interchange by fragmenting habitat and isolating populations. Impoundments also alter the thermal and chemical regimen of stream sections immediately below the dam and cause community shifts favoring centrarchid fishes, (Brim 1991), which may prey on darters.[32]

Another factor affecting these species are habitat loss associated with erosion that results in siltation of stream bottoms and increased levels of suspended sediment. Sources of increased sediment loads include timber clear cutting, clearing of riparian vegetation, urbanization, road construction, and other practices that allow bare earth to enter streams. Light to moderate levels of siltation are ubiquitous in many streams of the Etowah River system with Cherokee darters; however, siltation problems are severe in many tributaries where these fish have been extirpated. Excessive sedimentation and suspended sediment cause multiple adverse effects on fishes including increased predation and parasitism, reduced availability of prey/feeding rates, reduced reproductive success, and increased physiological stress.[33]

Increased point source and non-point source pollution associated with urban development, road development, landfills, agricultural practices, and other sources also affects these species. Toxic chemicals, such as many petroleum products, detergents, industrial and domestic wastes, herbicides, fungicides, insecticides, and other pesticides, can affect stream water quality. Large spills of these pollutants can kill aquatic organisms in areas well downstream of the spill. Even small amounts of these toxic chemicals, if continually released over time into streams, can act cumulatively to seriously affect the ability of some aquatic organisms to maintain healthy populations. Nutrients from excessive fertilizer use, animal waste, household and industrial detergents, and septic tank leakage also can affect streams. These nutrients, particularly nitrogen and phosphorus, increase plant productivity and, in excess quantities, can lead to algae blooms on stream bottoms that limit foraging and reproduction by benthic organisms.[34]

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[32] Biological Opinion p14.
[33] Biological Opinion p15.
[34] Biological Opinion p15.

i. CHEROKEE DARTER:

The Cherokee darter is endemic to the Etowah River system in north Georgia and, historically, is thought to have occurred in most of the system's tributaries (U.S. Fish and Wildlife Service 2000). Currently, the darter exhibits a disjunct and discontinuous distribution pattern, associated to a large degree with construction of the Allatoona Reservoir in the middle Etowah River system. Most Cherokee darter populations occur upstream of Lake Allatoona in tributaries of the Etowah River that drain the Piedmont physiographic province (43 of 49 populations, as identified by Bauer et al. 1995). Populations downstream of Allatoona Dam are geographically and genetically isolated from other populations in the Etowah River basin. These southern tributary systems tend to drain areas exhibiting less relief and, on average, are much more degraded than streams above the reservoir (U. S. Fish and Wildlife Service 1994). The Cherokee darter is most abundant in sections of smaller streams with relatively clear water and clean substrates with little silt deposition. The Cherokee darter is relatively intolerant of moderate to heavy silt deposition and to impoundment (Bauer et al. 1995).[35]

ii. ETOWAH DARTER

The Etowah darter is endemic to the upper Etowah River system in north Georgia, although historically it may have occurred further downstream in the Etowah River mainstem. This darter has one of the most restricted distributions in the southeast for a fish that occurs in moderate to large creeks or small rivers (Lee et al. 1980).[36] It currently is found only in the upper Etowah River mainstem and in Amicalola, Shoal (Dawson County), Long Swamp, and Smithwick Creek. This distribution suggests habitat specialization, since all streams inhabited by this species are geographically adjacent in the most upland portion of the river system (U.S. Fish and Wildlife Service 1994). Sites with the greatest abundance of Etowah darters had clear water and relatively little silt in the riffles. The darter is intolerant of impoundments and is not found in pool habitats (U.S. Fish and Wildlife Service 1994).[37]

iii. AMBER DARTER

The Amber darter is endemic to the Coosa River basin. This fish is found only in a 33-mile reach of the Conasauga River, a 26-mile reach of the Etowah River, and the lower portions of two Etowah River tributaries, Shoal and Sharp Mountain Creeks in Cherokee County. Amber darters occurred in relatively low densities in stream riffles that generally supported large populations of other species of small benthic fish. Amber darters never were observed in habitat characterized by slow current and extensive silt substrates.

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[35] Biological Opinion p.15-16.
[36] Biological Opinion p15.
[37] Biological Opinion p17

iv. OTHER FISH

Other fish species collected in reaches of the Hickory Log Creek system where Cherokee darters were located included southern brook lamprey (*Ichthyomyzon gagei*), largescale stoneroller (*Campostoma oligolepis*), Alabama shiner (*Cyprinella callistia*), tricolor shiner (*C. trichroistia*), bluehead chub *(Nocomis leptocephalus*), silverstripe shiner (*Notropis stilbius*), Coosa shiner (*N. xaenocephalus*), creek chub (*Semotilus atromaculatus*), Alabama hog sucker (*Hypentelium etowamum*), snail bullhead (*Ameiurus brunneus*), speckled madtom (*Noturus leptacanthus*), sculpins (*Cottus* spp.), redeye bass (*Micropterus coosae*), spotted bass (*M. punctulatus*) largemouth bass (*M. salmoides*), redbreast sunfish (*Lepomis auritus*), bluegill (*L. macrochirus*), blackbanded darter (*Percina nigrofasciata*), bronze darter (*P. palmaris*), and mobile logperch (*P. kathae*).[38]

b. IMPACTS FROM PAST PROJECTS

An existing 8.5-acre impoundment is located on Hickory Log Creek just upstream of the proposed reservoir dam. The existing dam effectively isolates Cherokee darter populations above the dam from other populations in Hickory Log Creek and the Etowah basin. (Dr. Freeman 2000).[39]

Since December 1998, the Service has provided non-jeopardy biological opinions on 14 projects in waters of the United States that were likely to adversely affect Cherokee, Etowah, and/or amber darter populations in the Etowah River watershed. Two of these projects, the Bluff Parkway and Great Sky Subdivision, also impact stream habitat in the Hickory Log Creek catchment; the action areas considered in these biological opinions overlap the action area for the Hickory Log Creek biological opinion.[40]

Construction of the proposed Bluffs Parkway, a new 2.92-mile road in the City of Canton, will require piping of 300 feet of Hickory Log Creek downstream of the proposed Hickory Log Creek Reservoir dam and 1190 feet of perennial and intermittent stream on five tributaries to Hickory Log Creek. Construction of the proposed Great Shy Subdivision on a 915-acre property in the City of Canton will require piping of 740 feet of Hickory Log Creek tributaries upstream of the reservoir footprint. The Service anticipated project construction and maintenance of these projects would take all Cherokee darters: (1) in the Hickory Log Creek watershed from the most upstream tributary the Bluffs Parkway will cross downstream to Hickory Log Cree's confluence with the Etowah River; (2) in Hickory Log Creek tributaries that flow from the Great Sky property downstream to their confluences with Hickory Log Creek, and (3) a one-mile reach of Hickory Log Creek downstream of these the Great Sky property.[41]

Most of this area overlaps the reach of Hickory Log Creek and its tributaries that would be flooded following dam construction or that would be affected by altered flow regimes.

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[38] Biological Opinion p22.
[39] Biological Opinion p.22.
[40] Biological Opinion p18.
[41] Biological Opinion p22.

Some fish included in this baseline may have been killed, stressed, suffered degradation of habitat, or otherwise taken if the reservoir is constructed after these other projects on Hickory Log Creek are completed.[42]

Since December 1998, the Service also has reported to Law Enforcement four projects in Cherokee and Paulding Counties that either killed Cherokee darters or resulted in significant loss of known occupied habitat due to increased sedimentation, improper use of chemicals, and illegal piping and/or filling of streams with Cherokee darter populations. These impacts, combined with impacts to water quality caused by extensive upland development within the watershed, pose an increasing threat to listed fish populations.[43]

c. DIRECT EFFECTS FROM PROPOSED ACTION[44]

i. HABITAT LOSS

The proposed reservoir will flood 8.3 miles of Hickory Log Creek and its tributaries, including 5 miles of streams that provide habitat for a large, apparently stable population of Cherokee darters. Inundation will change the stream from a lotic to a lentic habitat, an action that will significantly modify Cherokee darter habitat within the reservoir footprint by changing flow characteristics, channel substrates, and aquatic communities. Cherokee darters are obligate benthic riverine fishes and will not survive in the reservoir. Little data exist on the distance Cherokee darters will disperse to avoid unsuitable habitat; however, studies on other species of small darters indicate home ranges are small, and large-scale movement in response to degraded habitat may be limited (Dr. Mary Freeman, USGS-Biological Resources Division, and Dr. B. Freeman, pers.comm., December 1999). Based on this information, we anticipate that habitat changes associated with inundation are likely to result in death of the majority of Cherokee darters in the inundated area by significantly impairing spawning, foraging, and sheltering.

ii. FRAGMENTATION OF HABITAT AND ISOLATION OF POPULATIONS

Dam construction and inundation will block fish movement and genetically isolate Cherokee darter populations that might remain downstream of the dam and in the headwaters of Hickory Log Creek and its tributaries after the reservoir is flooded. The majority of these remnant populations are likely to be relatively small and therefore more susceptible to genetic drift, or random changes in gene frequencies independent of mutation, recombination, and natural selection. Major impacts of genetic drift include a loss of genetic variation within populations, genetic divergence between populations, and loss of population viability.

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[42] Biological Opinion p22.
[43] Biological Opinion p18.
[44] Biological Opinion p25.

iii. DOWNSTREAM SEDIMENTATION DURING CONSTRUCTION

Land-clearing operations and other activities during dam and reservoir construction are likely to increase sediment loads in Hickory Log Creek and the Etowah River. Excessive sedimentation and suspended sediment in aquatic systems can cause multiple adverse effects on benthic fish, including loss of stream habitat essential for foraging and spawning; increased mortality of eggs, larvae, juveniles, and adults; increased predation on eggs by sediment-dwelling invertebrates; increased vulnerability of adults to predation; reduced reproductive success; induced physiological stress; reduced feeding and weight loss; reduced availability of prey; increased parasitism; simplification of community structure; and hypertrophy/necrosis of gill epitheliums (Newcombe and Jensen 1996).

iv. OTHER

Movement of heavy machinery and placement of fill dirt in Hickory Log Creek during dam construction may crush Cherokee darters that occur within the dam area. Pumps that move water from the Etowah River to fill the reservoir could entrain and kill Etowah and amber darters. Lands that currently are in agriculture, or that have significant commercial and residential development, could affect the quality of reservoir waters if these lands, when flooded, release high levels of fertilizers, pesticides, nutrients, or other chemicals.

d. INDIRECT EFFECTS FROM PROPOSED PROJECT[45]

Dams change the physical environment of a stream system, altering the variation and cycles of flow that occur daily, seasonally, and annually; changing stream temperature and other water quality parameters; and modifying sediment transport in the system. We anticipate indirect impacts associated with construction and operation of the reservoir will include:

i. CHANGES IN FLOW PATTERNS

Lowed spring flows may limit recruitment of juveniles into the Cherokee darter population downstream of the dam. Cherokee darters are thought to deposit eggs on the sides or under large rocks; like many riverine species, relatively swift currents may be needed to keep nests and eggs well oxygenated and free of smothering silt (EPA/FWS 1999). Continued low flows and slower water movement during the Cherokee darter spawning period is likely to increase deposition of suspended sediment and reduce dissolved oxygen levels in spawning areas, as well as increase water temperatures that affect incubation, survival, and emergence of fry in Hickory Log Creek downstream of the dam. Low flows may also increase predation and affect spawning behavior (Mr. John Biagi and Dr. Chris Skelton, GADNR, pers.comm., April 2002). Repeated and/or extended high flows at any period may flush larval, juvenile, and adult Cherokee darters into the Etowah River, where they are unlikely to survive, and/or scour the larger channel substrates that provide darter habitat.

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[45] Biological Opinion p26-27.

ii. CHANGES IN STREAM GOEMORPHOLOGY

Large dams are effective sediment traps, commonly retaining over 99% of the sediment flowing into a reservoir. Curtailment of sediment supply, particularly in combination with repeated long-duration releases of reservoir water, typically results in a lowering of the mean bed level (with associated increased sedimentation) downstream from the dam unless the substrate is dominated by very coarse material or bedrock. The resulting entrenched stream often then begins to wide within the newly established channel, causing increased bank erosion and downstream sedimentation.

iii. CHANGES IN WATER TEMPERATURE

In many reservoirs, solar energy heating causes temperature stratification of stored water. Stratification is the layering of a reservoir into an upper, warm layer, called the epilimnion; a mid-depth transitional layer, the metalimnion; and a lower, dark, cold, and unproductive layer, the hypolimnion. These layers are separated by a thremocline in the metalimnion, a sharp transition in water temperature between upper warm water and lower cold water. This stratification varies seasonally, being most pronounced in the summer and absent in the winter. Between these extremes are periods of less pronounced stratification and spring and fall overturns, when the entire waterbody mixes together.

The extent of changes in water temperature downstream of a dam due to reservoir releases depends on the retention time of water in the reservoir and the withdrawal depth of releases from the reservoir. The Service has no information on reservoir depths from which water will be withdrawn for release from the Hickory Log Creek Reservoir. However, withdrawals from a single strata within the reservoir could result in water releases warmer or colder than normal water temperatures. Fish can generally function in a wide range of temperatures but have an optimum range, as well as lower and upper lethal temperatures for various activities. Changes in water temperature, in addition to directly affecting listed darter health and survival, may also have negative effects on invertebrate populations and other food sources.

iv. REDUCED DISSOLVED OXYGEN LEVELS AND/OR HIGH CONCENTRATIONS OF ANOXIC PRODUCTS

Dissolved oxygen levels in many reservoirs are tied to the overturn, mixing, and stratification processes. The epilimnion tends to be enriched with oxygen from the atmosphere and photosynthesis. Dissolved oxygen, however, tends to become depleted in the hypolimnion due to decomposition of organic substances, algal respiration, and nitrification. Little new oxygen is introduced into his lower layer by wind mixing, algae photosynthesis, or other sources. The Service has no information on reservoir depths from which water will be withdrawn for release from the Hickory Log Creek Reservoir. However, withdrawals form the hypolimnion could result in low downstream dissolved oxygen levels that fail to support aquatic life, including listed darters, in the basin.

Anoxic conditions in the hypolimnion, in addition, may stimulate the formation of reduced species of iron, mangaese, sulfur, and nitrogen. Chemical cycling of these lements occurs when they change from one state to another (e.g., from solid to dissolved).

Many chemicals enter a reservoir attached to sediment particles or quickly become attached to sediment. Many of these chemicals are not toxic as solids to many organisms. Some, however, are easily reduced under anoxic conditions and become soluble. The reduced, soluble forms of these chemicals may be toxic to many aquatic organisms at relatively low concentrations. We have no data on toxicity of these chemicals to listed darters in the Etowah.

Reductions or increases of instream flows in the Etowah River below the intake structures may alter water temperatures and channel morphology in this reach of the River. Changes in flow timing and duration, in addition, may alter the condition or availability of important types during various life stages of the Etowah and amber darter. However, we do not have sufficient data on flow requirements of the Etowah and amber darter, or on how altered flows affect these species' life history or habitat, to assess indirect impacts to these fish associated with altered flow in the Etowah River. Changes in stream geomorphology in the Etowah River due to altered flows in Hickory Log Creek below the reservoir are likely to be minimal (Dr.B.Freeman, pers. Comm.., April 28,2000).

Many stream fish populations vary from year to year under natural conditions; therefore, it may be difficult to conclusively tie any of the anticipated impacts described below to observed population fluctuations within these species.

Impacts on water quality are minimized by the incorporation of appropriate design features into the dam. By incorporating baffles or other aeration devices to oxygenate the water, and selective withdrawals from appropriate depths assures that water temperature and chemistry is optimized to achieve higher water quality.

e. PENDING PROJECTS

There are currently 21 pending projects in the study area that may have affects on either streams and/or wetlands. Given the presence of protected aquatic specifies throughout the entire Study Area, the Fish and Wildlife Service's participation in the development of project designs that minimize potential impacts to protected aquatic resources, and the FWS's participation through the formal consultation process to incorporate terms and conditions into the permits, these and other similar projects will not result in a significant impact on aquatic resources in the Study Area. The larger Northern Arc project, if pursued by the State of Georgia, will require the preparation of and EIS. The FWS's participation in that process will insure that any final design will minimize impacts to such resources to ensure no significant cumulative impact.

f. SUMMARY AND CONCLUSION[46]

The Etowah River basin, until recently, was largely rural with low human population densities. Land use practices included forestry, grazing, poultry production, and hay and small scale row-crop agriculture (Freeman 1993). These activities may have degraded some stream reaches within the basin, but probably did not have a major effect on aquatic

[46] Biological Opinion p28.

systems due to low human density.

This situation is rapidly changing. Aquatic diversity is threatened by increased development due in large part to the basin's close proximity to the rapidly expanding Atlanta metropolitan area. Agricultural lands and forests are being converted to subdivisions, industrial parks, recreational facilities, and other developments at an accelerated rate. Riparian vegetation that stabilizes stream banks and moderates water quality is being cleared, runoff from upland areas with large expanses of impervious surfaces has increased and is of poorer quality, and stream geomorphology is being altered by fill, piping, channelization, flashy stream flows, and other modifications. These changes in land use frequently cause accelerated erosion that silts in stream bottoms and reduces foraging and spawning success and/or increases point source and nonpoint source pollution in streams.

Construction of the Hickory Log Creek reservoir will provide the City of Canton and Cobb County/Marietta Water Authority with a more reliable water supply for customers in their service area. The City of Canton's service area includes only city residents; however, the Cobb County/Marietta Water Authority's service area includes both Cobb and Paulding Counties as sole source customers and Douglas and Cherokee Counties as non-sole source customers. These service areas lie within the majority of the Cherokee and amber darters' ranges, and a portion of the Etowah darter's range. A reliable supply of water is likely to facilitate continued residential and commercial growth in the basin; however, the anticipated growth will continue regardless of whether the Hickory Log Creek Reservoir is constructed. This assumption of continued growth is based on population forecasts developed by the Atlanta Regional Commission and a consulting firm, Brown and Caldwell (data provided in the application).

Some of the future growth in this basin will directly impact stream systems with listed fish (i.e., stream culverting, fill, and inundation) and will require separate consultation pursuant to section 7 of the Act. Other actions either will not result in take or will require a section 10 permit under the Act. The FWS, with its partners, is currently developing a Habitat Conservation Plan that will minimize and mitigate for non-Federal, activities in the basin that will take listed aquatic species. No critical habitat has been designated for Cherokee, amber, or Etowah darters in the Etowah River watershed.

After reviewing the current status of the Cherokee, Etowah, and amber darter; the environmental baseline for the action area; the effects of the proposed actions; and the cumulative effects, the FWS concludes that the project, as proposed, is not likely to jeopardize the continued existence of these species.

VI. CONCLUSION

The foregoing cumulative impacts assessment considered the impacts of the proposed project, past projects and reasonably foreseeable future projects on streams, wetlands, water quantity, water quality and aquatic species.

Based on the preceding assessments, it is our contention that the proposed project will not result in a significant cumulative impact on the environment.