Attachment 5

**Final Biological Assessment from
United States Department of Transportation, Federal Highway
Administration to United States Fish and Wildlife Service
for Replacement of Bridge Nos. 143 and 61 on SR 1304 and SR 197
Over North Toe River Mile 11.8, Yaney/Mitchell
Counties, North Carolina – Federal Aid Project No. BRSTP-197(1),
State Project No. 8.1900401, T.I.P. No. B-1443, and Federal Aid Project
No. BRZ-1304(04), State Project No. 8.2880401, T.I.P. No. B-2848,
dated February 17, 2006**

310 New Bern Avenue, Suite 410
Raleigh, North Carolina 27601

U.S. Department of Transportation
Federal Highway Administration

February 17, 2006

In Reply Refer To:
HDA-NC

Mr. Brian P. Cole
State Supervisor
U.S. Fish And Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801

Dear Mr. Cole:

Pursuant to the Federal Highway Administration's (FHWA) obligation to consult with the United States Fish & Wildlife Service (USFWS) under Section 7 of the Endangered Species Act, FHWA submitted a Biological Assessment (BA) on May 12, 2005 for the projects below:

- Bridge Replacement of Bridge #61: Federal-Aid Project # BRSTP-197(1), State Project # 8.1900401, TIP # B-1443.
- Bridge Replacement of Bridge #143: Federal-Aid Project # BRZ-1304(04), State Project # 8.2880401, TIP # B-2848.

On June 23, 2005, you responded that the initiation package was not complete. After discussions with your staff, we are now re-submitting the BA for these projects.

The federally-protected species addressed in the BA for these two projects are:

Alasmidonta raveneliana	Appalachian elktoe
Clemmys muhlenbergii	Bog turtle
Corynorhinus townsendii virginianus	Virginia big-eared bat
Puma concolor cougar	Eastern cougar
Geum radiatum	Spreading avens
Glaucomys sabrinus coloratus	Carolina northern flying squirrel
Gymnoderma lineare	Rock gnome lichen
Hedyotis purpurea var. montana	Roan mountain bluet
Liatris helleri	Heller's blazing star
Microhexura montivaga	Spruce-fir moss spider
Myotis sodalis	Indiana bat
Solidago spithamea	Blue Ridge goldenrod

The BA includes:

- descriptions of the actions being considered;
- descriptions of the specific area that may be affected by the actions;
- a description of listed species and critical habitat that may be affected by the actions;
- a description of the manner in which the actions may affect the listed species and critical habitat, and an analysis of indirect and cumulative effects;
- relevant reports, including the Categorical Exclusions; and
- other information available on the action (plan sheets & demolition plans).

Please review the attached Biological Assessment and provide us with your Biological Opinion. If you have any questions, please contact Rob Ayers at (919) 856-4330, extension 116 or rob.ayers@fhwa.dot.gov.

Sincerely,

For John F. Sullivan, III, P.E.
Division Administrator

Attachment

cc: Logan Williams, NCDOT
Harold Draper, TVA
Clarence Coleman, FHWA

BIOLOGICAL ASSESSMENT

For

Bridge Replacement Projects on the North Toe River (TIP # B-1443 and B-2848)

Prepared by:
The Catena Group Inc.
NCDOT Biological Survey Unit
FHWA-NC Division Office

Prepared For:
Federal Highway Administration (Lead Federal Agency)
Tennessee Valley Authority (Cooperating Agency)

17 February 2006

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1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT) proposes to replace the following two bridges located along the Mitchell/Yancey County line:

- Bridge No. 61 (B-1443); and
- Bridge No. 143 (B-2848).

The purpose of this Biological Assessment (BA) is to determine whether the proposed action may affect federally listed species that occur in the Action Area. This BA is prepared for the FHWA (as the lead federal agency) and the TVA (as a cooperating agency) in accordance with legal requirements established under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 (c)). FHWA and NCDOT will provide funding for project and it is anticipated that federal permits will be needed from TVA and USACE. FHWA is acting as lead agency in this consultation process. In coordination with the US Fish and Wildlife Service (USFWS), the North Carolina Wildlife Resources Commission (NCWRC), the FHWA and the TVA, the NCDOT has decided to evaluate the combined effects on protected species from these two projects.

The species being evaluated in the BA are:

Alasmidonta raveneliana	Appalachian elktoe
Clemmys muhlenbergii	Bog turtle
Corynorhinus townsendii virginianus	Virginia big-eared bat
Puma concolor couguar	Eastern cougar
Geum radiatum	Spreading avens
Glaucomys sabrinus coloratus	Carolina northern flying squirrel
Gymnoderma lineare	Rock gnome lichen
Hedyotis purpurea var. montana	Roan mountain bluet
Liatris helleri	Heller's blazing star
Microhexura montivaga	Spruce-fir moss spider
Myotis sodalis	Indiana bat
Solidago spithamea	Blue Ridge goldenrod

1.1 Statutory Authority of Action

Section 7(a)(2) of the ESA requires that each Federal agency shall, in consultation with USFWS, ensure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of an endangered or threatened species or result in the destruction or adverse modification of critical habitat.

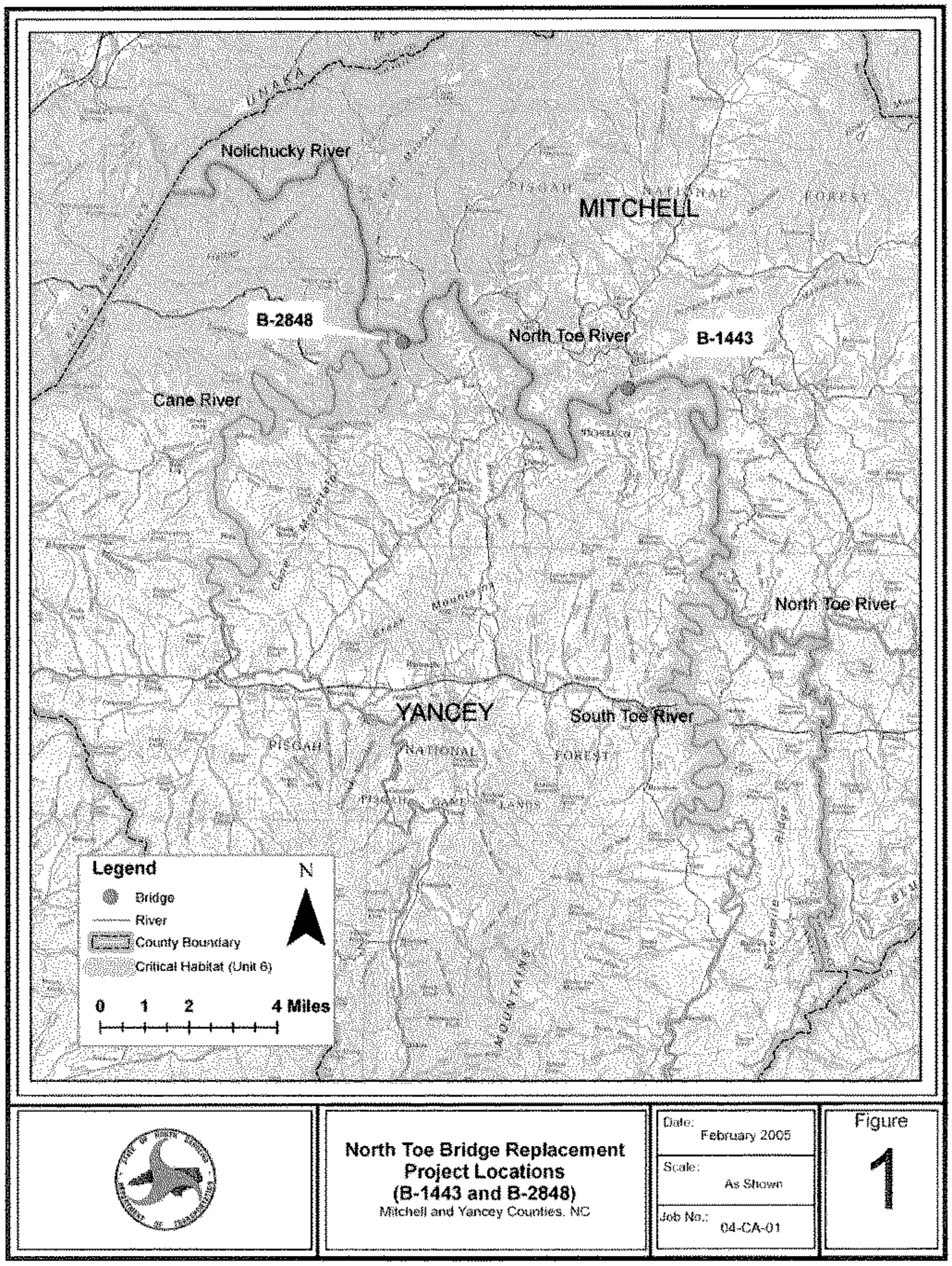
As defined in 40 CFR Part 1508.18, "actions" include new and continuing activities, such as projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies. Since the proposed project includes both funding by FHWA and permit approval by TVA, it is subject to consultation under Section 7 of the ESA.

2.0 PROJECT DESCRIPTION

2.1 Bridge Replacements

The two bridge replacement projects addressed in this BA occur approximately 12 river miles apart on the North Toe River along the Yancey/Mitchell County line (see Figure 1).

Figure 1. Project Locations & Appalachian elktoe Critical Habitat, Unit 6



Brief descriptions of each bridge replacement project are provided below. More detailed information for each project is contained within the Categorical Exclusion (Appendix A), Plan Sheets (Appendix B) and Bridge Demolition Plans for each bridge project.

2.1.1 Bridge Number 61 (B-1443)

Bridge Number 61 was built in 1925 and is a continuous reinforced concrete closed spandrel arch structure measuring 270 feet (82.32 m) in length. It is comprised of five spans with a clear roadway width of 15.6 feet (4.8 m). Bridge Maintenance Unit records indicate the bridge has a sufficiency rating of 49.2 out of a possible 100 for a new structure. The sufficiency rating for this structure is 4 out of 10 for the deck, 4 out of 10 for the railing and 6 out of 10 for the substructure. In general, the quality of concrete in the bridge is poor. There is spalling of concrete over the entire surface of the bridge which has exposed re-bar which in turn compromises the structural integrity of the bridge. The bridge is fast approaching the end of its useful life. It is considered to be structurally deficient due to deteriorating structural integrity and functionally obsolete due to narrow roadway geometry on the bridge. Bridge Maintenance has kept the bridge un-posted for weight restrictions as long as possible but this will not continue for much longer. Postings and even road closure are possibilities for the near future. Currently the bridge handles, on average, 1450 vehicles per day; an average of 2800 vehicles per day is projected for year 2025. The replacement of this inadequate structure will result in safer traffic operations.

Five proposed build alternates were considered. The preferred alternate, Alternate 4A, involves replacing Bridge Number 61 on new alignment approximately 180 feet to the southeast of the existing structure. The proposed bridge will be on a curved alignment. This alignment was chosen because it minimized "impacts to the sensitive natural ecosystems in the vicinity of the proposed site and provides the most economic design" (FHWA/NCDOT CE for B-1443), as it is the only Build alternate studied that does not have a tangent alignment, and it requires the least amount (distance) of improvements to the approach roadways. The proposed structure will be approximately 360 feet (109 m) in length with a width of 36 feet (10.9 m). The inside shoulder will be 8 feet (2.4 m) to accommodate horizontal sight distance and the outside shoulder will be 3.28 feet (1 m). Improvements to the approach roadways will be required for a distance of approximately 213 feet (65 m) to the south and 59 feet (18 m) to the north.

Bridge Construction

The proposed construction of the new bridge involves two piers that will be placed in the river which will result in 57 ft^2 of permanent fill in surface water. Construction of a structure that spans the river without piers in the water is not practical. This type of structure would require a much deeper girder that would infringe on the 500 year flood elevation, and likely create too much water pressure against the bridges during major flood events such as those in September 2004 caused by Hurricanes Frances and Ivan. Period-of-record peak river stages were recorded at over 20 sites in western North Carolina during these floods. Raising the bridge above the 500 year flood plain, would require an elevation of the existing roadbed for significant distances. In addition to the concern of potential erosion involved in raising the roadbed, because the roadways run parallel to the river on both sides for considerable distances, raising the elevation, would likely require fill slopes to encroach into the river. Additionally, transportation a girder of that size to the construction site would be very difficult given the winding nature of the roads leading to the bridge site, as girder length may be too long for the transport vehicle to maneuver up the mountain.

Rock causeways required to construct the piers will result in 4,972 ft^2 (462 m^2) of temporary fill in surface water. The workpad will consist of a rock causeway of class II rip rap with a 1' workpad of class I Rip Rap on top. The construction of the causeways/solid barriers will follow a phasing plan such that not all causeways/solid barriers are utilized in the river at the same time. Each phase will require that the causeways stay in the water a different length of time. Construction of causeways will be phased to minimize flow restrictions.

Plan sheets and permit drawings depicting the proposed design and location of the replacement structure and temporary causeways are provided.

Bridge Demolition

The Contractor will be required to submit for approval a proposed demolition plan. This plan must be sealed by a Professional Engineer, registered in NC. Demolition techniques that minimize the amount of debris in the river shall be used. Below is a brief description of an anticipated removal technique:

- Prior to bridge demolition, remove all asphalt-wearing surface and earth fill from inside the concrete arch bridge. This will be accomplished in a manner that doesn't allow asphalt or fill material to enter the river. Most likely a backhoe will load the material into dump trucks, working from one end of bridge to the other.
- The existing steel beam guardrail will be removed by unbolting and cutting as needed.
- At this point the bridge superstructure will consist of concrete arches connected by solid concrete floor. A portion of the concrete deck will be removed by saw cutting and lifting out. This will help reduce the weight for the next step of demolition. Some portion of the floor must remain to keep the arches from separating.
- An attempt will be made to dismantle the remaining portion of bridge without dropping components into the river. Temporary support frames will be placed in the river under the arch. The support frame foundation will most likely be precast concrete (such as concrete barrier). The contractor may also choose to use a timber or steel foundation. Due to the irregular rock streambed, small amounts or rip rap or sandbags may be required to level up the support frame foundation. Support frames will need to be placed in at least three locations under each arch (midspan and quarter points). The arches will then be sawed into sections and an attempt will be made to lift these sections out with a crane. The arches may separate and all or a portion fall into the river. Any portion that falls will be lifted out of the stream by crane (large sections at a time).
- The proposed solid barrier/causeway will be used as access for bent removal. Causeway materials such as class 1 aggregate and fabric construction may be used for construction and for demolition purposes. Due to the use of clean stone, all surface drainage will pass through the causeway making containment impractical. The causeway located along the west bank of the river will be positioned closely against the bank to reduce the footprint in the water. DOT will incorporate the use of jersey rail or similar devices around the perimeter of the causeway to help contain the material. Equipment will need to be staged adjacent to the bent to facilitate sawing it into manageable sections above water elevation. Cranes will lift the sections out. Once the bents have been removed to water elevation, the remaining mass of concrete will be removed to stream bed elevation by underwater sawing or use of hoe ram to break the bent at stream bed interface to allow lifting out as a unit. During this

process, turbidity curtains will be used (if water depth is sufficient) and disturbance of the steam bottom limited to an area 3 feet around the perimeter of the bent. The existing footing below streambed will be left in place to avoid additional streambed disturbance.

- Construction of causeways/solid barriers will follow a phasing plan such that not all causeways/solid barriers are utilized in the river at the same time. Each phase will require that the causeways stay in the water a different length of time. Construction of causeways will be phased to minimize flow restrictions.
- Use of explosives will not be allowed.
- Saw slurry must be contained by approved vacuum methods.

The above demolition description is provided to give an example of what NCDOT considers practical at these sites. The actual approved plan may vary from this method. Similar techniques may be used in certain aspects of the construction of the proposed bridge as well. DOT's focus will be on minimization, and the contractor will be required to develop techniques that provide equal to or fewer impacts than described above. Procedures used that are not as described as above, will be reviewed by a resident engineer and construction engineer according to DOT practice for bridge removal in North Carolina, as well as by a representative from the US Fish and Wildlife Service for compatibility with environmental practices.

Rock causeways required for the removal of existing bridge Number 61 will result in 3,993.4 ft^2 (371.0 m^2) of temporary fill in surface water. The existing bridge has 2 piers totaling an area of 151.2 ft^2 (14.0 m^2) that are in the North Toe River. Temporary bridges, for construction and demolition activities are not feasible in lieu of causeways, due to the amount of bedrock present at the construction site. Because of the presence of bedrock, pile driving to erect the bridges is not possible, thus a temporary work bridge would need to be a drilled shaft structure, which would still require a rock causeway in the river to allow equipment access for drilling and pier and girder setting.

2.1.2 Bridge Number 143 (B-2848)

Existing bridge Number 143 is a one-lane bridge constructed in 1922. It has five spans, totaling 367.0 feet (111.9 meters) in length, and has a clear roadway width of 12.0 feet (3.6 meters). The superstructure of the bridge consists of a reinforced concrete deck, an asphalt wearing surface, and metal guardrails. The substructure consists of reinforced concrete earth filled spandrel arches, reinforced concrete abutments, and reinforced concrete piers. Bridge Number 143 was constructed on a vertical curve. The crest of this curve is located approximately in the middle of the bridge and has estimated 1.0 percent grades on each side of the crest. The bridge deck in the middle of the bridge is approximately 28.0 feet (8.5 meters) above the river bottom. Bridge Maintenance Unit records indicate the bridge has a sufficiency rating of 23.0 out of a possible 100 for a new structure. The bridge is considered to be structurally deficient due to it's poor condition and functionally obsolete due to its substandard design. The bridge has no horizontal curvature. According to the 2004 NCDOT Bridge Inspection Report, the bridge has a sufficiency rating of 23.0 and is considered structurally deficient. The original bridge rails were replaced with metal guardrails in 1980 due to their deteriorated condition. There are currently no posted restrictions on the bridge. The replacement of this inadequate structure will result in safer traffic operations.

Three build alternatives were studied (June, 2003 Categorical Exclusion, B-2848). The selected Alternative (Alternate B) is less costly than Alternate C and will have less impact on the natural environment than Alternate A or C. Alternate B will have a shorter bridge than Alternate C because it will be downstream of the meander in the North Toe River and west of the horizontal curve in SR 1417/SR 1340. Alternate B will not encroach upon McKinney Branch located north of SR 1340 and east of the existing bridge.

Bridge Construction

The existing bridge is proposed to be replaced with multi-span bridge with an overall length of 366 feet. The bridge will be replaced approximately 50.0 feet (15.2 m) downstream of the existing location. One bent consisting of two drilled piers totaling 32.0 ft^2 (3.0 m^2) will be built in the North Toe River. Another bent with similar dimensions will be constructed at the water's edge on the east bank of the river. As with bridge No. 61 (B-1443) replacement with a structure that totally spans the river is not feasible for the same reasons discussed earlier.

The new bridge will be placed at approximately the same elevation as the existing structure. The bridge will have a clear roadway width of 24.0 feet (7.2 meters) which includes two travel lanes totaling 20.0 feet (6.0 meters) in width and a 2.0 feet (0.6 meter) shoulder on each side of the bridge. The roadway approaches will have a pavement width of 20.0 feet (6.0 meters) and 2.0 feet (0.6 meters) unpaved shoulders on each side. The length and height of the proposed structure may be increased or decreased as necessary to accommodate peak flows as determined by further hydraulic studies and to minimize impacts to endangered species and their habit. The existing bridge will remain in place to maintain traffic during construction. It will be removed after construction is complete.

As is necessary with bridge Number 61 (B-1443), a temporary rock causeway work pad will be placed in the river to facilitate the construction of the new bridge at bridge Number 143 (B-2848). Rock causeways required to construct the piers will result in 15,551 ft^2 (1,445 m^2) of temporary fill in surface water. Causeway construction and phasing will be similar to that described above for Bridge Number 61 (B-1443).

Bridge Demolition

The Contractor will be required to submit for approval a proposed demolition plan. This plan must be sealed by a Professional Engineer, registered in NC. Demolition techniques that minimize the amount of debris in the river shall be used. Below is a brief description of an anticipated removal technique.

- Prior to bridge demolition, remove all asphalt-wearing surface and earth fill from inside the concrete arch bridge. This will be accomplished in a manner that doesn't allow asphalt or fill material to enter the river. Most likely a backhoe will load the material into dump trucks, working from one end of bridge to the other.
- The existing steel beam guardrail will be removed by unbolting and cutting as needed.
- At this point the bridge superstructure will consist of concrete arches connected by solid concrete floor. Approximately 50% of the concrete floor will be removed by saw cutting and lifting out. This will help reduce the weight for next step of demolition. Some portion of the floor must remain to keep the arches from separating. (same as diagrams in B-1443 bridge)
- Temporary support frames will be placed in the river under the arch and removal of the arches will continue as described above for B-1443.

- Bents will be removed in same manner as described for B-1443
- Use of explosives will not be allowed.
- Saw slurry must be contained by approved vacuum methods.

Rock causeways required for the removal of existing bridge number 143 will result in 1,786 ft^2 (166 m^2) of temporary fill in surface water in addition to the temporary fill associated with the new structure construction causeways. The volume of structural material to be retrieved from the existing bridge will be approximately 150 cubic yards (114.6 cubic meters). The existing bridge has 3 piers totaling an area of from 349 ft^2 (32.4 m^2) that are in the North Toe River. As discussed above for bridge No. 61 (B-1443) temporary work bridges in lieu of construction causeways is not practical due to the predominance of bedrock at the bridge site.

2.2 Description of Action Area

The defined action area of the proposed project includes:

- the areas directly impacted by construction activities (see plan sheets);
- the areas potentially impacted by indirect impacts (a 500 meter boundary around each bridge site (400 meters downstream to 100 meters upstream)); and
- the areas in which proposed conservation measures to help offset impacts will occur (see Figure 3 for mussel relocation site).

3.0 ENVIRONMENTAL BASELINE-APPALACHIAN ELKTOE

The current status and conditions of the Appalachian elktoe and its designated critical habitat in the Nolichucky River Subbasin are evaluated here with regards to past and present impacts of all Federal, State, or private actions, and other human activities and natural events in the action area.

3.1 French Broad River Subbasins Occupied By Appalachian Elktoe

The Appalachian elktoe occurs in Nolichucky River, North Toe River, South Toe River and Cane River of the Nolichucky River drainage area (FBR Subbasin 04-03-06 and 04-03-07) (Figure 2). These subbasin classifications are assigned by the North Carolina Department of Environment, and Natural Resources (DENR), Division of Water Quality (DWQ) section (NCDWQ 2003).

3.1.1 Subbasin 04-03-06

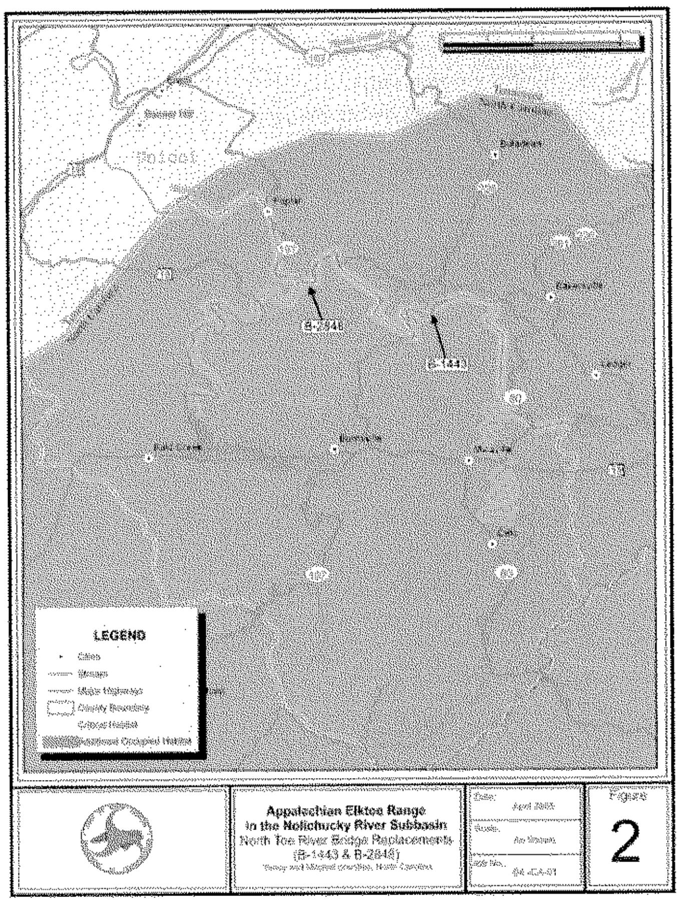
This subbasin includes the South Toe, North Toe and Nolichucky Rivers and their tributaries. The headwaters of the South Toe River arise in Mt. Mitchell State Park in Yancey County and the river forms at the confluence of the right and left Prongs of the South Toe River (@ South Toe River Mile (RM) 32). The river generally flows north through Hamrick (@ ST RM 22) and Newdale (@ ST RM 6) until the confluence with the North Toe River (NT RM 22/ST RM 0). The North Toe River originates in central Avery County approximately 5 miles northeast of Newland. From Newland the river flows east for approximately 4 miles to Minneapolis (North Toe River Mile 64). The river generally flows in a southwest direction from Minneapolis through the city of Spruce Pine in Mitchell County (@ NT RM 32) until the confluence with the South Toe River (@ NT RM 22/South Toe River Mile 0 near Kona in

Mitchell/Yancey County). The North Toe River continues to flow northwest along the Mitchell/Yancey County border through Toecane (@ NT RM 14) and Relief (@ NT RM 4) until the confluence with the Cane River near Huntdale, where it forms the Nolichucky River (NT RM 0/Cane River Mile 0/Nolichucky River Mile 111). The Nolichucky River flows into Unicoi County Tennessee at @ NC RM 101 and eventually into the French Broad River near Erwin, Tennessee.

3.1.2 Subbasin 04-03-07

This subbasin includes the Cane River and its tributaries. The headwaters of the Cane River arise in Mt. Mitchell State Park in Yancey County. The river flows in a general southerly direction for approximately 40 miles before joining the North Toe River to form the Nolichucky River. The drainage area of the Cane River is 158 mi^2, two-thirds of which is in the Pisgah National Forest.

Figure 2. Appalachian elktoe range in Nolichucky River Subbasin



The proposed bridge replacement projects occur within the French Broad River Basin (FBR), subbasin 04-03-06. Subbasin 04-03-07 will not be impacted by the proposed actions. The dominant land use in this subbasin 04-03-06 is forested/wetland (87%), with pasture land accounting for approximately 11% to 14% of the land area. Urban area comprises less than 1% of the watershed.

3.2 Water Quality of the Nolichucky River Basin

The Appalachian elktoe occurs in both subbasins 04-03-06 and 04-03-07, as one large population management unit. This section discusses water quality of these two subbasins, which will be referred to in this Biological Assessment collectively as the Nolichucky River Basin.

3.2.1 Best Usage Classification

The DENR, assigns a best usage classification to all waters of North Carolina. These classifications provide for a level of water quality protection to ensure that the designated usage of that water body is maintained. Local programs to control non-point source and stormwater discharge of pollution are required with this designation. These waters are suitable for all Class C uses. Class C designates waters suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation and agriculture. Class C imposes a minimum standard of protection for all waters of North Carolina. The Best Usage classifications of the major tributaries of the Nolichucky River Basin appear in Table 1.

Table 1. Best Usage Classifications in the Nolichucky River Basin.(NCDENR 2003)

River	Location	Classification	Date	Index #
North Toe	From 0.2 miles upstream of Pyatt Creek to a point 0.5 miles of US Hwy 19E	WS-IV; Tr,	08-01-98	7-2 (21.5)
North Toe	0.5 miles upstream of US Hwy 19E to town of Spruce Pine	WS-IV; Tr, CA	11-01-95	7-2 (27.3)
North Toe	From Spruce Pine water supply intake to Mitchell Co. SR 1187	C; Tr	11-01-95	7-2 (27.7)
Nolichucky	From source to NC/TN state line	B	08-01-02	7
South Toe	From source to US Hwy 19E	B; Tr, ORW	05-01-87	7-2-52 (1)
Left prong of South Toe	From source to South Toe	C; Tr, ORW	05-01-87	7-2-52-3
Right prong of South Toe	From source to South Toe	B, Tr, ORW	05-01-87	7-2-52-4
South Toe	From US Hwy 19E to N Toe River	C, Tr	07-01-73	7-2-52 (30.5)
Cane	From source to 1.0 mile upstream of Burnsville water supply intake	WS-II; Tr , HQW	08-03-92	7-3 (0.5)
Cane	From 1.0 mile upstream of Burnsville water supply intake to Burnsville intake	WS-II; Tr HWQ, CA	08-03-92	7-3 (13.3)
Cane	From town of Burnsville water supply intake to Nolichucky River	C; Tr	07-01-73	7-3- (13.7)

3.2.2 DENR Classifications:

Water Supply (WS II)--Waters used as sources of water supply for drinking, culinary, or food processing purposes for those users desiring maximum protection for their water supply where a WS-I classification is not feasible. WS-II waters are generally in predominantly undeveloped watersheds.

WS-IV--Waters used as sources of water supply for drinking, culinary, or food processing purposes for those users where a WS-I, II or III classification is not feasible. WS-IV waters are generally in moderately to highly developed watersheds or Protected Areas.

Class B (B)--Waters used for primary recreation and other uses suitable for Class C. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. There are no restrictions on watershed development activities. Discharges must meet treatment reliability requirements such as backup power supplies and dual train design.

Class C (C)--Waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses suitable for Class C. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. There are no restrictions on watershed development activities.

Outstanding Water Resource (ORW)--Supplemental classification intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance.

High Quality Waters (HQW)--Waters rated as excellent based on biological and physical/chemical characteristics.

Trout Waters (Tr)--Supplemental classification intended to protect freshwaters for natural trout propagation and survival of stocked trout. Affects wastewater discharges but there are no watershed development restrictions except stream buffer zone requirements of NC Division of Land Resources.

Critical Area (CA)—Supplemental classification intended to designate special protection for areas within ½ mile of a drinking water supply intake.

Both of the project areas (B-2848 & B-1443) occur within waters that carry a WS-IV; Tr best usage classification.

3.2.2 Water Quality Assessment

The Nolichucky River has had a long history of water quality degradation. Sedimentation from mining and agricultural practices is well documented (Tennessee Valley Authority 1981; Ahlstedt and Rashleigh 1996). Feldspar, mica and kaolin have been extensively mined in this watershed in North Carolina since the early 1900s (Muncy 1981). Nearly half of the nation's mica is produced in this region. In 1972 the Tennessee Valley Authority (TVA) abandoned operations at the Nolichucky Dam in Tennessee because the reservoir was 90% full of sediment. Much of this sediment originated from lands disturbed by mining activities in NC. Approximately

1,500 acres of abandoned minelands occur in the Nolichucky River Basin (Tennessee Valley Authority 1981). The TVA has been working to reclaim these areas through reseeding and replanting. As a result of this type of effort, as well as North Carolina state regulations (North Carolina Mining Control Act of 1971 and the Sedimentation and Pollution Control Act of 1973) the water quality of this basin has gradually improved (NCDENR 2003; Ahlstedt and Rashleigh 1996).

Water quality monitoring programs have been implemented by the DWQ to assess water quality trends in North Carolina Waters. One method used is the monitoring of benthic macroinvertebrates, or benthos, to assess water quality by sampling for selected benthos organisms. The species richness and overall biomass, as well as the presence of various groups intolerant of water quality degradation, are reflections of water quality. A biodiversity rating is given to a water body sampled, based on the taxa richness of the stream, and a qualitative sampling for intolerant forms such as mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera), collectively referred to as EPT. Biodiversity ratings include; Excellent, Good, Good-Fair, Fair and Poor. Excellent and Good ratings indicate that the best usage classification for that stream is being supported (S). A rating of Good-Fair indicates that the usage is supported, but is threatened (ST). A Fair rating relates to a partial support (PS) of the best usage, and a Poor rating indicates that the best usage classification for that stream is not being supported (NS). Monitoring stations demonstrated overall improvements in EPT scores throughout the Nolichucky River Basin from the 1980s through the mid 1990s (NCDWQ 2003). This trend has continued with eleven of the twelve waterbodies monitored for the basinwide assessment in the two subbasins receiving ratings of either good or excellent in 2002. All of these stations stayed the same or showed improvements since the 1997 monitoring (Table 2.).

Table 2. Water Bodies Monitored in Nolichucky River Basinwide Assessment (NCDWQ 2003)

Water Body	County	Location	1997	2002
North Toe River	Mitchell	SR 1321	Good	Good
North Toe River	Avery	US 19E	Good	Good
North Toe River	Mitchell	SR 1162	Fair	Good
North Toe River	Yancey	SR 1314	Good	Good
Big Crabtree Creek	Mitchell	US 19E	Excellent	Excellent
South Toe River	Yancey	SR 1167	Excellent	Excellent
Big Rock Creek	Mitchell	NC 197	Good	Excellent
Jacks Creek	Yancey	SR 1337	Fair	Fair
Pigeonroost Creek	Mitchell	SR 1349/NC 197	Excellent	Excellent
Cane River	Yancey	US 19E	Excellent	Excellent
Bald Mountain Creek	Yancey	SR 1408	Good	Excellent
Price Creek	Yancey	SR 1126	Good/Fair	Good

Waters that are rated excellent are eligible for ORW classification if one or more of the following criteria are met:

1. Outstanding fish habitat or fisheries,
2. Unusually high level of waterbased recreation,
3. Some special designation such as NC or National Wild and Scenic Rivers, National Wildlife Refuge, etc.
4. Important component of state or national park or forest,

5. Special ecological or scientific significance (rare or endangered species habitat, research or educational areas).

Given the presence of the endangered Appalachian elktoe in some of these stream segments, and the proximity of others to Appalachian elktoe populations, many of the waters listed above may be eligible to receive the ORW classification. The ORW classification would provide additional protection to the Appalachian elktoe and its designated Critical Habitat. ORW classification of these waters could be an effective tool to help address potential cumulative effects to this species.

Another method of assessing water quality is a fish community assessment which assigns an Index of Biotic Integrity (IBI). The IBI evaluates species richness and composition, trophic composition, and fish abundance and condition. Thirteen sites have been evaluated by the TVA (Table 3). As with the benthos monitoring an overall trend of improving water quality over time is indicated by this data.

Table 3. TVA Fish Community Assessments in Nolichucky River Basin (NCDWQ 2003)

Water Body	County	Location	Date	Score/Rating
North Toe River	Avery	US 19	08/17/99	50/Good
North Toe River	Yancey	NC 80	06/05/97 08/16/99	40/Fair 50/Good
North Toe River	Yancey	SR 1314	08/14/97 06/16/99	40/Fair 56/Good-Excellent
North Toe River	Yancey	SR 1336	08/15/97	48/Good
South Toe River	Yancey	NC 80	08/04/97	48/Good
Little Crabtree Creek	Yancey	US 19E	08/06/97 04/27/99	44/Fair 40/Fair
Cane Creek	Mitchell	NC 80	06/05/97 04/27/99	32/Poor 34/Poor
Big Rock Creek	Mitchell	NC 197	08/05/97 06/28/00	50/Good 50/Good
Jacks Creek	Yancey	SR 1336	06/28/00	40/Fair
Cane River	Yancey	US 19E	06/04/97 06/27/00	44/Fair 50/Good
Cane River	Yancey	US 19W	08/07/97 07/06/00	40/Fair 48/Good
Cane River	Yancey	US 19W	06/24/97	46/Fair-Good
Nolichucky River	Mitchell	SR 1321	08/13/97 05/20/02	50/Good 52/Good

3.2.3 Point Source Pollution

Point source pollution is defined as pollutants that enter surface waters through a pipe, ditch, or other well-defined conveyance. These include municipal (city and county) and industrial wastewater treatment facilities, small domestic discharging treatment systems (schools, commercial offices, subdivisions, and individual residents), and storm water systems from large, urban areas and industrial sites. The primary substances and compounds associated with point source discharge include nutrients, oxygen demanding wastes, and toxic substances such as chlorine, ammonia, and metals.

Under Section 301 of the Clean Water Act of 1977 (CWA) discharge of pollutants into surface waters is prohibited without a permit by the Environmental Protection Agency (EPA). Section 402 of the CWA establishes the National Pollutant Discharge Elimination System (NPDES) permitting program, which delegates permitting authority to qualifying states. In North Carolina, the DWQ of the DENR is responsible for permitting and enforcement of the NPDES program. The following facilities have been issued discharge permits for the Nolichucky River watershed in North Carolina (Table 4).

Table 4. NPDES Permitted Dischargers in Nolichucky River Basin (NCDWQ 2003)

Permit #	Facility	County	Type	MGD	Waterbody
NC0082767	Spruce Pine WTP	Mitchell	Minor	none	Beaver Creek
NC0025461	Bakersville WWTP	Mitchell	Minor	0.075	Cane Creek
NC0036421	International Resistive Co., Inc.	Avery	Minor	0.0008	Kentucky Creek
NC0023566	Taylor Togs, Inc.	Yancey	Minor	0.01	Little Crabtree Creek
NC0073695	Silver Bullet, Inc/ convenience store	Yancey	Minor	0.0015	Little Crabtree Creek
NC0000175	Unimin Corp./ Quartz	Mitchell	Major	3.6	N. Toe River
NC0000353	Feldspar Corp./ Spruce Pine	Mitchell	Major	3.5	N. Toe River
NC0000361	Unimin Corp. Schoolhouse quartz	Avery	Major	2.16	N. Toe River
NC0000400	K-T Feldspar Corp.	Mitchell	Major	1.73	N. Toe River
NC0021423	Spruce Pine WTP	Mitchell	Minor	0.6	N. Toe River
NC0021857	Newland WWTP	Avery	Minor	0.32	N. Toe River
NC0082571	New Life Fellowship, Inc	Avery	Minor	0.036	N. Toe River
NC0084620	Unimin Corp—Crystal operation	Mitchell	Minor	0.36	N. Toe River
NC0085839	Unimin Corp—Red Hill Quartz Pr	Mitchell	Minor	0.682	N. Toe River
NC0066729	Mitchell Co School	Mitchell	Minor	0.005	Raccoon Creek
NC0027685	DOC- Avery Correctional Center	Avery	Minor	0.0206	Three Mile Creek
NC0073962	NC DOC Blue Ridge Youth center	Avery	Minor	0.007	Three Mile Creek
NC0066737	Mitchell Co school (Mitchell HS)	Mitchell	Minor	0.0144	UT Cranberry Creek
NC0075647	Hidden Gap mobile home park	Henderson	Minor	0.02	UT Devils Fork
NC0083282	Mt View Motel	Yancey	Minor	0.0025	UT Little Crabtree Creek
NC0075965	Burnsville WTP	Yancey	Minor	0	UT Little Crabtree Creek
NC0033685	Avery Development Corp.	Avery	Minor	0.006	Whiteoak Creek
NC002090	Burnsville WWTP	Yancey	Minor	0.8	Cane River
NC0027898	DOC Yancey	Yancey	Minor	0.0177	UT Cane R.

3.2.4 Non-point Source Pollution

Non-point source (NPS) refers to runoff that enters surface waters through storm water or snowmelt. There are many types of land use activities which are sources of non-point source pollution, including land development, construction activity, animal waste disposal, mining, agriculture, and forestry operations as well as impervious surfaces such as roadways and parking lots. The effects of NPS, particularly from mining and agricultural practices, on water quality in the Nolichucky River Basin were discussed above. Various NPS source management programs have been developed by a number of agencies to control specific types of nonpoint source pollution (e.g. forestry, pesticide, urban, and construction related pollution etc.). Each of these management plans develops BMPs to control the specific type of nonpoint source pollution.

The Sedimentation and Erosion Control Program (SECP) applies to construction activities such as roadway construction, and is established and authorized under the Sedimentation Pollution Control Act of 1973. This act delegates the responsibility of administration and enforcement to the Division of Land Resources (DLR) (Land Quality Section) of DENR. The SECP requires the submission and approval of erosion control plans on all projects disturbing one or more acres prior to construction. On-site inspections by DLR are conducted to determine compliance with the plan and to evaluate the effectiveness of the BMPs which are being used. The NCDOT in cooperation with DWQ has developed a sedimentation control program for highway projects, which adopts formal Best Management Practices for protection of surface waters. Additional erosion control measures as outlined in Design Standards in Sensitive Watersheds (NCAC T15A:04B .0024) are implemented by NCDOT for projects within WS-I, or WS-II water supply watersheds, Critical Areas, waters designated for shellfishing, or any waters designated by DWQ as High Quality Waters (HQWs).

When crossing an aquatic resource containing a federally listed species, NCDOT has committed to implement erosion control guidelines Design Standards in Sensitive Watersheds, regardless of the DWQ classification. These areas are designated as "Environmentally Sensitive Areas" on the erosion control plans.

3.2.5 Ecological Significance

The North Carolina Natural Heritage Program (NHP) maintains a database of rare plant and animal species, as well as significant natural areas, for the state of North Carolina. The NHP compiles the DENR priority list of "Natural Heritage Areas" as required by the Nature Preserves Act (NCGS 113A-164 of Article 9). Natural areas (sites) are inventoried and evaluated on the basis of rare plant and animal species, rare or high quality natural communities, and geologic features occurring in the particular site. These sites are rated with regard to national, state, and regional significance. This list contains those areas which should be given priority for protection; however, it does not imply that all of the areas currently receive protection (NCDWQ 2003). The North Toe River/Nolichucky River Aquatic Habitat is considered to be of "National Significance", and the Cane River Aquatic Habitat is considered to be of "Statewide Significance". In addition to the Appalachian elktoe several other rare aquatic species have been recorded in the Basin (Table 5).

Table 5. Rare Aquatic Species in the Nolichucky River Basin in North Carolina

Scientific Name	Common Name	NC Status	Federal Status
Alasmidonta raveneliana	Appalachian elktoe	E	E
Cryptobranchus alleganiensis	Hellbender	SC	FSC
Etheostoma acuticeps	Sharphead darter	T	None
Etheostoma vulneratum	Wounded darter	SC	None
Lampsilis fasciola	Wavy-rayed lampmussel	E	FSC
Noturus flavus	Stonecat	E	None
Percina burtoni	Blotchside logperch	E	FSC
Percina squamata	Olive darter	SC	FSC

E, T, FSC, SC and SR denote Endangered, Threatened, Federal Species of Concern, Special Concern and Significantly Rare receptively.

3.3 SPECIES DESCRIPTION – Appalachian Elktoe

Brief descriptions of characteristics and habitat requirements for the Endangered Appalachian elktoe are provided below.

APPALACHIAN ELKTOE (*Alasmidonta raveneliana*) (Lea 1834)

Status: Endangered
Family: Unionidae
Listed: September-03-1993

3.3.1 Characteristics

Isaac Lea (1834) described the Appalachian elktoe from the French Broad River system in North Carolina. Its shell is thin, but not fragile, oblong and somewhat kidney-shaped, with a sharply rounded anterior margin and a broadly rounded posterior margin. (Parmalee and Bogan 1998) site a maximum length of 80 mm. However, individuals from the Little River (French Broad River Basin) in Transylvania County and West Fork Pigeon River (French Broad River Basin) in Haywood County measured in excess of 100 mm in length (personal observations). The periostracum (outer shell) of the Appalachian elktoe varies in color from dark brown to yellowish-brown in color. Rays may be prominent in some individuals, usually on the posterior slope, and nearly obscure in other specimens. The nacre (inside shell surface) is a shiny bluish white, changing to salmon color in the beak cavity portion of the shell. A detailed description of the shell characteristics is contained in Clarke (1981). Ortmann (1921) provides descriptions of the soft anatomy.

Until recently, little was known about the reproductive biology of the Appalachian elktoe; however nearly all freshwater mussel species have similar reproductive strategies, which involves a larval stage (glochidium), that becomes a temporary obligatory parasite on a fish. Many mussel species have specific fish hosts that must be present to complete their life cycle. Based upon laboratory infestation experiments (Watters 1994.) lists the banded sculpin (*Cottus carolinae*) as the potential fish host for the Appalachian elktoe, however, the ranges of these species rarely overlap. Keller documented transformation of Appalachian elktoe glochidia on the mottled sculpin (*Cottus bairdi*) in 1999 (USFWS 2002), and ongoing research at Tennessee Technical University identified 10 fish species with encysted Appalachian elktoe glochidia from the Little Tennessee River in North Carolina (Jim Layzer, TN Tech. Personal Communication).

Based on over two years of ongoing monitoring of the Appalachian elktoe population in the Little Tennessee River by the North Carolina Wildlife Resources Commission (NCWRC), it is apparent that the Appalachian elktoe is a bradytictic (long-term) breeder, with the females retaining glochidia in their gills from late August to mid-June (Steve Fraley NCWRC, personal communication). Glochidia are released in mid June attaching to either the gills, or fins of a suitable fish host species, and encysting within 2-36 hours. Transformation time (time until excystment) for the Appalachian elktoe occurs within 18-22 days, at a mean temperature of 18°c degrees (Jim Layzer, Tn Tech, personal communication). Encystment time for freshwater mussels is reduced at higher temperatures (Zale and Neves, 1982). McMahon and Bogan (2001) and Pennak (1989) should be consulted for a general overview of freshwater mussel reproductive biology.

3.3.2 Distribution and Habitat Requirements

Two populations of the Appalachian elktoe were known to occur when the species was listed in 1993: the Nolichucky River (including its tributaries of the Cane River and the North Toe River), and the Little Tennessee River and its tributaries. The record in the Cane River was represented by one specimen found just above the confluence with the North Toe River. Since listing, the Appalachian elktoe has been found in additional areas. These occurrences include extensions of the known ranges in the Nolichucky River (North Toe River, South Toe River and Cane River) and Little Tennessee River (Tuckaseegee River and Cheoah River) as well as a rediscovery in the French Broad River Basin (Pigeon River, Little River, Mills River and main-stem French Broad River). Many of these "newly discovered" populations are relatively small in size and range. The Appalachian elktoe has been observed in gravelly substrates often mixed with cobble and boulders, in cracks of bedrock, and in relatively silt-free, coarse sandy substrates (USFWS 1996).

Distribution in the Nolichucky River Basin

At the time of listing in 1993, the Appalachian elktoe population in the Nolichucky River Basin appeared to be restricted to scattered pockets within a short reach of the North Toe River in Yancey and Mitchell Counties in North Carolina and the main stem of the Nolichucky River in North Carolina extending downstream into the vicinity of Erwin, Unicoi County, Tennessee (USFWS 1996). A comprehensive and cooperative mussel survey effort was undertaken between 2000-2003 by the NCWRC, NCDOT, NHP, and USFWS throughout the upper Nolichucky River system in Yancey, Mitchell, and Avery Counties, North Carolina. The primary goal for these surveys was re-assessment of Appalachian elktoe population status. Many areas in the Nolichucky River system had not been surveyed since the early or mid 1990's. The NCWRC and the USFWS efforts are part of their continuing cooperation to monitor populations of federally listed endangered and threatened species under Section 6 of the Endangered Species Act. The NCDOT also needed updated survey information to assess potential impacts from a number of highway construction projects planned or proposed within the Nolichucky River Basin (Fraley and Simmons 2004). The survey efforts indicate that at least 73 miles of stream in the Nolichucky River system are presently occupied by the Appalachian elktoe; an apparent 15 miles increase from reported occupied habitat prior to 2000 (Fraley and Simmons 2004). This current range is more than twice the range when the species was listed. These surveys also indicate that mussel populations appear to be growing in numbers as well. Sites where mussels were found during 2000-2003 produced higher catch per unit effort (CPUE) than the nearest sites sampled prior to 2000 (Fraley and Simmons 2004).

As part of this comprehensive survey effort during 2000-2003, as well as part of the Section 7 Consultation process, surveys were conducted at the two bridge crossings addressed in this BA on September 09, 2002. A total of 11 Appalachian elktoe and 2 wavy-rayed lampmussel were found at the NC 197 (B-1443) crossing in 4 person-hours of survey time for a Catch Per Unit Effort (CPUE) of 2.75/hr for the Appalachian elktoe, and a total of 15 Appalachian elktoe and 2 wavy-rayed lampmussel were found at the SR 1304 (B-2828) in 3.5 person-hours of survey time (CPUE for Appalachian elktoe = 4.28/hr). The survey limits at these sites were confined to the areas immediately under the existing bridges, as pervious surveys documented the species occurrence at these sites. The highest CPUE for Appalachian elktoe during the comprehensive surveys in the basin were 16/hr (total of 96 individuals), at a site in the South Toe River (Fraley and Simmons 2004).

Previously, freshwater mussel surveys were conducted at the two bridge sites on July 24, 1996 by Tim Savidge, then of NCDOT using mask/snorkel. Surveys were conducted from a point approximately 400 meters downstream to 100 meters upstream of the existing bridges. A total of 7 Appalachian elktoe (2.33/hr) and 2 wavy-rayed lampmussel were found in 3 person hours of survey time at the B-2848 site and 5 Appalachian elktoe (2/hr) and 2 wavy-rayed lampmussel in 2.5 person-hours at the B-1443 site. Comparison of the CPUE from the 1996 and the 2002 surveys at the two bridge sites demonstrates the higher CPUE of surveys conducted after the year 2000 compared to prior surveys in similar areas.

Mussel surveys were conducted in 2002 by USFWS, NCWRC and NCDOT personnel in habitats in close proximity to the existing bridges. The purpose of these surveys was to identify potential relocation sites. Neither the exact locations, nor the results of these surveys were recorded.

3.3.3 Threats to Species (particularly the Nolichucky River Population)

The decline of the Appalachian elktoe throughout its historic range has been attributed to a variety of factors, including sedimentation, point and non-point source pollution, and habitat modification (impoundments, channelization, etc.). With the exception of the Little Tennessee River and the Nolichucky River populations, all of the other populations are generally small in numbers and restricted to short reaches of isolated streams.

The low numbers of individuals and the restricted range of many of the surviving populations make them extremely vulnerable to extirpation from a single catastrophic event or activity. Catastrophic events may consist of natural events such as flooding, or drought as well as human influenced events such as toxic spills associated with highways or railroads.

The Appalachian elktoe population in the Nolichucky River Basin is large enough (at least 73 miles) and is dispersed well upstream into major tributaries (South Toe River, Cane River, North Toe River) such that a single catastrophic event like a chemical spill is not likely to cause extinction from the river basin. However, an event such as this would obviously adversely affect the continued recovery of the Appalachian elktoe in the Nolichucky Basin that has apparently been occurring since the 1990s.

The Nolichucky River Basin, as did most of western North Carolina, experienced catastrophic flooding in late summer 2004, as a result of Tropical Storms Charley, Ivan and Jean. The effects of these flooding events on the Appalachian elktoe populations are not known at this time, and may take several years to fully assess. However, biologists with the NC Wildlife Resources Commission (WRC) observed numerous dead mussels, including the Appalachian elktoe, in over-wash areas along the Little Tennessee River after the flood events. Additionally, surveys conducted after the flooding yielded apparently lower CPUE of live mussels, including the Appalachian elktoe, compared to past survey efforts in this section of the river (Steve Fraley, NCWRC personal communication).

Siltation resulting from improper erosion control of various types of land usage, including agricultural, forestry, and development activities has been recognized as a major contributing factor to degradation of mussel populations (USFWS 1996). Siltation has been documented to be extremely detrimental to mussel populations by degrading substrate and water quality, increasing potential exposure to other pollutants, and by direct smothering of mussels (Ellis 1936; Markings and Bills 1979) Sediment accumulations of less than 1 inch have been shown to cause high mortality in most mussel species (Ellis 1936). The abrasive action of sediment on mussel shells has been shown to cause erosion of the outer shell, which allows acids to reach and corrode underlying layers (Harman 1974). The soils in the Nolichucky River Basin are considered to be some of the most erodable soils in the state. The generally steep topography in the watershed increases the erosion potential.

The impact of impoundments on freshwater mussels has been well-documented (USFWS 1992 a; Neves 1993). Construction of dams transforms lotic habitats into lentic habitats, which results in changes in the aquatic community composition. These changes associated with inundation adversely affect both adult and juvenile mussels, as well as fish community structure, which could eliminate possible fish hosts for glochidia (Fuller 1974)). In addition, the construction of dams often results in fragmentation of mussel populations by effectively blocking upstream expansion and recruitment of mussel and fish species. The population of the Appalachian elktoe in the Little Tennessee is believed to have been reduced by the Fontana Lake and Lake Emory impoundments (USFWS 1996).

In addition to modification of habitat, the construction of dams can indirectly impact freshwater mussel species by posing a barrier to fish migration.

Sewage treatment effluent has been documented to significantly affect the diversity and abundance of mussel fauna (Goudreau et al. 1988). Goudreau et al. (1988) found that recovery of mussel populations might not occur for up to two miles below points of chlorinated sewage effluent. Most of the water bodies where the Appalachian still exists have relatively few point source discharges within the watershed and have been rated as having good to excellent water quality (NCDWQ 2003, USFWS 1996). The Town of Burnsville's Waste Water Treatment Plant discharges into the Cane River. This is the only facility in the subbasin required to perform whole effluent toxicity testing. The DWQ reports that the facility "is currently meeting all its permit limits" (NCDWQ 2003).

The introduction of exotic species such as the Asiatic clam (*Corbicula fluminea*) and zebra mussel (*Dreissena polymorpha*) has also been shown to pose significant threats to native freshwater mussels. The Asiatic clam is now established in most of the major river systems in the United States (Fuller and Powell 1973), including the Nolichucky Basin, where it is abundant in some areas (personal observations). Concern has been raised over competitive interactions for space, food, and oxygen with this species and native mussels, possibly at the juvenile stages (Neves and Widlak 1987; Alderman 1995). When it was listed, it was speculated that due to its restricted distribution, the Appalachian elktoe "may not be able to withstand vigorous competition" (USFWS 1996).

The zebra mussel, native to the drainage basins of the Black, Caspian, and Aral Seas, is an exotic freshwater mussel that was introduced into the Great Lakes in the 1980s. Since its introduction, this species has rapidly expanded its range into the surrounding river basins, including those of the South Atlantic slope (O'Neill and MacNeill 1991). This species competes for food resources and space with native mussels and is expected to contribute to the extinction of at least 20 freshwater mussel species if it becomes established throughout most of the eastern United States (USFWS 1996). The zebra mussel is not currently known from any river supporting Appalachian elktoe populations.

3.3.4 Critical Habitat Designation

Critical Habitat for listed species consists of: (1) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of Section 4 of the ESA, on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species and (b) which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. Critical habitat for the Appalachian elktoe was designated on 9.27.02 in the Federal Register. Critical habitat has been designated in 144.3 total river miles in 6 distinct units.

1. Encompasses approximately 38.5 km (24 mi) of the main stem of the Little Tennessee River from the Lake Emory Dam in Franklin, Macon County, NC, downstream to the backwaters of Fontana Reservoir in Swain County, NC.
2. Encompasses approximately 41.6 km (26 m) of the main stem of the Tuckaseegee River, from NC State Route 1002 bridge in Cullowhee, Jackson County, NC, downstream to the NC 19 bridge, north of Bryson City, Swain County, NC.
3. Encompasses approximately 14.6 km (9.1 mi) of the main stem of the Cheoah River from the Santeelah Dam downstream to its confluence with the Little Tennessee River, in Graham County, NC.
4. Encompasses approximately 7.5 km (4.7 mi) of the main stem of the Little River (French Broad River Basin) from the Cascade Lake Power Plant, downstream to its confluence with the French Broad River in Transylvania County, NC.
5. Encompasses approximately 17.8 km (11.1 mi) of the main stem of the West Fork Pigeon River (French Broad River Basin) from the confluence with the Little East Fork Pigeon River downstream to the confluence with the East Fork Pigeon River, and the main stem of the Pigeon River from the confluence of the East Fork Pigeon River and West Fork Pigeon River downstream to the NC 215 crossing, south of Canton, Haywood County, NC.
6. Encompasses approximately 5.9 km (3.7 mi) of the main stem of the North Toe River, Yancey and Mitchell counties, NC, from the confluence with Big Crabtree Creek, downstream to the confluence of the South Toe River; approximately 22.6 km (14.1 mi) of the main stem of the South Toe River, Yancey County, NC, from the NC State Route 1152 crossing, downstream to its confluence with the North Toe River; approximately 34.6 km (21.6 mi) of the main stem of the Toe River, Yancey and Mitchell counties, NC, from the confluence of the North Toe River and South Toe River, downstream to the confluence of the Cane River; approximately 26.4 km (16.5 mi) of the main stem of the Cane River, Yancey County, NC, from the NC State Route 1381 crossing, downstream to its confluence with the Toe river; and approximately 21.6 km (13.5 mi) of the main stem of the Nolichucky River from the confluence of the Toe River and the Cane River in

Yancey County and Mitchell County, NC downstream to the US 23/19W crossing, southwest of Erwin, Unicoi County, TN (Figure 1).

When designating Critical Habitat, the USFWS identifies physical and biological features (primary constituent elements) that are essential to the conservation of the species, and that may require special management considerations or protection. The primary constituent elements essential for the conservation of the Appalachian elktoe are:

1. Permanent, flowing, cool, clean water;
2. Geomorphically stable stream channels and banks;
3. Pool, riffle, and run sequences within the channel;
4. Stable sand, gravel, cobble, and boulder or bedrock substrates with no more than low amounts of fine sediment;
5. Moderate to high stream gradient;
6. Periodic natural flooding; and
7. Fish hosts, with adequate living, foraging, and spawning areas for them.

Although there are specific sites within the 6 units that do not contain all of the primary constituent elements, these elements are found consistently throughout the designated river reaches and are present at the sites containing the "healthiest" of the occurrences (USFWS 2002).

3.4 PAST AND FUTURE FEDERAL ACTIONS IN NOLICHUCKY RIVER SUBBASIN

A large number of impacts to the Nolichucky River Basin (mining impacts, urbanization of Burnsville and Spruce Pine etc.), and consequentially the Appalachian elktoe occurred prior to the species being listed in 1993. Since this time federal actions occurring in the Nolichucky River Basin in Yancey and Mitchell counties that could potentially impact the Appalachian elktoe have been subject to Section 7 of the ESA. Below is a summary of past and currently planned Federal Actions that occurred in the Nolichucky River Subbasin that have, or may in the near future impact the Appalachian elktoe population, and/or designated critical habitat in this subbasin. Efforts have been and will be taken by the federal agencies to avoid/minimize, and offset impacts from future projects in this watershed.

3.4.1 NCDOT/FHWA

- B-2081- SR 1338 over North Toe River (Toe River), Yancey/Mitchell County. Occurs within occupied habitat (Critical Habitat); however no individual mussels were found in the project footprint. Critical Habitat was not designated at the time of the Section 7 Consultation. Concurrence of "Not Likely to Adversely Affect" was received. Construction was completed in 1998.
- B-3089-NC 80 over North Toe River, Yancey/Mitchell County. Occurs within occupied habitat (Critical Habitat); however no individual mussels were found in the project footprint. Critical Habitat was not designated at the time of the Section 7 Consultation. Concurrence of "Not Likely to Adversely Affect" was received. Construction was completed in 2002.
- B-4202-SR 1002 over Big Crabtree Creek, Yancey/Mitchell County. Occurs approximately 5.6 miles upstream of occupied Critical Habitat in the North Toe River. Consultation status unknown. Construction scheduled for 2006.

- B-4687-SR 1411 over Little Creek, Yancey County. Occurs approximately 0.6 miles upstream of occupied Critical Habitat in the Cane River. Consultation status: not yet begun. Construction scheduled for 2008.
- B-4848-SR 1128 over Possum Trot Creek, Yancey County. Occurs approximately 0.8 miles upstream of occupied habitat in the Cane River. Consultation status: not yet begun. Construction scheduled for 2010.
- B-4849-SR 1142 over Little Crabtree Creek, Yancey County. Occurs approximately 3.8 miles upstream of occupied Critical Habitat in the South Toe River. Consultation status: not yet begun. Construction scheduled for 2010.
- B-4850-SR 1147 over creek, Yancey County. Occurs approximately 0.9 miles upstream of occupied Critical Habitat in the South Toe River. Consultation status: not yet begun. Construction scheduled for 2010.
- B-4851-SR 1308 over creek, Yancey County. Occurs approximately 0.2 miles upstream of occupied Critical Habitat in the North Toe River. Consultation status :not yet begun. Construction scheduled for 2009.
- B-4852-SR 1323 over Shoal Creek, Yancey County. Occurs approximately 2.7 miles upstream of occupied Critical Habitat in the South Toe River. Consultation status:not yet begun. Construction scheduled for 2010.
- R-2518A, R-2518 B, R-2519 A and R-2519B-US 19 in Madison and Yancey counties and US 19E in Yancey and Mitchell counties. Involves widening of existing US 19 and US 19E from I-26 (US 23) in Madison County east to SR 1336 in Yancey County (R-2518A and R-2518B) and then from SR 1336 in Yancey County to an existing multi-lane section west of Spruce Pine in Mitchell County (R-2519A and R-2519B). The combined length of these two TIP projects, (R-2518 and R-2519) is 29.3 miles. The project involves crossing the Cane and South Toe rivers and multiple tributaries in the Cane, South Toe and North Toe river drainages. NCDOT, on behalf of the USACE and TVA, is in consultation with the USFWS to evaluate adverse direct impacts (loss of individuals and habitat) and indirect impacts (water quality degradation) to the Appalachian elktoe and Designated Critical Habitat. NCDOT is in Consultation

3.4.2 National Resources Conservation Service

The Natural Resource Conservation Service (NRCS) is assisting private landowners with clean-up and stream restoration efforts related to the fall 2004 flooding events caused by Hurricanes Frances and Ivan that occurred throughout western North Carolina including the Nolichucky River Subbasin. Multiple sites within the Nolichucky River Subbasin in Mitchell and Yancey counties have been identified as areas in need of repair. The areas identified are currently unstable due to the resulting severe erosion of river banks and/or the deposition of organic, mineral, and non-native materials that have reduced the hydraulic capacity of the river at these locations. These conditions threaten the stability of properties and structures immediately adjacent to and downstream of their locations. All of the projects addressed propose one or more of the general restoration activities designed to protect existing properties and structures, as follows:

1) Stabilizing degraded river channel through the placement of organic and rock structures.

2) Stabilizing eroded river banks by: removing unstable vegetation; stabilizing toe slopes through the placement of organic and rock structures; backfilling areas above

and behind toe slope structures; and topping areas with planting media and native riparian vegetation.

3) Removing deposits of organic, mineral, and non-native material from areas where the hydraulic capacity of the river channel has been reduced as based on existing cross-section evaluation and regional curves.

4) Softening of over-steepened banks with mechanical equipment and stabilizing with native riparian vegetation.

Although these restoration efforts will provide beneficial impacts to the Appalachian elktoe and Designated Critical Habitat, unavoidable adverse impacts to individual Appalachian elktoe are anticipated at 14 separate locations in the Nolichucky River Subbasin (9 in the North Toe River, 4 in the South Toe River and 1 in the Cane River). The NRCS is in consultation with the USFWS for these projects, and is proposing to relocate mussels from the respective Action Area impact zones to suitable habitat upstream of each restoration site.

4.0 PROPOSED CONSERVATION MEASURES-AVOIDANCE AND MINIMIZATION OF IMPACTS

The following conservation measures are proposed by NCDOT to avoid/minimize potential impacts from construction activities to the Appalachian elktoe. These measures have been incorporated into the design and implementation plans for these bridge replacement projects.

4.1 B-1443

Erosion Control Measures

The areas adjacent to the North Toe River at both bridge replacement projects will be identified as "Environmentally Sensitive Areas" on the Erosion Control Plans for this project. Within the Environmentally Sensitive Areas the following shall apply:

1. Provide a 50-foot Buffer Zone (both sides of stream) which allows clearing but not grubbing until immediately before grading operations.
2. Limit grubbing operations to within 10 days of grading.
3. Erosion and Sediment Control Measures to be installed immediately after clearing.
4. Require "Seeding and Mulching" to be performed immediately following grade establishment.
5. Require "Staged Seeding" –20 foot fill sections or 2 acres, whichever is less.
6. Erosion and Sediment Control Measures must be cleaned out when ½ full.
7. Increase sediment storage capacity by 50% above standard BMP guidelines.

Agency Coordination

NCDOT will invite representatives from the U.S. Fish and Wildlife Service and the North Carolina Wildlife Resources Commission to the pre-construction meeting for these projects, along with all subsequent field inspections prior to construction, to ensure compliance with all special project commitments.

Bridge Drainage

Deck drains will be placed at the ends of the replacement bridge so that no drainage will occur over the North Toe River Channel. Currently drainage from the decks of both the existing structures flows directly into the river. The amount of discharge from the roadway entering the river will be reduced with the new structures. This commitment has been incorporated in the Structure Design Plans for each project.

Preconstruction Survey

NCDOT conducts final surveys (just prior to construction) in the project footprint of projects impacting waters known to contain protected mussel species. NCDOT is anticipating that Appalachian elktoe will be found in surveys of the project footprint and is proposing to relocate these mussels to appropriate upstream habitat. The preconstruction survey is incorporated into the mussel relocation plan for these bridges (See Sec. 6.1).

4.2 B-2848

HIGHWAY DIVISION 13, HYDRAULICS UNIT, STRUCTURE DESIGN UNIT

In order to avoid and minimize environmental impacts associated with the replacement of Bridge No. 143, all standard procedures and measures, including NCDOT's Best Management Practices for Protection of Surface Waters and the Tennessee Valley Authority's (TVA) Water Management Standard Conditions will be strictly enforced during the construction stage of the project. Provisions to preclude contamination by toxic substances during the construction interval will also be strictly enforced.

1. In addition to NC DOT Best Management Practices, the contractor must submit a bridge demolition plan for approval by the Resident Engineer and the Bridge Construction Engineer prior to beginning bridge removal. Since some bridge debris may enter the water, the contractor must submit a work plan sealed by a PE registered in North Carolina and that *follows the guidelines provided in the Plan for Removal of Existing Structures that is included in the Biological Assessment for this project, attached to this Consultation.* The contractor's work plan will detail the maximum amount of the bridge that can be safely removed dropping minimal portions into the water. Also, this plan will not allow the use of explosives and will detail the methods to be used to retrieve and dispose of any components of the existing bridge dropped into the water. The volume of structural material to be retrieved from the existing bridge will be approximately 150 cubic yards (114.61 cubic meters).

2. Construction will be accomplished so wet concrete does not contact water entering or flowing in the river. Demolition of the existing structure will be completed such that minimal debris from the existing deck enters the river. Any debris or construction material that falls into the river will be removed immediately.

3. No deck drainage will be allowed to enter into the water, and every effort will be made to minimize the overall footprint of bents, any scour problems, and any debris accumulation associated with the project.

Roadway Design Unit, Project Development and Environmental Analysis Branch, Roadside Environmental Unit, Highway Division 13, Structure Design Unit

1. Upon completion of the project the existing approach fill will be removed to natural grade and the area will be planted with native grasses and tree species such as Bluegrass or as recommended by Roadside Environmental landscape plans. Should the contract for such plantings expire during the summer, landscaping should extend into the planting season, which continues through December.

2. Activities in the flood plain will be limited to those needed to construct the proposed bridge and remove the existing bridge. Areas used for borrow or construction by-products will not be located in floodplains.

3. Every effort will be made to minimize work pads in the flood plain.

HIGHWAY DIVISION 13, HYDRAULICS, PD&EA, STRUCTURE DESIGN UNIT

1. NCDOT will coordinate with the U.S. Fish and Wildlife Service to incorporate sufficient measures and monitoring, as required, in addition to those listed below, to avoid impacts to the endangered Appalachian Elktoe mussel (Alasmidonta raveneliana).

2. All Elktoe mussels found may be removed prior to construction with approval from the US Fish and Wildlife Service. In water construction may be subject to a moratorium.

3. The NCDOT Project Development and Environmental Analysis Branch and the U.S. Fish and Wildlife Service will be invited to the pre-construction conference to discuss with the contractor the provisions of the Endangered Species Act of 1973 and penalties for violation of the Act.

4. Stringent erosion control measures included in the Division of Water Quality's High Quality Waters Erosion Control Guidelines will be implemented during all construction activities.

5. Riparian vegetation will be maintained wherever possible, especially large trees.

6. If riparian areas are disturbed, they will be revegetated with native species as soon as possible after construction.

7. Prior to construction the contractor will be required to give notification of the construction initiation date to the U.S. Fish and Wildlife Service, N.C. Wildlife Resources Commission, and the Tennessee Valley Authority.

8. Pre-let surveys will be performed at the bridge for occurrence of the Appalachian Elktoe (Alasmidonta raveneliana).

9. The North Toe River contains a significant small mouth bass fishery in the area of the project; North Carolina regulations entitled Design Standards in Sensitive Watersheds shall be implemented during the design and construction of this project, as applicable. A letter of notification, with reference to impacts to small mouth bass water habitat, will be provided to the U.S. Army Corps of Engineers - Asheville Regulatory Field Office and the N.C. Wildlife Resources Commission (WRC) office prior to construction of the project. An in water work moratorium will be enforced from May 1st to June 1st in order to protect this small mouth bass fishery.

10. Due to the presence of the migratory birds in the vicinity of the existing bridge, construction should be planned to occur after the nesting season. Alternatively, netting to prevent swallows from nesting prior to the beginning of construction activities may be utilized in accordance with the Migratory Bird Treaty Act and after PDEA/ONE coordination with the US Fish and Wildlife Service.

5.0 IMPACT ANALYSIS- APPALACHIAN ELKTOE

Potential project-related impacts to the Appalachian elktoe and designated Critical Habitat for this species are considered here. Direct, indirect and cumulative impacts as defined in 50 CFR 402.02 are analyzed.

5.1 Direct Impacts

Direct impacts refer to consequences that are directly attributed to the project. Direct impacts associated with road construction include but are not limited to land clearing, loss of habitat, stream rechannelization, hydrologic modification, and erosion.

Potential direct impacts to mussel species associated with transportation projects include; substrate disturbance/loss, siltation, alteration of flows and introduction of toxic compounds.

5.1.1 Loss of Individual Mussels

Individual Appalachian elktoe mussels occur within the construction footprint of the replacement structures as well as the various causeways required for construction of the new structures and demolition of the existing structures. These losses will occur within the construction footprint and extend downstream 80 meters and upstream 20 meters. The 100 meter area around the construction footprint of anticipated loss is consistent with salvage efforts to relocate mussels at construction sites in North Carolina as well as other states. Potential impacts to individual mussels occurring beyond the 80 meters downstream and 20 meters upstream are not anticipated to be significant enough to warrant moving mussels beyond these points.

The losses of individual Appalachian elktoe at these 2 sites are not expected to adversely impact the overall population within the Nolichucky River Subbasin, as this species occupies a range of at least 73 miles in the subbasin and numerous other locations throughout the subbasin have comparable or even greater numbers of mussels (Fraley and Simmons 2004, Tim Savidge personal observations). The relocation of these mussels to the upstream limits within the North Toe River, may help facilitate continued upstream recruitment in the river and help bolster population numbers in the upper limits of the range.

5.1.2 Substrate Disturbance/Placement of fill into the North Toe River

B-1443: The construction of B-1443 will result in the placement of permanent and temporary fill into the North Toe River. The following direct impacts to the river are anticipated as a result of construction:

- Permanent fill (piers) – 57.0 ft^2 (5.3 m^2)
- Temporary fill (rock causeways to construct piers) - 4,972 ft^2 (462 m^2)
- Temporary fill (rock causeways for bridge removal) - 3,993 ft^2 (371 m^2)

Total Surface water fill: 57.0 ft^2 (5.3 m^2) of permanent fill and 8,965 ft^2 (833 m$^{2)}$ of temporary fill.

B-2848: The construction of B-2848 will result in the placement of permanent and temporary fill into the North Toe River. The following direct impacts to the river are anticipated as a result of construction:

- Permanent fill (piers) - 32 ft^2 (3 m^2)
- Temporary fill (rock causeways to construct piers) - 15,551.0 ft^2 (1,445 m^2)
- Temporary fill (rock causeways for bridge removal) - 1,786 ft^2 (166 m^2)

Total surface water fill: 32 ft^2 (3 m^2) of permanent fill and 17,337 ft^2 (1,611 m^2) of temporary fill.

There will be a combined permanent loss of 89.0 ft^2 (8.3 m^2) habitat at the two sites. It is unclear whether the substrate will be suitable for mussels at the location of the existing piers, once they are removed.

The combined temporary loss of habitat from the construction/demolition causeways is 26,302 ft^2 (2444 m^2). Although impacts to the streambed from the work bridges are temporary, it is unclear if these impacts are temporary from the standpoint of mussel recruitment. Substrate compaction from this type of temporary fill may occur, possibly creating unsuitable habitat for mussels. However, given the amount of bedrock at, or near the substrate surface in these locations, substrate compaction is not likely.

5.1.3 Erosion and Sedimentation

The detrimental effects of siltation on aquatic species have been discussed earlier. Suspended solids, sedimentation and turbidity result in reduced biodiversity as well as a decline in productivity at all trophic levels (Gilbert 1989). Because of the topography and the erodable nature of the soils in the project area, project construction has the potential to result in sedimentation in the North Toe River. To eliminate/minimize the potential for sedimentation the NCDOT has developed specific erosion control measures for this project designed to protect environmentally sensitive areas (See Sec. 4.1.1). Although there are no practical erosion control measures that can totally eliminate the chance for sedimentation from a project site, if the Erosion Control Plans are properly incorporated into project construction and strictly adhered to, adverse effects to the aquatic habitat of the Nolichucky River from erosion and sedimentation should be minimal.

5.1.4 Alteration of Flows/Channel Stability

Geomorphically stable stream channels and banks are a primary constituent element essential for the survival and conservation of the Appalachian elktoe. Stream channel instability can directly result from bridge construction. Natural stream stability is achieved when the stream exhibits a stable dimension, pattern, and profile such that over time, the channel features are maintained, and the channel neither aggrades, nor degrades. Channel instability occurs when scour results in degradation, or when sediment deposition leads to aggradation (Rosgen and Silvey 1996). The placement of fill, such as bridge piers and causeways into streams can alter the normal flow pattern of a water body by reducing flow velocities upstream, thus increasing sedimentation and flow velocities downstream resulting in scour and erosion.

The locations and designs of the two new crossings were developed to minimize the amount of in-stream piers. The new structures will have fewer piers in the river than the existing structures. Reducing the number of piers in the river will lessen the impact of the crossings on normal stream flow. With the presence of the rock line at the bed surface at Bridge Number 143 (B-2848), and close to the surface at Bridge Number 61 (B-1443) scour potential is low at these sites. Stream bottom and stream bank stability will be monitored before, during, and after construction at both bridge sites (See Sec. 6.10).

Temporary construction causeways will be used at both construction sites. The temporary construction/demolition causeways used for these projects were designed to result in the least amount of fill into the river as is practical.

The placement of causeways in the river will also constrict flows, thus creating higher velocities downstream. The use of full pipes in the causeway will help to maintain linear flow. Causeway construction will be phased at both bridge replacement sites. The phasing of the causeway construction will limit the amount of causeway in the river at any one time and at no time will the causeway extend the entire width of the river. At the narrowest point, 52% of the river channel width will remain open at the Bridge Number 143, (B-2848) site, and 50% open at the Bridge Number 61 (B-1443) site. The predominance of bedrock in the North Toe River limits the potential for significant scour of the riverbed to occur. The effects of increased velocities on channel stability are expected to be minimal and temporary; reverting to normal conditions once the causeways are removed.

Stream bottom and stream bank stability will be monitored before, during, and after construction (See Sec. 6.10) at both bridge sites. If any problems with regards to stream stability are detected during the monitoring, NCDOT will take immediate actions to correct the problems.

5.1.5 Roadway Runoff Impacts

Numerous pollutants have been identified in highway runoff, including various metals (lead, zinc, iron, etc.), sediment, pesticides, deicing salts, nutrients (nitrogen, phosphorus), and petroleum hydrocarbons (Yousef et al. 1985; Gupta, Agnew et al. 1981). The sources of these runoff constituents range from construction and maintenance activities, to daily vehicular use. Hoffman et al. (1984) concluded that highway runoff can contribute up to 80% of the total pollutant loadings to receiving water bodies. Petroleum hydrocarbons, polycyclic aromatic hydrocarbons, lead, and zinc were some of the pollutants identified in this study.

The toxicity of highway runoff to aquatic ecosystems is poorly understood. A major reason for this poor understanding is a lack of studies focusing solely on highway runoff. Potential impacts of highway runoff have often been inferred from studies conducted on urban runoff, however, the relative loadings of pollutants are often much greater in urban runoff, because of a larger drainage area and lower receiving water dilution ratios (Dupuis et al. 1985). The negative effects of urban runoff inputs on benthic macroinvertebrate communities have been well documented (Garie and McIntosh. 1986; Jones and Clark 1987; Field and Pitt 1990). Lieb (1998) found the macroinvertebrate community of a headwater stream in Pennsylvania to be highly degraded by urban runoff via a detention pond. Improvements were observed at continual distances downstream from the discharge point, however all sites examined were still impaired compared to a reference community.

The few studies that examined actual highway runoff show that some species demonstrate little sensitivity to highway runoff exposure, while others are much more sensitive (Dupuis, Kobriger et al. 1985). Maltby, Boxall et al. (1995) found elevated levels of hydrocarbons and metals in both stream sediments and the water column below a heavily traveled British motorway. They demonstrated that the benthic amphipod (*Gammarus pulex*) experienced a decrease in survival when exposed to sediments contaminated with roadway runoff. However, this species showed no increase in mortality when exposed to water contaminated with roadway runoff. Unfortunately, most of these studies only measured acute toxicity to runoff and did not examine long-term impacts.

The effects of highway runoff on freshwater bivalves have not been studied extensively. (Augspurger 1992) compared sediment samples and soft tissues of the common eastern elliptio (*Elliptio complanata*) upstream and downstream of the I-95 crossing of Swift Creek in Nash County, North Carolina. The sediment samples as well as the mussels (n = 3) exhibited higher levels of aliphatic hydrocarbons, arsenic, lead, zinc, and other heavy metal contaminants in the downstream samples. Because of the small sample size the effect on the health of these mussels was not studied. NCDOT recently funded a 2-year study that investigated the impacts of highway runoff on the health of freshwater mussels. Contaminant analysis of stream sediments showed an increase of polycyclic aromatic hydrocarbons and some metals downstream of road crossings, although there was no direct correlation found between increasing contaminant levels and decreasing mussel abundances at these crossings (Levine, Bogan et al. 2004). The common eastern elliptio was the only mussel species that was found in large enough numbers for statistically valid comparisons. The eastern elliptio is generally considered to be more tolerant of water quality degradation than many other mussel species, such as members of the genus *Alasmidonta*. Further research is needed before the effects on highway runoff on sensitive mussel species such as the Appalachian elktoe can be determined.

The storm water coming off of the two bridges will not directly enter into the North Toe River. It will be directed into catch basins and will then sheet flow through vegetated buffers (Appendix B). Storm water coming off of approaching roadway in these locations will be managed in a similar manner. (Finley and Young 1993) found grassy swales to be an effective means of pollutant removal from storm water. Upon the completion of these two projects there will be a reduction in the amount of roadway runoff directly entering the river.

5.2 Indirect Impacts

Indirect impacts are those effects that are caused by or will result from the proposed action and are later in time but are still reasonably certain to occur [50 CFR 402.02]. These types of impacts can include natural responses to the proposed action's direct impacts or can include human induced impacts associated with the proposed action.

5.2.1 Disruption of Fish Migration

In addition to the direct impacts of causeway construction that were discussed above, another concern with causeway construction is the potential for the causeway to act as a barrier to fish migration. Disruption of fish migrations can indirectly affect freshwater mussels if the fish that are disturbed serve as fish hosts for the mussel species, and are infested with glochidia (juvenile mussels) at the time when their migration patterns are disrupted. The temporary duration of the causeways and the partial width causeway design, which ensures that at least 50% of the river channel will remain open during the life of the causeways, is not expected to permanently interfere with normal migration of any fish species in the North Toe River.

Temporary disruptions to the normal migration of individuals of some fish species may occur while the causeway is constructed and in place. Individual fish may be restricted, or deterred from swimming upstream of the causeways, however, these temporary disruptions to the fish behavior are not expected to significantly affect the survival of transforming Appalachian elktoe as there is ample habitat downstream of the causeways for transformed mussels. Additionally, temporary restriction of individual fish from habitat upstream of the causeways will not impact the distribution of the Appalachian elktoe upstream of the causeway impact areas, as all of the identified potential fish host species that occur in the North Toe River, are widely distributed throughout the river. Quantifying the impacts of the causeways on glochidia transformation would be very difficult, and require intensive fish sampling and examination. Such an analysis may also have more of an adverse impact on Appalachian elktoe glochidia than the actual impacts of fish migration disruption that may occur from the causeways.

5.2.2 Project-induced Changes in Land Use

Project-induced changes in land use are also considered indirect impacts. These types of land use changes are not direct consequences of the road construction, but result from modifications in access to parcels of land and from modifications in travel time between various areas (Mulligan and Horowitz 1986).

Both projects involve replacement of existing structures in essentially the same locations. The new structures are not intended, or expected to increase accessibility to the adjacent lands, nor are they expected to result in changes in the type or volume of traffic using the structures. Although the existing 1-lane Bridge No. 143 (B-2848) will be replaced with a wider 2-lane structure, thus allowing larger trucks more room to negotiate the sharp turns at each end of the bridge, this increased width is not expected to foster land development. The curves at each end of the existing bridge are negotiable (although with some difficulty) by vehicles that are able to negotiate the winding approach roads on both sides of the river (Doug McNeil NCDOT Division 13 District Engineer personal communication, personal observations). Additionally, an existing 2-lane bridge occurs approximately 3 RM upstream near Relief on SR 1338, which would allow construction vehicles access to the same areas accessed by Bridge No. 143, as would the existing bridge along NC 197.

5.2.3 Toxic Spill Inputs

One other indirect effect that roadway crossings of water bodies can have on the aquatic environment is the potential for toxic spills once the facility is in operation. The elimination of drop inlets with the new structures will lessen the potential for toxic spills entering the river at these two locations. Hazardous spill catch basins are not proposed for these two bridge replacement projects, as a closed drain system will be used on both replacement structures.

5.3 **Cumulative Impacts**

Cumulative Impacts are those effects of future state or private activities, not involving federal activities, which are reasonably certain to occur within the action area of the proposed federal action.

As discussed earlier the Nolichucky River Basin has experienced water quality degradation from past mining and agricultural practices. This degradation undoubtedly adversely impacted the aquatic fauna of the watershed, including the Appalachian elktoe. Given the dynamic nature of riverine habitats, and the large amount of land area encompassed in a watershed, it is virtually impossible to eliminate all potential impacts to the aquatic species in these habitats. However, aquatic species can be conserved with environmentally sound land use in the respective watershed. As a result of an overall improvement of land-use practices in recent years, overall water quality has improved in the Nolichucky River Basin. Due in part to the improving water quality, the Appalachian elktoe population in the Nolichucky River Basin appears to be viable and expanding. The recent (summer-fall 2004) catastrophic flooding in this region may have adversely impacted the Appalachian elktoe population in the basin; however, given the expansive range and apparent health of the population prior to these events, it is unlikely that the flooding will affect the population's future viability.

Infrastructure projects such as water and sewer service have the potential to stimulate land development and directly or indirectly result in impacts to the Appalachian elktoe and it's Designated Critical Habitat. Water and sewer services are planned to be extended from Burnsville to Spruce Pine along US 19E and from Micaville to Bakersville along NC 80. The extension of these services could lead to development of residential communities. Within the Cane River watershed, a 300-unit private Mountain Air Country Club was built off of Phipps Creek Road just west of the Cane River, and a proposed 40-unit affordable housing development is proposed on the north side of US 19 E in Burnsville near Mt. Heritage High School. In Mitchell County just north of Spruce Pine approximately 2,000-5,000 acres within the North Toe River drainage area owned by Penland Bailey Corporation is being divided into one half to two acre lots, with some of the lots bordering the North Toe River. Another development to be patterned after the Mountain Air Country Club is proposed near Altapass in Mitchell County, also within the North Toe River watershed.

The construction of residential developments of this nature has the potential to adversely affect water quality in a variety of ways. Houses, driveways, and access roads increase the amount of impervious surface area within a watershed. Applications of pesticide and fertilizer to lawns can ultimately reach waters. In particular golf course development communities such as the ones mentioned above have the potential to impact surface and ground water quality. Turf grass associated with golf courses are the most intensively managed biotic system in metropolitan landscapes (Shuman et al. 2000), with continual applications of various pesticides, herbicides and fertilizers. Concentration of these compounds in adjacent water bodies via movement from runoff, or leaching is reportedly low in some studies (Harrison et al. 1993), and much higher in others (Smith and Bridges 1996, Mallin and Wheeler 2000 and Lewis et al. 2001). Shuman et al. (2000) found that it may take 20-50 days for various fertilizers to appear in leachate, depending on fertilizer source and rainfall. These findings may suggest that concentrations of certain compounds are underestimated in studies that have shorter monitoring periods following application. Winter et al. found significant differences in the benthic macroinvertabrate community in streams associated with golf courses compared to reference forested streams, with the streams associated with forested habitats containing more species intolerant species (EPT species discussed above in Sec.) compared to streams associated with golf courses.

The East Yancey Water and Sewer District has applied for an NPDES permit to develop a facility to discharge 0.125 million gallons per day (mgd) of treated domestic wastewater into the South Toe River (draft permit #@ NC0087891). This application states an anticipated need for future increase of the mgd at this facility as part of the county plans to extend water and sewer services to accommodate anticipated development.

In addition to the impacts associated with the bridge replacement projects addressed in this BA, other impacts to the Appalachian elktoe population in the Nolichucky River Basin have occurred and will continue to occur. These types of impacts are difficult to identify or quantify, but may include sedimentation/erosion impacts from agricultural and residential land use, water quality impacts (fertilizers, pesticides etc) from agricultural and residential sources, small-scale littering into the river, impacts from recreational uses of the river (fisherman stepping on individual mussels, or using mussels as bait etc.), and others, all of which could adversely impact individual mussels, or habitat. These potential impacts are expected to be localized and small in size and their cumulative effect is not likely to be large enough to cause serious declines to the overall population.

NCDOT is not aware of any other major projects planned in the action areas that would threaten the viability of the Appalachian elktoe population in the Nolichucky River Basin, however localized land-use impacts such as agricultural practices or illegal pollution (dumping into river etc.) may occur in the watershed that could result in small-scale adverse impacts to the species. Conservation and protection of riparian habitats in the watershed will help to alleviate some of the cumulative impacts affecting this species (See Sec. 6.9)

5.4 Summary of Impacts: Appalachian elktoe

5.4.1 Direct impacts

The construction of the two bridge projects will result in combined permanent loss of 89 ft^2 (8.3 m^2) and a temporary loss of 26,302 ft^2 (2,444 m^2), or 0.6 acres of occupied habitat. The combined temporary loss of habitat from the construction/demolition causeways is 26,302 ft^2 (2443.5 m^2). The temporary loss of habitat may have long-lived effects on the Appalachian elktoe's re-colonization of the impacted habitat.

The combined permanent and temporary loss of habitat, as well as the construction activities taking place in the river will result in the loss of individual Appalachian elktoe mussels. NCDOT is proposing to relocate as many individuals from the impact area as possible to help to offset these impacts (See Sec. 6.1). The losses of individual Appalachian elktoe at these 2 sites are not expected to adversely impact the overall population within the Nolichucky River Subbasin.

Adverse impacts to the Appalachian elktoe and its habitat resulting from project-related sedimentation/erosion are expected to be minimal. Erosion control standards will be strictly enforced by NCDOT to ensure that these potential impacts are minimal. Enforcement will involve various levels of quality control above and beyond what is implemented on standard NCDOT projects (See Sec. 6.11).

The reduction in the number of piers in the North Toe River is expected to reduce the bridge-effects on stream-flow patterns at the respective bridge sites. The temporary causeways proposed at both project sites may result in small-scale localized changes in flow patterns at the respective sites. However, these changes will be temporary (during the life of the respective causeways) and are not expected to result in significant impacts to the Appalachian elktoe and its habitat.

The elimination of drop inlets at the two new bridges will provide a reduction of roadway runoff into the North Toe River. The elimination/reduction of runoff to the North Toe River will result in a decrease of daily pollutant loads to the North Toe River. This may result in localized improvement of water quality, and thus have a beneficial effect on the Appalachian elktoe. In addition, the elimination of drop inlets will lessen the likelihood of hazardous spill materials entering the river.

5.4.2 Indirect Impacts

Indirect impacts to the Appalachian elktoe resulting from the proposed action are expected to be minimal. The construction of the two bridges is not expected to result in channel instability, and thus habitat degradation, over time. The construction practices, particularly the temporary causeways, are not expected to affect the distribution of Appalachian elktoe in the river. Additionally, the replacement projects are not expected to induce any changes in land use practices within the action area that may adversely affect the Appalachian elktoe.

5.4.3 Cumulative Impacts

The proposed actions will result in adverse, direct impacts to the Appalachian elktoe (discussed in Section 5.4.1). Other small-scale impacts to the species may also occur within the project action areas. These impacts are difficult to predict or quantify but may include sedimentation/erosion impacts from agricultural and residential land-use, localized water quality impacts from agricultural and residential lands, small-scale littering into the river, impacts from recreational uses of the river (fisherman stepping on individual mussels, or using mussels as bait, etc.) and other unforeseen impacts, all of which could adversely impact individual mussels, or habitat. These potential impacts are expected generally to be localized, small in size, and even when added together are likely not of a magnitude to cause serious declines to the overall population, which as stated above has expanded in recent years. Conservation and protection of riparian habitats in the watershed (See Sec. 6.9) will help to alleviate the effects of potential cumulative impacts within the project action areas.

5.5 Summary of Impacts: Designated Critical Habitat

5.5.1 Direct Impacts

The permanent and temporary loss of habitat discussed in Section 5.4.1 occurs within designated Critical Habitat for the Appalachian elktoe (Unit 6). This combined loss of habitat (permanent and temporary for both bridges) is relatively small compared to the amount of available habitat occurring in the 69.4 river miles (111.1 km) comprising Unit 6. This loss of habitat is not expected to impact the Critical Habitat for the Appalachian elktoe to the point that conservation values are compromised, nor will it eliminate the primary constituent elements from the impacted river reaches.

5.5.2 Indirect Impacts

Indirect impacts to Critical Habitat for the Appalachian elktoe (Unit 6) resulting from the proposed action are expected to be minimal. The construction of the two bridges is not expected to result in channel instability or habitat degradation over time. Additionally, the replacement projects are not expected to induce any changes in land use practices within the action area. The primary constituent elements of the Designated Critical Habitat within the action areas, including fish host species, will not be eliminated by any indirect impacts associated with the proposed projects.

5.5.3 Cumulative Impacts

The proposed actions will directly result in adverse impacts to the Appalachian elktoe (see Section 5.5.1). Other small-scale impacts to the species may also occur within the project action areas. These impacts are difficult to predict or quantify but may include sedimentation/erosion impacts from agricultural practices, small-scale littering into the river, impacts from recreational uses of the river (fisherman stepping on individual mussels, or using mussels as bait, and others, all of which could adversely impact individual mussels, or habitat. These potential impacts are expected to be localized, and small in size.

The cumulative effects of project-related impacts added with other potential small-scale localized impacts in the action area are not expected to impact the Critical Habitat for the Appalachian elktoe (Unit 6) to the point that conservation values are compromised, nor will they eliminate the primary constituent elements from the impacted river reaches.

6.0 CONSERVATION MEASURES TO REDUCE THE AMOUNT OF "TAKE"

There are a number of conservation measures that can be taken to reduce the amount of take to the Appalachian elktoe as a result of project construction. Potential opportunities have been discussed between the USFWS, FHWA, NCWRC and the Project Development & Environmental Analysis Branch of NCDOT. The NCDOT proposes the following measures to help offset the impacts from the two projects and provide protective measures from the impacts to the Appalachian elktoe population within the project action areas.

6.1.1 Mussel Relocation

Mussel surveys have confirmed that individual Appalachian elktoe mussels occur within the action area for both of these projects. In addition, the wavy-rayed lampmussel has also been documented at these sites. NCDOT is proposing to remove all individual mussels from the impact sites (as determined by NCDOT and approved by USFWS and NCWRC) and relocate them to suitable locations in the river outside of the potential impacted area (approved by USFWS and NCWRC).

Freshwater mussels have often been relocated to mitigate impacts from in-stream construction activities, with varying degrees of success (Dunn et al. 2000, Cope and Waller 1995). Cope and Waller (1995) revealed that mortality of relocated mussels was >70% in 30% of the relocation studies reported in the literature, with mortality exceeding 90% mortality in some projects. Several factors can be attributed to the successful relocation of freshwater mussels. The most important stream attributes to consider include size, substrate stability, hydrology and riparian vegetation (Cope et al. 2003, Morris and Corkum 1996, DiMaio and Corkum 1995, Lewis and Riebel 1984, Strayer 1983, Vannote and Minshall 1982). Vaughn (1977) suggested that most riverine unionids are located in areas with stable substrate but with the current substantial enough to keep fine silts and sand from depositing. This observation is consistent with the conditions in which mussels were found in the Nolichucky River Subbasin by TCG June-July 2005.

Relocation methods must be developed to minimize stress caused by handling and movement of the mussels (Cope et al. 2003, Cope and Waller 1995). Dunn et al. (2000) noted that the use of personnel experienced in handling mussels is crucial to insure the proper placement of the animals back in the substrate. In addition, avoiding extreme temperatures, and keeping the animals moist are also critical considerations for a successful relocation (Dunn 1994). Minimizing the amount of aerial exposure increases the chance of survival of relocated mussels (Dunn et al. 2000). Waller et al. (1995) reported a decreasing trend of survival of relocated mussels with increased duration of exposure.

Carefully planned and implemented relocation plans can lead to success. For instance, Watson (2002) reported that only 3 *Elliptio* Complex mussels out of 334 relocated in North

Carolina were found dead on the two week monitoring date. The small amount of mortality observed was attributed to predation and it was surmised that this mortality did not result from stress.

6.1.2 Relocation Methods

NCDOT proposes the following plan to relocate all mussels, including the Appalachian elktoe from the footprints and extending downstream 80 meters and upstream 20 meters of the two bridge replacement projects addressed in this BA. The following methods were developed based on recommendations outlined by Dunn et al 2000), from procedures developed by the North Carolina Wildlife Resources Commission (NCWRC) (Watson 2002), and from experiences with other freshwater mussel relocation efforts (The Catena Group Inc.). These procedures were developed in order to relocate freshwater mussels in such a way as to reduce stress and minimize the risk of injury while the species are in transit. If at any time during the relocation it is determined that these procedures are not meeting the stated objectives, then in cooperation with the NCWRC and the USFWS, more stringent methods may be developed to insure the mussels are relocated successfully. Relocation efforts will be carried out under the direct supervision of The Catena Group.

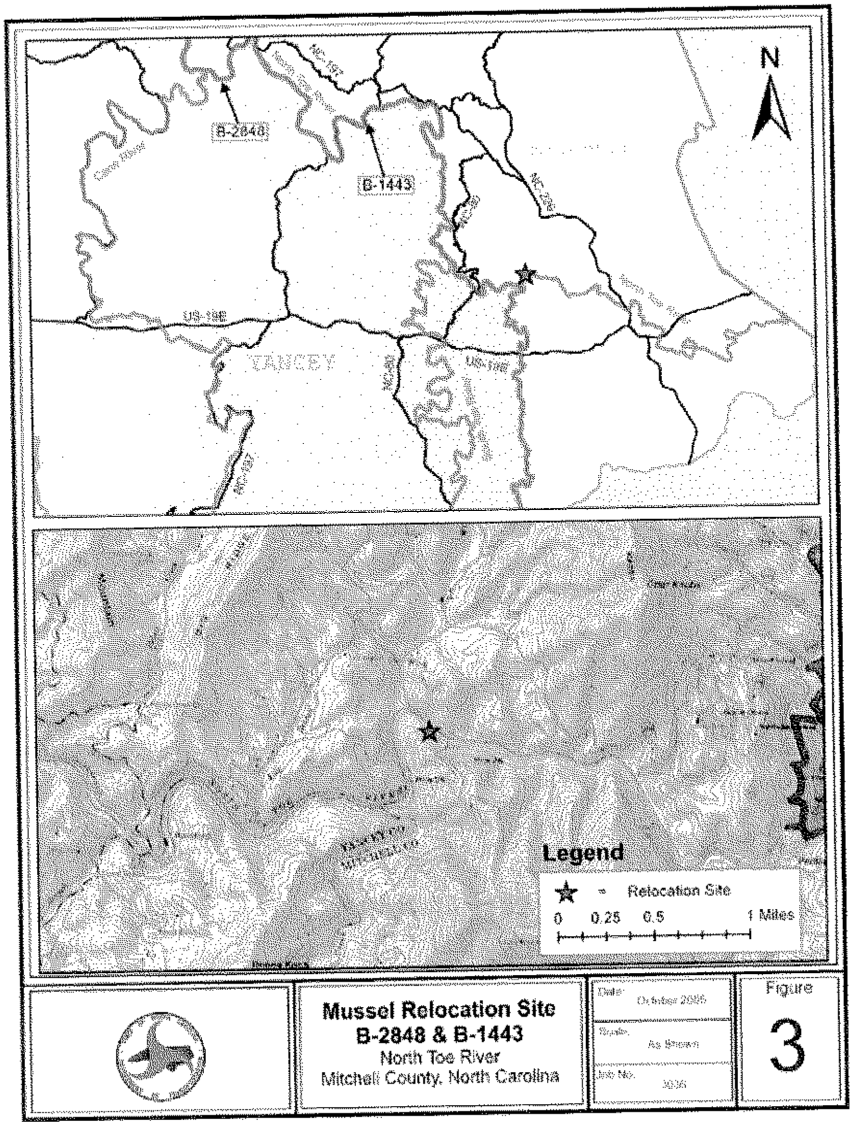
6.1.3 Selection of Relocation Sites

Initially plans to relocate mussels from the two impact sites focused on finding suitable relocation sites in close proximity to the two bridges. An alternative recommendation was made by the NCWRC Aquatic Non-Game Coordinator Steve Fraley for NCDOT to pool the mussels found at the two bridge replacement sites and move them to suitable habitat within the upstream limits of their distribution. As discussed earlier (Sec. 3.3.2), the Appalachian elktoe is believed to have increased its population size and range in the Nolichucky River Basin in recent years. Concentrating mussels in a location within the upper limits of its distribution, where numbers are currently very low, may help facilitate the continued up-river recruitment trend. The USFWS and NCDOT Natural Systems concurred with this recommendation.

On August a cooperative effort to locate a suitable relocation site was made. Persons involved in this search included Steve Fraley, Jeff Simmons, Jonathan Hartsell and Daniel Bell of the NCWRC, John Fridell of the USFWS, Dennis Herman, Mike Sanderson and Chris Manley of NCDOT Natural Systems Unit and Tim Savidge of the Catena Group Inc. Potential sites were selected based on existing habitat conditions, including substrate suitability, hydraulic refugia, stream bank stability, and the presence of freshwater mussels.

The selected site occurs along the right descending bank of the North Toe River, between Penland and Boonford, at approximately RM 25.5 (Figure 3). The vegetated banks on this side of the river consist of a moderate 30-35 feet) size buffer of trees and shrubs between the river and the existing railroad bed running parallel to the river. The site occurs in a 10 meter (33 feet) wide by 20 meter (66 feet long shallow run between the river bank and a small (6 meter long) cobble-gravel island in the channel. The head of the island creates an eddy which provides hydraulic refugia for the mussels. The substrate is dominated by cobble, gravel, and sand. One gravid Appalachian elktoe was found in 12 person hours of searching in this general location. The low CPUE (0.08/hr) is likely the result of much of that survey time being spent in the center of the channel in high velocity areas that are generally of poor habitat quality for the Appalachian elktoe. The habitat at the selected area for mussel relocation, where the 1 Appalachian elktoe was found, is of high quality. Mussels relocated into this area are expected to survive, thus accomplishing the goal of augmenting the existing low numbers-population in this reach of the river.

Figure 3. Mussel Relocation Site for B-1443 and B-2848



6.1.4 Collection of Mussels at Impact Site

All individual Appalachian elktoe found in the project footprints will be relocated to the relocation site approved for each restoration project. The salvage area will consist of the section of the river that will be directly disturbed by construction procedures (actively eroding river bank) and extend 20 meters upstream of the project area and 80 meters downstream. In addition to the Appalachian elktoe, the state Special Concern wavy-rayed lampmussel (*Lampsilis fasciola*) may also occur in the project areas. All freshwater mussels found at the impact site will be relocated to the sites chosen.

It is proposed that two visual-survey sweeps of each restoration site, as previously defined, be conducted to salvage freshwater mussels from the anticipated impact area(s). The type of visual method used (mask/snorkel, batiscope, SCUBA, etc.) will be determined during the salvage effort and will be based on depth, flow, visibility and temperature. A minimum of a 6-person crew will perform the relocation. Dunn et al. stressed the importance of personnel experienced with handling freshwater mussels in successful relocation projects. The relocation crew will be supervised by one lead technical specialist, and all of the personnel used will be experienced with handling freshwater mussels. A review/training session will be conducted prior to beginning the relocation efforts to insure each member of the relocation team is properly briefed and understands their respective roles in the operation.

Hand collecting of mussels will be performed by the surveyors spread out across the river beginning at the downstream end of the salvage area and proceeding upstream. Each crew member will carry dive mesh bag to place the mussels into. After the sweep of the salvage area has been performed, the mussels collected will be carried to the banks for data recording.

A final preconstruction survey will be conducted at the respective salvage areas for the two bridge sites. The pre construction survey will occur 1 month prior to initiation of in-stream construction activities. If any mussels are found during this survey, they will be relocated to the selected relocation site, and processed as described above.

6.1.5 Data Processing

All mussels will be measured (mm) and tagged and then placed in mesh dive bag and kept in shaded portion of the river until ready for transport. All mussel species will be tagged on both valves. Numerous relocation projects report scrubbing mussels with burlap to remove any algae, mud, or other debris and then drying to apply tags. This creates additional stress on the mussels, and does not appear to be necessary. Tags have been successfully applied to un-cleaned, moist mussels in other areas of North Carolina (Personal observations). Mussels will be kept as moist as possible while measuring and affixing the tags to avoid unnecessary stress. The tags (Hallprint Tags) are made of polyethylene, oval in shape, and approximately 9 mm long by 4 mm wide. Each tag is colored (e.g., green) and also has a unique 4-character code, which begins with a letter followed by 3 numbers. The tags will be applied to the mussels using Instant Krazy Glue© or another quick dry epoxy. Once the adhesive is dry, the mussels will be placed back into the stream in the designated mesh bags. This procedure will be repeated until all the collected mussels are tagged and measured and ready for transport. Each individual mussel will be kept out of the water for a period less than 5 minutes for data recording and tagging.

6.1.6 Transportation to Relocation Site

After the animals are collected from their source area, they will be transported to the selected relocation site. The first method merely involves layering the mussels in damp burlap within 10-gallon coolers, or other appropriate containers. Pieces of burlap soaked in the stream and will be placed in the coolers. The tagged mussels will then be placed on top of the damp burlap so no mussels are stacked on each other. A maximum of 50 mussels will be placed in each cooler with about 3 to 4 layers per cooler.

6.1.7 Preparation of Relocation Site

Monitoring survival of relocated mussels is a crucial component of a mussel relocation plan, in order to gauge the success of the relocation as a conservation measure. Therefore it is necessary to monitor the survival of resident mussels in the relocation plot and compare their survival rates to the mussels that have been relocated from the bridge sites. After the relocated mussels are brought to the relocation site, resident mussels in the site will be collected. The relocated mussels will be kept in the river while this is being done. The 1-m^2 squares will be placed across the downstream boundary of the relocation site. All mussels will be collected (surface visual collection) from within the squares, measured and tagged. Relocated and resident mussels will then be placed by hand into the substrate within the numbered squares. The number (resident and relocated) of each mussel species placed in each square will be recorded. Density of each species within the 1-m^2 square will not be increased by more than 3 times. Cope et al. (2003) demonstrated that increasing the density of mussels 2-3 times did not adversely affect survival rates. The number of mussels placed into each 1-m^2 square will be dependent on the number of mussels collected at the salvage sites. This method of collecting and tagging resident mussels and placing relocated mussels into the 1-m^2 squares will continue upstream until all squares (except for 3 control squares) within the grid are sampled. Three randomly selected squares will serve as controls to assess natural mortality. Resident mussels will not be disturbed in these squares.

6.1.8 Monitoring

The relocation sites will be monitored for recovery, survival (of recovered mussels) and movement 1 month after the all mussels have been removed from the defined salvage areas. One month after relocating the mussels, visual surveys for mussels will be conducted at the relocation site. Mussels observed at the surface will be taken from the substrate and recorded and placed back into the squares they were taken from. This initial survey will be conducted to record any mortality that would result from the handling of mussels. Excavation of the grid will not be performed to avoid additional stress on the mussels and to maintain substrate stability. Visual surveys will also be conducted in a 10m x 10 m area downstream of the relocation grid to record any mussels moving out of the grid. The relocation sites will be monitored for recovery, survival (of recovered mussels), movement and growth for a period of 5 years. All tagged mussels recovered during the yearly monitoring surveys will be collected, measured and returned to the 1-m^2 square it was collected from. Data will be recorded as before.

6.1.9 Riparian Habitat Protection

The role of forested riparian buffers on the protection of aquatic habitats is well documented (NCWRC 2002); and references therein). Some functions provided by riparian buffers are pollutant reduction and filtration, primary source of carbon for aquatic food web, stream channel stability and maintenance of water and air temperature. Numerous studies have developed recommended widths of buffers to maintain these functions. These widths vary greatly depending on the parameter or function that was evaluated. The NCWRC recommends a 200-foot native, forested buffer on perennial streams and a 100-foot forested buffer on intermittent streams in watersheds that support federally endangered and threatened aquatic species (NCWRC 2002). The Recovery Plan for the Appalachian elktoe (USFWS 1996) identifies establishment of stream buffer zones as a major Recovery Task (Task 1.4).

NCDOT has initiated a watershed search for potential riparian properties within the North Toe River. Potential restoration/enhancement and preservation sites have been targeted. The reach between the two bridge projects has been the primary focus of the search. Currently the following four sites have been identified as possible preservation opportunities (North Toe River Buffer Feasibility Study):

- Littleton Site: 2.8 acres, 1,200 linear feet (one side), 100 foot buffer
- Freund Site: 3.3 acres, 1,600 linear feet (one side) varying (100 foot maximum) buffer
- Binham Family Farm Site: 5.17 acres, 2,260 linear feet (one side), 100 foot buffer
- McCarty/Prisco Site: 15.6 acres, 4,576 linear feet (one side), 100 foot buffer

Total stream impacts (estimated in linear feet (l.f.)) of both projects are approximately 600 l.f. (100 l.f. downstream + 25 l.f. upstream + 25 l.f. width of causeway = 300 l.f. per bridge x 2 bridges = 600 l.f.). NCDOT proposes to acquire at least 3,000 l.f. of preservation from one or more of these sites.

The goal of purchasing these properties is to provide permanent protection of these riparian habitats, which in turn will benefit the Appalachian elktoe and help maintain the essential primary constituent elements within designated Critical Habitat for the species.

6.1.10 River Geomorphology Monitoring

As discussed above, construction of the two bridges will have a very low potential to result in significant changes to channel stability (scour, erosion, etc). To confirm this, NCDOT is planning to perform river channel monitoring at the proposed construction sites. This monitoring will also help to evaluate the impacts of construction on habitat in the North Toe River.

Buck Engineering has been retained by NCDOT to perform this analysis. They will conduct on-site surveys to document the existing channel condition at the two bridge relocation projects. This scope of work includes mapping of the channel bed, cross-sections, longitudinal profiles, bed material analyses, Bank Erodibility Hazard Index (BEHI) estimates, and photographs. The results of the surveys will be compiled into a report to be submitted to NCDOT.

The goal of this project is to document the existing morphological condition at the two bridge relocation projects.

1. Existing Condition Surveys

<u>1.1 Mapping of Channel Bed Topography</u> – Staff will conduct a topographic survey of the stream channel bed 50 feet upstream and 50 feet downstream of the bridge, including the area underneath the bridge. Special attention will be given to scour areas that result from bridge supports. The surveys will collect points from left top of bank to right top of bank and will map

out the location of bridge supports. The survey will be conducted such that an accurate 3-dimensional representation of the stream bed can be produced from the collected data.

In addition, cross-sections of the channel will be taken every 20 feet below the bridge for a distance of 200 feet. This information will be used along with the more detailed mapping to create a longitudinal profile for the surveyed reach.

For the two relocation sites, cross-sections will be taken every 10 feet for a distance of 100 feet, with the relocation area (15 meters long) centered within the surveyed length.

1.2 Substrate Analyses -- For each of the two impact reaches and two relocation reaches, the zig-zag pebble count procedure will be used to determine the grain size distribution for each reach. A total of 400 counts per reach will be sampled. For the impact sites, one pebble count will be conducted for the reach from 50 feet upstream to 50 downstream of the bridge, and a second pebble count will be conducted for the 200 foot reach downstream of the bridge.

1.3 BEHI Estimates – BEHI estimates will be conducted for both banks of the surveyed stream reaches, as described in section 1.1.

1.4 Photographs – Photographs will be taken of the stream banks, streambed, and bridge structures to visually document the condition of the sites.

2. Data Reporting

2.1 Production of Data Graphs and Base Mapping – The survey information collected will be processed into graphs and base mapping. The graphs and maps produced will be included in the Appendix of the report, described below. NCDOT will be supplied with electronic copies of all data. Survey data will be provided in Microstation format.

2.2 Summary Report – A summary report will be provided to NCDOT that describes the purpose of the project, methodology used in collecting the data, and hard copies of graphs and mapping that was produced from the surveys.

2.3 Project Management and Administration – The Buck Engineering project manager (PM) will direct and manage the performance of the work among members of the project team. The PM will provide the NCDOT project manager with monthly progress reports and invoices.

6.1.11 Erosion Control Practices/Habitat Monitoring

NCDOT has developed erosion control measures for these two projects specifically to protect the Appalachian elktoe and its habitat. Inspection of erosion control devices are done on a daily basis by the Construction Project Inspector positioned in the District Office in which the project occurs. The Roadside Environmental Branch of NCDOT also has Area Field Operations Engineers that perform compliance inspections of the erosion control devices a minimum of twice a month during the life of a project. These inspections are generally more frequent on projects within an endangered species habitat. In addition to these levels of inspection, NCDOT will implement another layer of quality control regarding erosion control supplementary to other project commitments. An Environmental Specialist with the ONE Biological Surveys Unit will perform periodic site inspections of the erosion control measures at the respective construction sites. This person will also be making qualitative assessments of the North Toe River habitat at the construction sites. These visits will be unannounced and directly in relationship to rain events whenever possible.

7.0 DETERMINATION OF EFFECTS-APPALACHIAN ELKTOE & CRITICAL HABITAT

7.1 DETERMINATION OF EFFECTS-APPALACHIAN ELKTOE

The replacement of the two bridges discussed in this Biological Assessment will result in both adverse and beneficial effects to the Appalachian elktoe in the North Toe River (Unit 6 Designated Critical Habitat). As summarized in Section 5.4.1, the potential adverse effects include loss (take) of individuals and habitat from the two project locations in the North Toe River, as well as the low to moderate potential for short-term erosion/sedimentation and channel instability impacts addressed above. Considerations to avoid and minimize impacts to the North Toe River, and thus the Appalachian elktoe were taken during the planning and design phases for both of these projects. Measures will also be taken during the construction phases of these projects to minimize impacts.

The combined impacts to the habitat and the individual mussels at these two sites are considered to be fairly small compared to the extensive amount of occupied habitat in the Nolichucky River Basin (~73 miles). Although the individual Appalachian elktoe mussels occurring in the two action areas will technically be lost (taken) from the population, the proposed mussel relocation will help to offset these losses by giving these mussels a chance of survival by moving them to appropriate habitat outside of the project action areas, and likely facilitating the continued upstream recruitment into suitable habitats within the North Toe River.

The purchase and protection of riparian habitats within the action area watershed will serve to offset some of the potential current and future cumulative impacts that will affect the Appalachian elktoe.

7.2 DETERMINATION OF EFFECTS-CRITICAL HABITAT

The replacement of the two bridges discussed in this Biological Assessment will result in both adverse and beneficial effects to the Critical Habitat in the North Toe River (Unit 6 Designated Critical Habitat). As summarized in Section 5.4.1, the potential adverse effects include loss of habitat from the two project locations in the North Toe River, as well as the low to moderate potential for short-term erosion/sedimentation and channel instability impacts addressed above. Considerations to avoid and minimize impacts to the North Toe River, and thus the Critical Habitat were taken during the planning and design phases for both of these projects. Measures will also be taken during the construction phases of these projects to minimize impacts.

The combined impacts to the Critical Habitat at these two sites are considered to be fairly small compared to the extensive amount of occupied habitat in the Nolichucky River Basin (~73 miles). The purchase and protection of riparian habitats within the action area watershed will serve to offset some of the potential current and future cumulative impacts that will affect the Appalachian elktoe and its Critical Habitat.

8.0 OTHER FEDERALLY PROTECTED SPECIES IN THE PROJECT COUNTIES

The USFWS maintains a list of Federally Protected Species occurrences for each county in North Carolina. There are a total of 14 species listed for Mitchell and Yancey counties (Table 8).

Table 6. Federally Protected Species in Mitchell and Yancey Counties*

Scientific Name	Common Name	County	Status
Alasmidonta raveneliana	Appalachian elktoe	Mi, Ya	E
Clemmys muhlenbergii	Bog turtle	Mi, Ya	T/SA
Corynorhinus townsendii virginianus	Virginia big-eared bat	Ya	E
Puma concolor couguar	Eastern cougar	Ya	E
Geum radiatum	Spreading avens	Mi, Ya	E
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	Mi, Ya	E
Gymnoderma lineare	Rock gnome lichen	Mi, Ya	E
Hedyotis purpurea var. montana	Roan mountain bluet	Ya	E
Liatris helleri	Heller's blazing star	Mi	T
Microhexura montivaga	Spruce-fir moss spider	Mi, Ya	E
Myotis sodalis	Indiana bat	Mi	E
Solidago spithamea	Blue Ridge goldenrod	Mi	T
Spiraea virginiana	Virginia spiraea	Mi, Ya	T

E - Denotes Endangered (a species that is threatened with extinction throughout all or a significant portion of its range).
T - Denotes Threatened (a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range).
T S/A - Denotes Similarity of Appearance (a species that is listed as threatened due to similarity of appearance with other rare species).
*as adapted from February 25, 2003 USFWS federally protected species by county list

The proposed bridge replacement projects are both expected to result in adverse impacts to the Appalachian elktoe. These likely impacts were discussed above. The other 15 species are not expected to be adversely impacted by the proposed actions.

8.1 Species Descriptions

Brief descriptions of characteristics and habitat requirements for each of the listed species are provided below, along with a Biological Conclusion concerning potential impacts for each species by the proposed project. The NC-NHP database of protected species was consulted prior to the field visits. No records of any of these species occur within the project action areas.

8.1.1 Clemmys muhlenbergii *Bog turtle*

Status: Threatened (S/A)
Family: Emydidae
Listed: November 4, 1997

The bog turtle is distinguished from other turtles by its small size and the bright orange or yellow blotch on each side of its head. The bog turtle is a small semi-aquatic reptile, measuring 7.5-11.4 cm in length, with a weakly keeled, dark brown carapace and a blackish plastron with lighter markings along the midline. This species exhibits sexual dimorphism; the males have concave plastrons and longer, thicker tails, while females have flat plastrons and shorter tails. The bog turtle is found in the eastern United States, in two distinct regions. The northern population, in Massachusetts, Connecticut, southern New York, New Jersey, Pennsylvania, Maryland, and Delaware is listed as Threatened and protected by the Endangered Species Act. The southern population, occurring in Virginia, North Carolina, South Carolina, Tennessee, and Georgia is listed as Threatened Due to Similarity of Appearance.

Preferred bog turtle habitat consists of fens, sphagnum bogs, swamps, marshy meadows and pastures. Areas with clear, slow-flowing water, soft mud substrate, and an open canopy are ideal. Clumps of vegetation such as tussock sedge and sphagnum moss are important for nesting and basking. This species hibernates from October to April, hiding just under the frozen surface of mud. The diet consists of beetles, moth and butterfly larvae, caddisfly larvae, snails, nematodes, millipedes, seeds, and carrion (Nemuras 1967).

Mating takes place in May and June, and the female deposits the clutch of 2-6 eggs in a sedge tussock, a clump of sphagnum moss, or loose soil about a month after mating. The eggs hatch in 42-56 days. A female may not nest every year and probably only produces one clutch per reproductive year. The primary threats to the bog turtle are loss of habitat (from increased residential and commercial development as well as draining, clearing, and filling wetlands) and illegal collecting for the pet trade. Nest predation and disease may also play a role in the population decrease (USFWS 1992 b).

The bog turtle is listed as T/SA, which is not subject to the provisions of Section 7. Potential impacts to this species were not evaluated.

8.1.2 Corynorhinus townsendii virginianus *Virginia big-eared bat*
Status: Endangered
Family: Vespertilionidae
Listed: November 30, 1979

The Virginia big-eared bat is most easily recognized by its large ears and large glandular masses on its muzzle. The ears are held erect when the bat is awake and are curled around the head when it is hibernating or at its summer roost. The fur on Virginia big-eared bats is long and soft, it is brown in color and darker on the dorsal side. The hair on the feet does not extend beyond the toes.

Virginia big-eared bats occupy caves in the summer and winter. Hibernating colonies are typically located in deep cave passage ways that have stable temperatures and air movement, the temperature in these hibernacula may be lower than that tolerated by other bats. Roost sites are generally located in mines or caves in oak-hickory forests. They will use alternate roost sites but there is no record of long migrations. They are nocturnal and leave their roost to forage on moths, beetles, and other insects (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for the Virginia big-eared bat. There are no caves located near the bridge. A search of the NHP database found no occurrence of the Virginia big-eared bat in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.3 Puma concolor cougar *Eastern cougar*
Status: Endangered
Family: Felidae

Listed: June 4, 1973

Cougars are tawny colored with the exception of the muzzle, the backs of the ears, and the tip of the tail, which are black. In North Carolina the cougar is thought to occur in only a few scattered areas, possibly including coastal swamps and the southern Appalachian Mountains. The eastern cougar is found in large remote wilderness areas where there is an abundance of the white-tailed deer, their primary food source. Cougars usually occupy ranges of 25.0 miles and are most active at night (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for the eastern cougar. The project area is characterized by residential, agricultural, and other disturbed areas. A search of the NHP database found no occurrence of the eastern cougar in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.4 Glaucomys sabrinus coloratus *Carolina northern flying squirrel*

Status: Endangered
Family: Sciurdiae
Listed: July 1, 1985

The Carolina northern flying squirrel has a large well furred flap of skin along either side of its body. This furred flap of skin is connected at the wrist in the front and at the ankle in the rear. The skin flaps and its broad flattened tail allow the northern flying squirrel to glide from tree to tree. It is a solely nocturnal animal with large dark eyes.

There are several isolated populations of the northern flying squirrel in the western part of North Carolina, along the Tennessee border. This squirrel is found above 1517 m (5000 ft) in the vegetation transition zone between hardwood and coniferous forests. Both forest types are used to search for food and the hardwood forest is used for nesting sites (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for the Carolina northern flying squirrel. The project areas are characterized by agricultural and rural residential areas at elevations of approximately 671 m (2200 ft) for B-1443 and 620 m (2040 ft) for B-2848 respectively. The Carolina northern flying squirrel is found in habitats above 1,517 m (5,000 ft). A search of the NHP database found no occurrence of the Carolina northern flying squirrel in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.5 Microhexura montivaga *Spruce-fir moss spider*

Status: Endangered
Family: Dipluridae
Listed: February 6, 1995

The spruce-fir moss spider occurs in well-drained moss and liverwort mats growing on rocks or boulders. These mats are found in well-shaded areas in mature, high elevation (> 1524 m/5000 ft) Fraser fir and red spruce forests. The spruce-fir moss spider is very sensitive to desiccation and requires situations of high and constant humidity. The need for humidity relates to the moss mats which cannot become too parched or else the mats become dry and loose. The moss mats cannot be too wet either because large drops of water can also pose a threat to the spider. The spider constructs its tube-shaped webs in the interface between the moss mat and the rock surface. Some webs have been found to extend into the interior of the moss mat. No prey has been found in the webs, but the probable prey for the spruce-fir moss spider are the abundant springtails found in the moss mats (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for the spruce-fir moss spider. There are no well-shaded areas of mature Fraser fir and red spruce forest near the two bridge replacement projects. A search of the NHP database found no occurrence of this species in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.6 Myotis sodalist *Indiana bat*
Listed: Endangered
Family: Vespertilionidae
Listed: 1967

The Indiana bat is medium in size (7 to 9 g) with dull grayish chestnut colored fur with pinkish to cinnamon underparts. This species is very similar to the little brown myotis (*Myotis lucifugus*) except that the heel of the foot (calcar) of the Indiana bat is strongly keeled. The Indiana bat breeds on the ceilings of large rooms near cave entrances. Mating takes place at night during the first ten days of October. During the winter, the bats hibernate in limestone caves which have a temperature of 2.7 to 6.1°C (37 to 43°F) and 87 % humidity. The bats hang from the ceiling in tight clusters. The hibernating colonies disperse in late March. Females give birth to a single new offspring in June, usually under loose tree bark in wooded streamside habitat. Development to the flying stage and independent feeding usually takes about one month.

Indiana bats feed on insects, preferring the orders Hymenoptera (bees and wasps), Homoptera (cicadas), and Coleoptera (beetles). The bats forage in the air near the foliage of riparian and floodplain trees. The ideal foraging habitat is along a riparian corridor with a width of at least 30 m (98 ft) of woody vegetation on each bank (USFWS 1992 b).

Biological Conclusion: No Effect

No hibernating habitat exists in the project area for the Indiana bat. The project area is characterized by agricultural and residential areas. Trees will presumably be cut, but it is extremely unlikely that any maternity colonies would be present in areas that are primarily open and frequently disturbed. Foraging habitat may exist along the riparian corridor, however, a search of the NHP database found no occurrence of the Indiana bat in the project vicinity. If the Indiana bat utilizes this area for foraging, construction of the bridge should have little effect, as the bats can forage upstream or downstream of the project. It can be concluded that the project will not impact this endangered species. Additionally, the Mitchell county record for Indiana bat is a winter record only; therefore tree cutting should not be an issue.

8.1.7 Geum radiatum *Spreading avens*
Status: Endangered
Family: Rosaceae
Listed: April 5, 1990

Spreading avens is a perennial herb having stems with an indefinite cyme of bright yellow radially symmetrical flowers. Flowers of spreading avens are present from June to early July. Spreading avens has basal leaves which are odd-pinnately compound; terminal leaflets are kidney shaped and much larger than the lateral leaflets, which are reduced or absent.

Spreading avens is found only in the North Carolina and Tennessee sections of the Southern Appalachian Mountains. Spreading avens occurs on scarps, bluffs, cliffs and escarpments on mountains, hills, and ridges. Known populations of this plant have been found to occur at elevations of 1535.-1541 m (5060-5080 ft), 1723-1747 m (5680-5760 ft) and 1759 meters (5800 ft). Other habitat requirements for this species include full sunlight and shallow acidic soils. These soils contain a composition of sand, pebbles, humus, sandy loam, clay loam, and humus. Most populations are pioneers on rocky outcrops (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for spreading avens. The elevations of the project areas are approximately 671 m (2200 ft) for B-1443 and 620 m (2040 ft) for B-2848 respectively, and known populations occur above 1524 m (5000 ft). A search of the NHP database found no occurrence of spreading avens in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.8 Gymnoderma lineare *Rock gnome lichen*
Status: Endangered
Family: Cladoniaceae
Listed: January 18, 1995

The rock gnome lichen is a squamulose lichen in the reindeer moss family. The lichen can be identified by its fruiting bodies which are born singly or in clusters, black in color, and are found at the tips of the squamules. The fruiting season of the rock gnome lichen occurs from July through September. The rock gnome lichen is a narrow endemic, restricted to areas of high humidity. These high humidity environments occur on high elevation (> 1220 m/ 4000 ft) mountaintops and cliff faces which are frequently bathed in fog or lower elevation (< 762 m/ 2500 ft) deep gorges in the Southern Appalachians. The rock gnome lichen primarily occurs on vertical rock faces where seepage water from forest soils above flows at (and only at) very wet times. The rock gnome lichen is almost always found growing with the moss *Adreaea* in these vertical intermittent seeps. The major threat of extinction to the rock gnome lichen relates directly to habitat alteration/loss of high elevation coniferous forests. These coniferous forests usually lie adjacent to the habitat occupied by the rock gnome lichen. The high elevation habitat occurs in the counties of Ashe, Avery, Buncombe, Graham, Haywood, Jackson, Mitchell, Rutherford, Swain, Transylvania, and Yancey. The lower elevation habitat of the rock gnome lichen can be found in the counties of Jackson, Rutherford and Transylvania (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for rock gnome lichen. The elevations of the project areas are approximately 671 m (2200 ft) for B-1443 and 620 m (2040 ft) for B-2848 respectively, and known populations occur above 1524 m (5000 ft). A search of the NHP database found no occurrence of rock gnome lichen in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.9 Hedyotis purpurea var. Montana *Roan Mountain bluet*
Status: Endangered
Family: Rubiaceae
Listed: April 5, 1990

Roan Mountain bluet is a perennial species with roots and grows in low tufts. Roan Mountain bluet has several bright purple flowers arranged in a terminal cyme that are visible from June to July although best viewing is mid June. This plant can be found on cliffs, outcrops, steep slopes, and in the gravelly talus associated with cliffs. Known populations of Roan Mountain bluet occur at elevations of 1400-1900 m (4600-6200 ft). It grows best in areas where it is exposed to full sunlight and in shallow acidic soils composed of various igneous, metamorphic, and metasedimentary rocks (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for Roan Mountain bluet. The elevations of the project areas are approximately 671 m (2200 ft) for B-1443 and 620 m (2040 ft) for B-2848 respectively, and this species occurs above 1400 m (4600 ft). A search of the NHP database found no occurrence of Roan Mountain bluet in the project vicinity. It can be concluded that the project will not impact this endangered species.

8.1.10 Liatris helleri *Heller's blazing star*
Status: Threatened
Family: Asteraceae
Listed: 1987

Heller's blazing star is a perennial herb with an erect stem growing from a cormlike rootstock. The stiff stems are purple near the base turning to green, and are strongly ribbed and angulate. Both basal and cauline leaves are numerous, decreasing in size upward. The leaves are long and narrow, with those at the base 20 to 30 cm (8 to 12 in) in length. The stems reach up to 40 cm (16 in) in height and are topped by a showy spike of lavender flowers 7 to 20 cm (0.3 to 8 in) long. Flowering occurs from July through September.

Heller's blazing star typically occurs on sandy soil on rocky summits, cliffs, ledges, and rocky habitats at high elevation [1067 to 1829 m (3500 to 6000 ft)]. The plants grow in humus or clay loams on igneous and metasedimentary rock. Soils are generally acidic (pH 4) and shallow. Sites occupied by the Heller's blazing star are generally exposed to full sun (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for Heller's blazing star. The elevations of the project areas are approximately 671 m (2200 ft) for B-1443 and 620 m (2040 ft) for B-2848 respectively, and this species occurs above 1067 m (3500 ft). A search of the NHP database found no occurrence of Heller's blazing star in the project vicinity. It can be concluded that the project will not impact this threatened species.

8.1.11 Solidago spithamaea *Blue Ridge goldenrod*
Status: Threatened
Family: Asteraceae
Listed: 1995

The Blue Ridge goldenrod is a perennial herb with an erect, angled stem 10.2 to 40.6 cm (4 to 16 in) tall. This sparsely to densely pubescent herb arises from a stout, short rhizome. The elliptic leaves are serrate 10 to 25 cm (3.9 to 9.8 in) long. The flowers are yellow and are borne in heads of 20 to 30 flowers in a compact corymb. Flowering occurs during July and August. The Blue Ridge goldenrod occurs at elevations above 1402 m (4600 ft). It is an early successional species which occurs in the crevices of granite outcrops in full sun (USFWS 1992 b).

Biological Conclusion: No Effect

No habitat exists in the project area for Blue Ridge goldenrod. The elevations of the project areas are approximately 671 m (2200 ft) for B-1443 and 620 m (2040 ft) for B-2848 respectively, and this species occurs above 1402 m (4600 ft). A search of the NHP database found no occurrence of Blue Ridge goldenrod in the project vicinity. It can be concluded that the project will not impact this species.

8.1.12 Spiraea virginiana *Virginia spiraea*

Status: Threatened
Family: Rosaceae
Listed: Threatened, June 15, 1990

This shrub has arching and upright stems that grow from one to three meters tall. Virginia spiraea often grows in dense clumps, having alternate leaves, which vary greatly in size, shape, and degree of serration. The leaves are green above and usually somewhat glaucous below. The cream-colored flowers are present from June to July and occur in branched, flat-topped inflorescences. Virginia spiraea is easily located during the late fall while herbaceous growth is minimal and the leaves are down. Virginia spiraea is found in a very narrow range of habitats in the mountains of North Carolina. Habitats for the plants consist of scoured banks of high gradient streams, on meander scrolls, point bars, natural levees, or braided features of lower reaches. The scour must be sufficient to prevent canopy closure, but not extreme enough to completely remove small, woody species. This species occurs in the maximum floodplain, usually at the water's edge with various other disturbance-dependent species. It is most successful in areas with full sunlight, but can survive in shaded areas until it is released from competition (USFWS 1992 b).

Virgina spiraea is sporadically distributed along the lower reaches of the Cane, North Toe, South Toe and main stem Nolichucky Rivers. Within North Carolina, there are a total of 12 spatially distinct extant occurrence sites of Virginia spiraea within the Nolichucky River Subbasin. These occur as follows: three on the South Toe River (NCNHP element occurrence (EO) records 009, 010, and 038), two on the North Toe upstream from its confluence with the South Toe River (NCNHP EO records 020 and 030), three on the North Toe between its confluence with the South Toe and its confluence with the Cane River (NCNHP EO not yet assigned), one on the Cane River near Lewisburg, NC (NCNHP EO record 008), and three on the Nolichucky River proper downstream of Poplar, NC (NCNHP EO records 004, 011, and 012) (Carolyn Wells, USFWS, personal communication). In addition there are three extant occurrences along the Nolichucky River within Tennessee.

Of these known occurrence sites all are considered currently extant, in that when monitored in recent years, individuals were observed to be present. There is one occurrence previously known from the Nolichucky Subbasin in North Carolina that may no longer be present. This record was along Little Rock Creek, a tributary to the North Toe River in Mitchell County (NCNHP EO record 018). Recent searches have been unable to locate this occurrence. Although it has been speculated that the plants at this location may have been relocated as part of a mitigative measure for a bridge replacement or stream restoration measures, this cannot be confirmed (Carolyn Wells, USFWS, personal communication).

Biological Conclusion: Not Likely to Adversely Affect

Suitable habitat exists for this species at both bridge replacement sites. Surveys have been conducted in the project area during the NEPA planning document phase of this project on September 9, 2002, by Tim Savidge. Additional surveys were conducted in the project impact areas of B-1443 and B-2848 on July 21, 2004 and May 8, 2003, respectively, by NCDOT personnel. Further details of these survey efforts are available upon request. Since this species has been recorded at several locations in the North Toe River, and given its nature of dispersal, recruitment of Virginia spiraea into the project area(s) is possible prior to construction. However, as no individuals were located in the project impact areas, project construction is Not Likely to Adversely Affect Virginia spiraea.

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APPENDIX A (CATEGORICAL EXCLUSIONS FOR B-1443 & B-2848)

APPENDIX B (PLAN SHEETS FOR B-1443 & B-2848)

APPENDIX C (DEMOLITION PLANS FOR B-1443 & B-2848)

Demolition Plans
Projects: B-1443 and B-2848
County Mitchell / Yancey
Description: Replacement of Bridge Nos. 61 and 143 Over the North Toe River

Removal of Existing Structures

The Contractor will be required to submit for approval a proposed demolition plan. This plan must be sealed by a Professional Engineer, registered in NC. Demolition techniques that minimize the amount of debris in the river shall be used. Below is a brief description of an anticipated removal technique.

B-1443

- Prior to bridge demolition, remove all asphalt-wearing surface from the concrete deck. This will be accomplished in a manner that doesn't allow asphalt to enter the river. Examples of approved techniques include milling or "scrapping" with a backhoe bucket. Depending on the technique used, containment headers may be required. Typically this consists of vertical boards (say 2" x 6") attached to the bottom of concrete barrier rail to prevent material from spilling into the river during removal.
- Remove all concrete rail and deck by saw cutting or non-shattering methods and lift out without dropping into the stream.
- At this point the bridge superstructure will consist of concrete arches connected by concrete diaphragms (small concrete beams connecting the aches). An attempt will be made to dismantle the remaining portion of bridge without dropping components into the river. Temporary support frames will be placed in the river under the arch. The support frame foundation will most likely be precast concrete (such as concrete barrier) but the contractor may choose to use a timber or steel foundation. Due to the irregular rock streambed, small amounts or rip rap or sandbags may be required to lever up the support frame foundation. Support frames will need to be placed in at least three locations under each arch (midspan and quarter points). The arches will then be sawed into sections and an attempt will be made to lift these sections out with a crane. The arches may separate and all or a portion fall into the river. Any portion that falls will be lifted out of the stream by crane (large sections at a time).
- The proposed causeway will be used as access for bent removal. Equipment will need to be staged adjacent to the bent to facilitate sawing it into manageable sections above water elevation. Cranes will lift the sections out. Once the bents have been removed to water elevation, the remaining mass of concrete will be removed to stream bed elevation by underwater sawing or use of hoe ram to break the bent at stream bed interface to allow lifting out as a unit. During this process, turbidity curtains will be used (if water depth is sufficient) and disturbance of the steam bottom limited to an area 3 feet around the perimeter of the bent. The existing footing below streambed will be left in place to avoid additional streambed disturbance.
- Use of explosives will not be allowed.
    - Saw slurry must be contained by approved vacuum methods.

B-2848

- Prior to bridge demolition, remove all asphalt-wearing surface and earth fill from inside the concrete arch bridge. This will be accomplished in a manner that doesn't allow asphalt or fill material to enter the river. Most likely a backhoe will load the material into dump trucks, working from one end of bridge to the other.
- The existing steel beam guardrail will be removed by unbolting and cutting as needed.
- At this point the bridge superstructure will consist of concrete arches connected by solid concrete floor. A portion of the concrete deck will be removed by saw cutting and lifting out. This will help reduce the weight for the next step of demolition. Some portion of the floor must remain to keep the arches from separating.

- An attempt will be made to dismantle the remaining portion of bridge without dropping components into the river. Temporary support frames will be placed in the river under the arch. The support frame foundation will most likely be precast concrete (such as concrete barrier). The contractor may also choose to use a timber or steel foundation. Due to the irregular rock streambed, small amounts or rip rap or sandbags may be required to level up the support frame foundation. Support frames will need to be placed in at least three locations under each arch (midspan and quarter points). The arches will then be sawed into sections and an attempt will be made to lift these sections out with a crane. The arches may separate and all or a portion fall into the river. Any portion that falls will be lifted out of the stream by crane (large sections at a time).
- The proposed solid barrier/causeway will be used as access for bent removal. Causeway materials such as class I aggregate and fabric construction may be used for Construction and for demolition purposes. Due to the use of clean stone, all surface drainage will pass through the causeway making containment impractical. Causeway located along the west bank of the river will be positioned closely against the bank to reduce the footprint in the water. DOT will incorporate the use of jersey rail or similar devices around the perimeter of the causeway to help contain the material. Equipment will need to be staged adjacent to the bent to facilitate sawing it into manageable sections above water elevation. Cranes will lift the sections out. Once the bents have been removed to water elevation, the remaining mass of concrete will be removed to stream bed elevation by underwater sawing or use of hoe ram to break the bent at stream bed interface to allow lifting out as a unit. During this process, turbidity curtains will be used (if water depth is sufficient) and disturbance of the steam bottom limited to an area 3 feet around the perimeter of the bent. The existing footing below streambed will be left in place to avoid additional streambed disturbance.
- Construction of Causeways/solid barriers will follow a phasing plan such that not all causeways/solid barriers are utilized in the river at the same time. Each phase will require that the causeways stay in the water a different length of time. Construction of Causeways will be phased to minimize flow restrictions.
- Use of explosives will not be allowed.
  - Saw slurry must be contained by approved vacuum methods.

The above demolition description is provided to give an example of what the Department considers practical at these sites. The actual approved plan may vary from this method. Similar techniques may be used in certain aspects of the construction of the proposed bridge as well. DOT's focus will be on minimization, and the Contractor will be required to develop techniques that provide equal to or fewer impacts than described above. Procedures used, that are not as described as above, will be reviewed by a resident engineer and construction engineer according to DOT practice for bridge removal in North Carolina, as well as by a representative from the US Fish and Wildlife Service for compatibility with environmental practices.