Biological Opinion
I-26 Connector from I-40 to US 19/23/70 North of Asheville
Buncombe County, Asheville, North Carolina

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CONSULTATION HISTORY

The I-26 Connector was first funded in 1989 by the Trust Fund Act and added to the N.C. Department of Transportation (NCDOT) State Transportation Improvement Plan (STIP) as project number I-2513. Informal consultation for the I-26 widening project began in 1993. At that time, the Asheville Connector project was included in a suite of projects termed the "Asheville Area Pilot Project". In 1995, NCDOT published the Phase I Environmental Analysis–Asheville Urban Area (Phase I Study) for the I-26 Connector (NCDOT 1995) and included a preferred corridor for the I-26 Connector (I-2513). NCDOT continued to develop alternatives for the I-26/I-40/I-240 interchange and refined preliminary engineering designs for widening I-240 and the alternatives connecting I-240 to US 19-23-70. Agency coordination and public involvement continued and environmental studies regarding the effects of the alternatives were conducted, culminating in the preparation of a Draft Environmental Impact Statement (DEIS) in March 2008. However, after the addition of a new alternative, elimination of another alternative to Section B of the project, and refinement of many of the technical studies supporting the DEIS, FHWA, and NCDOT determined that it was necessary to rescind the 2008 DEIS and prepare a new DEIS incorporating the most current information into a single document. Due to a new project funding priority rating system implemented by NCDOT in 2010, the DEIS was put on hold. Project development studies for the I-2513 were re-initiated in spring 2012. AECOM, Inc. (AECOM) was tasked with preparing the DEIS and subsequent Final Environmental Impact Statement (FEIS). Designs were further modified, and the new DEIS was signed in October 2015. The Merger Team met on May 18, 2016, to choose a preferred alternative. Section C – Alternative F-1, Section A – Widening Alternative, and Section B – Alternative 4-B, were chosen as the least environmentally damaging practicable alternative (LEDPA) (the Merger Team is a group of federal and state environmental agency partners). Documentation of the comprehensive project history is available here: https://xfer.services.ncdot.gov/PDEA/Web/I26/150827%20I-2513%20Project%20History.pdf. The FEIS was signed January 09, 2020.

Informal consultation for MYGR for this project began in August 2016, after the North Carolina Wildlife Resources Commission (NCWRC) discovered MYGR roosting in a bridge near the project in Buncombe County. CALYX Engineers and Consultants, Inc., and NV5 Company (CALYX/NV5) was contracted by NCDOT in December 2016 to conduct surveys for MYGR and to complete the BA for MYGR. Through acoustic surveys, MYGR was confirmed to be present in several locations along the proposed project corridor. Three Oaks Engineering, Inc. (Three Oaks) was contracted by NCDOT in May 2017 to complete aquatic mussel surveys for the project. Appalachian elktoe was discovered in the main stem of the French Broad River, approximately 1.5 mi. upstream from the I-40 bridge over the French Broad River, in September 2017. Three Oaks was subsequently hired to complete the portion of this BA pertinent to Appalachian elktoe.

The following information provides a detailed consultation history for the subject project.

- June 8, 1993: U.S. Fish and Wildlife Service (USFWS) submitted written comments to NCDOT for the Asheville Urban Area Pilot Project, which included the I-2513 project.
- May 17, 1994: USFWS submitted written comments to NCDOT for the Asheville Urban Area Pilot Project, which included the I-2513 project.

- In 1995, NCDOT published the final Phase I Environmental Analysis – Asheville Urban Area (NCDOT 1995). This publication contained a preferred corridor for I-2513. The USACE approved the recommendations.
- January 16, 1996: NCDOT letter to USFWS requesting information regarding potential environmental impacts that could result from the project.
- January 24, 1996: USFWS letter to NCDOT in response to January 16, 1996. The letter stated that while there are no known occurrences of federally protected species within the general corridor area, thorough surveys have not been conducted, the presence or absence of these species in the project area should be addressed in any environmental document prepared for this project.
- 2002-2008: NCDOT developed alternatives for the I-26/I-40/I-240 interchange and refined the preliminary engineering designs for widening I-240 and the alternatives connecting I-240 to US 19-23-70. Agency coordination continued.
- March 2008: A draft environmental impact statement (DEIS) was completed for the I-2513. Due to the addition of an alternative and the elimination of another, as well as the refinement of many technical studies supporting the DEIS, FHWA and NCDOT determined that it was necessary to rescind the 2008 DEIS and prepare a new DEIS to incorporate the most current information available into a single document.
- In 2015, the DEIS presented the biological conclusion of "may affect-not likely to adversely affect" for the Appalachian elktoe, and "unresolved": for MYGR (NCDOT 2015).
- December 7, 2015: USDOI provided written comments on the DEIS to FHWA. USDOI recommended that NCDOT and FHWA continue coordination with the USFWS in the Merger Process.
- July 19, 2016: MYGR discovered by NCWRC and USFWS in bridge roost approximately 2.5 mi. south of Action Area.
- May 2017: Three Oaks Engineering, Inc. (Three Oaks) was contracted by NCDOT to complete mussel surveys for the project. Although no Appalachian elktoe were found within the study area, they were found in the French Broad River 1.5 river mi. upstream from the study area in September of 2017 (see Mussel Survey Report in Appendix D).
- June 29, 2017: Meeting with USFWS, NCWRC, NCDOT, AECOM provided overall project status updates and began discussions about appropriate surveys for MYGR. The group decided that structure checks and acoustic surveys would be appropriate. NCDOT intends to fund a MYGR research project to improve knowledge of species ecology in North Carolina. The possibility of a programmatic consultation for all NCDOT projects within the French Broad Watershed was discussed.
- August 24, 2017 CALYX/NV5 discovers bat roost in culvert within the study area. MYGR believed to be present.
- September 7, 2017: NCWRC and USFWS confirm MYGR are using culvert roost discovered by CALYX/NV5 on August 24, 2017.
- October 3, 2017: Call with NCDOT, NCWRC, USFWS to discuss monitoring of MYGR activity at culvert roost.
- October 25, 2017: Meeting with USFWS, NCWRC, CALYX/NV5, NCDOT, AECOM to review surveys to date, plans for upcoming surveys (acoustic, structure, and culvert roost), and coordinate MYGR culvert safety inspection with NCDOT Division 13.

- July 17, 2018: CALYX/NV5, Indiana State University (ISU, See Section 2.3.7.3 for details), NCWRC provided update to USFWS and NCDOT on status of MYGR surveys in western North Carolina. Updates on acoustic, mist-netting, structure checks, and telemetry were provided
- July 18, 2018: Section 404/NEPA Merger Process – Concurrence Point 4a (CP4A) Meeting. NCDOT assumed Appalachian elktoe are present and will comply with Section 7 of the ESA of 1973. Commitment to revisit CP4A after completion of the BA and study the hydraulic impacts of construction associated with major hydraulic structures.
- July 25, 2018: Biological Assessment and Bridge Construction Meeting with USFWS, FHWA, USACE, NCDOT, CALYX/NV5, and Three Oaks. Reviewed NCDOT's potential project commitments.
- September 17, 2018: CALYX/NV5 provided Structure Survey Report to USFWS on behalf of NCDOT.
- October 10, 2018: NCDOT and USFWS discussed conservation measures related to sediment and erosion control measures and the need to go "above and beyond" the typical requirements.
- November 14, 2018: Bridge Construction and Biological Assessment Meeting with USFWS, FHWA, NCDOT, CALYX/NV5, and Three Oaks. Reviewed the project commitments for the Biological Assessment and discussed bridge construction and lighting on the project
- November 30, 2018: On behalf of NCDOT, CALYX/NV5 coordinated with USFWS to solidify a plan for acoustic surveys and data analysis for the upcoming season.
- February 20, 2019: Call with AECOM, CALYX/NV5, NCDOT, USFWS to discuss plan for 2019 acoustic surveys.
- March 7/8, 2019: Series of emails exchanged between USFWS, CALYX/NV5, and NCDOT finalizing the details of acoustic surveys for 2018.
- March 8, 2019: Call between NCDOT and USFWS to discuss acoustic surveys. Decision was made to collect acoustic data at all monitoring locations through the fall, until bat activity ceases for the year. However, in the interest of the project schedule, and time needed to prepare the acoustic survey report and biological assessment, data analysis will cover the time frame from the beginning of the season through the last week in July.
- April 12, 2019: NCDOT, USFWS, CALYX/NV5 phone call to discuss plans for permanent lighting at bridge crossings.
- April 26, 2019: NCDOT and USFWS met in Asheville to discuss project commitments, and lighting commitments in particular.
- April 30, 2019: NCDOT, USFWS, CALYX/NV5 phone call to discuss plans for permanent lighting at multiple crossings.
- May 6, 2019: NCDOT provided a draft BA to USFWS for review
- May 20, 2019: NCDOT received Draft BA comments from USFWS.
- May 22, 2019: NCDOT provided the I-2513 lighting summary to USFWS
- May 23, 2019: NCDOT and USFWS discussed BA comments
- June 24, 2019: NCDOT received email from USFWS regarding lighting
- July 1, 2019: NCDOT responded to USFWS lighting email and comments regarding NLEB language
- August 7, 2019: USFWS responded via email regarding NLEB

- August 22, 2019: NCDOT provided a revised Draft BA to USFWS
- October 24, 2019: NCDOT provided the Final BA to USFWS
- March 2, 2020: USFWS provided the Draft Biological Opinion to NCDOT and FHWA
- March 11, 2020: FHWA provided comments to the USFWS
- April 15 2020: NCDOT provided comments to the USFWS
- April 24, 2020: NCDOT and USFWS discussed all BO draft comments
- April 29, 2020: USFWS provided new additions for review by FHWA and NCDOT
- May 5 & May 7, 2020: USFWS received comments from FHWA and NCDOT, respectively
- May 15, 2020: USFWS provided a revised Term and Condition for Bowen Bridge lighting to FHWA and NCDOT for comment
- June 16, 2020: USFWS and NCDOT finished Bowen Bridge Term and Condition revision discussions
- June 19, 2020: USFWS provided the Final Biological Opinion to NCDOT & FHWA

BIOLOGICAL OPINION

1. INTRODUCTION

The Federal Highway Administration (FHWA) and the North Carolina Department of Transportation (NCDOT) propose improvements to upgrade the I-240 corridor in west Asheville, Buncombe County, NC for approximately seven miles (mi.) from south of the I-26/I-40/I-240 interchange through the I-240 interchange with US 19-23-74A/Patton Avenue west of the French Broad River so I-240 can be re-designated as I-26. NCDOT proposes to upgrade the corridor to accommodate the amount and types of future traffic. NCDOT also proposes to upgrade the I-240 interchange with US 19-23-74A/Patton Avenue to provide an interstate highway to interstate highway interchange for I-240 and future I-26 (Figure 1 of Appendix A).

Project construction is anticipated to begin approximately 2 months after the contract is let (finalized), and will continue for approximately 60 months (5 years). This Biological Opinion considers the effects of the Action on the Appalachian elktoe (*Alasmidonta raveneliana)* and the gray bat (*Myotis grisescens,* MYGR).

2. DESCRIPTION OF THE PROPOSED ACTION

2.1 Description of Action Area

The Action Area as defined in 50 CFR 402.02 includes all areas in which federally listed species will be affected by the Proposed Action. Under section 7(a)(2) of the Act and the recent update to the regulations, effective October 28, 2019, "effects of the action" to be analyzed in this Biological Opinion (BO) are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action.

The Action Area for the project includes the immediate project footprint, including work areas, staging areas, and access areas, as well as areas immediately adjacent to areas affected by project activities. For example, noise and vibrations from project activities could potentially result in effects in immediately adjacent areas.

The project Action Area (Figure 5 of Appendix A) is primarily based on the Final Environmental Impact Study (FEIS) area (NCDOT 2020), which includes the corridor required to improve existing I-240 from the I-26/I-40/I-240 interchange to the interchange with US 19-23-74A (Patton Avenue) west of the French Broad River. From this interchange northward, the Action Area broadens to provide for a freeway on new location that would cross the French Broad River and tie into existing US 19-23-70 on the east side of the French Broad River. The Action Area also includes the current I-40 interchange with US 19-23-74A (Smoky Park Highway) and the I-40 corridor between this interchange and the I-26/I-40/I-240 interchange.

The Action Area has been expanded from the FEIS study area in four locations:

- A section of Hominy Creek from where it leaves the I-2513 study area downstream to its confluence with the French Broad River (approximately 0.3 mi.).
- The French Broad River from the Hominy Creek confluence to where the river enters the project study area, approximately 0.3 mi. downstream (central portion of the project).
- A section of French Broad from where it leaves the central/eastern portion of the project study area downstream to where the Amboy Road (U-4739) study area begins (approximately 0.5 mi.).
- The French Broad River from where it leaves the project study area at the north end of the project to where an old rock dam is present, approximately one mi. north (downstream).

Preliminary roadway designs are in progress at the time of this BO submittal. Additional easements may be required for drainage, utilities, and construction.

2.2 Proposed Action

2.2.1 General Information

The I-2513 project will provide a link in the I-26 corridor by improving and constructing a multi-lane freeway, part of which is on new location, from I-26 southwest of Asheville to US 19-23-70 (Future I-26) in northwest Asheville (Figure 2 in Appendix A). The project spans approximately seven miles; about two-thirds of the project is related to improvements to I-240 on the west side of Asheville. The project improvements are defined in three separate sections (A-C) (Figure 3 in Appendix A) that must be combined to comprise the entire project:

Section A includes a best-fit alignment for the widening and reconstruction of existing I-240 from a four-lane freeway to a six-lane freeway, including reconstruction of the I-26/I-240 and NC 191 (Brevard Road) and SR 3556 (Amboy Road) interchanges, and upgrades the existing I-26/I-240 and US 19-23 Business (Haywood Road) interchange to a tight urban diamond interchange configuration.

Section B separates the local and I-240 traffic across the Captain Jeff Bowen Bridges (I-26/US 19/US 23, Patton Avenue) over the French Broad River and creates three new crossings over the river: two bridges carrying I-240 traffic, and a third carrying I-26. The design routes I-26 to the east and crosses the French Broad River approximately one-half mi. north of the Captain Jeff Bowen Bridges. An interchange at Patton Avenue would also be included. This section of the project also includes improvements to Riverside Drive, formerly STIP project U-5868, recently added to I-2513 (the improvements fall within the I-2513 FEIS study area).

Section C maintains the existing I-26/I-40/I-240 interchange configuration and adds a loop and a ramp to provide all ramp movements. It also includes the reconstruction of the I-40/US 19-23-74A (Smoky Park Highway) interchange. Riverside Drive will be widened from Hill Street to Broadway and includes a 10-foot multi-use path to the west of the roadway, between the railroad and Riverside Drive.

The I-2513 project requires a minimum of four and a maximum of eight basic freeway lanes on I-26 to meet the capacity requirements presented in the purpose and need for the project. I-26 sections have been designed with 12-foot travel lanes and 12-foot paved shoulders. South of the I-40 interchange, I-26 will be an eight-lane section with a varying median width divided by barriers and a retaining wall. In this area of the project, I-26 is transitioning to tie to the I-4400/I-4700 project (I-26 Widening). This project is in the preliminary design phase, so detailed drawings are not currently available.

Throughout the I-40 interchange, I-26 will use a basic four-lane section with a bifurcated median. This portion of the project uses standard cut and fill slopes to tie construction to existing ground. North of the I-40 interchange, I-26 will transition to a six-lane freeway section separated by a 35-foot median and a 41-foot concrete barrier. This portion of the project will also use standard cut and fill slopes to tie construction to existing ground. For I-26 north of the I-40 interchange to SR 1781 (Broadway), the median will narrow to 26 ft. over the French Broad River bridges, where it transitions to an eight-lane typical section from US 19-23-70 to SR 1781.

This project's construction schedule will likely overlap with that of the I-4400/4700 project (I-26 widening) to the south. Construction is expected to begin in 2022 and continue for approximately five years. The exact construction sequence will be determined during final design; however, it is anticipated that the new location construction will begin prior to the replacement of existing roadway. Construction activities associated with the proposed project may include, but are not limited to, clearing, grubbing, grading, installation of base material, installation of pavement, striping, signs, and lighting. Extensions of existing culverts, replacement of some existing bridges and culverts, and installation of new bridges and culverts will also be necessary. Earth-moving and road-building equipment of various kinds and sizes will be utilized to complete the project construction. The FEIS (NCDOT 2020) noted that the new location work in Section B will require substantial earthwork to provide level roadbed.

Multiple bridges will be built or replaced for the project, including three new bridges over the French Broad River. See Table 1 for list of bridges/crossing structures. Temporary causeways in waterways have been identified as the most likely mechanism to be used to access areas for bridge construction. Generally, construction locations will be reached using existing roadways where possible; temporary access roads may be constructed to get to locations where access is physically restricted. The creeks and rivers listed in this document are all used for recreation and cannot be closed for the duration of construction. Closures and portage options will be detailed in a separate document, a river user plan. Coordination with the City of Asheville regarding portage options will be conducted once designs are finalized.

Additional information can be found on the project website:
https://www.ncdot.gov/projects/asheville-i-26-connector/Pages/default.aspx.

It is anticipated that a portion or the entire project will be awarded as a Design-Build project. This method of project delivery can accelerate a project, in several ways. A Design-Build Team (DBT) is comprised of a Contractor and a design firm. The Contractor works closely with the designer, sharing his or her construction expertise, to reduce the need for redesigns based on constructability issues, which can add to project costs and project delays. Allowing the Contractor to tailor the project design and apply appropriate innovations provides flexibility for the Contractor to manage and compensate for cost increases in one area through efficiencies in another. This does not include changes to environmental commitments, but control of the means and methods. Project commitments (conservation measures (CM)) that pertain to the species discussed in this document are listed in Section 7.0 (Conservation Measures). The DBT will continue to follow the Merger Process, which includes USFWS and other stakeholders in ensure that environmental commitments are addressed through the design and construction process. The term "Contractor" shall be understood to mean Bid Build Contractor or Design-Build Team in this document.

2.2.2 Hill Street Culvert Roost Area

A culvert system located within Section B, in the vicinity of the flyover bridges carrying I-26 and I-240 over the French Broad River, has been identified as a roost for MYGR. Special precautions will be taken to reduce disruption to the bats, particularly during the spring, summer, and fall months (Section 2.3.1). NCDOT will monitor bat activity at the culvert before, during, and after construction. Acoustic monitoring and/or emergence surveys, as appropriate, will be conducted between March and November (Section 2.3.7).

The culvert system conveys an unnamed tributary (UT) to the French Broad River and drains approximately 0.25 mi^2. The UT flows approximately 175 ft. from the culvert outlet to the river. NCDOT will maintain water sources that provide baseflow to the culvert (non-stormwater sources) to provide a naturally occurring, continual water source.

The culvert system generally consists of a mixture of reinforced concrete box culvert (RCBC), corrugated metal arched pipe (CMAP), and corrugated metal pipe (CMP). The longest pipe run extends approximately 3,700 ft. (0.7 mi) under a nearby interchange. In total, there is an estimated 14,700 linear ft. of pipe associated with this system under I-26, I-240, the I-26/I-240 interchange, Hill Street, Riverside Drive, Norfolk Southern Railroad, Atkinson Street, and other smaller roads. In some locations, the culverts are buried under 60-70 ft. of fill material. The system will be partially replaced or rehabilitated to ensure structural integrity and longevity. Construction activities associated with the culvert system may last three to four years and may occur during the day or night.

Two 63-in. CMAPs are in place to convey stormwater and the UT to the French Broad River under the Norfolk Southern Railroad tracks and Riverside Drive, where they meet the main trunk line, an 8 ft. x 8 ft. RCBC. Moving upstream, the RCBC extends approximately 1,100 ft. until it meets an 84-in. corrugated metal pipe. Most of the pipes upstream from the junction of the RCBC and the 84" CMP junction are metal. The RCBC portion of the culvert system, as well as the dual CMAP at the culvert outlet, will remain in place. No work on these portions of the culvert system will occur until bat activity ceases for the season (and bats are presumably no longer using the culvert for roosting). This time frame is approximately between November 15 and March 15. NCDOT will monitor the culvert with an acoustic detector and/or emergence counts to determine when bat activity ceases for the season. Then, a federally permitted bat biologist will enter the culvert to confirm no bats are present.

Work along Riverside Drive will involve widening the roadway, including nearby ramps and intersections for I-240 eastbound and westbound, and US 23 southbound, across the existing culvert system in the vicinity of the roost. Modifications to the main trunk line (8'x8' RCBC) are not anticipated in conjunction with the widening of Riverside Drive. However, the existing culvert branches must be removed and modified to accommodate the new roadway alignments. It is likely that the entire culvert system upstream from the junction of the RCBC and the 84-in. CMP will be replaced with concrete pipe or RCBC which will provide more potential bat roosting habitat. Attempts will be made to tie the modified culvert branches back into the RCBC. If connections cannot tie back to the main RCBC, then separate, shallow, systems will be put in place to handle drainage.

A 60” CMP is located adjacent to Courtland Avenue and the entrance to Isaac Dickson Elementary School that conveys streamflow under Hill Street to the RCBC. This section of the culvert system will either be replaced, or a liner will be inserted into the existing culvert to rehabilitate the section of the culvert. During this process, a liner (possibly steel, plastic, or a few other types) which is a smaller diameter pipe, is pushed through an existing pipe and the end of the pipe is sealed in-between the liner and the existing pipe. Next, the void between the outside of the new liner and the inside of the existing pipe is filled with flowable fill or grout (concrete with no large aggregate). This process will take a few weeks. NCDOT will conduct this activity between October 15 and April 1, when most bats are hibernating elsewhere. NCDOT will install a barrier/baffle in the RCBC between the intersection with the 60” CMP (located adjacent to Courtland Ave. and the entrance to Isaac Dickson Elementary School that conveys flow under Hill Street) and the upstream end of the RCBC to buffer noise and light associated with the CMP replacements further upstream.

Construction activities associated with areas other than the CMAP outlets, RCBC, and 60” CMP may occur at any time of year.

For the first step of the CMAP and RCBC work, areas identified as needing repair will be steam cleaned. After cleaning, the areas will be repaired using an epoxy or polyuria-based patch. It is not anticipated that large areas will need repair. Steam cleaning and repair will occur when bats are hibernating elsewhere and may take up to one month to complete.

To perform the required work to the CMAP, RCBC, and 60” CMP the Contractor shall access the hydraulic structures as follows:

- Clean and apply patching to the CMAP and RCBC - equipment must access the culvert outlets.
- Replace or insert the liner to the 60” CMP - equipment must access the inlet of the 60” CMP.

Operational work pad areas will be established near the culvert inlet and outlets to complete the work. These areas may be cleared of vegetation for up to approximately 50 ft. downstream, and to top of banks. Class I rip rap may be used to temporarily stabilize the stream banks, if needed. Grubbing of roots will be necessary so equipment can safely and efficiently move about the area to perform work. Grubbing of roots will also allow for better establishment of woody vegetation when replanting the area. The area cleared for the work pad will not be any larger than necessary to accomplish the construction activities. NCDOT will cut plants in the work pad area in a way that will not be detrimental to bats and their activity. For instance, vegetation will not be removed if the area will be left bare for many months prior to construction. Cutting of vegetation will be coordinated with USFWS and will not occur until all bats have left the culvert for the winter. This will be determined through acoustic monitoring and/or emergence counts and a physical check of the culvert for remaining bats. Cutting of vegetation will be limited to only what is necessary to complete the work, and no more than 50 ft. from culvert entrance.

An equipment staging area will be established adjacent to the work pads near the culvert outlets and inlet areas to complete the culvert rehabilitation. NDOT will attempt to use areas already cleared of vegetation whenever possible. Equipment involved in the culvert rehabilitation process may be parked at these areas to load/unload machinery and store supplies used during the process. This area will only be used for culvert rehabilitation activity staging and will not be used for any other project construction purposes.

2.2.3 Smith Mill Creek Culvert Roost Area

Five MYGR were also found roosting in a triple-barrel 8 ft. x 11 ft. RCBC that carries Smith Mill Creek under Patton Avenue west of the French Broad River and the I-26/I-240/Patton Avenue interchange (project Section B). The culvert has three sections. The upstream-most section carrying Smith Mill Creek under the ramps is 330 ft. long, the middle section is 140 ft. long, and the downstream-most section carrying Smith Mill Creek under Patton Avenue is 210 ft. long. After exiting the culvert, Smith Mill Creek flows 0.75 mi. to the French Broad River. The culvert will remain in place and will not be extended or shortened as part of this project. Repairs to this culvert are not anticipated at this time.

Equipment staging areas are not anticipated in the vicinity of the culvert inlet or outlet. After the pavement associated with the existing ramps is removed, minor regrading and revegetation will be necessary. It is not anticipated that any vegetation at the culvert inlet and outlet will be disturbed. There are currently no plans for development or designated open space for the area where the ramps will be removed, but a greenway path will likely be added to the south side of Patton Avenue in the area of the Smith Mill Creek culvert. On the outlet end, there is no proposed work directly at the outlet, but Regent Park Blvd, just west of and parallel to the culvert will be widened.

2.2.4 Bridge Replacements

Seven bridges (or bridge pairs) over waterways will be replaced as part of the project. Table 1 provides information on all locations where bridges cross streams within the Action Area, and Figure 4 in Appendix A (including Figures 4A through 4D) shows the location of these crossings. Bridges on new locations are discussed in Section 2.1.3. Bridge demolition and construction of replacement bridges may take up to five years.

Table 1. Bridge Replacement and New Construction Locations

Crossing Number	Project Section	New or Replacement	Road Carried	Water Body	Lanes	Notes
HC-1	C	Replacement	I-40 EB	Hominy Creek	4	
HC-2	C	Replacement	I-40 WB	Hominy Creek	4	
HC-3	C	Replacement	I-26 NB/I-240 NB	Hominy Creek	5	
HC-4	C	Replacement	I-26 SB/I-240 SB	Hominy Creek	4	
HC-5	C	Replacement	I-40	Hominy Creek	7	Replace dual structure with one new structure
FBR-1	C	Replacement	I-40	French Broad River	7	Replace dual structure with one new structure
HC-6	C	New	I-40 Ramp to 191	Hominy Creek	1	
HC-7	A	Replacement	I-26/I-240 NB and SB	Hominy Creek	10	Replace dual structure with one new structure
SMC-2	B	New	I-240 Ramps	Smith Mill Creek	2	Removing existing box culvert at this location
SMC-1	B	New	Resort Dr.	Smith Mill Creek	2	
SMC-3	B	New	I-26	Smith Mill Creek	8	
SMC-4	B	New	I-240 Ramps	Smith Mill Creek	1 lane & 2 lanes	Two ramps cross creek at this location
SMC-5	B	New	I-26	Smith Mill Creek	8	Creek is slightly under I-26 bridge here
SMC-6	B	New	I-240/I-26 Ramp	Smith Mill Creek	8 lanes & 2 lanes	Two bridges cross creek at this location
SMC-7	B	New	I-240 Ramp	Smith Mill Creek	1	Ramp to I-240 EB
SMC-8	B	New	I-240 Ramp	Smith Mill Creek	1	Ramp to I-240 EB
SMC-9	B	New	I-240 Ramp	Smith Mill Creek	1	Ramp to I-240 EB
EB-4	B	New	I-240 Ramp	Emma Branch	1	Exit ramp from I-240 WB to Patton Ave
EB-3	B	New	I-240/I-26 Ramps	Emma Branch	1 lane & 2 lanes	Two bridges cross creek at this location
EB-2	B	New	I-26	Emma Branch	7	I-26 Bridge
EB-1	B	New	I-240 Ramps	Emma Branch	3	I-240 EB Bridge
FBR-2	B	New	I-240 EB	French Broad River	3	I-240 EB
FBR-3	B	New	I-26 EB/WB	French Broad River	7	I-26 Bridge
FBR-4	B	New	I-240 WB	French Broad River	3	I-240 WB Bridge

2.2.4.1 French Broad River

The two existing bridges carrying I-40 over the French Broad River will be replaced by a single bridge in the same location (Figure 4B of Appendix A). A phased approach will be necessary to maintain traffic flow during construction. Span lengths and bent types will be determined during final design. It is estimated that three bents will be placed on riverbed for this bridge. Causeways are needed for construction and demolition (discussed in Section 2.2.5.6).

2.2.4.2 Hominy Creek

There are seven locations where the project will bridge Hominy Creek, six of which will be bridge replacements. The two existing bridges carrying I-40 across Hominy Creek (closest to the French Broad River) will be replaced by a single bridge in the same location (crossing HC-5, see Figure 4B in Appendix A). It is estimated that the bridge will have a total of five spans and one to two bents will be located at the water's edge, but none will be in the water. Causeways for demolition are anticipated, but not for construction (discussed below).

Shortly upstream from I-40, the northbound (NB) and southbound (SB) bridges carrying I-240/I-26 across Hominy Creek will be replaced (crossing HC-7, Figure 4B in Appendix A). The new bridge will also cross a potentially historic bridge used for greenway traffic. The exact configuration of the new bridge bents is uncertain until further in the design process. It is anticipated that one bent may be placed in Hominy Creek with up to three bents located near the water's edge. However, as a worst-case estimate, four bents could be placed in Hominy Creek. The bridge bents will be separated and offset such that they do not affect the historic bridge. A causeway is expected to be used during demolition of the existing bridges. Phased construction will be used. Access to the site is available via NCDOT right-of-way. Portage for recreational creek traffic may be available, depending on construction phasing, as an existing greenway path is adjacent to the site. The proposed bridge will span this greenway and accommodations will need to be made for pedestrian traffic during construction. Although the new bridge is currently planned as a single structure spanning both the waterway and historic bridge, it may be separated into three to four smaller structures during final design to allow for strategic bent placement, potentially resulting in zero bents in the water.

As Hominy Creek meanders around, I-240/I-26 crosses it again further upstream, near the interchange with I-40. The bridges carrying I-26 NB and I-26 SB (crossings HC-3 and HC-4, respectively, Figure 4A), will both be replaced. The existing bridges do not have any bents in the water and are anticipated to be replaced in-kind. No bents are expected to be located within the water, but they could be near the water's edge. No causeways are expected to be needed for demolition or construction. These bridges will need to be constructed in phases to maintain traffic. Access to the site is available via NCDOT right-of-way.

Near the I-40/I-26 interchange, the pair of bridges carrying I-40 eastbound (EB) and westbound (WB) (crossings HC-1 and HC-2, respectively, Figure 4A, Appendix A) over Hominy Creek will be replaced. They currently have three bents each, none of which are in the water, and are anticipated to be replaced in kind, with no bents expected in the water. No causeways are anticipated for demolition or construction. Access to the site is available via the NCDOT right-of-way and phased construction is expected. Hominy Creek is used regularly for recreation and cannot be closed for the duration of construction. A greenway is located just to the east of Hominy Creek at the existing I-40 bridges. Using the greenway for portage may be possible for recreational creek traffic, but safety accommodations will need to be made as the greenway runs under the bridges.

For more details regarding I-2513 bridges, see Appendix F, Bridge Construction Document.

2.2.4.3 Demolition of Existing Bridges

A total of seven bridges will be demolished as part of I-2513, including a bridge pair over the French Broad River, carrying I-40 (crossing FBR-1). The remaining demolitions will all be at Hominy Creek (crossings HC-1 through HC-5, and HC-7, Figures 4A and 4B in Appendix A). During demolition, each bent will be removed by either by tipping it over and removing the entire bent, or by cutting off the bent at riverbed elevation. Because the remnants of each cut-off bent will be at riverbed elevation, no backfill will be needed. Exposed steel will be cut off. The method of removal will be dependent on the foundation conditions present at the site. No loose portion of the existing bents will remain in the river.

Once the center bents are demolished, all remaining causeways will be removed, including causeway material left along the riverbank for temporary protection. Temporary access roads (discussed in Section 2.2.6) will also be removed.

The timing (night versus day) of bridge demolition will be at the discretion of the Contractor and is not required to occur at night. Nighttime bridge demolition activities typically involve the removal of the concrete bridge deck and lifting of existing beams. It is usually necessary when the Contractor must sit in the existing roadway with a crane to lift off the bridge beams and load them on a truck. This requires a lane closure, which is a safety measure in areas of high daytime traffic volume. Contractors often prefer to perform bridge demolition from a causeway to avoid the added expense and safety risk involved with lane closures and night work. Demolition of individual bridges is anticipated to last a month or less per bridge, depending on the bridge size, material, and design.

2.2.5 New Construction Bridges

Multiple new bridges over waterways are necessary as part of the project. Table 1 provides information on all the locations where bridges cross streams within the Action Area, and Figure 4 (including Figures 4A through 4D) in Appendix A shows the location of these crossings. Replacement bridges were discussed in Section 2.2.4.

2.2.5.1 French Broad River

In Section B of the project, three flyover bridges carrying I-240 eastbound (EB) (FBR-2), I-26 (FBR-3) and I-240 westbound (WB) (FBR-4) over the French Broad River will be constructed on new location (Figure 4D, Appendix A) north of the existing Captain Jeff Bowen Bridges, which currently carry I-240/I-26/Patton Avenue. The new bridges will each be over one-half mile long and span Smith Mill Creek and Emma Branch, which join and feed into the French Broad River nearby. The sections over the French Broad River are expected to consist of three main spans utilizing curved girders and three bents in the river each, totaling nine bents for this river segment. Due to the constricted turning radii of the bridge, long bridge spans are not feasible. The bridge decks will be approximately 66 (FBR-3), 91 (FBR-2), and 104 (FBR-4) ft. above the river. An uneven span arrangement is anticipated. The bridges will take an estimated three to four years to complete and will likely be phase-constructed. To build the three bridges, the use of access roads and causeways is anticipated.

2.2.5.2 Hominy Creek

The I-40 ramp to NC 191 (HC-6) will be constructed on new location over Hominy Creek, just north of I-40 (Figure 4B, Appendix A). No bents are expected to be in the water; the bridge is anticipated to span the creek and no causeways will be needed. Access to the site is available via NCDOT right-of-way.

2.2.5.3 Smith Mill Creek

Smith Mill Creek and its tributary, Emma Branch, will be crossed by bridges multiple times for I-2513. The new location bridges crossing Smith Mill Creek and Emma Branch will be part of the bridge network that combines the ramps and main lines to carry I-240 and its ramps across the French Broad River (crossings SMC-1 through 9 and EB-1 through 4, see Table 1 and Figures 4C and 4D of Appendix A). The structures will extend across all three waterbodies; the Smith Mill Creek and Emma Branch structures all connect to or are part of the I-26 and I-240 French Broad River bridges (FBR-2, 3 and 4). The Smith Mill Creek bridges will likely be phase-constructed and take two to three years to build. None of the bridges will have bents in the water, and no causeways will be needed.

2.2.5.4 Investigative Drilling

In case drilled shafts will be used for bridge construction, investigative drilling for bridge footings will require roughly two 0.5 sq. ft. diameter borings for each bent to be placed in the water. Each boring will reach a depth of 25 to 30 ft. Investigative drilling will be conducted approximately ten hours/day, drilling roughly four holes per day (Jody Kuhne, NCDOT Regional Geological Engineer, personal communication). It will take approximately two months to complete the work in the French Broad River, including set-up time. The drill rig will sit on a 15 by 20 ft. (approximate) barge that is surrounded by a containment boom to minimize turbidity. If water levels do not allow the use of a barge, investigative drilling would happen immediately upon completion of bridge construction causeways, using the causeways for access.

Roughly 45-60 borings may be needed in the French Broad River, covering about 15 sq. ft. in total (Jody Kuhne, NCDOT Regional Geological Engineer, personal communication). Additional borings may be needed in Hominy Creek if bents will be placed in the water. The noise will be equivalent to or quieter than normal bridge traffic. The drilling fluid will be clear water and the output will consist of silt-sized rock dust, approximately one pound per hole, which is direct sediment output from the hole.

2.2.5.5 Construction Drilling

Geotechnical investigations have not been completed for this project; bridge footing sizes and types will not be known until those investigations have been performed. Information for spread footings is provided below in Section 6.1 (Construction Effects). Drilled shaft footings are also a potential construction method.

If drilled shafts are used for bridge footings, drilling will be conducted in different phases for different bridges, potentially separated by significant periods of time. Each drilled shaft will be roughly 40 ft. deep and approximately eight ft. in diameter (Cameron Cochran, NCDOT Division 13 Regional Bridge Construction Engineer, personal communication). The total number of bents in the French Broad River may be up to 12, with a rough estimate of 63 shafts in the river (estimate based on two drilled shafts used in place of each spread footing). Drilling may take up to 95 weeks in the French Broad River, but will not be continuous. Additional drilling may occur in Hominy Creek, where up to four bents may be placed in the water. The drilling fluid will be a mixture of bentonite (a natural, inert clay material) and river water, the majority of which is recycled. The drilled core is typically pulled out by crane. If used, the area of riverbed to be affected by drilled shafts is approximately 3,165 sq. ft. for the French Broad River and approximately 502 sq. ft. for Hominy Creek.

2.2.5.6 Causeways

Temporary causeways are the preferred option for construction equipment to access the river, to operate safely, and to minimize the amount of time during which construction effects can occur. After access road construction is complete, causeway construction will begin. The causeways at each bridge end will extend along the riverbank from one edge of the proposed superstructure to the other. These causeways will be used as work pads for construction cranes and other equipment needed during demolition and construction activities.

The causeways needed for the three new location bridges over the French Broad River (bridges FBR-2 through 4) are estimated to use up to 38% of the river width at FBR-2 and FBR-3, and up to 26% at FBR-4 (Table 5). Each location will require multiple causeways during construction. Potential additional restrictions of the channel may be necessary for short durations, and these additional restrictions will be coordinated with USACE and USFWS prior to permitting.

Four causeways could be used to build the three bridges; one large causeway against the west bank to provide access to all the bridges crossing the French Broad at this location, and three smaller causeways serving the bridge construction on the east bank. The causeways may temporarily cover 197,700 sq. ft. of riverbed in total. This is a preliminary estimate based on planning documents, with causeway sizes determined at the surface of the causeway, not the base. Actual causeway footprints may be greater, depending on side slopes of the causeways and the final design.

The two existing bridges crossing the French Broad River carrying I-40 will be replaced by a single bridge in the same location (crossing FBR-1). It is estimated that causeways will be used to demolish the existing bridges and to build the new substructure, covering up to 36,600 sq. ft. of riverbed in total.

The two existing bridges carrying I-40 across Hominy Creek will be replaced by a single bridge in the same location (crossing HC-5). A causeway is anticipated for demolition but not for construction. The size of the causeway is expected to be 825 sq. ft.

The NB & SB bridges carrying I-26 across Hominy Creek will be replaced by a single bridge (crossing HC-7). A causeway is expected to be used during demolition of the existing bridges, covering up to 1,225 sq. ft. Causeways are not anticipated for the remaining bridges over Hominy Creek or for the Smith Mill Creek/Emma Branch crossings.

Once bridge demolition/construction is complete, all causeways will be removed from the river. Length of time in water for the construction causeways will be determined after plan/phasing development. Estimating the length of time with accuracy is not currently possible given the limited amount of information available.

2.2.6 Access Roads

Construction locations will be reached using existing roadways where possible. However, temporary access roads may be needed for transporting materials and equipment to construction worksites. Some access roads will tie to the temporary causeways located on the corresponding side of the river. Areas used for access roads will be cleared of trees and other vegetation. Since this project is in the preliminary design phase, detailed drawings are not currently available.

Temporary access roads may be required to construct the portions of the I-240 and I-26 flyover bridges at the western bank of the French Broad River (crossings FBR-2, 3, 4), as access to the construction area on new location is highly constricted. Access to the east bank of the river will utilize acquired right-of-way for staging and construction.

The bridge network crossing Smith Mill Creek and Emma Branch (crossings SMC-1 through 9 and EB-1 through 4) will need temporary access roads in conjunction with the I-26/I-240 bridge access. The same access constraints exist at Smith Mill Creek as at the western bank of the French Broad River (rail lines, height restrictions, and limited road access). Temporary piping of the creeks may be required for access; if so, this information will be provided to resource agencies once final design is complete. Any temporary piping will be removed once building demolition and bridge construction are complete.

Access to I-40 over the French Broad River (crossing FBR-1) is limited by the Biltmore property to the east. An access road will need to be constructed within the right-of-way to build the eastern bents within the river. Access roads may also need to be constructed on the west bank for construction traffic.

It is anticipated that access to other bridge construction sites can be obtained via existing or acquired right-of-way.

2.2.7 Culverts

According to the CP4A merger packet (NCDOT 2019, Appendix G), up to 23 jurisdictional streams will be affected by the project. Assuming all streams within a 25-ft. buffer of the slope stake limits will be affected, approximately 4,186 linear ft. of jurisdictional waterways will be permanently affected (NCDOT 2019, Appendix G Actual effects may be reduced once final design is completed). Temporary culverts may be needed at Smith Mill Creek and/or Emma Branch to allow access to the I-26 bridge construction site at the French Broad River; the amount of temporary piping will depend upon final design and will be reported to USFWS and other resource agencies as soon as it is determined.

2.2.8 Utilities

Electric service to residents is provided by Progress Energy. There are electric transmission lines within the project study area that run east-west, south of the I-26/I-40/I-240 interchange. The transmission lines cross NC 191 south of I-40 before turning north and paralleling the French Broad River on the west bank. They continue north to Haywood Road where they proceed northwest over I-240 and Crowne Plaza before exiting the study area. These transmission towers and electric distribution poles may need to be adjusted or relocated within the right-of-way due to the project.

Water service is widespread in the urbanized portions of Asheville. Project construction may require relocation of water lines owned by the City of Asheville. However, the extent of those relocations will not be known until final design. Gas lines ranging from 2-12 inches in diameter have been identified that would require adjustment or relocation.

There are two sewer lines adjacent to the French Broad River in the vicinity of the Jeff Bowen Bridges. They are part of major trunk lines for the City of Asheville and must be maintained. The lines consist of pipes of at least 60 inches in diameter, with smaller branching sections. NCDOT will leave the sewer line in the vicinity of the Jeff Bowen Bridges in place (no relocation). A cleared sewer easement is located adjacent to Hominy Creek beneath the I-26 and I-40 bridges. No relocation is expected in the vicinity of these bridges. No pump stations are anticipated to be affected by the project. Other relocations will likely be required outside of the vicinity of the bridges.

Gas lines ranging from 2 to 12 in. in diameter have been identified that would require adjustment or relocation.

AT&T/BellSouth owns phone lines and fiber optic routes within the Action Area. Construction of the project would affect four major duct banks (multiple cables within a conduit used to protect from accidental breakage) and nine fiber optic routes. Fiber optic cable runs along the major roads, including Patton Avenue. Buried cable lines are present near Brevard Road (NC 191). Additional survey work is needed to evaluate the extent of possible relocations.

2.2.9 Lighting

Permanent lighting in the form of commercial and residential fixtures, as well as temporary lighting from vehicle headlights, are all present in the Action Area to varying degrees, depending on location. NCDOT will utilize temporary lighting associated with construction activities, as well as permanent lighting associated with roadway operation for this project. Light type, color, and intensity are variable, depending on location, light source types, and construction phase.

2.2.9.1 Light color

Light color is described in correlated color temperature (CCT) and measured in degree Kelvin (K). A warm light is around 2700K, moving to neutral white at around 4000K, and to cool white at 5000K or more. Light-emitting diode (LED) lights can produce light anywhere within this range. High pressure sodium (HPS) fixtures have a warmer CCT in the 2,200K area. Metal halide (MH) fixtures are a cooler color in the 4,000-4,500K range. NCDOT's current specification requires the LED fixtures to have a CCT of 3,500-4,500K. All NCDOT-installed lighting along the I-26 corridor is 4,000K LED lights. The local utility in Asheville is in the process of upgrading all lighting to 4000K LED as well. While HPS fixtures remain in the area, the vast majority have been upgraded to 4000K LED.

Warmer, lower temperature lights typically don't have the same lumen output, requiring the use of more lights and a tighter pole spacing. This typically equates to increased maintenance for NCDOT and increased obstacles in the median or road shoulders, which generally decreases safety to the traveling public. Additional information about NCDOT lighting standards, and existing light conditions are provided below and in Appendix J (Lighting Summary).

2.2.9.2 Light Intensity and Brightness

A foot candle is a measure of illumination and is generally considered the illuminance produced by one candle at one foot. It relates to the brightness of light at the illuminated object. For reference, full, unobstructed sunlight has an intensity of approximately 10,000 fc. An overcast day will produce an intensity of around 100 fc. A full moon is generally considered to be 0.01 fc (Engineering Toolbox 2004).

Lumens measure the amount of light radiated from a source. Generally, the higher the lumen rating, the brighter the lamp will appear.

2.2.9.3 Construction Lighting

Temporary lighting will be used during construction to meet safety requirements and aid in night work. Temporary lights used for construction activities could be of various types, colors, and brightness, depending on the activity and the equipment used by the Contractor. All lights shall be directed towards the work area and will not shine out over any waterways. NCDOT commits to limit lighting to whatever is necessary to maintain safety in active work areas during construction. Lighting will be directed at active work areas. In addition, night work will be limited, and no nighttime lighting directed away from the work area will be permitted within 50 ft. of the French Broad River, Hominy Creek, Emma Branch, or Smith Mill Creek between March 15 and November 15.

2.2.9.4 Permanent Lighting

NCDOT policy requires the installation and maintenance of lighting systems at interchanges and along continuous sections of fully controlled access roadways which meet specific criteria established by the American Association of State Highway Transportation Officials (AASHTO) and the NCDOT Roadway Lighting Committee. NCDOT is currently in the process of updating all State owned and maintained lighting to LED. The existing lighting along the I-26 corridor has been upgraded to LED. Existing I-26 has continuous roadway lighting from the Woodfin Road interchange (Exit 23) south to the Brevard Road (NC 191) interchange (Exit 33). As part of the upcoming I-26 widening projects the existing lighting will have to be modified, and new lighting will be required in some locations. NCDOT plans to reuse the existing fixtures as part of the I-2513 project. Appendix J (Lighting Summary) describes the existing lighting conditions, initial conceptual designs, and proposed (or "mitigation") designs for the I-2513 project. USFWS will be given the opportunity to discuss/review/comment on final lighting design.

I-26/I-240/Patton Avenue Connector Interchange

The I-26/I-240/Patton Avenue Connector (east of the Jeff Bowen Bridge) interchange is currently partially lit using a combination of high mast and single arm poles. The existing interchange will be redesigned as part of the I-2513 projects. Full interchange lighting which seamlessly ties into the existing lighting on I-240, Patton Avenue and the Captain Jeff Bowen Bridges will be included in the project.

Lighting Minimization at Named Stream and River Crossings

In order to achieve maximum pole spacing along continuously lit roadway corridors, the Department traditionally uses single arm and twin arm light poles with LED light fixtures mounted 45 ft. above the pavement surface. The specification that the Department has for LED light fixtures states that the low level 'cobrahead' fixtures may have a Backlight-Uplight-Glare (BUG) rating of 3-0-3. The light pattern from these fixtures is somewhat football shaped which leads to some light falling outside of the travel lanes. In most installations, this is a desired affect because lighting outside of the travel lanes can assist motorists in identifying hazards on the shoulder.

To reduce the amount of light projected outside of the roadway, which could impact MYGR, the Department has committed to the following at all crossings of the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Branch:

- using shorter poles which will provide an overall LED light fixture mounting height of 35' above the pavement surface
- using LED light fixtures with a more rectangular light pattern as well as house side shields to minimize lighting outside of the pavement area.
- using LED light fixtures with a BUG rating of 1-0-3 or less
- using LED light fixtures with a lower lumen output, reducing overall brightness

Lighting designs for interchanges or continuous sections of roadway that are approved for lighting by the Roadway Lighting Committee are designed to an average of 0.8 fc at a 4:1 uniformity ratio (average fc to minimum fc). The 2018 AASHTO Roadway Lighting Design Guide recommends interstate lighting facilities be designed to an average of 0.6 fc (down from a range of 0.6 fc to 0.8 fc in previous versions of the Guide) at 3:1 or 4:1 uniformity ratio, but also gives member States the option to design to higher values. The NCDOT has designed around 0.8 fc at 4:1 uniformity ratio for many years based on previous AASHTO guidance. To enhance the mitigation efforts to MYGR as part of this project, NCDOT commits to meeting the AASHTO minimum requirements of 0.6 fc at 4:1 uniformity at all crossing locations identified in Appendix K. This represents a 25% reduction in the average light on the pavement surface and should reduce the amount of light reaching the various crossings.

At all identified crossings, the proposed high mast poles and 45 ft. poles with GE Cobrahead (GE) fixtures (3-0-3 BUG) were removed and replaced with 35 ft. poles with Cooper Cobrahead

(Cooper) fixtures (1-0-3 BUG). Both the GE and Cooper fixtures have a Type 2 light distribution pattern, however the house side shield on the Cooper fixture significantly changes the backlight and overall shape of the light. From outer to inner, respectively, the rings of light shown emitting from the GE and Cooper fixtures are 0.1 fc, 0.2 fc, 0.4 fc, 0.8 fc, 1.0 fc and 1.2 fc.

Hill Street Culvert Roost Outlet Area and New French Broad River Bridge

As part of the installation of the new bridge and ramps associated with the new I-26 crossing of the French Broad River, new light fixtures will also be installed. Existing lighting in this area consists a variety of light colors, types, and brightness on private property and city streets. On the private property adjacent to the roost, there are seven light fixtures, of which, four are LED, two are HPS and one is an old NEMA fixture which is probably metal halide. The lights closest to the roost are LED. NCDOT will meet with landowners adjacent to the roost culvert to discuss replacement or augmentation of existing lighting to reduce existing baseline conditions determined by the NCDOT Roadway Lighting Squad.

NCDOT originally designed the lighting in the area of the new bridge crossing over the river utilizing high mast poles, flooding the entire area with generalized lighting. However, MYGR are light averse (See Section 3.1.3), and this design was made without considering the potential impact of light on the species. The most effective way to reduce the amount of light cast onto the river and the culvert outlet while still providing adequate lighting for the driving public is to replace the 120 ft. and 100 ft. high mast poles with 35 ft. single arm light poles mounted on the bridge and flyover barriers.. To reduce impacts further, a light fixture with a very narrow distribution pattern will be used. This will keep more light on the bridges and flyovers and spill less light onto the river and the culvert outlet. Using this design results in zero calculated change to the baseline light levels at the culvert and the ditch near the culvert roost outlet. Additionally, the levels of light that are calculated to be cast onto the river are reduced by 94% to a value of roughly two and a half times that of the light from a full moon.

Hill Street Culvert Roost Inlet Area

The City of Asheville currently maintains LED lighting on Houston Street and Courtland Avenue north of the culvert roost inlet, as well on the unnamed road that leads to the back entrance of Isaac Dickson Elementary School just south of the culvert opening. The original lighting design near the Hill Street culvert inlet called for 80 ft. high mast poles installed between I-26 and Hill Street. These high masts flooded the mainline, Hill Street, and the surrounding area with light. To address mitigation efforts and better align with the NCDOT Roadway Lighting Policy for NCDOT-owned lighting inside of controlled access areas, the high mast poles were removed and replaced with GE light fixtures installed on twin arm poles on the mainline median barrier.

I-26/I-240/Patton Avenue Smith Mill Creek Culvert Area

As depicted in the diagram at the end of Appendix J (Lighting Summary), due to the distances from the culvert and the existing vegetation, the existing roadway lighting should provide little to no light at the culvert inlet. The existing high mast pole within the ramps near the culvert produces a small amount of light that shines in the area of the culvert outlet. The existing lighting system is currently not operational and is under repair, with full functionality expected by the end of 2019. This interchange will be completely reconfigured as part of the I-2513 project, with the existing ramps and loop at the culvert being removed. As a result of the reconfiguration, the existing lighting closest to the culvert opening will be removed. The proposed lighting system transitions the roadway light further away from the culvert inlet and outlet.

2.2.10 French Broad River Geomorphology & Water Quality Monitoring

To ensure the I-26 Connector (I-2513) and I-26 Widening (I-4400/I-4700) projects will not result in substantial changes to channel stability (scour, erosion, etc.) or water quality, NCDOT is working with the US Geological Survey (USGS) to evaluate the impacts of construction and temporary causeways on river habitat. The USGS investigation will help NCDOT ensure that the I-26 projects have minimal adverse effects on the French Broad River corridor. The monitoring will support NCDOT construction-site inspections, allow adaptive response to construction impacts, support holistic understanding of construction impacts over time, and provide the public, agencies, and other interested parties with readily accessible information regarding conditions in the French Broad River corridor. Details of the proposed study are described below.

Terrestrial Light Detection and Ranging (T-LiDAR) technology will be used annually to produce a laser scan of river banks. Bathymetric surveys will be conducted concurrently one to two times a year. Bathymetric data will be used to generate a gridded surface representation (digital elevation model, or DEM) of the channel bed for each survey. A similar approach will be applied to T-LiDAR data to evaluate stream bank position between successive surveys.

Water quality monitoring will include real-time (continuous) data collection of temperature, turbidity, and specific conductance. Discrete water-quality samples will be collected during a variety of flow conditions to measure total suspended sediment (TSS) and suspended sediment concentration (SSC).

Continuous streamflow, precipitation, and water-quality (temperature, conductance, and turbidity) data will be available online at http://waterdata.usgs.gov/nc/nwis/rt/ and via text and email alerts. Yearly summaries for each monitoring site will be available on demand from the USGS National Water Information System web interface (NWISWeb). Real-time alerts will be available to NCDOT via the NWISWeb when temperature or turbidity concentrations spike or exceed a predetermined threshold.

2.2.11 Standard Stormwater Control

NCDOT's Construction General Permit (NCG01) allows for stormwater discharge under the National Pollutant Discharge Elimination System (NPDES). The terms and conditions associated with this permit apply to all sections of I-2513.

They include, but are not limited to the following:

- For all perimeter dikes, swales, ditches, and slopes steeper than 3:1, stabilization must occur within seven days.
- Slopes ≤ 3:1 that are greater than 50 ft. in length, must be stabilized within seven days.
- All other areas must be stabilized within 14 days. Areas where stabilization must happen in seven days versus 14 days must be shown in the Erosion and Sedimentation Control Plan.
- Sediment and erosion control measures must be inspected weekly and within 24 hours of any storm event greater than one-half inch during a 24-hour period.
- Other requirements cover the handling of building wastes such as concrete, inspection and reporting requirements, earthen stockpiles and sediment basins.

2.2.12 Highway Operations

Once I-2513 is widened and in operation, the additional capacity may allow for an increase in the number of vehicles travelling I-26 and I-240 in the Action Area. The following activities may be conducted as part of general highway operation: pavement maintenance, including re-painting lane markings, patching potholes and cracks, and repaving highway surfaces; vegetation management, including mowing, use of herbicides in selected areas, and removal of hazardous trees; winter maintenance, such as plowing, salting, and brining; bridge and culvert maintenance; removal of trash, debris from wrecks, and animal carcasses; clean-up of spills; and maintaining ditches and stormwater control devices.

2.2.13 Project Design Modifications for Avoidance and Minimization

NCDOT has already begun to implement changes to the project design to avoid and minimize impacts to jurisdictional resources (streams and wetlands), including:

- Eliminated approximately 20,000 ft. of collector-distributer roads and added retaining walls added in Section C, along I-40. This resulted in reduction of impacts to Ragsdale Creek and avoidance of impacts to Upper Hominy Creek.
- Redesigned of the ramps associated with the new bridge over the French Broad River in Section B, resulting in the daylighting of approximately 440 ft. of Smith Mill Creek.
- Reduced overall permanent impacts to streams by 724 linear ft.
- Reduced overall impacts to wetlands by 0.63 ac.

Minimization of impacts to these resources will help protect water quality, which will benefit a variety of plant and animal species.

2.3 CONSERVATION MEASURES

As previously mentioned, NCDOT has already implemented design changes that will reduce impacts to Waters of the United States.

In addition, the following measures are being implemented by NCDOT to avoid/minimize and offset potential effects from construction activities and roadway operation to MYGR and Appalachian elktoe. These conservation measures fall into two general categories:

1. Measures to avoid/minimize effects

2. Measures to compensate for, or partially offset anticipated effects

Some of these efforts directly benefit one species or the other, but many are beneficial to both species. These measures are summarized below and categorized per the species that may derive the most benefit from the activity. These measures have been further classified by the broad groups of activity associated with this project: road construction, culvert construction, bridge replacement, and road operation.

2.3.1 Measures to Avoid/Minimize Effects to Gray Bat during Culvert Roost Construction

The following measures are proposed by NCDOT to avoid/minimize potential impacts to MYGR during construction activities associated with the culvert roost.

2.3.1.1 Timing of Construction

- The RCBC portion of the culvert system, as well as the dual CMAP at the culvert outlet will remain in place. Work on this portion of the culvert system will not occur until bat activity ceases for the season (and bats are presumably no longer using the culvert for roosting). This time frame is approximately between November 15 and March 15. NCDOT will monitor the culvert with an acoustic detector and/or emergence counts to determine when bat activity ceases for the season. After bat activity ceases for the season, a federally permitted bat biologist will enter the culvert to confirm no bats are present. This will determine when construction activity may safely begin, and/or when it should end to avoid effects to MYGR that may use the culvert system for roosting.
- NCDOT will conduct sleeving or replacement of the 60" CMP adjacent to Courtland Ave. and the entrance to Dickson Elementary School (that conveys flow under Hill Street to the RCBC) between October 15 and April 1.
- NCDOT will monitor bat activity at the culvert before, during, and after construction. Acoustic monitoring and/or emergence surveys will be conducted between March and November.

2.3.1.2 Vegetation Removal

- An operational work pad area will be established near the culvert outlets to complete the culvert rehabilitation process, as well as at the inlet near Courtland Avenue where the 60" CMP will be replaced or lined. Vegetation must be cleared to allow room for the work pad. NCDOT will cut plants in the work pad area in a way that will minimize impacts to bats and their activity by implementing the following measures: vegetation will not be removed if the area will be left bare for many months prior to construction; cutting of vegetation will be coordinated with USFWS and will not occur until all bats have left the culvert for the winter. This will be determined through emergence counts and/or acoustic monitoring and a physical check of the culvert for remaining bats; and limiting cutting to only what is necessary to complete the work and no more than 50 feet from culvert inlet/outlets.

2.3.1.3 Additional Commitments

- An equipment staging area will be established adjacent to the work pads near the culvert outlets and inlet areas near Courtland Avenue to complete the culvert rehabilitation process. NCDOT will attempt to use areas that are already cleared of vegetation whenever possible. This area will only be used for culvert rehabilitation activity staging and will not be used for any other project construction purposes.
- NCDOT will maintain baseflow to the RCBC and CMAP portion of the culvert (non-stormwater sources) to provide a naturally occurring, continual water source.
- NCDOT will either replace or install a liner in the 60" CMP located adjacent to Courtland Ave. and the entrance to Isaac Dickson Elementary School that conveys flow under Hill Street to the RCBC. NCDOT will complete this activity between October 15 and April 1.
- NCDOT will install a barrier/baffle (from here referred to as a baffle) in the RCBC between the intersection with the 60" CMP (located adjacent to Courtland Ave. and the entrance to Isaac Dickson Elementary School that conveys flow under Hill Street) and the upstream end of the RCBC to buffer noise and light associated with the CMP replacements further upstream.

2.3.2 Measures to Avoid/Minimize Effects to Gray Bat during Road Construction

The following measures are proposed by NCDOT to avoid/minimize potential impacts to MYGR during road construction activities

2.3.2.1 Preservation of Riparian Vegetation

- NCDOT will ensure the Contractor preserves riparian buffer trees where practicable and feasible.

2.3.2.2 Roadway Construction Lighting

- Due to MYGR activity on the landscape, NCDOT will limit all construction-related lighting to whatever is necessary to maintain safety in active work areas closest to the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek.
- Construction-related lighting will be indirect in nature and will not project into adjacent forested areas or over the water surface of the French Broad River, Hominy Creek, Emma Branch, or Smith Mill Creek, whenever practicable.

2.3.3. Measures to Avoid/Minimize Effects to Gray Bat during Bridge Construction

The following measures are proposed by NCDOT to avoid/minimize potential impacts to MYGR during bridge construction activities

2.3.3.1 Access Roads

- NCDOT will revegetate all access roads created for bridge construction and replacement activities where practicable.

2.3.3.2 Nighttime Construction Activities

- NCDOT will limit the use of nighttime construction within 50’ of the French Broad River, Hominy Creek, Emma Branch, or Smith Mill Creek between April 1 and October 15 to only the following activities: causeway construction, drilled shafts, concrete pours, beam setting, and traffic shifts.
- NCDOT shall commit to restrict the Contractor to no night work at crossings of the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek to minimize potential impacts to lactating females and their pups between June 1 and June 14. Between June 15 through August 1, NCDOT will also commit to restrict the Contractor to no more than 28 total nights of work, with no more than four consecutive nights. Lighting used for construction will be limited to what is necessary to maintain safety standards and will only be directed toward active work areas.

2.3.3.3 Pre-Demolition Check for Bats

- If bridge demolition is required between April 1 and October 15, NCDOT will conduct a check of all subject bridges within 30 days of demolition to determine if bats are present. See Term and Condition 12 for checks specific to culverts.
- If bats are present, one of the following options will be implemented (options listed in order of preference). NCDOT will:
    1. Wait for bats to leave for the season (approximately mid-October to early November) before beginning work; or
    2. A biologist will monitor the bridge and work will begin after bats leave the bridge for the evening, or
    3. A permitted biologist will exclude bats from work area immediately prior to the start of work using acoustic deterrents, or
    4. A permitted biologist will hand remove bats from work area immediately prior to the start of work.
    5. If pre-demo check determines pups are present, NCDOT will refrain from bridge demolition until it can be determined by a biologist that the pups are volant, and then use the previous options to proceed with demolition.

2.3.3.4 Red Safety Lighting

- As part of NCDOT’s Communication Plan specific to the construction/demolition of the bridges over the French Broad River, NCDOT will place solar-powered, steady-state red lights on the causeways to alert river users to their locations. Generators will not be used to provide power.

2.3.4 Measures to Avoid/Minimize Effects to Gray Bat and Appalachian Elktoe during Bridge Construction

Various measures have been incorporated into the project to avoid and minimize adverse effects to MYGR and Appalachian elktoe by reducing impacts to the French Broad River and its tributaries.

2.3.4.1 Contract Language

Contract language will include the following, or similar language as appropriate for bridges over the French Broad River

- The Contractor will be required to prosecute the work in a continuous and uninterrupted manner from the time work begins until completion of each phase of structure construction, demolition, and completion. The Contractor will not be permitted to suspend operations except for reasons beyond their control or except where the Engineer has authorized a suspension of the Contractor's operations in writing.

2.3.4.2 Causeways – French Broad River, Hominy Creek, and Smith Mill Creek

- Causeways will not restrict more than 50% of the existing channel width of the French Broad River, Hominy Creek, and Smith Mill Creek. Potential additional restrictions of the channel may be necessary for short durations, and these additional restrictions will be coordinated with USACE and USFWS prior to permitting.
- NCDOT will require the Contractor to use clean rock (free of debris and pollutants) for the construction of the causeways to minimize unnecessary sediment input into the river.
- Causeway material will be removed to the extent practicable and either disposed of off-site or used in areas that require permanent stone protection after project completion. NCDOT will also require that concrete barriers (barrier rail) be placed along the downstream edge of each causeway to limit the downstream movement of causeway material during high flow events.
- If the final causeway plan is staged, causeway material will be added/removed as needed for each stage to minimize the causeway footprint over the length of the project.
- Construction fabric will not be used under the causeway material, as it tends to tear into tiny pieces and float downstream during removal.
- Any equipment on the causeways will be removed any time throughout a work day when the water level rises, or is expected to rise overnight, to a point where the equipment could be flooded, or during periods of inactivity (two or more consecutive days). The only exception to this measure is that the drill rig and crane may be left in place for periods of inactivity; however, they must also be removed if the water rises, or is expected to rise, to a point where the drill rig and crane could be flooded.
- NCDOT will require its Contractor to have clean, non-leaking equipment, diapers on-site for each causeway, and spill kits located at each causeway.
- Causeways needed for the new bridges over the FBR will be designed so that during a 100-year storm event there will not be a rise in water surface elevation outside the Action Area greater than normal seasonal variation.

2.3.4.3 Containment

- All construction equipment shall be refueled above the 100-year base flood elevation plus a foot of freeboard and be protected with secondary containment. During crucial periods of construction and demolition, when the drill rig and crane cannot be moved, the drill rig and crane can be refueled while inside the 100-year floodplain provided that spill response materials (such as spill blankets and fueling diapers) are used during the refueling. Hazardous materials, fuel, lubricating oils, or other chemicals will be stored above the 100-year base flood elevation plus a foot of freeboard.
- Areas used for borrow or construction by-products will not be located within wetlands or the 100-year base flood elevation plus a foot of freeboard.
- When constructing drilled piers for the I-240, I-40 and I-26 French Broad River bridges, a containment system will be developed so material does not enter the river. Material by-product will be pumped out of the shaft to an upland disposal area to the extent practicable and treated through a proper stilling basin or silt bag.
- Construction of all bridges will be accomplished in a manner that prevents uncured concrete from coming into contact with water entering or flowing in the river.
- Removal of existing bridges shall be performed so as not to allow debris to fall into the water. If debris is dropped in a waterway, it will be immediately removed.
- NCDOT will not place bridge bents in Smith Mill Creek or Emma Branch.

2.3.5 Measures to Avoid/Minimize Effects to Gray Bat and Appalachian Elktoe during Road Construction and Bridge Replacement

2.3.5.1 Erosion Control Measures

- The Soil and Erosion Control (SEC) plan will be in place prior to any ground disturbance for all bridge replacements and construction. When needed, combinations of erosion control measures (such as silt bags in conjunction with a stilling basin) will be used to ensure that the most protective measures are being implemented.
- NCDOT standard procedures dictate that when a project has both Environmentally Sensitive Areas and a requirement to follow DSSW, and uses the GP NCG01 permit, NCDOT will default to the most-restrictive SEC measure requirement (Appendix H).

2.3.5.2 Agency Coordination (Post-Biological Opinion Checkpoints)

NCDOT Requirements

- NCDOT will revisit CP4A with the Merger Team after the BA is submitted to discuss any new avoidance and minimization efforts for major crossings of the French Broad River and Hominy Creek including those in the Biological Assessment.
- NCDOT will provide USFWS with the final roadway lighting plans and allow 15 days for review upon acknowledgement of receipt of notice.
- NCDOT will continue to identify avoidance and minimization measures to all Waters of the U.S. and ensure that major hydraulic structures associated with the project are designed

and installed to minimize negative impacts to stream stability (and therefore, water quality) to the greatest extent practicable.

- NCDOT will provide USFWS with the total size of bridge footings in the water as project design progresses and the information becomes available.
- NCDOT will provide USFWS with the results of the hydrology modeling (described below) as it becomes available, including change in French Broad velocity with causeways in place, and change in water surface elevation with causeways in place.
- Once ROW plans are developed where vegetation will be removed in riparian areas, NCDOT will meet with USFWS and NCWRC to discuss re-vegetation plans with the goal of establishing native forested buffers in all impacted areas (Hominy Creek, Smith Mill Creek, Emma Branch, and the French Broad River). NCDOT, USFWS and NCWRC will also discuss re-vegetation for acquired riparian ROW that was not forested when purchased. Additionally, NCDOT will coordinate with USFWS and NCWRC to develop a revegetation and invasive species management plan for these areas.

Bid Build Contractor Requirements

- The Bid Build Contractor shall meet with NCDOT personnel and USFWS and regulatory agency representatives immediately after contract execution to review the project and project commitments. At this time, the USFWS shall be afforded the opportunity to meet with key Bid Build Contractor members and NCDOT employees to provide education on the effects of artificial lighting, noise, and construction on nearby wildlife habitat and behavior. The Bid Build Contractor shall coordinate with the NCDOT Environmental Analysis Unit to schedule these meetings. This meeting shall be made prior to submitting any required permit modification application.
- The Bid Build Contractor shall provide USFWS with the construction phasing plan for each bridge.
- The Bid Build Contractor and / or NCDOT shall contact USFWS if new information about MYGR is discovered, as it relates to the project.
- The Bid Build Contractor shall report any dead bats found on the construction sites to USFWS.
- The Bid Build Contractor shall adhere to project commitments within the ROD and the Biological Opinion relating to Section 7 of the Endangered Species Act.

Design-Build Team Requirements

- NCDOT will arrange a meeting between each shortlisted DBT, representatives of the USFWS, and other regulatory agencies prior to the due date for the submission of Technical and Price Proposals. The discussions and answers provided at these meetings are not contractually binding but intend to offer the shortlisted teams an opportunity to inquire as to the permitting process as well as specific team concepts.
- NCDOT will arrange a meeting with the selected Design-Build Team (DBT) to provide an opportunity for USFWS to convey their concern about potential effects to protected species. The DBT shall meet with NCDOT personnel and USFWS and regulatory agency representatives immediately after contract execution to review the project and project commitments. At this time, the USFWS shall be afforded the opportunity to meet with key DBT members and NCDOT employees to provide education on the effects of artificial lighting, noise, and construction on nearby wildlife habitat and behavior. The NCDOT

Design-Build Unit shall coordinate with the DBT and the NCDOT Environmental Analysis Unit to schedule this meeting. This meeting shall be made prior to submitting the permit application. This is prior to the standard pre-con environmental meeting.

- The DBT shall adhere to project commitments within the ROD and the Biological Opinion relating to Section 7 of the Endangered Species Act. The DBT will be required to prepare information for any event in which NCDOT and FHWA reinitiate Section 7 consultation with the USFWS. It is possible that consultation be reinitiated prior to Concurrence Point 4B and again at Concurrence Point 4C.
- NCDOT will continue to identify avoidance and minimization measures to all Waters of the U.S. and ensure that major hydraulic structures associated with the project are designed and installed to minimize negative impacts to stream stability (and therefore, water quality) to the greatest extent practicable. As part of this process, NCDOT and the DBT will continue to coordinate with the Merger Team to identify avoidance and minimization measures and ensure that project impacts are minimized to every practicable extent, including impacts to federally protected species.
- The DBT shall invite USFWS and regulatory agency representatives to the pre-construction meeting for the proposed project, as well as to all subsequent field inspections prior to construction, to ensure compliance with all special project commitments.
- The DBT shall provide USFWS with the sediment and erosion control plan and allow 15 days for review upon acknowledgement of receipt of notice.
- The DBT shall provide regulatory agency representatives with the demolition plan for all bridges and allow 15 days for review upon acknowledgement of receipt of notice. All agencies will be notified prior to start of demolition so they may have a representative on site.
- The DBT shall provide USFWS with the construction phasing plan for each bridge.
- The DBT and / or NCDOT shall contact USFWS if new information about MYGR is discovered, as it relates to the project.
- The DBT shall report any dead bats found on the construction sites to USFWS.
- The DBT shall include an Environmental Coordinator as a member of their Team who will be required to attend all design, merger, and preconstruction meetings, and who will consult bat and mussel experts, as needed.
- Once ROW plans are developed where vegetation will be removed in riparian areas, NCDOT will meet with USFWS and NCWRC to discuss re-vegetation plans with the goal of establishing native forested buffers in all impacted areas (Hominy Creek, Smith Mill Creek, Emma Branch, and the French Broad River). NCDOT, USFWS and NCWRC will also discuss re-vegetation for acquired riparian ROW that was not forested when purchased. Additionally, NCDOT will coordinate with USFWS and NCWRC to develop a revegetation and invasive species management plan for these areas. Certain ROW areas will not be forested because they must be mowed or maintained at a low height for safety purposes.

2.3.6 Measures to Avoid/Minimize Effects to Gray Bat and Appalachian Elktoe During Roadway Operation

2.3.6.1 Stormwater Control Measures

- NCDOT's stormwater commitment guidance, will apply at crossings of the French Broad River and its tributaries, and any portion of the NCDOT stormwater conveyance system draining to those waters within the right-of-way.
- NCDOT will prepare a stormwater management plan (SMP) to implement post-construction stormwater best management practices (BMPs) to the maximum extent practical, consistent with the Department's National Pollutant Discharge Elimination System (NPDES) Post-Construction Stormwater Program.
- When preparing the SMP, NCDOT commits to using a hierarchical BMP selection process, optimized to treat silt, nutrients, and heavy metals.
- At each discharge location outside of the 100-year floodplain, the hydraulics engineer will evaluate the feasibility of installing either an infiltration basin or a media filter as described in NCDOT's BMP Toolbox. If neither is feasible, the hydraulics engineer will select a feasible BMP.
- NCDOT will commit to evaluating the use of emerging BMP technologies that the Department has not yet published in its BMP Toolbox:
    - Bioswales
    - Bioembankments
    - Biofiltration conveyances
    - Soil improvement to maximize infiltration
- The NCDOT hydraulics design engineer will consult with the State Hydraulics Engineer and obtain prior approval before proposing one of these BMP technologies in the SMP.

2.3.6.2 Permanent Lighting

(Crossing numbers in this section refer to Table 1 in Section 2.2.4 and Figures 4A-4D in Appendix A).

- General CM's for the entire project:
    - Use shorter poles, providing an overall LED light fixture mounting height of 35' above the pavement surface.
    - Use LED light fixtures with a more rectangular light pattern as well as house side shields to minimize lighting outside of the pavement area.
    - Use LED light fixtures with a BUG rating of 1-0-3 or less
    - Change the design standards to meet the AASHTO minimum requirements of an average of 0.6 fc at 4:1 uniformity at all crossing locations identified in the lighting document, from the original design of 0.8 fc at 4:1 uniformity.
    - At all identified crossings, the proposed high mast poles and 45' poles with GE Cobrahead (GE) fixtures (3-0-3 BUG) were redesigned with 35' poles with Cooper Cobrahead (Cooper) fixtures (1-0-3 BUG).
- Culvert Outlet – The current design near Southern States property results in zero calculated change to baseline light levels at the culvert opening and ditch leading to the FBR.

- Culvert Outlet – NCDOT will meet with landowners adjacent to the roost culvert to discuss replacement or augmentation of existing lighting to reduce existing baseline conditions determined by the NCDOT Roadway Lighting Squad.
- Culvert inlet – The original lighting design near the Hill Street culvert inlet had 80’ high mast poles installed between the mainline and Hill Street behind the Isaac Dickson Elementary School. NCDOT is revising this design to replace them with GE light fixtures installed on twin arm poles on the mainline median barrier.
- New French Broad Crossing (NFBC) – Use of single arm light poles mounted on the bridge and flyover barriers in place of the 120’ and 100’ high mast poles.
- NFBC – 35’ single arm poles with a narrow distribution light fixture and a house side shield will be used.
- FBR-1 – The GE fixtures were replaced with the lower BUG rated Cooper fixtures.
- FBR-1 – Fixtures were redesigned to have the outer ring (as shown in the figures within the lighting document) ending roughly 115’ from the west bank of the FBR.
- FBR-2, FBR-3, & FBR-4 – All high mast poles within the connector interchange were removed and replaced with Cooper fixtures mounted on the outer and/or center bridge barrier rail.
- FBR-2, FBR-3, & FBR-4 – The Cooper fixtures are located so the crossings are centered between fixtures where the light level is the lowest.
- HC-1 – Replacing the GE fixtures with the Cooper fixtures. The crossing is still centered between the Cooper fixtures, as it was for the GE fixtures.
- HC-1 - Replacing the 120’ high mast pole with an 80’ high mast pole.
- HC-2 & HC-3 – Removal of a 120’ high mast pole and replaced with Cooper fixtures.
- HC-2 & HC-3 - The Cooper fixtures are located so the crossings are centered between fixtures where the light level is the lowest.
- HC-4 - The Cooper fixtures are located so the crossings are centered between fixtures where the light level is the lowest.
- HC-5 & HC-6 – Removal of 80’ high mast pole and replacing with Cooper fixtures along the mainline and ramp in both directions.
- HC-5, HC-6, HC-7 - The Cooper fixtures are located so the crossings are centered between fixtures where the light level is the lowest.
- All SMC and EBC – Removal of all high mast poles within the connector interchange and replaces them with Cooper fixtures mounted on the outer and/or center bridge barrier.
- All SMC and EBC - Cooper fixtures located so the crossings are centered as best as possible between fixtures where the light level is the lowest.
- SMC culvert area – Existing high mast pole located within the interchange ramps will be removed.

2.3.7 Conservation Measures to Benefit Gray Bat

The following conservation measures will be undertaken by NCDOT to benefit MYGR.

2.3.7.1 Monitoring for MYGR Return and Activity

- NCDOT will conduct acoustic monitoring (or emergence counts, as appropriate) for MYGR at some locations immediately before, during and up to two years after construction. This monitoring may help determine changes in bat activity due to construction. NCDOT will coordinate the locations and time frame for monitoring with USFWS.
- To help determine whether MYGR avoid active construction zones at night, NCDOT will investigate the use of night-vision video recordings, or other methods, in an attempt to monitor bat activity at locations where they may be most susceptible to disturbance.
- NCDOT will conduct additional monitoring/research to at a minimum include additional telemetry, coordinated monitoring of roosts, monitoring of new panels, basin-wide acoustics to be conducted at key points during and after construction. This additional monitoring will be coordinated with USFWS, NCWRC and NCDOT. Please refer to Term and Condition 10 for clarification.

2.3.7.2 Hill Street Culvert Roost Area

- NCDOT will replace most, if not all the CMP within the culvert system upstream from the RCBC with RCBC and/or concrete pipe, which will effectively create additional bat roostiwillng habitat.
- NCDOT will meet with landowners adjacent to the roost culvert to discuss replacement or augmentation of existing lighting to reduce existing baseline conditions determined by the NCDOT Roadway Lighting Squad.
- NCDOT will acquire a permanent drainage easement (PDE) or additional right of way at the culvert inlet (near Courtland Ave.) and outlets, where replanting with containerized, native, woody vegetation will occur. In addition, if NCDOT acquires additional right-of-way or conservation easements along the French Broad River or adjacent to the culvert, NCDOT will replant with native, woody vegetation to provide, in time, a buffer for noise, light, and surface water runoff. NCDOT will coordinate with USFWS and NCWRC to develop a revegetation and invasive species management plan for these areas.

2.3.7.3 NCDOT-Sponsored Gray Bat Research Project

NCDOT, with the cooperation of the USFWS and NCWRC, committed to a three-year study on MYGR within the French Broad River Basin. This study will serve as a conservation measure for NCDOT projects within the Divisions 13 and 14 for a limited time. NCDOT will fund Indiana State University $900,000 to conduct the research project, to gather the information needed to allow NCDOT and USFWS to enter a programmatic consultation to cover MYGR for NCDOT Divisions 13 and 14, as well as help to develop species-specific avoidance and minimization measures. This agreement was reached, in part, for the I-4400/I-4700 (I-26 widening) project in Buncombe and Henderson Counties, but also benefits this project.

2.3.7.4 Protection of Culvert Roost Entrance

- NCDOT will coordinate with USFWS to assess the need to deter trespassing/use of the culvert by humans, and install signage or barriers, as needed.

2.3.7.5 Gray Bat Conservation Funding

- NCDOT will provide $350,000 for measures consistent with the recovery objectives outlined in the MYGR recovery plan (Brady et al. 1982).

2.3.7.6 Installation of Temporary Bat Roost Panels on Bridges

- In their BA, NCDOT committed to temporarily installing modern bat roost panels or comparable structures on four bridges within the French Broad River basin that were currently or had recently been used by roosting bats. **However, NCDOT, FHWA, and USFWS have come to a new agreement, described below.**

- NCDOT will provide modern bat roost panels or comparable structures that could serve as a temporary alternate roost for bats potentially disturbed by work on the culvert roost for the duration of construction of the I-2513 project. This will be in the place of the panels on four bridges NCDOT has committed to in the BA, which were to be placed on bridges with documented signs of bat use. These bridges are all relatively far from the Hill Street Culvert roost. The USFWS believes that panels placed on one bridge close to the Hill Street Culvert roost has greater potential to minimize take than panels placed on four bridges farther away (Reasonable and Prudent Measure 3). Refer to Term and Condition 9 for more details.

<u>2.3.8 Conservation Measures to Benefit Appalachian Elktoe</u>

The following conservation measures will be undertaken by NCDOT to benefit Appalachian elktoe.

2.3.8.1 Appalachian Elktoe Conservation Funding

- NCDOT will provide $500,000 to the North Carolina Nongame Aquatic Projects Fund for the French Broad River Conservation Plan (FBRCP) proposed by USFWS, which will aid in the recovery and conservation of Appalachian elktoe. The funding will be held by the NCWRC. A multi-agency/organization group of mussel species experts, including USFWS, will determine how to expend the funds.
- The French Broad River Conservation Plan proposes to improve aquatic habitat and diversity and to mitigate risks in the French Broad River. It may include the following:
  - Species Reintroduction: Developing a normal cohort of companion species will benefit long-term Appalachian elktoe recruitment and survival; mussel species are healthier in dense multi-species mussel beds (Vaughn et al. 2008).
  - Early Warning and Emergency Capacity: A monitoring network and propagation facility devoted to species introduction pairs an early warning system with emergency production capacity to immediately mitigate unforeseen effects to the Appalachian elktoe population should the need arise.
  - Genetic Management Program: A study of the genetic health/potential genetic drift of the population will provide feedback to the previous two program aspects and will fine tune management of Appalachian elktoe.

- o Miscellaneous: Other projects could include development of technologies such as the use of passive integrated transponder (PIT) tags to locate mussels; radio tracking equipment to study movement of mussels during high flow; development of techniques to artificially stabilize habitat for the placement of propagated mussels; and/or a cost-benefit study of watershed improvement options.

This agreement was reached, in part, for the I-4400/I-4700 (I-26 widening) project in Buncombe and Henderson Counties, but also benefits this project.

2.3.8.2 French Broad River Geomorphology Monitoring

- NCDOT is working with the US Geological Survey (USGS) to evaluate the impacts of construction and temporary causeways on river habitat. This monitoring project encompasses several Transportation Improvement Projects (I-2513, I-4400 and I-4700). Therefore, the monitoring project will span several years to accommodate the varying construction schedules.
  - o Terrestrial Light Detection and Ranging (T-LiDAR) technology will be used annually to produce a laser scan of river banks. Bathymetric surveys will be conducted concurrently one to two times a year. Bathymetric data will be used to generate a gridded surface representation (digital elevation model, or DEM) of the channel bed for each survey. A similar approach will be applied to T-LiDAR data to evaluate stream bank position between successive surveys.
  - o Water quality monitoring will include real-time (continuous) data collection of temperature, turbidity, and specific conductance. Discrete water-quality samples will be collected during a variety of flow conditions to measure total suspended sediment (TSS) and suspended sediment concentration (SSC).
  - o Continuous streamflow, precipitation, and water-quality (temperature, conductance, and turbidity) data will be available online at http://waterdata.usgs.gov/nc/nwis/rt/ and via text and email alerts. Yearly summaries for each monitoring site will be available on demand from the USGS National Water Information System web interface (NWISWeb). Real-time alerts will be available to NCDOT via the NWISWeb when temperature or turbidity concentrations spike or exceed a predetermined threshold.
  - o If monitoring at the French Broad River reveals excessive bank erosion, bank instability, or sedimentation associated with the bridge replacement, NCDOT will work to identify the cause and will make improvements to address the problems in a timely manner.

3. STATUS OF THE SPECIES

3.1 GRAY BAT

This section summarizes best available data about the biology and current condition of the gray bat (*Myotis grisescens* - gray bat) throughout its range that are relevant to formulating an opinion about the Action. The USFWS published its decision to list the gray bat as endangered on April 28, 1976. There is no designated critical habitat for this species.

3.1.1 Species Description and Life History

The gray bat is one of the largest species in the genus *Myotis* in eastern North America, with a forearm length of 40 to 46 millimeters, a weight of 7 to 16 grams (usually 8 to 11 grams), and a wingspan of 27.4 to 30 centimeters (Barbour and Davis 1969). Gray bats can most readily be distinguished from other *Myotis* by their wooly, unicolored dorsal fur, which may seem paler on the bats' belly. The fur appears gray after the mid-summer molt, becoming chestnut brown or bright russet leading to the next molt (Gore 1992). Another important characteristic is the wing membrane, which is also gray, connects to the foot at the ankle rather than the base of the toes (Barbour and Davis 1969, Gore 1992). The nails on the feet are notched and the calcar is unkeeled (Harvey *et al.* 1981, Sealander 1979).

The primary range of the gray bat is concentrated in the cave regions of Alabama, Arkansas, Kentucky, Missouri and Tennessee, with smaller populations found in adjacent states, including a growing population in a quarry in Clark County, Indiana (Harvey *et al*. 1981, Brack *et al*. 1984, Harvey 1992, Harvey 1994, Mitchell 1998). Gray bats are one of the few species of bats in North America inhabiting caves year-round. The species occupies cold caves or mines in winter and warmer caves during summer (Tuttle 1976a, Harvey *et al*. 1981, Harvey 1994, Martin 2007). In winter, gray bats hibernate in deep vertical caves that trap large volumes of cold air and the species typically forms large clusters with some aggregations numbering in the hundreds of thousands of individuals (Harvey 1994, Tuttle and Kennedy 2005). The species chooses hibernation sites where there are often multiple entrances, good air flow (Martin 2007) and where temperatures are approximately 5°-9° C, though 1°-4° C appears to be preferred (Tuttle and Kennedy 2005). Tuttle (1979) noted that an estimated 95% of the range-wide population was confined to only nine hibernacula.

There are some exceptions to this cave-specific roosting strategy. Many bat species use bridges as roost sites (Keeley and Tuttle 1999) and the gray bat is no exception. Bridges provide a warm refuge for individuals either foraging far from their primary daytime roosts or can serve as primary roosts during summer months. Gray bat bachelor and maternity colonies have been found in culverts in Arkansas (Harvey and McDaniel 1988, Timmerman and McDaniel 1992), Kentucky (Hays and Bingham 1964), and Kansas (Decher and Choate 1988). Culvert conditions can mimic those found in natural caves in terms of high levels of humidity and clear running water. Maternity colonies have also turned up in more unusual places, such as a barn in Missouri (Gunier and Elder 1971) and the gate room of a large dam in Tennessee (Lamb 2000). We are continually expanding our knowledge of where gray bats can roost, and bridge and culvert roosts are more common than previously thought.

Gray bats show strong philopatry to both summering and wintering sites (Tuttle 1976a, Tuttle 1979, Tuttle and Kennedy 2005, Martin 2007). Because of their highly specific roost and habitat requirements, only about 5% of available caves are suitable for occupancy by gray bats (Tuttle 1979, Harvey 1994). At all seasons, males and yearling females seem less restricted to specific cave and roost types (Tuttle 1976b). Bachelor males segregate in separate aggregations within a colony home range that usually includes several caves that may extend up to 70 kilometers along a particular river valley (Tuttle and Kennedy 2005).

Gray bat hibernacula are often comprised of individuals from large areas of summer range.

Based on band recovery data, Hall and Wilson (1966) calculated that a gray bat hibernaculum in Edmonson, County Kentucky attracted individuals from an area encompassing 27,195 square kilometers in Kentucky, southern Illinois, and northern Tennessee (Hall and Wilson 1966). Gray bats are documented to regularly migrate from 17 to 437 kilometers between summer maternity sites and winter hibernacula (Tuttle 1976b, Hall and Wilson 1966), with some individuals moving as much as 689 to 775 kilometers (Tuttle 1976b, Tuttle and Kennedy 2005).

Gray bats are reproductively mature at two years of age (Miller 1939, Tuttle 1976a) and mate between September and October. Copulation occurs upon arrival at hibernating caves, whereupon females immediately enter hibernation. Mating males may take a few weeks to replenish fat stores, but are typically in hibernation by early November (Tuttle 1976b, Tuttle and Stevenson 1978). Adult females store sperm throughout hibernation, a strategy known as delayed fertilization, and pregnancy begins following their spring emergence (Krulin and Sealander 1972). After a gestation period of 60 to 70 days (Saugey 1978), females give birth to one pup between late May and early June. Newborn young weigh approximately one-third of their mother's weight and are volant within 21-33 days (Tuttle 1976b, Harvey 1994, Tuttle and Kennedy 2005).

In summer, female gray bats form maternity colonies of a few hundred to many thousands of individuals. Nursery colonies typically form on domed ceilings of caves that are capable of trapping the combined body heat from clustered individuals and where the temperature ranges between 14° and 25° C (Harvey 1992, Harvey 1994, Tuttle and Kennedy 2005 and Martin 2007). All other individuals not actively mating, both male and female, occupy caves on the outlying edge of the home range (Tuttle 1976b).

Gray bats feed exclusively on insects, with flies (Diptera), beetles (Coleoptera), caddisflies (Trichoptera), moths (Lepidoptera), wasps (Hymenoptera), stoneflies (Plecoptera), leafhoppers (Homoptera), and mayflies (Ephemeroptera) being the most important orders of insect prey (Rabinowitz and Turtle 1982, Clawson 1984, Brack 1985, Lacki *et al*. 1995, Best *et al*. 1997). Diet has been found to coincide most directly with the predominantly available prey species in the foraging area (Clawson 1984, Barclay and Bingham 1994), including both terrestrial and aquatic species (Clawson 1984). A study examining fecal remains conducted by Brack and LaVal (2006) indicates that gray bat diets fluctuate to a minor degree depending upon varying factors such as age, sex, and location.

Gray bat summer foraging is strongly correlated with open water of rivers, streams, lakes or reservoirs, where insects are abundant (Tuttle 1976b, LaVal *et al*. 1977). Results of surveys conducted in Tennessee indicate that wetland depressions are also important foraging sites for gray bats (Lamb 2000). Although the species may travel up to 35 kilometers between prime feeding areas over lakes and rivers and occupied caves, (LaVal *et al*. 1977, Tuttle and Kennedy 2005, Moore *et al*. 2017), most maternity colonies are usually located between 1-4 kilometers from foraging locations (Tuttle 1976b). Newly volant gray bats travel 0.0 – 6.6 kilometers between roost caves and foraging areas (Tuttle 1976a, Tuttle 1976b). At foraging sites, Tuttle (1976b) estimated that gray bats forage within roughly three meters of the water's surface. Abbreviated instances of bad weather in early spring and late fall are generally the only times gray bats deviate from primarily feeding along local bodies of water, and then they are found foraging in forest canopies (LaVal *et al*. 1977, Stevenson and Tuttle 1981).

Gray bats are known to establish foraging territories as insect numbers drop after dusk. Territories are controlled by reproductive females, which annually return to preferred territories (Brady *et al*. 1982, Goebel 1996). Gray bats tend to have large home ranges. Thomas and Best (2000) reported non-reproductive gray bats (males and females) from one northern Alabama cave foraged over areas of approximately 97 square kilometers. Moore *et al.* (2017) found reproductive female gray bats in Arkansas had a larger home range than previously thought, with an average of 159 square kilometers, and they depend on water for foraging and traveling. The home range for reproductive females may change depending on reproductive status, but could also change based on colony size, insect abundance, habitat continuity, land use, or a combination of these factors (Moore *et al.* 2017). During times of limited food resources, males and pre-reproductive females may be excluded from foraging territories (Stevenson and Tuttle 1981).

Forested areas along the banks of streams and lakes serve as corridors for travel and as protective feeding cover for newly volant young (Tuttle 1979, Brady *et al*. 1982, Moore *et al.* 2017). Whenever possible, gray bats of all ages fly in the protection of forest canopy between roosts and feeding areas (USFWS 1982). In addition, young often feed and take shelter in forest areas near the entrance to cave roosts (Tuttle 1979). Individuals may also fly overland from relatively land-locked roost sites to reach the main river channel or tributary systems that lead to open-water foraging sites (Thomas 1994, Best and Hudson 1996). Gray bats do not feed in areas along rivers or reservoirs where the forest has been cleared (LaVal *et al.* 1977).

Young, non-volant gray bats experience healthy growth rates because their energy expenditure for thermoregulation is reduced by the roosting colony (Herreid 1963, 1967). In undisturbed colonies, young may take flight within 20 to 25 days after birth. However, young may not become volant for 30 to 35 days if disturbed (Tuttle 1975). Hunting is primarily learned by young on their own after learning to fly (Stevenson and Tuttle 1981), though lactating females will continue to nurse their offspring for a short time after they become volant. Survival and growth of volant young is inversely proportional to the distance travelled for shelter and food (Tuttle 1976a). Roosts are cool during this period of lactation and females are often required to feed continuously to sustain the high body temperatures required to nurse (Tuttle and Stevenson 1977). Distance traveled to feeding areas may also be correlated with adult mortality (Martin 2007).

Gray bats have been recorded as living up to 17 years (Harvey 1992, Tuttle and Kennedy 2005), with a mean annual survival rate of 70 percent in males and 73 percent in females (Gunier and Elder 1971). While survivorship among juveniles is relatively high (Saugey 1978), only 50 percent of gray bats reach maturity (USFWS 1980). Mortality rates are higher during the spring migration when fat stores have been expended and food resources can be scarce (Tuttle and Stevenson 1977).

3.1.2. Status and Distribution

The gray bat largely occupies a limited geographic range in karst areas of the southeastern United States. They are mainly found in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. A few can be found in northwestern Florida, western Georgia, southeastern Kansas, southern Indiana, southern and southwestern Illinois, northeastern Oklahoma, northeastern Mississippi, western Virginia, and western North Carolina.

In the late 1970s, Tuttle (1979) estimated the total population to be approximately 2.25 million. The population was estimated at only 1.6 million in the early 1980s (Brady *et al*. 1982) and fell to 1.5 million within the next 10 years (Harvey 1992). By 2001, the population increased to 2.3 million (Mitchell and Martin 2002), and again to 2.5 million in 2003 (Harvey *et al.* 2004). This is a net increase in population size of approximately 10 percent between the 1970's and 2003, and an increase of 40 percent from the smallest population estimate. The status of hibernating populations of gray bats was further reviewed in 2006 (Harvey and Currie 2007). At that time, the population was estimated at 3,377,100 – an estimated increase of 104 percent from 1982 (Harvey and Currie 2007).

As defined in the Gray Bat Recovery Plan, Priority 1(P1) hibernacula include caves occupied now or in the past by more than 50,000 gray bats in northern Alabama and Tennessee, and 25,000 elsewhere (USFWS 1982). Most of the 17 current P1 caves were designated in the recovery plan, but several additional caves have been identified as having significant winter populations in more recent times. From 2013 -2015 many of the 17 P1 hibernacula were surveyed, however not all caves were surveyed in the same winter. In 2017, winter surveys of all P1s were conducted, including the largest hibernaculum, Fern Cave in Alabama. This coordinated, rangewide effort provided the best opportunity in decades to estimate the gray bat population, now estimated at approximately 4,358,263 (Shauna Marquardt pers. comm.).

3.1.3 Threats

The primary cause of gray bat population decline is human disturbance of their natural habitat (Barbour and Davis 1969, Mohr 1972, Harvey 1975, Tuttle 1979, USFWS 1982, USFWS 2009b), with wintering sites and maternity roosts being especially susceptible to disruption. Commercialization of caves, spelunking, and looting for archaeological artifacts are activities that most commonly result in disturbance to roosting bats (USFWS 1982, USFWS 2009b). Disturbance in the hibernacula occurs when a human enters the cave and bats wake from hibernation, using vital energy stores that cannot be recovered before emerging in the spring (Tuttle 1976b). Approximately 20 to 30 days of stored energy is depleted with each arousal (Daan 1973). Losing these fat stores can cause bats to leave the roost prematurely in search of food during unsuitable circumstances, which may result in high mortality rates. During the first hour of arousal, individuals may lose up to 0.48 g of body weight; a significant amount when contrasted with the typical hibernation losses of 0.01 g per day (Brady *et al*. 1982). When this human interference occurs in maternity caves it is typically most devastating in late spring and early summer (May to July), as non-volant offspring are in the roost. Thousands of bats may die from a single disruption (USFWS 1982). In addition, Stevenson and Tuttle (1981) found that banded gray bats tended to avoid roosts where they had been handled by researchers.

Humans are also impacting the environment in other ways that can negatively impact bats. Deforestation close to cave entrances, at foraging sites, and along commuting routes is likely to have negative effects due to the removal of prey abundance and reduced cover from natural predators (Tuttle 1979). Recently-volant young are especially susceptible to the effects of deforestation, as they require the protection of forest cover while becoming proficient fliers.

Insecticide use historically had a detrimental impact on gray bat populations (Clark *et al.* 1978, Clark *et al.* 1988), though many of the toxic substances are now banned from the market. The longevity, high metabolic rate, and insectivorous diet of bats increases their likelihood of exposure to bioaccumulating chemicals in the environment. While modern pesticides (e.g., organophosphates, neonicotinoids, pyrethroids, carbonates) aren't expected to bioaccumulate in tissues, they are still a concern, are highly toxic, and may kill bats from direct exposure (Shapiro and Hohmann 2005). The presence of other contaminants of concern that can bioaccumulate (e.g., pharmaceuticals, flame retardants) has been documented in bats (Secord *et al.* 2015), though additional research is needed to understand impacts. Additionally, pesticides and other pollutants could indirectly impact bats by reducing insect populations.

Siltation and nutrient loading of waterways where bats forage and drink may negatively affect the species. As previously stated, a large portion of the gray bat diet is comprised of adult aquatic insects such as mayflies, stoneflies, and caddisflies. These groups of aquatic insects are especially susceptible to degraded water quality. Any substantial declines in the populations of these insects may have a detrimental effect on gray bat populations as well (USFWS 1982). Tuttle (1979) presented a correlation between a decline in gray bat numbers and an increase in sedimentation in several Alabama and Tennessee waterways.

Tied to increased waterway siltation is impoundment of streams and rivers to create reservoirs. While it was originally suspected that this practice would increase suitable foraging habitat for gray bats, it was ultimately found that the opposite is true (USFWS 1982). Disturbance to roosting bats using caves adjacent to these impoundments has also been observed. Noise from passing watercraft increased, as did access to cave roosts previously far from population centers and roads (USFWS 1982).

Gray bat populations could also be impacted by temperature and precipitation changes due to climate change. Climate change will likely affect the distribution of suitable hibernacula for bats (Humphries *et al.* 2002). Since gray bats are a cave-obligate species, requiring highly specific hibernacula and maternity caves, they are acutely at risk from fluctuating climate conditions. As temperatures rise, conditions within gray bat hibernacula and maternity caves could change, making them less suitable. In addition, the increase in overall temperatures may lead to earlier arousal from hibernation, resulting in higher energy expenditure and potentially premature parturition (Sherwin *et al.* 2013). Changes in precipitation is also of concern. Under drought conditions, bats have to travel further distances for food and more rainfall could inhibit insect flight and decrease prey availability. These changes could have particularly adverse effects on nursing females, as the energy costs associated with traveling longer distances for food and water result in longer lactation times, slowing overall juvenile development (Tuttle 1976b, Adams 2010). Furthermore, increased frequency of severe storms could lead to flooding of important roost sites.

Another potential threat to gray bat populations is the fungal disease white-nose syndrome (WNS). The disease is caused by the fungus *Pseudogymnoascus destructans*, which grows on the wings, ears, and muzzle of hibernating bats (Cryan *et al.* 2013). Since its discovery in New York in 2006, WNS has had an overwhelmingly negative effect on North American hibernating bats, eradicating millions of individuals. Mortality rates in afflicted bats often exceed 90 percent (Thogmartin *et al.* 2013). Bats that have been infected with WNS display erratic changes in behavior including day-time flying and increased frequency of arousal during hibernation (Cryan *et al.* 2013).

In 2012, USFWS confirmed the first instance of WNS in gray bats (USFWS 2012b). The full impact of WNS on overall gray bat populations is still being determined. It seems plausible that WNS would pose a serious threat to a species like the gray bat, where individuals overwinter in few high-density hibernacula, should it infect those colonies. However, some studies have found that *P. destructans* may not spread through gray bat colonies as quickly as once expected, nor be as substantial a threat to the species as initially suspected (Flock 2014, USFWS 2012). As of spring 2017, the species has yet to experience any WNS-related declines and their populations appear to have remained stable within Tennessee (Bernard *et al.* 2017) and Virginia (Powers *et al.* 2016). Several behavioral traits, such as preferred microclimates within hibernacula and sustained activity and foraging throughout winter (Bernard and McCracken 2017) may enable this species to prevent or minimize the colonization of *P. destructans* during torpor.

Bats and Light
Studies have consistently shown that bat species richness decreases with the presence of artificial lighting in foraging and roosting areas, with *Myotis* species being particularly vulnerable (Spoelstra et al. 2017; Stone et al. 2012; Downs 2003; Linley 2017).

Lighting may exacerbate the barrier effect of roads, since those species reluctant to cross open spaces are also those most likely to avoid light. There are no data specific to MYGR for the use or avoidance of lighted areas that may occur along roadways. Research by Rydell and Baagøe (1996) indicates that bats in the genera *Eptesicus* (big brown bats, *Eptesicus fuscus*) and *Lasiurus* (red and hoary bats, *Lasiurus borealis* and *L. cinereus,* respectively) are the species typically noted foraging around artificial lights. In contrast, they noted that bats in the genus *Myotis* seem to avoid open spaces, preferring to feed in woodlands or low over water. Additional studies (e.g. Rydell 1992; Blake et al. 1994; Stone et al. 2009, 2012) have shown that road lighting deters many bat species, notably slow-flying, woodland-adapted species such as members of the genera *Rhinolophus, Myotis* and *Plecotus*, from approaching the road. Therefore, it is possible that artificial lighting may cause avoidance behavior in MYGR.

Type and color of artificial lighting has been shown to impact bat species differently. Studies have shown a significant decrease in *Myotis* foraging activity levels under white and green light (4000K and higher) (Spoelstra et al. 2017). Red light (approximately 3000K) has been shown to cause a minimum amount of disturbance activity levels of *Myotis* bats when compared to dark foraging areas (Downs 2003).

Bats' eyes have evolved to function in low light and are less effective in brightly lit areas, and some groups of bats, including three species of *Myotis* occurring in North America, can detect UV light (Gorresen et al. 2015). Artificial lighting of any kind can cause a delay in emergence and increase the overall duration of emergence (Stone et al. 2009; Rydell et al. 2017). This in turn decreases available foraging time, juvenile growth rates, and the overall colony health (Stone et al. 2015). Studies have shown that bats using roosts lit by artificial light exhibit delayed emergence (Stone et al. 2009; Rydell et al. 2017); while one study has noted an overall drop in bat activity at artificially lit sites (Linley 2017). The presence of artificial lighting may force light-shy bats to use suboptimal flight routes or fly further to reach foraging sites and require them to expend more energy in the process (Stone et al. 2009; Stone et al. 2012). Artificial roost sites lit omnidirectionally, leaving no dark corridor to and from the roost, show high colony loss (Rydell, et al. 2017). Additionally, *Myotis* sp. have shown an increased avoidance of drinking areas lit by LED lighting (Russo et al. 2017). But both HPS and LED light disturbance caused spatial avoidance of preferred commuting routes by *R. hipposideros* and *Myotis* spp. (Stone et al. 2009).

LED lights produce a small amount of light in the UV range, when compared to other light sources like fluorescent, HPS, and MH (Lewanzik and Voight 2017, Wakefield et al. 2016, Wakefield et al. 2018). Insect activity has been shown to increase with the presence of ultraviolet (UV) light (Wakefield et al. 2016; Lewanzik and Voight 2017). More specifically, Wakefield et al. (2018) found greater numbers of insects were attracted to MH streetlights and a greater diversity of insects were attracted to white LEDs compared with long-wavelength-dominated HPS lights. While UV-producing lights may attract a larger number or greater diversity of insects, Lewanzik and Voight (2017) found that the number of *Myotis* calls increased after MH streetlights were backfitted with LED lights. This may be because of their sensitivity to UV light (Gorresen et al. 2015), causing them to avoid those areas.

3.2 APPALACHIAN ELKTOE

This section summarizes best available data about the biology and current condition of Appalachian elktoe (*Alasmidonta raveneliana*) throughout its range that are relevant to formulating an opinion about the Action. The USFWS published its decision to list Appalachian elktoe as endangered on September 3, 1993. There is no designated critical habitat for this species in the Action Area.

3.2.1 Species Description and Life History

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) cite a maximum length of 8 cm. 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 more than 9.9 cm in length (USFWS 2009b). 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.

The reproductive cycle of the Appalachian elktoe is similar to that of other native freshwater mussels. Males release sperm into the water column, and the sperm are then taken in by the female through their siphons during feeding and respiration. The females retain the fertilized eggs in their gills until the larvae (glochidia) fully develop. The mussel glochidia are released into the water, and within a few days they must attach to the appropriate species of fish, which they parasitize for a short time while they develop into juvenile mussels. They then detach from their fish host and sink to the stream bottom where they continue to develop, provided they land in a suitable substrate with the correct water conditions (USFWS 2002). The Appalachian elktoe is a bradytictic (long-term) breeder, with the females retaining glochidia in their gills from late August to mid-June (USFWS 2009b). Glochidia are released in mid-June, attaching to either the gills or fins of a suitable fish host species. Transformation time for the Appalachian elktoe occurs within 18 to 22 days at a mean temperature of l 8°C. The Appalachian elktoe can use a variety of common fish hosts but appears to specialize on darters and sculpins, which are common in the action area.

3.2.2 Status and Distribution

The Appalachian elktoe is known only from the mountain streams of western North Carolina and eastern Tennessee. It is found in gravelly substrates often mixed with cobble and boulders, in cracks of bedrock, and in relatively silt-free, coarse sandy substrates (USFWS 1996).

Although the complete historic range of the Appalachian elktoe is unknown, available information suggests that the species once lived in the majority of the rivers and larger creeks of the upper Tennessee River system in North Carolina, with the possible exception of the Hiwassee and Watauga River systems (the species has not been recorded from either of these river systems). In Tennessee, the species is known only from its present range in the main stem of the Nolichucky River. At the time of listing, two known populations of the Appalachian elktoe existed--the Nolichucky River, including its tributaries (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 its confluence with the North Toe River (USFWS 1996). 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 the Little Tennessee River (Tuckasegee River and Cheoah River) as well as a rediscovery in the French Broad River basin (Pigeon River, Little River, Mills River, and the main stem of the French Broad River). Many of these newly discovered populations are relatively small in numbers and range.

The Appalachian elktoe has experienced declines in two populations across its range. A sudden die-off in the Little Tennessee River, once considered the largest and most secure population, began in 2005 and continued through 2015, when periodic monitoring efforts failed to find any live individuals. Surveys during 2016 also failed to produce any observation of Appalachian elktoe, but surveys in 2017, 2018 and 2019 produced very low numbers, indicating a remnant population, but the population is limited and only a tiny fraction of its previous size. Appalachian elktoe also have declined in the lower portion of the Nolichucky River. Appalachian elktoe were once common in all three tributaries of the Nolichucky River: North Toe, South Toe and Cane River. In 2008, a fish kill linked to a waste water plant failure resulted in the death of most of the Appalachian elktoe in the Cane River. Beginning in 2013, the Appalachian elktoe population in the lower South Toe River declined steeply. This decline coincided with a major highway construction project and only occurred downstream of receiving streams from construction. Appalachian elktoe are still present in the South Toe River, but at reduced densities. Appalachian elktoe are still present in the North Toe River, but at low densities. It appears that the North Toe population is limited by urban runoff and mining effects to the river. The other populations of Appalachian elktoe appear to be stable (Tuckasegee, Cheoah, and Pigeon Rivers) or expanding (French Broad River). A remnant population known in the Cheoah River since the early 2000's is presently being augmented by the NCWRC with hatchery-propagated individuals sourced from the Tuckasegee River. This effort appears to be successful in bringing this population back to a viable state. Prior to 2004, the French Broad River population appeared to be confined to two tributary streams (Little River, Mills River), but over the last few years the known range of Appalachian elktoe in the main stem of the French Broad River has expanded and now appears to be well established, albeit at low density, over a broad area.

3.2.3 Threats

The decline of the Appalachian elktoe throughout its historic range has been attributed to a variety of factors, including sedimentation, point and nonpoint-source pollution, and habitat modification (impoundments, channelization etc.). The low numbers of individuals and the restricted range of most 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.

Natural flooding events combined with alteration of watersheds can lead to large fluctuations in abundance observed in Appalachian elktoe populations. Portions of the French Broad River basin and most of western North Carolina experienced catastrophic flooding in late summer 2004 as a result of Tropical Storms Francis, Ivan, and Jeanne. Numerous dead mussels, including the Appalachian elktoe, were observed in over-wash areas along the Little Tennessee River after the flood events. Additionally, surveys conducted in the Little Tennessee River after the flooding yielded noticeably lower catch per unit effort of live mussels, including the Appalachian elktoe, compared to past survey efforts in this section of the river (USFWS 2009).

Siltation resulting from improper erosion control of various types of land use, including agriculture, forestry, road construction, and development, has been recognized as a major contributing factor to the 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 direct smothering of mussels (Ellis 1936, Marking and Bills 1979). Sediment accumulations of less than an 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).

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 2 RM (3.22 km) below points of chlorinated sewage effluent. Most of the water bodies where Appalachian elktoe still exist have relatively few point source discharges within the watershed and are rated as having "good" to "excellent" water quality (NCDWR 2012**,** USFWS 1996).

The introduction of exotic species, such as the Asian clam (*Corbicula fluminea*) and zebra mussel (*Dreissena polymorpha*), has also been shown to pose significant threats to native freshwater mussels. The Asian clam is now established in most of the major river systems in the United States (Fuller and Powell 1973). At the time the Appalachian elktoe was listed, the Asian clam was not known from the stretch of the Little Tennessee River that it occupies; however, it has been observed in the Little Tennessee River in recent years and, as mentioned earlier, may be a contributing factor to the decline of that population. Concern has been raised over competitive interactions for space, food, and oxygen between this species and native mussels, possibly at the juvenile stages (Neves and Widlak 1987). When the Appalachian elktoe was listed, it was speculated that, due to its restricted distribution, it "may not be able to withstand vigorous competition" (USFWS 1996).

Another exotic species that has the potential to adversely impact aquatic species, including Appalachian elktoe, is the Japanese knotweed (*Fallopia japonica*). The plant is considered to be an invasive species that can reproduce from its seed or from its long, stout rhizomes. It can tolerate a variety of conditions, such as full shade, high temperatures, high salinity, and drought. It can be spread by wind, water, and soil movement to an area where it quickly forms dense thickets that exclude native vegetation and greatly alter the natural ecosystem. This species has become established in riparian habitats throughout western North Carolina. The species has a very shallow root system; because of this shallow root system and its preclusion of other vegetation, areas where this species has been established may be susceptible to erosion during flood events.

4. ENVIRONMENTAL BASELINE

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline.

4.1 GRAY BAT

4.1.1 Species Status and Distribution in the Action Area

The best available information on the status of the species in and near the action area comes from pre-construction acoustic surveys (10 stations within the action area) and structure checks conducted by Calyx in 2017 and 2018; wider ranging acoustic surveys (12 stations throughout the FBR basin), radio telemetry, and emergence counts conducted during the ISU research project in 2018 and 2019, and telemetry by NCWRC in 2016 and 2017. Additional information on methods and results of these efforts can be found in appendices C and D.

Emergence counts conducted by Indiana State University (ISU) at known roosts in western NC in 2018 and 2019 suggest there are at least 1900–2300 MYGR in the French Broad River basin (USFWS 2019). Data collected during monitoring and research by Calyx and ISU indicate bats arrive on the landscape in March and depart by mid-November. Based on acoustics and emergence counts, gray bat numbers and activity appears to be low early in the season. Based on acoustics, activity levels increase later in the spring and peak in July and August after pups become volant. This makes sense because more individual bats are present on the landscape during this time. Counts at roosts produce large numbers of bats throughout the late spring, summer and fall. Numbers start to drop off in late October (Appendix C).

A total of 51 bridges and 15 culverts were identified within the Action Area and checked in the field for the presence of bats or evidence of bat use (guano, staining, and/or urine) (Appendix C and D). Telemetry data also provided information on bridge and culvert roosts in and near the action area. (Appendix D and Joey Weber pers. com. 2019). A total of 31 roosts have been identified in the FBR basin and three of these occur in the action area: two in culverts and one in a building. One of the culverts (Hill Street culvert) is considered a primary roost (defined as having use by >=200 bats) and the others are secondary roosts. No evidence of bat use was found on any bridges or other culverts in the action area. Roosts within and near the action area are used in the spring, fall and summer (Appendix D). No hibernacula are known from North Carolina.

The Hill Street culvert is located adjacent to the French Broad River and conveys a UT under Riverside Drive. It is a primary roost used by at least 250 bats. For purposes of protection of the resource, the exact location of this structure will not be identified in this report. As described in Section 2.2.3, the main culvert is an 8 ft. by 8 ft. concrete box culvert that is over 1000 ft. in length. The downstream end of the culvert has two smaller metal pipes attached. Multiple corrugated metal pipes of various lengths and diameters join the box culvert along its length and at its upstream end. These pipes and drop inlets provide other potential points of entry/exit for bats. Although the culvert system carries stormwater from a relatively large area, flow from a perennial stream is present year-round. Unlike other culverts investigated for this project, there does not appear to be regular human activity in the culvert system.

Bats appear to use the Hill Street culvert throughout the spring, summer, and fall. Trapping efforts throughout this time period in 2018 and 2019 resulted in 223 and 117 captures, respectively. Only 12% of captures during 2018-2019 mistnetting efforts were female, whereas 88% were male. Volant juvenile gray bats (23) have been captured in July and August, so it is likely an important roost for young bats. Bats were trapped flying both out of and into the culvert, and bats tagged at the culvert also used other roost sites. During visits to the culvert for trapping and general observation, it was noted that bats seem to be emerging well after sunset, and activity at the culvert (bats flying in and out) continues well into the night or early morning. (Joey Weber, personal communication). Based on evidence from radio tracking and these observations, it appears the culvert is a significant night roost, in addition to serving as a day roost (Joey Weber, personal communication). A summary of other surveys and bat activity associated with culverts is included in Appendix L.

The other two roosts in the action area are Smith Mill Creek culvert, which carries Smith Mill Creek under Patton Avenue west of the FBR, and a shed located about 100 ft. from the Hill Street culvert. On September 12, 2019, five MYGR were found roosting at the top of the wall in the Smith Mill Creek culvert, near the intersection of the upstream and middle sections. Two of the bats had forearm bands, one of which was identified as an ISU band. ISU checked this culvert in summer 2018 and did not see any bats (Joey Weber, ISU, personal communication). CALYX biologists checked the culvert in August 2017 and did not see any bats or evidence of bat use. No evidence of frequent bat use (i.e. guano, staining) was noted on the culvert walls. No emergence or acoustic surveys have been conducted at this culvert. Due to the small number of bats that were documented using this culvert as a roost, as well as the presumed infrequent use, this site is considered a secondary roost site for MYGR. A single adult male was tracked to the building roost in 2019. The bat was documented using the roost only one night, and no bats were observed emerging from the structure during subsequent emergence surveys (Joey Weber, personal communication). This roost is also considered a secondary roost.

Radio telemetry tracking studies were conducted by NCWRC in 2016 and 2017, and ISU in 2018 and 2019 (although those data are not yet available) on bats captured at roosts near and within the Action Area. In addition to documenting new roosts, telemetry data provide information on foraging areas and behavior, commuting routes, and movement between roosts. Radio tracked bats commute and forage in and through the Action Area and have also been documented flying to a known hibernacula in Tennessee and to a separate known cave in Tennessee. Biologists have not been given permission to survey this second cave by the property owner, so it is unclear how the cave is used and by how many bats. (NCWRC 2017, Appendix D, Joey Weber, personal communication). Bats have been documented foraging at various locations along the FBR, along Hominy Creek, Bent Creek, Long Valley Lake, and Sandy Bottom Bog. In general, bats appear to forage mainly over water, usually along the French Broad River and associated tributaries. Bats also appear to commute back and forth to foraging areas by flying through the action area, primarily along waterways, but also over land. They clearly move between the various roosts within and near the action area. Use of the FBR and associated tributaries is also supported by acoustic surveys conducted by Calyx and ISU. Within the FBR basin, gray bats have been found roosting on 16 smaller tributaries, one of which was inside the Action Area (Smith Mill Creek). It appears bat activity is highest along the FBR, but larger tributaries also see significant bat activity.

4.1.2 Factors Affecting the Species' Environment in the Action Area

The main factor that could negatively impact gray bats in the Action Area is increasing urbanization. Development directly adjacent to the FBR has fragmented gray bat habitat by removing vegetation and creating more artificially lighted areas that the bats must avoid as they commute from roost areas to forage areas. However, other factors in the Action Area could have a positive impact on the species. Improvements in water quality in the FBR have likely increased the prey base and improved the overall ability of bats to feed over the river.

See the Biological Assessment, Section 4.1, Pg (34 - 38) for detailed baseline watershed conditions.

4.2 APPALACHIAN ELKTOE

4.2.1 Species Status and Distribution in the Action Area

Appalachian elktoe is assumed to occur within a portion of the Action Area, specifically the main stem of the French Broad River (Figure 8 of Appendix A). Freshwater mussel surveys were conducted June 12 through October 6, 2017, and the results of these surveys are included in the Freshwater Mussel Survey Report (Appendix E).

Although no Appalachian elktoe were found within the Action Area, they were found in the French Broad River approximately 1.5 river mi. upstream from the Action Area in September 2017 (Three Oaks Engineering 2018). Based on habitat conditions and the difficulty detecting species that are present in low numbers, it is possible that the Appalachian elktoe occurs within the Action Area in the French Broad River but was not detected during survey efforts.

4.2.2 Factors Affecting the Species' Environment in the Action Area

French Broad River water quality in the Action Area historically suffered from industrial and agricultural pollution. Beginning in the 1970's, efforts were begun to reduce pollution and sediment entering the River. While the FBR is much cleaner today than in the past century, there are still threats from ongoing development. Portions of the FBR and several of the larger tributaries are on the 303d list of impaired waters. There have been no previous formal sec.7 consultations for Appalachian elktoe in the FBR in the Action Area.

See the Biological Assessment, Section 4.1, Pg (34 - 38) for detailed baseline watershed conditions.

5. EFFECTS OF THE ACTION

5.1 GRAY BAT

Under section 7(a)(2) of the Act and the recent update to the regulations, effective October 28, 2019, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. The federal agency is responsible for analyzing these effects. The effects of the proposed action are added to the environmental baseline to determine the future baseline, which serves as the basis for the determination in this Opinion. Should the effects of the federal action result in a situation that would jeopardize the continued existence of the species, we may propose reasonable and prudent alternatives that the federal agency can take to avoid a violation of section 7(a)(2).

5.1.1 Factors to Be Considered

5.1.1.1 Proximity of the Action

Based on acoustic and telemetry surveys within the Action Area, the gray bat occurs throughout the Action Area from mid-March through mid-November. Three roosts were identified in the Action Area; one of which contained hundreds of bats, one which contained five bats, and one which had one bat for one night. Multiple roosts have also been identified nearby.

Based on the results of radio-tracking, we know that bats are flying into the Action Area from roosts outside the Action Area. NCWRC telemetry studies in 2016 and 2017 (NCWRC 2017) and ISU telemetry work in 2018 (Weber et al. 2018) revealed that MYGR who left the closest primary roost are using the French Broad River for commuting and foraging, although some individuals abandoned the river, choosing to fly over land or along large tributaries to the French Broad River such as Hominy Creek and Bent Creek. A smaller number of individuals also foraged in locations that were more unusual for the species, such as heavily wooded areas along the Blue Ridge Parkway, and partially wooded areas like the Riverside Cemetery, with no associated water sources.

Acoustic and telemetry studies showed that MYGR are present throughout the Action Area. They primarily use large waterways (the French Broad River) but are also present on smaller tributaries. Any work conducted over waterways when bats are present will impact the population. Although measures to avoid and minimize impacts to gray bats are included in the project plans, implementation of the project will result in unavoidable impacts to habitat and individual bats.

Surveys of all bridges in the Action Area (51) in 2017 and 2018 found no bats or evidence of bat use. However, MYGR change roosts throughout the summer, and could roost in bridges that will be demolished.

5.1.1.2 Nature of the Effect

Commuting and foraging habitat along the FBR and tributaries in the Action Area will be affected for the duration of the construction project and there could be permanent impacts in the form of new lighting along waterways.

- At the bridge replacement sites, additional lighting and noise from construction equipment may repel some bats, potentially causing them to find other areas for foraging and commuting. The addition of new structures in the waterways and new lighting could also have impacts. There is a chance bats could be forced to fly over the highways or through other open areas making them more susceptible to being hit by cars or predation.
- Riparian vegetation removed during construction will allow more light and noise from traffic and existing development to reach the river and tributaries, potentially repelling foraging bats.
- In-stream habitat for aquatic insects in the footprint of causeways will be impacted by the construction, and for some time after the construction is completed. There will be some

loss of in-stream habitat due to the presence of new bridge bents in the river and tributaries.
- Water quality impacts from construction and increased impervious surface runoff may decrease food and drinking water source quality for MYGR.
- Bats repelled from their forage areas and commuting routes may expend additional energy finding new foraging and commuting areas, which could result in lower fitness. Pregnant and lactating females will be particularly susceptible to impacts given the increased energy demands during this time period and could lose pups due to longer flight distances to forage.

Roosting bats will be impacted by work at the Hill Street Culvert and possibly during bridge demolition work that occurs when bats are on the landscape.

- Despite efforts to minimize direct impacts to bats roosting in the culvert through a barrier, bats may be disturbed by noise and potentially changes in the microclimate of the culvert from the temporary baffle, permanent changes to the culvert configuration, and removal of vegetation around the outlet.
- Depending on the timing of the work, the disturbance could cause bats to leave in daylight hours to find alternate roosts, or attempt to forage after being woken from torpor when sufficient food is not available, which could reduce fitness or result in mortality.

5.1.1.3 Disturbance Duration, Frequency and Intensity

Gray bats will be affected by the construction from mid-March through mid-November, when they are present in the action area for the duration of the project (estimated to be five years). Disturbance from elevated nighttime lighting and noise associated with construction will be temporary, but will exist until construction is complete. After the construction causeways are removed from the FBR, the substrate and its invertebrate population will continue to recover for some period of time as the river has bankfull flows that resort the riverbed and reestablish the riffle section. The widened highway and new river crossings are likely to result in more permanent impacts from noise associated with an increase in vehicles and the addition of permanent lighting, which may impact foraging and commuting bats, including bats traveling to and from the culvert roost. Tree clearing associated with the project will further fragment habitat and may leave openings that act as a barriers in certain locations since *Myotis* are reluctant to cross wide, open areas and some species of bats avoid lights and large roads (Berthinussen and Altringham 2012). Bats may temporarily abandon the culvert roost for the duration of construction because of noise, vibrations and/or changes in the microclimate. They could also abandon the roost due to the removal of trees near the outlet, which provides cover for bats entering and leaving the roost. If the microclimate of the culvert is significantly altered after repairs, bats may permanently abandon the roost.

5.1.2 Analysis of Effects of the Action

5.1.2.1 Beneficial Effects

Reduction in Permanent Fill at French Broad River Crossings

The I-40 bridge replacement over the French Broad River (crossing FBR-1) will reduce the number of bents in the water (from five to three). This means that more of the river bed will be available for colonization of aquatic fauna, including aquatic insects, which are the main food source for MYGR. Furthermore, MYGR will have fewer vertical impediments to navigate as they fly near the water surface through this section of the river while foraging and commuting.

Eliminating deck drains over water on replacement bridges, especially bridges over the French Broad River, could result in an overall net benefit with localized improvements to water quality, potentially resulting in a beneficial effect for MYGR.

Removal of Impervious Surfaces

Numerous industrial and commercial facilities, which account for large impervious surfaces near the French Broad River and Smith Mill Creek, will be demolished to construct the I-2513 project. It is estimated that over 7.7 acres of pre-1975 buildings will be removed (City of Asheville 2019) that were constructed before stormwater control devices would have been used. (This acreage was not factored into the impervious surface calculation for the project.) Although portions of the building footprints will be covered by the new I-26, stormwater control measures will be used where they had not been previously, helping to improve water quality along the river. The post-construction re-establishment of vegetation will also help provide buffer treatment. Although some of the buildings will be removed to make way for the new I-26 bridge (including ramps and flyovers), details of what will be in place post-construction will not be available until project plans are more complete. It is likely that some locations where buildings are removed, will be covered by bridges, rather than filled to create approaches to bridge ramps, which will allow for infiltration of water into the ground, where impervious surfaces previously existed.

5.1.2.2 Effects Likely to Adversely Affect Listed Species

5.1.2.2.1 Highway Construction

Construction activities associated with the project may include, but are not limited to clearing, grubbing, grading, installation of base material, installation of pavement, culvert extensions and replacements, bridge installations and replacements, striping, signs, and lighting. MYGR are present in the Action Area and most vulnerable to effects from highway construction from mid-March to mid-November when flying adjacent to or across active construction areas and when roosting in the Hill Street culvert. Stressors from highway construction are generally long term in nature near the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek bridge crossings, as well as at the Hill Street culvert roost, and generally short term in nature elsewhere, but short-term effects could occur periodically during the entire construction process, estimated up to five years.

NCDOT has committed to the following minimization measures:

- NCDOT will limit the use of nighttime construction within 50' of the French Broad River, Hominy Creek, Emma Branch, or Smith Mill Creek between April 1 and October 15 to only the following activities: causeway construction, drilled shafts, concrete pours, beam setting, and traffic shifts.
- NCDOT shall commit to restrict the Contractor to no night work at crossings of the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek to minimize potential impacts to lactating females and their pups between June 1 and June 14. Between June 15 and August 1, NCDOT will also commit to restrict the construction Contractor to no more than 28 total nights of work, with no more than four consecutive nights. Lighting used for construction will be limited to what is necessary to maintain safety standards and will only be directed toward active work areas.

One of the most critical time periods for reproductive success of bats is the maternity season, when females are pregnant, give birth to pups, and nurse pups until they can fly and forage on their own. This time period generally runs from early June through mid-July. Newly volant pups are also extremely vulnerable in late July as they are learning to fly and forage on their own. Although night work associated light and noise will be limited for two weeks of this two month time period, light and noise from construction in the other six weeks could increase stress on pregnant and lactating females, leading to reduced fitness and pup survivorship. These effects of light and noise on specific habitats are discussed in detail below.

5.1.2.2.1.1 Lighting Effects

The use of lighting after sunset will be necessary to complete some aspects of construction. Lighting associated with construction activities will be brighter than ambient light generated by headlights or nearby overhead lighting around interchanges or near developed areas. Nighttime construction activities could take place throughout the life of the project, with some restrictions stated above.

Night lighting could still occur for a large portion of the project while bats are present on the landscape. MYGR could be exposed to this stressor if they fly adjacent to or across active work zones. This stressor could cause them to abandon foraging areas and commuting areas, which could expose them to additional stressors, (e.g., increased energy expenditure, increased risk of predation, increased competition for resources).

Myotis sp. are light averse (Voigt 2018, More details in Section 3.1.3) and the addition of night lighting at the water level and in the riparian corridor will likely repel some bats from waterways where there is disturbance. More detail on potential impacts of lighting on specific bat activities is provided below.

5.1.2.2.1.1.1 Potential Light Impacts to Foraging and Commuting Habitat

As previously mentioned, within the Action Area, MYGR activity is generally highest along the French Broad River and its tributaries where MYGR are foraging and commuting. Although the majority of construction will occur during the day, multiple major bridge construction activities could occur at night. As previously stated, NCDOT will permit the following bridge construction activities from April 1 through October 15: causeway construction, drilled shafts, concrete pours, beam setting, and traffic shifts. Appendix K includes a detailed list of what these activities entail, the likelihood of occurrence and the type of lights that could be used. Any manner of construction activities could occur at night over the FBR and its tributaries in late March and late October to mid-November when some bats could still be on the landscape. Additional construction lighting from bridge demolition and construction (and from road work adjacent to the river) will create a temporarily elevated level of light, which may affect any MYGR that are present. Bridge construction/demolition activities will occur at multiple locations within the foraging and commuting area of bats that utilize the Action Area. One bridge will be demolished and replaced over the FBR, and three bridges (all near each other and near the primary culvert roost) will be constructed on a new location. Six bridges will be demolished and replaced over tributaries, and 14 will be constructed on new locations over tributaries to the FBR. Demolition of individual bridges may last up to one month depending on bridge materials, size, and design. Bridge demolition/construction is anticipated to last up to five years, which is a particularly long period of exposure time, and may occur concurrently at multiple locations within the Action Area. Construction activities that illuminate the river or riparian areas, especially on the causeways at the river level, could deter bats from foraging and commuting areas for the duration of the project. If MYGR avoid areas that are brighter than they are accustomed to, and particularly if they must do so for multiple years while construction is underway, this may lead to increased travel time/distance between their roosts and foraging areas. Additionally, although night work lighting will be limited for two weeks of the estimated two months most critical to the reproductive success of MYGR, night lighting on commuting and foraging habitat during the other six weeks of this time period could increase stress on pregnant and lactating females, leading to reduced fitness and pup survivorship. These activities are anticipated to have long term impacts on the local MYGR population.

5.1.2.2.1.1.2 Potential Light Impacts to Roosting Habitat

<u>Hill Street Culvert Roost</u>

Lights associated with construction equipment may illuminate culvert inlets during this process and disturb any bats that use the culvert for roosting. As previously mentioned, it appears that MYGR are roosting in the culvert both day and night during the active season and are utilizing multiple culvert inlets/outlets. However, MYGR do not appear to use the roost for winter hibernation. The CMAPs and RCBC portion of the culvert system are the primary areas used by MYGR and these will be repaired when bats have left the roost for the season. The 60” CMP confers flow under Hill Street and into the RCBC portion used by the bats. This section will be replaced or lined between October 15 and April 1, when most bats are at or are migrating to/from hibernacula. Since small numbers of bats could be present in the second half of March and mid-Oct. through early November, some individuals could be impacted by lighting associated with work on the 60” CMP as they commute to/from the roost. There are 14,700 feet of pipe associated with the culvert system, and work on the remainder of the culvert system may occur any time of year. Construction associated with the culvert system may last up to four years. Therefore, there is the potential that MYGR utilizing the culvert roost will be affected by light associated with these activities for up to four years. However, NCDOT will install a baffle between the RCBC portion used by bats and the 60” CMP section. This baffle should block light from any work done on the 60” CMP section when bats are present and other sections outside of the RCBC portion of the culvert. The baffle will minimize the impact of light on roosting bats. The impact of tree clearing on culvert conditions, including elevating ambient light at certain inlets and the outlet, is discussed in Section 5.1.2.2.1.3.

Smith Mill Creek Culvert Roost

The Smith Mill Creek culvert will remain in place, and no construction activities at the inlet or outlet are anticipated as part of this project. Repairs to this culvert are not anticipated at this time. Furthermore, woody vegetation is in place adjacent to the Smith Mill Creek culvert inlet and outlet which provides a buffer to incoming light, and construction activities associated with the removal of the interchange ramps. Therefore, construction lighting should not shine into the culvert and impact any bats roosting there.

5.1.2.2.1.1.3 Construction Lighting effect summary

NCDOT’s commitments to restrict rehabilitation activities associated with the RCBC and CMAPs to when the bats are not present, restrict the timing of the lining or replacement of the 60” CMP to when most of the bats are not present, and to install a baffle/barrier for work upstream of roosting bats (See Conservation measures, Section 2.3.2), will minimize impacts from lighting related to construction activities. We believe there will be little to no increase of lighting inside the culvert from construction activities when bats are roosting, and therefore little to no impact to roosting habitat. However, see Section 5.1.2.2.1.3 for potential impacts to roost suitability from vegetation removal and associated elevated ambient light.

Construction lighting may exacerbate the barrier effect of roads. Therefore, it is anticipated that MYGR will modify their preferred foraging and commuting areas, and potentially their roosting areas, due to increased light associated with construction activities. If MYGR avoid areas that are brighter than they are accustomed to, and particularly if they must do so for multiple years while bridge construction is underway, this may lead to increased travel time/distance between their roosts and foraging areas. This could result in diminished fitness of adults and/or reduced survivorship of pups and/or adults. Bats that continue to utilize areas that are brightly lit may experience higher levels of predation.

Although night work associated lighting will be limited for two weeks of the estimated two months most critical to the reproductive success of MYGR, night lighting on commuting and foraging habitat during the other six weeks of this time period could increase stress on pregnant and lactating females, leading to reduced fitness and pup survivorship. Considering the duration of combined activities in the Action Area (up to five years), we anticipate the stress associated with construction lighting will cause long term impacts to the local MYGR population.

5.1.2.2.1.2 Noise and Vibration Effects

The use of heavy equipment is anticipated to cause noise disturbance during construction activities within the Action Area. Noise will be generated primarily from work using heavy equipment such as drilling, jackhammering, running generators, and pile driving. Although the majority of construction will occur during the day, multiple major bridge construction activities will occur at night. As previously stated, NCDOT will permit the following activities from April 1 through October 15: causeway construction, drilled shafts, concrete pours, beam setting, and traffic shifts. Appendix K includes a detailed list of what these activities entail, the likelihood of occurrence and the type of lights that could be used. Daytime and nighttime noise associated with these activities is expected to affect MYGR if it occurs near the culvert roost. Noise from nighttime construction activities will impact MYGR flying over or adjacent to the roadway and bridge construction locations. At these locations MYGR may be exposed to noise intensity that they may not have previously experienced in those locations and potentially for long durations. More details on the impacts of noise is provided below.

5.1.2.2.1.2.1 Potential Noise Impacts to Foraging and Commuting Habitat

Construction activities in or adjacent to foraging and commuting habitat will create a temporarily elevated noise level, which may affect any MYGR present. Bridge construction/demolition activities will occur at multiple locations within the foraging and commuting area of bats that utilize the Action Area. One bridge will be demolished and replaced over the FBR, and three bridges (a series of high flyover bridges estimated to be 66 (FBR-3), 91 (FBR-2), and 104 (FBR-4) feet tall)) will be constructed on a new location near the Hill Street Culvert Roost (See section 5.1.2.2.1.2.2 for impacts to the roost). Six bridges will be demolished and replaced over tributaries, and 14 will be constructed on new locations over tributaries to the FBR. Demolition of individual bridges may last up to one month depending on bridge materials, size, and design. Bridge demolition/construction is anticipated to last up to five years, which is a particularly long period of exposure time, and may occur concurrently at multiple locations within the Action Area.

Although night work associated noise will be limited for two weeks of the bat maternity season, (See Section 2.3.3 for restrictions on night work), noise from construction in commuting and foraging habitat during the other six weeks of this time period could increase stress on pregnant and lactating females, leading to reduced fitness and pup survivorship. Similar to lighting, noise may exacerbate the barrier effect of roads and may create a barrier along the FBR and tributaries. It is anticipated that MYGR will modify their preferred foraging and commuting areas due to increased noise associated with construction activities. If MYGR avoid areas that are noisier than they are accustomed to, and particularly if they must do so for multiple years while construction is underway, this may lead to increased travel time/distance between their roosts and foraging areas. Potentially resulting in diminished fitness of adults and/or reduced survivorship of pups and/or adults.

5.1.2.2.1.2.2 Potential Noise and Vibration Impacts to Roosting Habitat

<u>Hill Street Culvert Roost</u>

The CMAPs and RCBC portion of the culvert system are the primary areas used by MYGR and these will be repaired when bats have left the roost for the season. The 60” CMP confers flow under Hill Street and into the RCBC portion used by the bats. This section will be replaced or lined between October 15 and April 1, when most bats are at or are migrating to/from hibernacula. Since small numbers of bats could be present in the second half of March and mid-

October through the beginning of November, some individuals could be impacted by noise and vibrations associated with work on the 60” CMP while roosting.

French Broad River Bridge Construction

Noise and vibrations associated with construction of the new French Broad River bridges near the roost may impact bats using the roost. Potential activities that would produce the highest decibel levels and most vibration include pile driving and drilling in bedrock. The I-240 eastbound ramp will be constructed closest to the culvert. The preliminary designs show the eastbound lane arching around the culvert inlet, approximately 500 feet away. The in water work is approximately 500 feet downstream from the culvert ditch outlet into the FBR. The other two major bridges are approximately 100 and 600 feet further downstream. Noise and vibrations from bridge construction in close proximity to the roost may deter bats from the area, causing them to use the roost less frequently or to abandon it. If noise and vibrations associated with work on the French Broad River Bridge reaches the culvert while bats are present, it may disturb them and cause them to be more active and expend more energy. This could lead to diminished fitness of adults. If disruptive enough, noise and vibrations could also cause all or a portion of the bats to abandon the roost. This could result in diminished fitness of adults and/or reduced survivorship of pups and/or adults

Repairs and replacement of the culvert structure upstream of the 60” CMP

While work occurs on the 60” CMP, a barrier/baffle will be in place to separate the area where the bats roost. However, it is unknown how effective the barrier will be at blocking noise and it will not block vibrations. Therefore, there is the potential that MYGR utilizing the culvert roost system will be affected by noise and vibration associated with culvert system and adjacent bridge and road construction. While the number of bats impacted during this time period is expected to be small, it is important to note that they may be particularly vulnerable during this time period. Bats are more likely to use torpor to conserve energy during cold spells in early spring and late fall. Arousal from noise and vibration associated with construction could lead to depleted fat reserves and reduced fitness or even death. Work on the remainder of the culvert system and the street above the culvert could occur any time of year, day and night, and associated noise could disturb roosting bats. If the noise and vibration is enough to disturb bats while roosting, it could cause them to be more active and expend more energy. If disruptive enough, they could leave the culvert during the day and seek an alternate roost, making them susceptible to predation. If they have difficulty finding a new roost, this could reduce the fitness of adults and/or reduce survivorship of pups and/or adults.

Repairs to the 60” CMP

As previously mentioned, bats could be present starting in early March through late November in the culvert, and the 60” CMP section could be replaced anytime from October 15th through April 1st. Although the baffle should block light, it is unknown how effective it will be at blocking noise and it will not minimize vibrations. Bats are vulnerable to disturbance in early spring and fall because they are relying on torpor to conserve energy when temperatures are fluctuating and food availability is not consistent. If bats are aroused from torpor due to noise or vibrations from the nearby work on the “60 CMP section in March and after October 15th, when food may be limited, they could deplete fat reserves, which could lead to decreased fitness and even death.

Smith Mill Creek Culvert Roost

The Smith Mill Creek culvert will remain in place, and no construction activities at the inlet or outlet are anticipated as part of this project. Repairs to this culvert are not anticipated at this time. Furthermore, woody vegetation is present at the culvert inlet and outlet, which provides a buffer to incoming noise, and construction activities associated with the removal of the interchange ramps should not involve removal of woody vegetation near the culvert inlet/outlet. Therefore, construction noise is unlikely to increase above ambient noise and impact any bats that might choose to roost there.

Factors considered for the baffle/barrier in the culvert roost effects

Additionally, it should be noted that although the baffle NCDOT has committed to install in the culvert before work begins on the “60 CMP and any upstream culvert system work, is intended to minimize impacts of construction (light and possibly noise), it may have unintended consequences. The baffle could be in place for three to four years while work on the upstream section of the culvert is ongoing. The baffle will be designed so that water flow is maintained (and NCDOT has committed to maintain base flow in the culvert) but it will alter airflow. This could alter the microclimate of the culvert so that it is undesirable to bats, causing them to abandon the roost, but we weighed the consequences and have decided that the potential benefits of blocking light and excluding bats from construction outweigh the risks of altering the microclimate.

5.1.2.2.1.3 Removal of Woody Vegetation

The project is anticipated to affect 374 acres of maintained/disturbed habitat and 191 acres of forested habitat Most of the proposed construction activities will occur within existing NCDOT right of way and/or other urbanized areas, where woody vegetation is limited. Areas outside the existing right of way that may require clearing are largely limited to existing interchanges, which are already cleared of most woody vegetation, and other areas that tend to be urbanized. Clearing will likely begin approximately one year after the project is let for construction and may continue for a period of up to two years.

Forested areas in the Action Area are fragmented due to urban development. However, along the French Broad River and other major tributaries, there is generally a continuous, narrow riparian buffer. This buffer is important for blocking light from developments and roads on the water bodies and for providing cover for commuting and foraging bats. More detail on the potential impacts of removal of woody vegetation is provided below.

5.1.2.2.1.3.1 Potential Impacts to Foraging Habitat

MYGR are forest bats that typically forage and commute in/near forested areas. The removal of riparian forest adjacent to foraging habitat could lead to bats abandoning existing foraging areas and having to find new foraging areas. MYGR with foraging areas that will be fragmented, will have to expend increased energy to establish new foraging areas or new travel corridors between roosting and foraging. Additionally, they may be subject to an increase in inter- and intra-specific competition. Bats remaining loyal to certain foraging areas may continue to cross through newly cleared areas in the activity footprint and may have an increased risk of mortality from predation, although this risk is not detectable or measurable. It is unclear whether MYGR that regularly forage in the Action Area will have difficulty establishing new foraging areas due to the availability of remaining suitable habitat in the surrounding landscape.

Removal of woody vegetation can also lead to increased sedimentation in waterways and subsequent reduction in aquatic insects, which are a primary food source for MYGR. This is further discussed in Section 5.1.2.2.1.4 (Water Quality).

As previously discussed in Sections 3.1.1 and Section 5.1.1, MYGR are active throughout the Action Area and are generally most active along the French Broad River and its tributaries, where they are foraging and commuting. Any clearing of woody vegetation associated with the project has the potential to affect MYGR using these areas. Riparian vegetation will be cleared for the following new bridges: four over the FBR, nine over Smith Mill Creek, four over Emma Branch, and one over Hominy Creek. Existing openings will also be widened for the following bridge replacements: six over Hominy Creek and one over the FBR.

5.1.2.2.1.3.2 Potential Impacts to Commuting Habitat

As previously mentioned, MYGR are roosting in a large culvert system under Riverside Drive and I-26, and are utilizing multiple culvert inlets/outlets, but do not appear to use the roost for winter hibernation. Bats utilize the vegetated corridors between the culvert inlets, and particularly the culvert outlet to access the FBR, where they forage or commute to other foraging locations. In order to clean and apply patching to the CMAP and RCBC, equipment must access the culvert outlet and inlet (near Courtland Ave.). This area in front of the outlet may be cleared of vegetation for up to approximately 50 ft. downstream, and to the top of the bank. Vegetation could also be cleared up to 50 feet around the 60” CMP culvert inlet. Therefore, MYGR commuting to and from the culvert roost will be affected by these clearing activities (See Section 5.1.2.2.1.3.3 below for the impacts of clearing the roosting habitat).

MYGR are also using the French Broad River, Hominy Creek, Smith Mill Creek, and Emma Branch for commuting purposes as they move between roosts and foraging areas. MYGR experiencing fragmented commuting habitat could expend an increased amount of energy to establish new travel corridors between roosting and foraging areas. Additionally, they may be subject to an increase in inter- and intra-specific competition. Bats that remain loyal to certain commuting areas may continue to cross through newly cleared areas in the activity footprint and may have an increased risk of mortality from predation, although this risk is not detectable or measurable.

MYGR will travel over land to reach roosts and foraging areas. From telemetry data we know that at least some of the population commutes over land and at least some individuals are moving over urban areas. Decreasing tree cover over land could also cause some bats to change commuting routes with possible consequences as described above. Further, bats that continue to use impacted routes are exposed to predation while outside the protection of forest canopy, and decreasing tree cover will increase predation risks.

It is unclear if MYGR will establish new commuting areas, and if they do, whether they will have difficulty establishing them due to the availability of remaining suitable habitat in the surrounding landscape. Additionally, they currently commute through a fragmented landscape both along waterways and over land. MYGR are tolerant of the current level of fragmentation, and may adjust to the increased loss of forested habitat, but there is probably some level of fragmentation that they will not be able to tolerate.

While it is likely that MYGR commuting behavior will be altered by tree clearing during project construction, we do not anticipate the ability to measure, detect, or evaluate the effects to MYGR from these activities.

5.1.2.2.1.3.3 Potential Impacts to Roosting Habitat

Although three MYGR were separately tracked to two sycamore trees and one green ash tree adjacent to water as part of the ISU study, MYGR do not typically utilize trees for roosting and this behavior has not been documented before. While unusual, the potential for roosting in riparian trees further supports the importance of protecting riparian corridors. However, given gray bats are cave obligates, clearing of woody vegetation is not anticipated to diminish MYGR roost availability.

Tree clearing will occur at the inlet (60" CMP adjacent to Courtland Ave. and the entrance to Isaac Dickson Elementary School) and outlet (dual CMAPs) to establish work pads (weight bearing pad or slab for machinery operation) and equipment staging areas to complete the culvert rehabilitation process. The staging areas will only be used for equipment used during culvert rehabilitation and will not be used for any other project construction purposes. Additionally, NCDOT might be able to use existing open areas for staging equipment, which would help minimize tree clearing.

Removal of trees at the inlet and outlet will allow more light to hit the entrances during and after construction and the lack of cover could result in bats abandoning the roost temporarily or permanently or increased predation near the roost if bats continue to use it. NCDOT has committed to re-establishment of woody vegetation at the culvert outlet and inlet. These plantings will mature and over time, will restore and could even improve conditions at this roost. Additional information about these measures is included in Section 2. Additionally, although it is difficult to accurately predict changes in microclimate, it is possible that removal of woody vegetation may alter the internal microclimate of the culvert. If the microclimate changes, the roost may no longer be suitable, and bats could abandon it until vegetation matures and conditions are restored.

5.1.3.4 Summary of effects from removal of woody vegetation:

Cleared areas are susceptible to erosion, and this may contribute to increased suspended sediment in adjacent streams, and ultimately the French Broad River. This aspect of project construction is further discussed in the next section (Water Quality). Cleared areas may serve as ecological barriers for some species, including bats. It is unclear how removal of woody vegetation associated with the project in the already fragmented urban environment will affect MYGR. If MYGR avoid areas where clearing is occurring/has occurred, this may lead to increased travel time/distance between their roosts and foraging areas, potentially reducing fitness in adults. Bats continuing to use cleared areas could be susceptible to increased predation. It would be difficult, if not impossible, to measure these effects.

If vegetation clearing impacts the suitability of the culvert roost by increasing light, changing the microclimate and/or reducing cover so that the entrances and exits are no longer desirable, all or a portion of the bats may abandon the roost and seek an alternate. This could result in diminished fitness of adults and/or reduced survivorship of pups and/or adults. Bats continuing to use the roost could be susceptible to increased predation because of the lack of cover.

5.1.2.2.1.4 Hydrology/Water Quality

NCDOT has implemented design changes to minimize impacts to surface waters and wetlands. However, not all impacts could be eliminated and NCDOT activities may negatively affect water quality within the Action Area. These effects are anticipated to be short term in nature, and may include:

- temporary sedimentation from land-clearing and earth moving activities such as preparation, installation of drainage features, utility installation, culvert installation/extension, and grading activities;
- temporary sedimentation from in-water work associated with bridge demolition and construction activities such as investigative drilling for bridge footings, installation and removal of temporary causeways, removal of existing bents, and construction drilling, and
- accidental spills of petrochemicals, uncured concrete, etcetera

Twenty-three streams (NCDOT 2019, Appendix G), in addition to the French Broad River, will be impacted in some way by the project. Most of these are small streams, which MYGR do not typically utilize for foraging and commuting, but activities associated with these streams may contribute to diminished water quality within the Action Area. Diminished water quality caused by sedimentation, contamination, and the destruction of wetlands and stream habitats where MYGR are present may reduce the availability of certain aquatic insects and/or reduce the quality of suitable drinking sources. Insects associated with aquatic habitats make up a large portion of the diet of MYGR Many species of aquatic insects can be negatively affected by a decrease in water quality. Therefore, a change in water quality can affect a portion of the prey base of the species. However, MYGR diet has been found to coincide most directly with the predominantly available prey species in the foraging area (including both terrestrial and aquatic species).

The Hill Street culvert system where MYGR are roosting conveys a perennial stream as well as stormwater from surrounding areas. There is concern that if the hydrology of this system is altered, either temporarily during construction, or permanently as a result of construction, MYGR may find the roost site less desirable and abandon it. However, NCDOT has committed to maintain water sources that provide baseflow to the culvert.

Although water quality impacts may cause a reduction in specific portions of the prey base and diminish the quality of drinking sources for MYGR, adverse effects will be temporary, and are likely to be undetectable due to the availability of alternative prey and drinking sources in the surrounding landscape. Additionally, with baseflow maintained in the culvert system, it is unlikely that flow will be altered enough to make the culvert an unsuitable roost. Therefore, we do not anticipate any measurable effect on MYGR due to potentially diminished water quality.

5.1.2.2.1.5 Stream Fill – Habitat Disturbance/Loss

It is anticipated that the temporary fill associated with the causeways in the French Broad River, Smith Mill, Creek, and Hominy Creek will have some effect on MYGR. It is difficult to predict whether the potential changes to flow velocities, and any associated increases in sedimentation produced by the temporary causeways will affect MYGR that utilize these areas for foraging or commuting. However, the causeways will temporarily reduce the available habitat for aquatic insects in these streams, where MYGR are known to forage. If the prey base in this area is reduced while causeways are in place, and MYGR are forced to find other foraging areas, this may lead to increased travel time/distance between their roosts and other foraging areas. We anticipate that temporary stream fill that may remain in place in various locations throughout the Action Area and may cause some MYGR to seek alternative foraging locations. However, we do not anticipate being able to measure this effect, and believe it will be insignificant.

5.1.2.2.1.6 Physical loss of roosting structures

MYGR have been documented moving between roosts in and near the Action Area. Although structure checks of bridges in the Action Area did not find any bats or evidence of roosting bats, MYGR could use these bridges in the future. Considering the amount of predicted disturbance at the Hill Street culvert roost, MYGR may be more likely to seek out additional alternate roosts. The sections of the project are anticipated to be let from 2021 to 2025, which could result in a span of three to nine or more years since bridges were checked for bat use. Therefore, NCDOT has committed to the following avoidance and minimization measures (from Section 2.3.3.3).

<u>Pre-Demolition Check for Bats</u>

- If bridge demolition is required between April 1 and October 15, NCDOT will conduct a check of all subject bridges within 30 days of demolition to determine if bats are present.
- If bats are present, one of the following options will be implemented (options listed in order of preference). NCDOT will:
    1. Wait for bats to leave for the season (approximately mid-October to early November) before beginning work; or
    2. A biologist will monitor the bridge and work will begin after bats leave the bridge for the evening, or
    3. A permitted biologist will exclude bats from work area immediately prior to the start of work using acoustic deterrents, or
    4. A permitted biologist will hand remove bats from work area immediately prior to the start of work.
    5. If pre-demo check determines pups are present, NCDOT will refrain from bridge demolition until it can be determined by a biologist that the pups are volant, and then use the previous options to proceed with demolition.

These measures will minimize take to an insignificant level from April 1st through October 15th. However, as previously discussed, bats can also be on the landscape in late March and mid-October to early November and are vulnerable to disturbance because they are relying more on torpor to conserve energy when temperatures are fluctuating and food availability is not consistent. If bats are aroused from torpor and abandon their roosts due to demolition activities in March and after October 15th, they could deplete fat reserves, which could lead to decreased fitness and even death. Additionally, if initial disturbances do not wake bats from torpor, they could be injured or killed as the bridge is demolished.

Although the culvert roost conditions may be altered so that the roost is undesirable during and post construction, it is not discussed in this section because the culvert will remain in place.

5.1.2.2.1.7 Summary of Construction Effects:

Lighting, noise, removal of woody vegetation, reduced water quality, stream fill and associated aquatic habitat alteration/destruction, could all adversely impact MYGR. Impacts to the Hill Street culvert roost, and to habitat at the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek bridge crossings are anticipated to have the largest effect on MYGR. Construction lighting, noise, and the removal of woody vegetation for the construction of multiple bridges at the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek are anticipated to be some of the most impactful activities. Additionally, work on and near the Hill Street culvert roost could have the most direct impact to bats, potentially causing them to abandon this primary roost. Reduced water quality, stream fill, and utility relocation have effects that are not as well understood, and harder to quantify, but are nevertheless predicted to have at least some negative effect on the species. In total, construction effects from these stressors are likely to adversely affect MYGR by potentially diminishing the fitness of adults and/or reducing the survivorship of pups and/or adults. Mortality is possible if bats are disturbed from torpor in March and after October 15th from work on the culvert roost and bridge demolition. If bats roost in bridges that are demolished, they could also be killed in March and after October 15th if they do not arouse from torpor.

5.1.2.2.2 Potential Effects from Highway Operation

Operational effects include those arising from daily vehicular use of the facility once it is in operation, as well as natural responses over time to the proposed action's post-construction effects. MYGR flying across or adjacent to the roadway during months when they are not hibernating, may be exposed to potential effects from highway operation including increased permanent lighting and increased traffic. The Traffic Forecast Report (AECOM 2016) indicates there will be an increase in traffic volume on all roadways associated with the project. With this increasewill come an associated increase in light, noise, and the elevated potential for bat-vehicle collisions. Increased permanent lighting along waterways could also impact bats post-construction. These impacts are discussed in more detail below.

5.1.2.2.2.1 Lighting from vehicles

Once the proposed roadway is in operation, and as traffic volume increases, the amount of ambient light generated by headlights will increase. MYGR travelling across or adjacent to the roadway, particularly in areas near the river and its larger tributaries would be most susceptible to increased light. As discussed in Section 5.1.2.2.1.1, lighting can induce a barrier effect for some bat species. If bats choose to avoid newly lit areas, they will need to find new travel corridors and foraging areas and could be impacted for some amount of time post-construction. Potential impacts include increased energy expenditure affecting fitness and reproductive success.

5.1.2.2.2.2 Noise

Effects from noise associated with increased traffic volume after the roadway is completed will become permanent and will increase over time. It is difficult to predict the degree to which MYGR could be disturbed by the noise associated with the completed project. MYGR travelling across or adjacent to the roadway during the months when they are not hibernating would be exposed to increased noise.

MYGR using roosts in bridges near the Action Area are accustomed to the associated level of traffic noise at those bridges. However, most of the roosts are located on two-lane roads with lower traffic volumes than those associated with this project.

It is unclear how increased noise from increased traffic may affect the bats using the culverts as roosts. The interior of the Hill Street culvert is currently somewhat noisy due to multiple openings such as drop inlets and culvert inlets near the interstate and secondary roads. It is very difficult to predict how noisy the interior of the culvert will become after construction is complete. The interior of the Smith Mill Creek culvert is not as noisy as the interior of the Hill Street culvert, and since nearby ramps will be removed and no new construction will occur near the culvert inlet/outlet, noise levels may decrease.

The results of studies conducted by Calyx and ISU and presented in Appendix C and Appendix D suggest MYGR activity throughout the action area, and theses bats are exposed to varying levels of noise from traffic. While traffic volumes are anticipated to increase (and associated noise will increase as well) we cannot predict how this might affect MYGR. There are no studies focused specifically on MYGR and noise effects. However, some studies suggest that *Myotis sodalis* (MYSO, a congener) may be able to tolerate disturbance from vehicular traffic noise at a roost near a large airport (Sparks et al. 2009). Although noise from traffic will increase in the action area, given the current level of noise tolerated by MYGR, and that traffic volumes will be lower at night, we do not anticipate an adverse impact to the species.

5.1.2.2.2.3 Vehicle Collisions

Bats attempting to cross the roadway will encounter a wider opening between areas of vegetated refugia where bridges are replaced, and will encounter new openings and obstacles where new bridges are constructed. MYGR attempting to cross the roadway could be struck by passing vehicles. Bats may be more likely to collide with cars when they are first confronted with new bridges, potentially deciding to fly over bridges. If this does occur, it would be more likely to occur with lower bridges and the risk would likely decrease as bats adjust to the structures. Bat mortality caused by impacts with passing vehicles is widely documented (Kiefer et al. 1995, Lesiński 2007, Gaisler et al. 2009, Russell et al. 2009, Lesinski et al. 2010, Medinas et al. 2013). Bat mortality may occur within the Action Area if bats fly too low to traffic when crossing over a bridge or roadway, typically when they are commuting. MYGR are probably less susceptible to vehicle collisions while foraging, because they typically forage within 6.5 to 10 ft. of the water surface (Tuttle 1976b, 1979, LaVal et al. 1977). Bat injury and mortality from vehicle strikes may increase within the Action Area from increased traffic.

5.1.2.2.2.4 Maintenance of Cleared Areas, Tree Trimming and Hazard Tree Removal

Forested areas that are cleared as part of the construction process will need to be maintained in low growing or herbaceous vegetation in most areas after construction completion. Potential effects to MYGR from woody vegetation removal are described in Section 5.1.2.2.1.3. Maintenance of cleared areas near water will result in a permanent increase in lighting from road work and highway operation and reduced cover for foraging and commuting bats. Openings in forest cover will be relatively small in size, and it is difficult to assess their impact on MYGR. We anticipate that bats will eventually adjust to vegetation changes and will still be able to find dark corridors for commuting and foraging.

Additionally, tree trimming and hazardous tree removal activities occur along roadside ROWs to reduce safety hazards from falling trees or limbs, or to improve line-of-sight issues. Hazardous tree-removal occurs on an as-needed basis, so quantifying the amount of habitat lost from this activity is not practicable. No MYGR roosts are anticipated to be impacted by this activity, and any clearing of this type along waterways where MYGR might be foraging or commuting is expected to be minimal.

We do not anticipate any detectable effects from maintenance of openings or tree trimming and hazard tree removal on MYGR.

5.1.2.2.2.5 Permanent Lighting

New or replacement lighting will be required in multiple locations over water, as outlined in the Lighting Summary document (Appendix J) and Section 2.2.9.4 (Permanent Lighting). Much of the foraging and commuting habitat on the FBR and tributaries are dark, with some small areas of light from existing bridges and private development. Light does not typically reach all the way across any of the waterways. The largest concentration of new lighting will be associated with the new bridges over the French Broad River and associated ramps/approaches. However, there will also be numerous lit single crossings of tributaries utilized by MYGR that are currently mostly dark.

MYGR travelling across or adjacent to the roadway, particularly in areas near the river and its larger tributaries, will be exposed to increased light from upgraded or new lighting (See Section 2.2.9.4 for new permanent lighting details). As discussed in Section 5.1.1 and 3.2.3, lighting can induce a barrier effect for some bat species. It is unclear whether there is a threshold of ambient light that would induce this effect for MYGR.

Permanent lighting has been minimized by eliminating high mast poles close to waterways, increasing pole spacing, and selecting light fixtures with minimal spill off roadways (Section 2.2.9.4). Additionally, NCDOT decided not to light the I-40 bridge over the FBR, leaving a dark corridor in this area, and lights will likely be minimized on the Bowen bridge when it is converted to a residential street. Table 2 shows the level of light predicted to hit the FBR at the new crossing location (FBR-2 through FBR4). The light expected at the water surface after minimization efforts will be around 0.026 foot candles (fc) (Appendix J). The minimized permanent lighting plan will not increase light levels at the Hill Street culvert or associated ditch. The light level predicted on the FBR from the new bridges is approximately 2.5 times the light of the full moon, which is 0.01 fc.

Table 2. Permanent Lighting Change from Initial Design

Area	Initial Design Assumed Measured Value	Minimization Design Assumed Measured Value	Percent Changed from Initial Design
Culvert Opening	0.25	0.13	-48%
Ditch	0.29	0.18	-38%
FBR	0.43	0.026	-94%

Lighting levels at the water level were not calculated for the other crossings where MYGR commute and forage on Hominy Creek, Smith Mill Creek, and Emma Branch. The mitigation lighting plan has minimized the placement of lighting so that typically only 0.10 fc will extend beyond the edge of the roadway. Due to the height of the lighting above the water, the light intensity at water level will generally be much less than 0.10 fc. Crossings HC-1 through HC-5 and HC-7 are bridge replacements with a new lighting design. Although these crossings already exist, in most of these locations the creek is not illuminated by road and bridge lighting. There will be one new crossing of Hominy Creek, nine new crossings of Smith Mill Creek, and four new crossings of Emma Branch. These locations were all previously dark. The areas illuminated will be relatively small, but will likely cover the width of the tributaries. The additional lighting could affect MYGR foraging and commuting behaviors, causing them to use illuminated areas less frequently, or avoid the creeks entirely. However, it is unknown what light level would lead to abandonment of habitat. It will be difficult, if not impossible, to measure the effect of increased permanent lighting on the population.

5.1.2.2.3 Consequences of other activities caused by the proposed action

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17).

5.1.2.2.3.1 Induced land development

Highway projects can induce changes in surrounding land use when they shorten commuting times or provide access to areas previously poorly served. The NCDOT studied the potential for changes in land use surrounding the Action Area (NCDOT 2016) and found that the nature of this project, as an upgrade to an existing roadway, without additional access along its length, would not induce significant amounts of additional development.

5.1.2.2.3.2 Waste and borrow sites

Another source of effects common to roadway projects is the siting of waste and borrow areas necessary for the temporary holding of construction materials. On large projects, the area necessary for waste, borrow and staging operations can be large and under certain conditions could create additional negative effects for aquatic species. NCDOT allows the Contractor to manage placement and operation of the waste and borrow sites after the contract is awarded and does not consider effects of the waste and borrow sites to be part of the authorized action, however, NCDOT does provide standard guidance for borrow/fill sites that are intended to regulate the environmental effects of these areas and requires consultation with the Division Engineer if their placement could affect a federally listed species. If not for the proposed action, the waste and borrow sites would not be necessary. Therefore, we consider them consequences of the proposed action. However, if NCDOTs standard guidelines are followed, we believe they will effectively minimize additional effects associated with these sites.

5.1.2.2.3.3 Utility relocations

Utility relocations required for I-2513 have the potential to affect local water quality through erosion and sedimentation, which could result in effects to MYGR if sediment reaches the French Broad River or the large tributaries to the River (see project description in Section 2.2.8 for information on potential utility relocations). The removal of woody vegetation associated with utility relocations could also adversely affect MYGR. Quantifying the degree of deforestation, or water quality degradation is difficult to project and depends on the location of the future activities, the amount of impervious surface area associated with the activity, and any stormwater controls that are put in place. Any such effects are likely to be localized and temporary.

Utility relocations that are small, such as overhead electric distribution lines, fiber optic lines, buried cable lines, and small gas lines should have minimal, if any, effects to MYGR, especially if located relatively far from the French Broad River. Larger relocations with associated land-clearing and relocations closer to the French Broad River and its larger tributaries have the potential to affect MYGR until the relocation areas can be stabilized. Electric transmission towers, some of which parallel the French Broad River, may need to be relocated as a result of I-2513. Water lines are wide-spread in urbanized areas, but the extent of those relocations will not be known until final designs are complete. Sewer lines are adjacent to the French Broad River and Hominy Creek, but relocations are not currently anticipated.

The preliminary project designs do not include utilities design, which will be completed during the final design phase. However, it seems feasible that some utility relocations will be necessary. The areas where utilities are currently located, as well as areas where they could potentially be moved are largely covered by maintained/disturbed habitat. Therefore, little woody vegetation is likely to be removed for the relocations, and the impact to MYGR is expected to be insignificant.

5.2 APPALACHIAN ELKTOE

Under section 7(a)(2) of the Act and the recent update to the regulations, effective October 28, 2019, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. The federal agency is responsible for analyzing these effects. The effects of the proposed action are added to the environmental baseline to determine the future baseline, which serves as the basis for the determination in this Opinion. Should the effects of the federal action result in a situation that would jeopardize the continued existence of the species, we may propose reasonable and prudent alternatives that the federal agency can take to avoid a violation of section 7(a)(2).

5.2.1 Factors to Be Considered

5.2.1.1 Proximity of the Action

Appalachian elktoe is assumed to occur within a portion of the Action Area, specifically the main stem of the French Broad River (Figure 8 of Appendix A). Freshwater mussel surveys were conducted June 12 through October 6, 2017, and although no Appalachian elktoe were found within the Action Area, they were found in the French Broad River approximately 1.5 river mi. upstream from the Action Area in September 2017 (Three Oaks Engineering 2018). Based on habitat conditions and the difficulty detecting species that are present in low numbers, it is possible that the Appalachian elktoe occurs within the Action Area in the French Broad River but was not detected during survey efforts. For the purposes of this BO we will assume the Appalachian elktoe is present, but due to low density, was not encountered during preconstruction surveys.

5.2.1.2 Nature of the Effect

In-stream habitat in the FBR will be permanently affected by new bents in the river and temporarily impacted by causeways. Project construction includes a cumulative 234,300 sq. ft. of temporary causeway footprint in the French Broad River and 19,725 sq. ft. of permanent fill for bridge footings, assuming spread footings are used. Work conducted in the FBR for bridge construction and demolition has the potential to kill mussels by crushing or burying them.

Temporary causeway fill in tributaries to the French Broad River (Hominy Creek) will total 2,050 sq. ft. The total area to be covered by bridge footings in French Broad River tributaries (Hominy Creek) is estimated to be 3,125 sq. ft., assuming spread footings will be used.

Up to 23 jurisdictional streams within the Upper French Broad River sub-basin will be permanently affected by the project, assuming all streams within a 25-ft. buffer of the slope stake limits will be affected. Approximately 4,186 linear ft. of jurisdictional waterways will be permanently affected by the project (Appendix G), Temporary piping may be used in streams in order to access sites for bridge construction.

5.2.1.3 Disturbance Duration, Frequency, and Intensity

The highway construction will create disturbance to tributaries and downstream resources that will be ongoing in different segments of the project for years. With appropriate sediment and erosion control measures, large inputs of sediment should be avoided during construction. After the project is completed and the roadway opens to traffic, there will be increases in stormwater runoff volume and pollutants, some of which may reach areas occupied by the Appalachian elktoe.

Disturbance to the riverbed from bridge construction and demolition will occur over three to four years. The causeways for construction and demolition will be in place for the length of time needed to construct and demolish the bridges. Although there will be direct impacts to the riverbed associated with the causeways, the construction of the causeways will be phased to limit the amount of causeway in the river at any one time, and only the causeways needed for an activity will be in place during that activity and will be removed when the action is completed. There will be temporary impacts to river hydrology both upstream and downstream of the causeways.

5.2.3 Analysis of Effects of the Action

5.2.3.1 Potential Beneficial Effects

The I-40 bridge replacement over the French Broad River (crossing FBR-1) will reduce the number of bents in the water (from five to three); the larger hydraulic opening in the river will have fewer adverse effects on the riverbed and may result in localized improvement of habitat suitability for the Appalachian elktoe.

Eliminating deck drains over water on replacement bridges could result in an overall net benefit with localized improvements to water quality, potentially resulting in a beneficial effect on the Appalachian elktoe. The effects at the French Broad River bridges would be greater than at the tributaries, due to the immediate presence of occupied habitat. The duration of the effects would last the lifetime of each bridge, potentially several decades.

Numerous industrial and commercial facilities, which account for large impervious surfaces near the French Broad River and Smith Mill Creek, will be demolished to construct the I-2513 project. Over 7.7 acres of pre-1975 buildings will be removed (City of Asheville 2019) that were constructed before stormwater control devices would have been used. (This acreage was not factored into the impervious surface calculation for the project.) Although portions of the building footprints will be covered by the new I-26, stormwater control measures will be used where they had not been previously, helping to improve water quality along the river. The post-construction re-establishment of vegetation will also help provide buffer treatment. Although some of the buildings will be removed to make way for the new I-26 bridge (including ramps and flyovers), details of what will be in place post-construction will not be available until project plans are more complete. It is likely that some locations where buildings are to be removed will be covered by bridges, rather than filled to create approaches to bridge ramps, which will allow for infiltration of water into the ground, where impervious surfaces previously existed.

5.2.3.2 Effects Likely to Adversely Affect Listed Species

5.2.3.2.1 Construction Effects

The project design crosses the French Broad River as well as waterbodies that drain to habitat occupied by Appalachian elktoe habitat in the French Broad River. As a result, there is potential for construction effects to occur that originate in areas not immediately adjacent to the French Broad River.

There is the potential for accidental spills of petrochemicals from construction equipment and uncured concrete at bridge construction sites. The type, timing, amount, and proximity to a water source of any accidental spills would determine the magnitude of effect in the French Broad River in the event of an accidental spill.

5.2.3.2.1.1 Investigative Drilling

During investigative drilling for bridge footings, any mussels present in the drilling area, about 15 sq. ft. in the French Broad River, will be killed. The cuttings (rock dust) from drilling could potentially smother any mussels that happen to be in the area. Given the rarity of Appalachian elktoe within the French Broad River, the chances of an individual occurring within the location of the borings is small but cannot be completely discounted. Investigative drilling in Hominy Creek, if needed, should have no effect on Appalachian elktoe, as they are not known to occur there.

5.2.3.2.1.2 French Broad River Bridge Demolition and Construction

The French Broad River will be crossed by the project four times, with one bridge replacement and three bridges on new location. Construction work in or adjacent to the French Broad River has a greater potential to affect Appalachian elktoe due to its immediate proximity to occupied habitat, compared to construction on, or near other waterways.

Geotechnical investigations have not yet been completed for this project. The required bridge footing sizes and types will not be known until those investigations have been performed. For the purposes of a "worst-case" scenario, footings were estimated to be of a spread type, sized as 25x25 sq. ft. per two lanes of traffic. Effects of drilled shaft footings, which would have a smaller footprint on the riverbed, have also been assessed in case they are used instead of spread footings.

The French Broad River crossing of I-40 will be at an existing crossing location (crossing FBR-1), where one new bridge will replace two existing structures, reducing the number of bents in the water from five for the existing structures to three with the new bridge. Fewer bents will allow for a larger hydraulic opening which will likely locally reduce scour potential to the riverbed and sheer stress to the riverbanks. Using an estimate for a worst-case scenario, the spread footings may cover as much as 6,600 sq. ft. of riverbed. Drilled shaft footings may be used as a construction method instead of spread footings, which would require a smaller footprint on the river bottom, but the construction methods will not be determined until later in the project design process.

The three bridges (FBR-2 through 4) carrying I-26 and I-240 over the French Broad River will be constructed on a new location north of the existing Captain Jeff Bowen Bridges. The bridges will each be over one-half mile long and will also span Smith Mill Creek and Emma Branch. The bridges will take three to four years to complete and will likely be phase-constructed. The bridges will each require three bents in the river, for a total of nine bents. The estimated spread footing sizes for these bridges in the French Broad River are 1,875 sq. ft. (crossing FBR-2), 9,375 sq. ft. (crossing FBR-3), and 1,875 sq. ft. (crossing FBR-4), for a total of 13,125 sq. ft.

In total, up to 12 bents will be placed in the French Broad River (Table 3). Actual foundation/bent sizes and types cannot be established without geotechnical reports, borings, and other investigation into the locations. Details will be provided to USFWS as project design progresses. If drilled shafts are used for bridge footings, there will be an estimated 63 shafts in the river. The area of riverbed be affected by drilled shafts would be approximately 3,165 sq. ft.

Table 3. Bridge Footing Estimates

Crossing Number #	Road Carried	Water Body	Current # bents in water	Future # bents in water (max estimate)	*Total spread footing size (sq. ft.)	Notes/ Assumptions
FBR-1	I-40	French Broad River	5	3	6,600	
HC-7	I-26 NB & SB	Hominy Creek	1	4**	3,125	**worst-case estimate
FBR-2	I-240	French Broad River	N/A	3	1,875	
FBR-3	I-26	French Broad River	N/A	3	9,375	
FBR-4	I-240	French Broad River	N/A	3	1,875	

*Use of spread footings assumed, with each footing 25x25 ft.

Any mussels present in the bridge construction areas could be killed by drilled shafts or placement of spread footings, placement of causeways, and/or the demolition and removal of existing bridges, all of which are described below. If sedimentation were to occur from any of those actions, it could affect mussels downstream. Land disturbance associated with accessing the river for construction is likely to be the greatest source of sedimentation. Potential effects to mussels could last for the duration of construction.

All four of the French Broad River bridges will need causeways for construction, demolition, or both. Causeways are discussed below (Section 5.2.3.2.1.6, Causeways).

Seven bridges will be demolished for I-2513, including one bridge over the French Broad River, carrying I-40 (crossing FBR-1). The remaining demolitions will all be at Hominy Creek (HC-1 through 5, HC-7). During demolition NCDOT will remove the existing bridges using methods that minimize the amount of construction debris in the river, and due to the unknown nature of the existing foundation construction and condition, many decisions about removal will have to be made on site. Small amounts of bridge debris may fall into the river. However, it will be removed and we do not believe that small amounts of construction debris temporarily in the river will have any effect on Appalachian elktoe.

5.2.3.2.1.3 Bridge Work - Tributaries to French Broad River

Hominy Creek and Smith Mill Creek are not considered to be occupied habitat for Appalachian elktoe. Both are urbanized streams with degraded habitat. Nevertheless, bridge construction in these tributaries has the possibility to affect Appalachian elktoe downstream in the French Broad River if sediment and erosion control measures are not properly developed and maintained. Construction work could result in sedimentation/erosion with temporary effects downstream in the French Broad River, altering mussel habitat or potentially smothering mussels. Details on the bridge replacements can be found in Section 2.2.4, and the sediment and erosion control impacts to Appalachian elktoe are discussed in Section 5.2.3.2.1.6 below.

5.2.3.2.1.4 Causeway Construction and Use

The causeways needed for bridge construction and demolition are summarized in Table 5. Three of the bridges over the French Broad River, for I-240 and I-26 (FBR-2 through 4), will need causeways for bridge construction. The fourth French Broad River bridge, for I-40, (FBR-1) will need causeways for both demolition and construction. The demolition causeway for I-40, needs to reach existing bents in the river, and could leave as little as 32% of the free-flowing river; however, the causeway will only be in place for a limited duration, and its placement will be coordinated with resource agencies prior to project construction. The total causeway footprint in the French Broad River will be 234,300 sq. ft. Estimated sizes are for the surface of each causeway, not the base on the riverbed.

The long duration of causeway operation (French Broad River bridge work is anticipated to last three to four years) needed to construct this project creates an opportunity for related effects to Appalachian elktoe and habitat near the construction area. Rock causeway material may be washed away during high flow events, where it could have a negative effect on the species by crushing individuals or fouling habitat. Additionally, the disruption of stream bottom affected by the installation and removal of the causeways may cause temporary negative effects to the habitat. However, the probability of this causing direct mortality is low, due to the presumed low density of Appalachian elktoe in the area. Furthermore, because the habitat in the FBR is bedrock dominant, the USFWS believes this habitat will likely revert back to its present suitability within a few years post construction.

The operation of causeways can also increase stream bed and bank scour near the project area. The area downstream of the causeways will experience higher velocities while causeways are in place, and may experience higher rates of scour as a result. Scouring could affect any mussels in the riverbed, washing them downstream and/or causing shell erosion. NCDOT proposes to avoid disturbance to the area downstream of the causeways to the extent possible and to monitor the area for scour. To ensure bridge construction will not result in substantial changes to channel stability (scour, erosion, etc.), NCDOT will conduct river channel and bank monitoring (see Section 2.3.8.2 for details). Other avoidance and minimization measures for causeways are discussed in Section 2.3.4.2. Should significant scour be detected, NCDOT has committed to making improvements to the causeway to prevent scour. The USFWS believes that the area, may be affected temporarily, but is likely to return to suitability within a few years post construction.

In addition to the potential changes in hydrology as a result of the causeways, there is the potential for the causeways to act as velocity barriers to fish movement. The disruption of fish movement could impact the Appalachian elktoe if fish hosts for the elktoe are unable to move freely in the river. These temporary disruptions to fish movement may cause some loss in recruitment to upstream or downstream areas for the period of time the causeways are in place. The USFWS believes the direction of disruption of fish host travel is primarily in the upstream direction. Downstream migration of fish is unlikely to be affected as strongly due to the nature of the causeways and associated flow disruptions. Since the distribution of the bulk of the Appalachian elktoe population is upstream of the project, and host fish directional movement downstream is the most important direction of movement in this case, the USFWS believes this effect will be minimal.

Table 5. Causeway Estimates

Crossing Number	Road Carried	Water Body	Causeway 1 Length X Width (ft)	Causeway 2 Length X Width (ft)	Causeway 3 Length X Width (ft)	Demolition Causeway Length X Width (ft)	Total Causeway Footprint (sq ft)	River Width (ft)	River Free-Flow with Widest Causeway in Place
HC-5	I-40	Hominy	0	0	0	825	825	50	35 ft, 70%
FBR-1	I-40	French Broad	18,000	9,000	0	9,600	36,600	235	^75 ft, 32% (for demolition causeway)
HC-7	I-26/I-240 NB and SB	Hominy	0	0	0	1,225	1,225	70	35 ft, 50%
FBR-2	I-240 EB	French Broad	45,500	15,600	12,000	0	73,100	350	220 ft, 62%
FBR-3	I-26 EB/WB	French Broad	27,000	45,500	0	0	72,500	350	220 ft, 62%
FBR-4	I-240 WB	French Broad	8,000	4,4100	0	0	52,100	350	260 ft, 74%
Total							**236,350**		

^ Demolition causeways will remain in place for limited duration.

5.2.3.2.1.5 Spills and Pollutant Discharge

The inadvertent spill or discharge of toxic pollutants, such as diesel fuel and hydraulic oil, into the river could result in mortality of Appalachian elktoe. Spills of construction fluids are not uncommon, and the long duration of heavy equipment use adjacent to waterways increases the possibility that a spill or discharge could occur. However, NCDOT has committed to conservation measures to refuel the equipment away from the water and to have spill kits near the equipment on the causeways, reducing the likelihood of a spill or discharge reaching the river. Spills could also take place near any other waterway and subsequently have an effect further downstream, but we believe normal spill response is capable of avoiding effects from minor spills. Major spills resulting from negligent operation are still possible, but unlikely.

5.2.3.2.1.6 Erosion and Sedimentation from Highway and Bridge Construction

Highway and bridge construction projects require significant earth moving activity. This includes clearing and grubbing, cut and fill, grading operations, etc., the impacts of which are discussed below.

5.2.3.2.1.6.1 Temporary Access Roads

Temporary access roads will be constructed to transport materials and construction equipment to bridge worksites. Roads may be required to construct the portions of the I-240 and I-26 bridges and ramps that lay at the western bank of the French Broad River (FBR-2 through 4). Temporary access roads will need to be installed to construct the crossings of Smith Mill Creek and Emma Branch (crossings SMC3 through 9 and EB-1 through 4) in conjunction with the I-240 and I-26 bridge access. Access to I-40 over the French Broad River (crossing FBR-1) will require an access road on the east bank, and possibly the west bank.

The access roads will require clearing of trees and other vegetation. The temporary access roads, if not maintained properly, could transport sediment into the river and its tributaries until disturbed slopes become stabilized with riprap, matting, or other measures. Since the roads slope down toward the river, they could channel sediment directly into Appalachian elktoe habitat. Access road designs will use DSSW for sediment and erosion control to minimize impacts.

5.2.3.2.1.6.2 Impacts to streams in the project area

Up to 23 jurisdictional streams (4,186 linear ft. of jurisdictional waterways) within the Upper French Broad River subbasin will be permanently affected by the project, assuming all streams within a 25-ft. buffer of the slope stake limits will be affected. Temporary fill may occur during construction from piping streams to create access roads. Sediment from erosion associated with these impacts will reach the FBR, the impacts of which are discussed below.

5.2.3.2.1.6.3 Erosion and sedimentation impacts on Appalachian Elktoe

All activities that expose soil create an opportunity for soil erosion from the project into the river. This can negatively impact aquatic species, including the Appalachian elktoe. With a duration of up to five years, multiple bridges being constructed, and effects to 23 streams draining to the FBR, this project has significant potential to cause long duration, widespread, negative effects to Appalachian elktoe and its habitat. Two previous population declines in this species coincided with erosive events. In the Little Tennessee River, hurricanes Frances and Ivan in 2004 caused major flooding resulting in landslides and chronically unstable banks throughout the watershed. Over the next few years, the population of Appalachian elktoe declined precipitously and is now critically imperiled. On the South Toe River, starting in 2013 a major road widening project began affecting dozens of tributaries of the South Toe River. Subsequently, the Appalachian elktoe population immediately downstream of this disturbance declined. Investigations into the mechanism that caused the decline are ongoing, but the proximity to potential erosive sources begs caution that this species is particularly sensitive to elevated levels of fine sediment.

The distribution of Appalachian elktoe in the FBR currently places most of them in the upper portions of the river. As previously described in the species baseline, the Appalachian elktoe appears to be currently expanding in the FBR and the known downstream extent of this species has expanded further every year since 2005. The known downstream range of the Appalachian elktoe is presently just upstream of the mouth of Hominy Creek. The presence of two other species of mussel downstream of this record and extending all the way into Tennessee gives us reason to believe that the downstream expansion of the Appalachian elktoe will continue unless external factors halt the population expansion. Due to the above mentioned losses in two other populations, the long term stability of the FBR population is a key factor in recovering this species.

The erosion control measures incorporated into the proposed action will reduce the levels of sedimentation into the FBR, but these measures have a design limit based on the amount of rainfall received at the project area. Rainfall events that are greater than the erosion control design limits will result in sediment loss into the river. The baseline levels of suspended sediment in the FBR are already elevated due to cumulative activity in the watershed. However, this baseline suspended sediment has allowed for recent population expansion. In 2018 the Asheville region experienced the highest level of rainfall on record. The previous record year was 2013. The five year duration of this project makes it possible that periods of significant rainfall will occur during the construction. In order to reduce the number and likelihood of sedimentation events from rainfall resulting in water quality impacts, the NCDOT has proposed several conservation measures to improve erosion control efficacy, monitor effectiveness and to fund resource agencies to plan for species recovery in case of unforeseen circumstances. However; if conditions are atypical or if effects to the species are greater than anticipated, NCDOT and USFWS have agreed to collaborate to seek solutions. Accordingly, we have included a Term and Condition that the USFWS can request an onsite meeting to discuss the project at any time. This will allow for adaptive improvements and ensure that problems are addressed early and impacts minimized.

5.2.3.2.2 Operation Effects

The construction of this project will lead to additional road surface drainage to the French Broad River indefinitely. The operation of roads is known to increase the rate of runoff into the river, causing potential destabilization of sensitive habitat within. Roadway runoff contains pollutants that may affect aquatic species at high concentration. Roadways are also a primary threat for toxic spills that could affect the river habitat.

5.2.3.2.2.1 *Impervious Surfaces*

The I-2513 project will increase impervious surface in the Action Area. There is an estimated increase of roadway pavement of 125 acres associated with this project. The increased impervious surfaces will cause an increase in stormwater runoff. NCDOT has committed to implementing stormwater control measures throughout the project where they are practical. We believe that proper stormwater controls will reduce the effects of stormwater on the receiving streams, but not entirely eliminate stormwater effects on the river, especially when rainfall rates are high. The increased stream velocities may have adverse erosive effects on tributary channels resulting in additional sedimentation in the river habitat. The NCDOT has committed to fixing erosion problems at culverts in tributary channels during construction. Proper outfall conditions should further reduce some erosion within the tributary channels. Therefore, based on the present conditions in the action area, as well as the conservation measures proposed we do not believe that the increase in impervious surface will significantly impact the suitability of the habitat in the future.

5.2.3.2.2.2 *Roadway Runoff*

There will be additional runoff due to the additional impervious surface created by the I-2513 project. Numerous pollutants have been identified in highway runoff, including various metals (e.g., lead, zinc, iron), sediment, pesticides, de-icing salts, nutrients (nitrogen, phosphorus), and petroleum hydrocarbons and many of these can be harmful to mussels. Mussels present in the Action Area may experience locally increased exposure to runoff from the I-2513 project and the resulting increase in impervious surface from the highway. The effects from roadway runoff will be long-lasting, spanning the life of the highway but will likely be sporadic and site specific. The long term effects of chronic exposure to roadway pollutants to mussels are poorly understood. The conservation funding provided by the NCDOT for activities aiding in the conservation of Appalachian elktoe will be expended to further study the health of the watershed, as well as the elktoe to aid in recovery of the species.

5.2.3.2.2.3 *Toxic Spills*

Toxic spills on roadways are a concern for aquatic species. This will be true any time large quantities of material are transported near waterways. Due to the large amount of existing roadway and train transport in the FBR basin, the I-2513 project will not appreciably increase the probability of a spill.

5.2.3.2.3 Consequences of other activities caused by the proposed action

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17).

5.2.3.2.3.1 Induced Land Development

Highway projects can induce changes in surrounding land use when they shorten commuting times or provide access to areas previously poorly served. These changes can be a consequence of the action if they would not occur without construction of the project. The NCDOT studied the potential for changes in land use surrounding the Action Area (NCDOT 2016) and found that the nature of this project, as an upgrade to an existing roadway, without additional access along its length, would not induce significant amounts of additional development.

Another source of effects from consequences of the action common to roadway projects is the siting of waste and borrow areas necessary for the temporary holding of construction materials. On large projects, the area necessary for waste, borrow and staging operations can be large and under certain conditions could create additional negative effects for aquatic species. NCDOT allows the Contractor to manage placement and operation of the waste and borrow sites after the contract is awarded and does not consider effects of the waste and borrow sites to be part of the authorized action, however, NCDOT does provide standard guidance for borrow/fill sites that are intended to regulate the environmental effects of these areas and requires consultation with the Division Engineer if their placement could affect a federally listed species. If not for the proposed action, the waste and borrow sites would not be necessary. Therefore, we consider them consequences of the proposed action. However, if NCDOTs standard guidelines are followed, we believe they will effectively minimize additional effects associated with these sites.

6. CUMULATIVE EFFECTS

Gray bat and Appalachian elktoe

Cumulative effects are defined under the ESA as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation" (50 CFR 402.02). Future federal actions unrelated to the proposed action are not considered because they require separate consultation pursuant to Section 7 of the ESA.

The Asheville Regional Cumulative Effects Study (NCDOT 2014a) evaluated cumulative effects for the I-26 corridor under the National Environmental Policy Act (NEPA) and indicated the I-2513 project would result in minimal cumulative effects. The majority of activities identified in the report, and since its release, will likely require federal authorization or funding requiring their own ESA Section 7 consultation, and would not be considered a cumulative effect under the ESA. However, the French Broad River corridor throughout the action area continues to experience heavy growth, with many small developments contributing non-point source pollution to the river in the form of sedimentation during construction and/or increased runoff carrying pollutants from the roads or private lands during rain events.

7. CONCLUSION

7.1 GRAY BAT

After reviewing the current status of the gray bat; the environmental baseline for the action area; the effects of bridge construction, demolition, culvert maintenance and highway construction; conservation measures incorporated into the proposed action; any effects from consequences of the action; and any cumulative effects, it is the USFWS's opinion that implementing this project is not likely to jeopardize the continued existence of the gray bat. No critical habitat for gray bat exists within the Action Area, therefore, none will be affected.

7.2 APPALACHIAN ELKTOE

After reviewing the current status of the Appalachian elktoe; the environmental baseline for the action area; the effects of bridge construction, demolition, and highway construction; measures identified in the NCDOT's BA to help minimize the potential impacts of the proposed project and assistance in the protection, management, and recovery of the species; any effects from consequences of the action; and any potential cumulative effects, it is the USFWS's opinion that implementing this project is not likely to jeopardize the continued existence of the Appalachian elktoe. No critical habitat for Appalachian elktoe exists within the Action Area, therefore, none will be affected.

8. INCIDENTAL TAKE STATEMENT

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

8.1 GRAY BAT

MYGR were observed roosting in two culverts and one building in the Action Area. One culvert and the building will not be affected. No evidence of bat roosting was observed on any bridges included in project construction activities, however, over the lifespan of the project, MYGR could roost in bridges planned for demolition. The USFWS anticipates incidental take of gray bats may occur as a result of impacts to the Hill Street culvert roost despite efforts to avoid and minimize take. Based on emergence counts, ISU estimates that there could be up to 250 bats using the Hill Street culvert. All or some portion of these bats may temporarily or permanently abandon the roost due to disturbance from construction and tree clearing. Most of the take associated with impacts to the Hill Street Culvert will be in the form of harm and harassment, but mortality of adult bats is possible. Noise and vibrations associated with work on and near the culvert system may cause bats to be more active and expend more energy, leading to diminished fitness. If disruptive enough, noise and vibrations could also cause all or a portion of the bats to abandon the roost. If bats are aroused from torpor due to noise from the nearby work on the 60" CMP section in March and after October 15th, when food may be limited, they could deplete fat reserves, which could lead to decreased fitness and even death. Mortality is also possible if bats are disturbed from torpor in March and after October 15^{th} from work associated with bridge demolition. Additionally if bats roost in bridges that are demolished, they could be killed in March and after October 15^{th} if they do not arouse from torpor. Tree clearing at the culvert outlet and one inlet will temporarily increase ambient light and could change the microclimate inside the culvert until replanted vegetation grows back. Changes in habitat and cover from tree clearing at the culvert entrance and potential changes in airflow could disturb bats to the extent that they abandon the roost for the duration of construction or permanently. Additionally, if changes in the structure of the culvert system permanently alter the microclimate of the culvert, bats may abandon the roost permanently. The loss of the roost could result in diminished fitness of adults and/or reduced survivorship of pups and/or adults since bats will expend energy finding new roosts or flying further to other existing roosts.

The USFWS also anticipates incidental take of gray bats may occur as a result of impacts to foraging and commuting habitat from the I-2513 construction work at the French Broad River, Hominy Creek, Emma Branch, and Smith Mill Creek bridge crossings. During construction, individual bats may be repelled from forage areas in the bridge footprints, along the FBR and tributaries, potentially reducing adult and juvenile fitness and affecting pup birth and health before they are able to fly and forage on their own. Additionally, more bats may be killed due to predation and car strikes if they are repelled from areas of active construction and forced to fly over the highway or through more open areas. Permanent changes in lighting may reduce suitable forage and commuting areas so that the number of bats utilizing the area decreases over the long term if bats avoid the elevated light levels. The number of gray bats using the FBR and its tributaries within and near the action area is estimated at 1900 to 2300 individuals. An unknown number of these will be affected by the construction activities (including: temporary lighting, noise, causeways, decrease in water quality, and loss of woody vegetation). Most of the take associated with impacts to commuting and foraging habitat will be in the form of harm and harassment, but some mortality of adult bats and newly-volant juveniles is possible. Additionally, some loss of recruitment is expected due to stress on pregnant and lactating females and subsequent loss of pups. This harm is not expected to cause mortality of all individuals within the Action Area, but could reduce fecundity and recruitment within the Action Area for five years while the project is under construction. This project, could have long-term impacts on the bat population in this area.

Data used to determine the number of gray bats in the Action Area is a conservative estimate, and gray bat populations are known to fluctuate seasonally and annually in a given area, therefore it is difficult to base the amount of incidental take on numbers of individual bats. Additionally, it is difficult to measure take of gray bats resulting from the action. Due to these reasons, the amount of incidental take will be monitored using the duration of construction activities over and adjacent to the river, and those that impact the culvert roost, which are the most disruptive aspects of the project, as a surrogate measure of take. Bridge construction activities are expected to take 5 years, and culvert construction activities upstream of the 60' CMP are expected to take up to four years. The amount of incidental take will be exceeded if 1) night operations at river crossings exceed five years, 2) if disruptive construction on the Hill Street culvert system upstream of the 60" CMP exceeds four seasons when bats are present, or 3) if disruptive construction on the 60" CMP exceeds one season when bats are present (March 15^{th} through April 1^{st}, or October 15^{th} through November 15^{th}).

The population utilizing the FBR basin is estimated at 1,900 to 2,300, and the entire gray bat population is conservatively estimated at 4,358,263. This project will impact less than 0.001% of the gray bat population. Therefore, it is the opinion of the USFWS that the level of take is not likely to result in jeopardy to the gray bat. In addition to the subsequent measures listed in the Reasonable and Prudent Measures and Terms and Conditions sections of this Opinion, the measures listed in the Conservation Measures section of this opinion must be implemented for this determination to remain valid.

8.2 APPALACHIAN ELKTOE

The USFWS anticipates incidental take of the Appalachian elktoe may occur as a result of the construction of the four bridges over the FBR. During construction, individual mussels may be crushed, harmed by siltation or other water quality degradation, or dislocated because of physical changes in their habitat. Appalachian elktoe have not been found in the Action Area during surveys for this project. However, they have been found 1.5 miles upstream during surveys for the I-4400/I-4700 project. For this project, we assume Appalachian elktoe occur at the same density estimated upstream for I-4400/I-4700. Our knowledge of the density and distribution of Appalachian elktoe is based on a small number of documented occurrences.

The survey data is not sufficient to populate a robust population model, but in an effort to estimate potential take, the USFWS applied a simple model incorporating survey effort and catch rates to estimate a baseline density for Appalachian elktoe in the I-4400/I-4700 Action Area. We estimated an experienced surveyor could reasonably cover 400 square meters in an hour of surveying. The mussels are not always at the surface, and due to difficulty seeing the small apertures in the substrate, surveyors are not likely to find every mussel. To compensate for this we estimated that a capture efficiency of 25% was reasonable based on previous experience with mussel survey techniques, i.e. the number of mussels found reflect 25% of the total mussels in a given area. Therefore, the model estimates an Appalachian elktoe density of 0.0005 mussels per square meter in the I-4400/I-4700 Action Area. For I-2513 we assume that Appalachian elktoe occur in the same densities.

This project proposes to directly affect around 253,425 square feet of habitat that will be covered by rock causeways and bridge footings. Based on the estimated density, we expect around 12 Appalachian elktoe to be in the area to be buried by bridge construction.

Due to the large extent and duration of this project, it is possible Appalachian elktoe in the Action Area will be affected by habitat degradation from sediment eroded from the project and from the degradation of channels receiving additional stormwater from the project. Applying the model density to the area of habitat in the Action Area returns an estimated population of 402 adult Appalachian elktoe in the Action Area. In order for the population to remain stable, recruitment in the action area needs to equal natural mortality in the population. Appalachian elktoe are estimated to live about 12 years with about 10 years of reproductive lifespan. That requires a recruitment rate of 0.10 annually, in this case approximately 40 new recruits per year that could be affected by project related effects.

Conservation measures outlined in the BA are intended to minimize effects due to sedimentation in the FBR. Even under standard construction conditions, we expect Appalachian elktoe within the Action Area may be harmed by the presence of turbidity or settling of sediment in depositional portions of its habitat. We expect this effect to be non-lethal harm to adults that could result in temporarily reduced recruitment throughout the duration of the project. The effects of sediment pollution within the Action Area should not reach a level that prevents recolonization of the Action Area after construction. However, if soil and erosion BMPs are not effectively implemented, prolonged increases in sediment transport in Appalachian elktoe habitat could cause habitat alteration that would prevent future population growth even after construction is finished, this take is not accounted for in this BO. Due to the difficulty of measuring these effects directly, the NCDOT proposes monitoring project erosion control with a study conducted by the USGS. USGS proposes to use existing water quality data available from the NCDEQ and combine it with pre-construction data collected from USGS monitoring stations to measure a baseline turbidity.

We believe the conservation measures and monitoring included in the BA are sufficient to reduce the effects of construction such that the population of Appalachian elktoe in the French Broad is likely to remain healthy and viable into the future. Therefore, in this Opinion, the USFWS has determined that this level of take is not likely to result in jeopardy to the Appalachian elktoe. In addition to the subsequent measures listed in the Reasonable and Prudent Measures and Terms and Conditions sections of this Opinion, the measures listed in the Conservation Measures section of this opinion must be implemented for this determination to remain valid.

9. REASONABLE AND PRUDENT MEASURES

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the gray bat and Appalachian elktoe. These non-discretionary measures include, but are not limited to, the commitments in the BA and the terms and conditions outlined in this Opinion.

1. The USFWS must be notified of any project modifications.

2. NCDOT will minimize impacts to roosting bats in the culvert roost to the extent possible through coordination with the USFWS for work that occurs between March 15th and November 15th.

3. NCDOT will provide modern bat roost panels or comparable structures that could serve as a temporary alternate roost for bats potentially disturbed by work on the culvert roost for the duration of construction of the I-2513 project. This will be in the place of the panels on four bridges NCDOT has committed to in the BA, which were to be placed on bridges with documented signs of bat use. These bridges are all relatively far from the Hill Street Culvert roost. The USFWS believes that panels placed on one bridge close to the Hill Street Culvert roost has greater potential to minimize take than panels placed on four bridges farther away.

4. NCDOT will minimize permanent lighting on waterways in the final lighting design plan to the extent possible, as well as current permanent lighting at the Hill Street Culvert Roost. Current plans for new permanent lighting (Appendix J) are preliminary in nature.

5. NCDOT will avoid and minimize potential take of bats roosting in culverts other than the Culvert Roost by conducting culvert checks before rehabilitation or repair work (see Term and Condition 12).

6. NCDOT will adhere to all BMPs for soil and erosion control, and will report to the USFWS (described in Term and Condition 7) if failures occur.

10. TERMS AND CONDITIONS

In order for the exemption from the take prohibitions of section 9(a)(1) of the ESA, the NCDOT must comply with the following terms and conditions, which implement the reasonable and prudent measures described previously and outline required reporting and/or monitoring requirements. These terms and conditions are non-discretionary. As necessary and appropriate to fulfill this responsibility, the NCDOT must require any permittee, Contractor, or grantee to implement these Terms and Conditions through enforceable terms that are added to the permit, contract, or grant document.

1. NCDOT will adhere to all measures listed in the Conservation Measures section of this Opinion and in the BA (if not revised in the BO).

2. NCDOT will simultaneously notify USACE and USFWS of any permit modification requests.

3. A USFWS biologist will be invited (at least seven days prior) to the preconstruction meeting(s) to review permit conditions and discuss any questions the Contractor has regarding implementation of the project. After the Contractor submits plans for various stages (outlined in post BO coordination Section 2.3.5.2) of the project, a USFWS biologist will review and provide comments (within 15 days upon acknowledgement of receipt of notice) on the plans and will be invited to attend any meetings to discuss implementation of the plans.

4. During construction, culvert inlets and outlets will be evaluated by the resident engineer with regard to stream stability immediately following installation and quarterly for a period of one year at each location. Indicators of instability, such as head cutting, scour, aggradation, or degradation, will be used to determine the need for corrective actions.

5. A final field inspection will be held with the Contractor to evaluate culvert placement and stream stability before the project is considered complete. If instability is detected during any of these reviews, corrective actions will be performed when deemed necessary by the engineer or by the conditions of any federal and state permits required by Section 404/401 of the Clean Water Act.

6. NCDOT and NCDEQ-DEMLR (land quality) will meet with USFWS to evaluate and discuss erosion control effectiveness if requested.

7. In the event of any failure of erosion control devices, within 48 hours, NCDOT will send a report to USFWS detailing the cause of the failure, photographs of the failure, and a plan for repair of the erosion control devices and reasonable methods to avoid future failure. NCDOT will notify the USFWS when failures are repaired.

8. To carry out Reasonable and Prudent Measure 2, the USFWS must be notified before work starts in the culvert.

- Work can only commence when the baffle is installed if work will occur from March 15th through November 15th.
- NCDOT will coordinate with the USFWS to determine the best timing for installing the baffle.
- The USFWS, or an individual approved by USFWS, must be present when trees are cleared near the culvert and when the baffle is installed if installation occurs when bats present.
- The USFWS may request that the baffle is moved, removed, or altered. It may be determined that disturbances from construction are less impactful than potential alterations to the culvert microclimate from the baffle, or noise levels no longer exceed the ambient level.
- If the RCBC outlet is needed to access other portions of the culvert, it will only be used when bats are not present.

9. The alternate bat roost structure from Reasonable and Prudent Measure 3 will consist of modern bat modular roost panels or comparable structures installed on a bridge over water as close to the culvert roost as possible, but out of areas disturbed by construction. Panels should be constructed of fiber-reinforced concrete with additives to mimic thermal mass and should be mounted using metal. Bridge selection and panel placement/design should be informed by work currently being conducted by Indiana State University. Panels must be installed before work starts on the culvert roost and should be checked for bat use once in early summer and once in late fall for three years following placement. The details of the location, size, design, and installation of the bat panels will be decided by a committee to include USFWS, NCWRC, and NCDOT. This panel will be installed temporarily for the duration of construction.

10. NCDOT will monitor bat activity before, during, and post construction.

- NCDOT has committed to conducting acoustic monitoring (and/or emergence counts, as appropriate) for MYGR at some locations immediately before, during and up to two years after construction. This monitoring may help determine changes in bat activity related to construction. NCDOT will coordinate the locations and time frame for monitoring with USFWS. This will include monitoring the culvert roost, including before and after the baffle is installed.
- To investigate whether MYGR avoid active construction zones (including bridges and the Hill Street culvert roost) at night, NCDOT will explore the use of night-vision video recordings, or other methods, in an attempt to monitor bat activity at locations where they may be most susceptible to disturbance.
- NCDOT will conduct additional monitoring/research to include telemetry, coordinated monitoring of roosts, monitoring of new panels, basin-wide acoustics to be conducted at key points during and after construction. The details of additional monitoring will be decided by a committee to include USFWS, NCWRC and NCDOT. Information gathered will be used to increase our knowledge of impacts to bats to help inform future consultation, to learn more about gray bats in the project area, to better conserve the species, and to track movements of bats and hopefully determine where bats go if they abandon the culvert roost and/or the area.

11. As part of Reasonable and Prudent Measure 4, NCDOT will give the USFWS the opportunity to discuss/review/comment on the lighting design drafts and final design plans (and allow 15 days for review upon acknowledgement of receipt of notice), including on the Bowen Bridge.

- Bowen Bridge: This bridge is being downgraded to carry four lanes of local traffic on the center lanes, and bike and pedestrian paths on the outer lanes. Lighting will be altered to accommodate these changes.
    - New lighting for vehicle and bike/pedestrian traffic will not exceed the current level of illumination on the water (an average of 0.10 foot-candle over an area that goes from shore to shore and extends approximately 50' to the north and south from the structures) as determined by a lighting engineer, and every effort will be made to reduce the level of illumination on the water.
    - NCDOT will work with USFWS to avoid and minimize impacts of light, including:
        - Light will be 3000 K or below
    - Proposed aesthetic panel lighting will not illuminate the water surface when bats are present (March 15th through November 15th). NCDOT and the City of Asheville will work with the USFWS to determine acceptable light color and levels when bats are present.
- Southern States: USFWS will be included in discussions about modifying the lights at Southern States to decrease light spill at the Hill Street culvert entrance. If the land owner does not agree to minimize lighting on their property, NCDOT will work with the USFWS to assess the effectiveness of and minimize light using a barrier (fence or vegetation) on their ROW easement.

12. In order to carry out Reasonable and Prudent Measure 5, NCDOT will conduct culvert checks for roosting bats within 30 days of rehabilitation or repair for any culverts five feet tall or higher, and 200 feet or longer, scheduled to occur from March 15th through November 15th. If bats are found, a similar protocol will be used to the pre-demolition check for bats in bridges.

If bats are present, one of the following options will be implemented (options listed in order of preference). NCDOT will:

1. Wait for bats to leave for the season (approximately mid-October to early November) before beginning work; or
2. A biologist will monitor the culvert and work will begin after bats leave the culvert for the evening (if work occurs over multiple days, the culvert will need to be monitored each day work occurs), or
3. A permitted biologist will exclude bats from work area immediately prior to the start of work using acoustic deterrents (if this method is employed, the culvert will need to be checked each day work occurs to determine efficacy), or
4. A permitted biologist will hand remove bats from work area immediately prior to the start of work (the culvert will need to be checked each day work occurs to ensure bats do not return).

5. If pre-work check determines pups are present, NCDOT will refrain from culvert work until it can be determined by a biologist that the pups are volant, and then use the previous options to proceed with work.

13. The nearest flyover bridge to the culvert roost will not be closer than 300 feet from the outlet.

11. MONITORING AND REPORTING REQUIREMENTS

In order to monitor the impacts of incidental take, the NCDOT must report the progress of the Action and its impacts on the species to the USFWS. This section provides the specific instructions for such monitoring and reporting. As necessary and appropriate to fulfill this responsibility, the NCDOT must require any permittee, Contractor, or grantee implement these Terms and Conditions through enforceable terms that are added to the permit, contract, or grant document. Such enforceable terms must include a requirement to immediately notify the NCDOT and USFWS if the amount or extent of incidental take specified in this Incidental Take Statement is exceeded during action implementation.

NCDOT will provide a final report and yearly bat monitoring summaries to the Service by January 31st of each year starting at the end of the bat monitoring season, and concluding up to two years after construction is completed.

12. REINITIATION NOTICE

Formal consultation for the I-2513 project is concluded. Reinitiation of consultation is required by law if:

a. the amount or extent of incidental take is exceeded
   i. Gray Bats: If construction operations at the bridges cannot be completed after five years from the start of causeway construction without night operations, or culvert system work cannot be completed after four seasons when bats are not present, or 60" CMP work cannot be complete after one season when bats are not present, all work should stop, and the USFWS should be contacted immediately to reinitiate consultation.

   ii. If a continuing NOV* is issued to NCDOT, the USFWS should be contacted immediately to determine if consultation should be reinitiated with the FHWA.

   *If severe problems are found that may result in loss of sediment into waterbodies or onto adjacent property owners, a Notice of Violation (NOV) is issued by NCDEQ-Energy Mineral and Land Resources to NCDOT. Consequently, NCDOT and its contractors will react immediately to correct items noted in the NOV. If deficiencies are not corrected within the timeframe directed by the Energy, Mineral and Land Resources NOV, a Continuing NOV will be issued. A Continuing NOV indicates that sufficient progress has not been made to correct environmental deficiencies on a project.

b. new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. a new species is listed or critical habitat designated that the action may affect.

13. Conservation Recommendations

We recommend the FHWA and NCDOT works with the USFWS to determine how roost panels on bridges could be installed permanently (with the option to remove them temporarily for maintenance), contributing to the FHWA 7(a)(1) commitments to proactively work toward recovery of the gray bat.

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