Biological Opinion and Conference Opinion

Addendum to the June 19, 2020 Biological Opinion for I-26 Connector from I-40 to US 19/23/70 North of Asheville, Buncombe County, North Carolina

Service Log #02-252
NCDOT STIP I-2513; WBS Element #34165.1.1

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Consultation History

June 19, 2020:	U.S. Fish and Wildlife Service (Service) issued a Biological Opinion (2020 BO) for the subject project and provided the signed document to the North Carolina Department of Transportation (NCDOT).
November 10, 2022:	NCDOT requested modification to language in select lighting commitments in the 2020 BO.
December 21, 2022:	Service issued a Modification and Clarification to the 2020 BO regarding lighting commitments.
May 2, 2023:	NCDOT requested to use the Federal Highway Administration (FHWA) programmatic framework for northern long-eared bat (*Myotis septentrionalis,* MYSE) consultation.
May 31, 2023:	Service provided NCDOT with issue list regarding use of FHWA programmatic consultation for MYSE consultation, resulting in the programmatic not being used.
June 20, 2023:	Meeting with NCDOT and Service to review conservation measures associated with the 2020 BO.
June 22, 2023:	NCDOT provided Service with lighting design draft and requested comments within15 days.
July 5, 2023:	Service provided NCDOT list of topics regarding listed and proposed bat species in relation to the subject project consultation and regarding handling of acoustic records.
July 5, 2023:	Service responded to NCDOT with lighting comments and additional questions.
July 24, 2023:	NCDOT provided the Service a draft addendum Biological Assessment (BA) for the subject project to address tree-roosting bat species within the action area.
July 25, 2023:	Service provided receipt verification to NCDOT.
August 10, 2023:	Service provided NCDOT with request for additional information.
August 15, 2023:	NCDOT provided Service with updated addendum BA.
August 23, 2023:	Service and NCDOT met virtually to discuss monitoring commitments and fund contribution amount.
October 10, 2023:	Service attended a virtual meeting with NCDOT to review lighting and tree clearing depictions on project figures.
October 11, 2023:	NCDOT provided Service with document compiling current consultation topics.
October 30, 2023:	Service provided NCDOT with comments on selected conservation measures, including the proposed telemetry study. NCDOT provided a response on the same date.
November 1, 2023:	NCDOT provided complete figures depicting lighting, tree clearing, and hydrography within action area, completing the updated addendum BA.
November 6, 2023:	NCDOT provided request to amend a conservation measure from original 2020 BO to edit language regarding causeway configuration.
November 9, 2023:	Service responded to NCDOT that we accept the proposed language edit.

Biological Opinion and Conference Opinion

1. Introduction

A biological opinion is the document that states the opinion of the Service in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (ESA), as to whether a Federal action is likely to jeopardize the continued existence of species listed as endangered or threatened; or result in the destruction or adverse modification of designated critical habitat. A conference opinion is the document that states the opinion of the Service in accordance with section 7 of the ESA, as to whether a Federal action is likely to jeopardize the continued existence of species proposed for listing. A conference opinion (CO) is equivalent to a biological opinion but addresses species that are not yet listed under the ESA and/or proposed critical habitats not yet designated. Therefore, the ESA prohibitions against jeopardy, adverse modification, and taking do not yet apply. The Service may adopt a CO as a biological opinion if the evaluated species/critical habitat are eventually listed/designated and while the action agency maintains discretion and involvement in the action.

This document transmits the Service's biological opinion and conference opinion (Opinion) based on our review of the proposed improvements and upgrades to 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, and its effects on the Federally endangered Indiana bat (*Myotis sodalis*, MYSO), Federally endangered northern long-eared bat (*Myotis septentrionalis*, MYSE), proposed endangered tricolored bat (*Perimyotis subflavus*, PESU), and at-risk little brown bat (*Myotis lucifugus*, MYLU). This Opinion is based on information provided in the addendum BA submitted to the Service by the NCDOT, field investigations, email communications between NCDOT and the Service, communications with experts on the affected species, and other sources of information as cited. The FHWA is the lead Federal action agency for this project, with authority delegated to the NCDOT.

Formal consultation occurred for this project during 2019-2020 and a biological opinion was issued for Federally endangered Appalachian elktoe (*Alasmidonta raveneliana*) and Federally endangered gray bat (*Myotis grisescens,* MYGR) on June 19, 2020. The project is expected to begin construction in 2024. In the time since the 2020 BO was issued, the Service has implemented several listing changes and species data for the project area has been updated. Those updates are as follows:

Acoustic data obtained from surveys conducted during a study on MYGR within the action area indicates potential presence of MYSO. Those acoustic records will be manually vetted, though that process is not yet complete at the time of this document. NCDOT assumes presence of MYSO within the action area and includes it in this consultation reinitiation to address impacts to the species.

MYSE was reclassified from threatened to endangered, as published in the *Federal Register* on November 30, 2022; effective on March 31, 2023. At the time of the 2020 BO, the proposed action was determined to be consistent with the final Section 4(d) rule for MYSE, codified at 50 C.F.R. § 17.40(o) and effective February 16, 2016. The reclassification removed the 4(d) rule and, given the reclassification of MYSE as Federally endangered, NCDOT reinitiated consultation to address impacts to this species.

On September 13, 2022, the Service announced a proposal to list PESU as endangered. Given the listing proposal and associated decision timeline, NCDOT requested to conference on PESU in the reinitiation to address impacts to the species.

In April 2023, the Service published an update to its National Listing Workplan (Workplan), which projects the anticipated timeline for listing-related decisions over the next five years (2023-2027). The

Workplan indicates a proposed listing determination for MYLU in 2024. Given the potential listing of MYLU, NCDOT included it in the consultation reinitiation to address potential impacts to the species.

Presence is assumed for these four species within the action area.

2. Proposed Action

As defined in the Service's section 7 regulations (50 CFR 402.02), "*action*" means "*all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas*." The "*action area*" is defined as "*all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action*." The direct and indirect effects of the actions and activities must be considered in conjunction with the effects of other past and present Federal, state, or private activities, as well as the cumulative effects of reasonably certain future state or private activities within the action area.

2.1 Action Area

No changes from 2020 BO. See Appendix A, Figure 3.

2.2 Project Description

No changes from 2020 BO, with the exception of the following:

NCDOT incorporated additional lighting minimization measures on behalf of bat species. Those measures are discussed below in the Conservation Measures section 2.3.2.5.

Additional information on tree clearing is shared here given its relevance to the biology of MYSO, MYSE, PESU, and MYLU. Based on the most circuitous alternative and widest slope stakes, the total limits of tree clearing are estimated at 211 acres for the entire project. The addendum BA states that actual tree-clearing will be much less in total as design plans are developed and refined. Forested areas to be cleared include riparian, upland, fragmented, and portions of intact swaths of forest (Appendix B, Figures 1-19). Tree clearing may occur during any time of year.

The project's proposed lighting and clearing areas as they relate to the surrounding landscape and hydrology features are displayed in Appendix B, Figures 1-19.

2.3 Conservation Measures

Conservation measures (CMs) represent actions, pledged in the project description, that the action agency will implement to minimize the effects of the proposed action and further the recovery of the species under review. Such measures should be closely related to the action and should be achievable within the authority of the action agency. We consider the beneficial effects of conservation measures in making our determination of whether the project will jeopardize the species.

The Service and NCDOT developed CMs and avoidance and minimization measures (AMMs) for MYGR which were included in the 2020 BO to minimize impacts from project construction and further species recovery. The effects of project actions discussed in the 2019 BA/2020 BO on MYGR are similar to the effects on MYSO, MYSE, PESU, and MYLU. Because of these similarities in effects, many of the CMs included for MYGR in the 2020 BO are expected to be protective of these four species as well. Therefore, the CMs and AMMs for MYGR in the 2020 BO are also considered applicable to MYSO,

MYSE, PESU, and MYLU. The CMs in the 2020 BO remain valid and are included as Appendix D in this document.

2.3.1 Modified Conservation Measures and Commitments

Modifications to commitments made in the 2020 BO are as follows:

2.3.1.1 Causeway Language Update

The original measure in the 2020 BO, *2.3.4.2 Causeways – French Broad River, Hominy Creek, and Smith Mill Creek* states:

- 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 U.S. Army Corps of Engineers and Service prior to permitting.

The updated *2.3.4.2 Causeways – French Broad River, Hominy Creek, and Smith Mill Creek* states:

- Causeways will not restrict more than 50% of the river or stream flow 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.

This adjustment was made given the understanding that "river or stream flow" is considered a more accurate measure than "river or channel width" by the NCDOT Assistant State Hydraulics Engineer.

2.3.1.2 Monitoring of Bat Activity Updates

Previous work conducted by NCDOT and Indiana State University has greatly advanced our knowledge of the MYGR population in the French Broad River watershed since the 2020 BO measures were written. For this reason, as well as a lack of ideal sites at which to conduct some of the agreed-upon measures (e.g. acoustics and night-vision video recording that would provide new information), several of the commitments have been adjusted or removed in order to better focus resources on current research questions and conservation efforts. Those changes are listed below.

CM *2.3.1.1 Timing of Construction* describes monitoring commitments that are updated below based on data obtained in the years since the 2020 BO.

- Original Measure: NCDOT will monitor bat activity at the [Hill Street] culvert before, during, and after construction. Acoustic monitoring and/or emergence surveys will be conducted between March and November.
- Update: Based on recent data, the Service, North Carolina Wildlife Resources Commission (NCWRC), and NCDOT decided the best approach to monitoring the culvert would be through a combination of daytime visual surveys within the culvert and acoustic surveys. Visual surveys will be conducted two times per year during the active season (pre- and post-volancy) before, during, and after construction. If visual surveys discover large numbers of roosting bats, counts will switch to emergence surveys. Acoustic monitoring should occur throughout the active season (March 1 – November 15) at the culvert before, during, and post construction with detectors placed at the inlet and outlet. NCDOT will coordinate these monitoring efforts, including the preferred points of ingress and egress, ahead of time with the Service and NCWRC.

CM *2.3.7.1 Monitoring for MYGR Return and Activity* and Term & Condition 10 in the 2020 BO present monitoring activities that can now be adjusted due to species information gained on MYGR over the past several years since the original consultation took place.

- Original Measure: 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.

- Update: The above measure is no longer necessary, as described above.
- Original Measure: To help determine whether MYGR avoid active construction zones [including bridges and the Hill Street culvert roost] 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.
- Update: The use of night vision recording at active construction zones (including bridges and the Hill Street culvert) is no longer necessary. The original commitment was to see if MYGR avoid active construction zones at night. This was investigated via the night vision work conducted by NCDOT at the I-26 bridge over the French Broad River (NCDOT project I-4400/I-4700) and additional work on this is not needed. It was also determined that there weren't other locations like the (I-4400/I-4700) I-26 bridge that lend themselves to successfully doing this type of work.
- Original Measure: (As stated in T&C 10) 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 [MYGR] bats and hopefully determine where bats go if they abandon the culvert roost and/or the area.
- Update: Only the coordinated monitoring of roosts and roost panel monitoring aspects of this measure remain valid. As stated above, information gained on MYGR in the French Broad River basin over the past several years obviates the need to pursue additional monitoring as described in the original measure. Coordinated monitoring in the form of emergence surveys will be conducted at primary bridge roosts. Survey methods will be coordinated with the Service, NCWRC and NCDOT. Surveys will occur two times per summer and will take place in 2024 and 2025 (pre-construction), then four times every other year during project construction, then two years after construction.

2.3.2 Added Conservation Measures

Additional CMs specific to the four bat species addressed in this Opinion are numbered below. The following AMMs and CMs (listed generally as CMs) shall be applied in addition to the measures in the 2020 BO:

2.3.2.1 Tree Clearing Minimization

The wooded buffer along Hominy Creek between the existing right-of-way and Hominy Creek will remain intact. Two locations will have stone rip rap installed at the outlets of two pipes (-RPD- Sta. 23+25.27). Some trees may be trimmed or removed to create an entrance point for the rip rap installation, however, the clearing for the two rip rap installations will be minimal and temporary, and vegetation will return. These two locations are adjacent to a maintained clearing for overhead electric transmission lines. An additional two areas involve clearing within the existing right-of-way to install ditches. The wooded area between the existing right-of-way and Hominy Creek will remain unaffected, which is expected to block lighting from the roadway. Clearing at this location is depicted via pink dashed lines in Appendix B, Figures 12 and 13.

2.3.2.2 Bat Telemetry Study

NCDOT, in coordination with FHWA, shall manage a contract funding a research institution to conduct a 2-year-minimum telemetry study focused on the subject bat species within a 30-mile radius of the I-26 Connector project, with the goal of finding roosting locations and gaining information about commuting

and foraging areas and habitat use. The research will include work to capture focal species (MYSO, MYSE, PESU, MYLU) to transmitter/track. Work may involve using acoustics to identify areas of high focal species activity and netting those locations, searching bridges and culverts, and netting nearby known occupied areas as well as Hominy Creek. Additionally, bats could be captured at nearby hibernacula in early spring to track where they go in the summer. Active ground telemetry, aerial telemetry, and fixed tower telemetry may be utilized. The structure and details of the study design and research decisions will be decided by a committee to include the Service, NCWRC, NCDOT, and the contracted researcher(s).

2.3.2.3 Structure Surveys

a) NCDOT shall survey bridges and culverts that meet the criteria detailed in the Standard Operating Procedures: NCDOT Preliminary Bat Habitat Assessments (Structures, Caves, and Mines) (NCDOT 2015), within 2 years of construction for each phase of the project. This measure applies to structures that are proposed for modification or replacement. CM 2.3.3.3 *Pre-Demolition Check for Bats* in the 2020 BO remains valid.
b) NCDOT shall conduct a 2023/2024 winter survey within the 15 originally surveyed culverts most suitable for winter roosting by PESUs and five smaller culverts that have features of high thermal stability that could support cold weather PESU roosting (e.g., concrete with longer lengths). NCDOT will involve the Service in deciding which five smaller culverts to survey.

2.3.2.4 Roost Panel Monitoring

NCDOT's monitoring plan of the Modern Bat Modular Roost Panels as described in the Terms and Conditions outlined in the 2020 BO shall include the Pratt-Whitney roost panels placed on the Biltmore Farms bridge (E. Frederick Law Olmsted Way) over the French Broad River.

2.3.2.5 Bat Conservation Funding

NCDOT shall contribute $150,000 to the NCWRC's North Carolina Non-Game and Aquatics Project Fund (NCNGAPF) to support conservation and recovery efforts for MYSO, MYSE, PESU, and MYLU. This fund and its dispensation will be managed by the Service and NCWRC. At the time of this document, the NCNGAPF has not yet been officially approved, though that approval is expected in 2024.

2.3.2.5 Lighting

a) Smokey Park Highway Interchange:
    - Lighting at Ragsdale Creek shall not change from baseline condition. The current lighting will remain and the project will not result in changes or increases to the amount of light reaching Ragsdale Creek.
    - All new low level and high mast lighting installed by NCDOT for I-2513 A, B, C, and D sections shall be 3,000K color temperature, with the exception of the new ramp along Smokey Park Highway.
b) I-26/I-40 Interchange Ramp East of Sand Hill Road:
    - The lighting fixtures installed at this location shall be 3,000K. This is a reduction from the existing lighting of 4000K.
    - At Trent Branch, high mast poles shall be reduced from existing conditions. At least four high mast poles shall be removed at this location. Replacement lighting shall be on single arm poles to the west of Trent Branch. This updated lighting configuration is designed to reduce lighting on Trent Branch.
c) I-26/I-40 Interchange North of Pond Road:
    - Lighting adjacent to Hominy Creek shall be decreased from existing conditions. The existing lighting at this location is 400-watt high pressure sodium (HPS) with dropped glass lenses. Such fixtures typically produce 50,000 lumens of light each. The light-emitting diode (LED)

replacement fixtures will produce less than 35,000 each. The LED fixtures have directional optics which enable light to be directed toward the road, as opposed to the HPS in dropped glass lens fixtures which result in more scattered light.

3. Status of the Species

3.1 Indiana Bat

Scientific Name: *Myotis sodalis*
Status: Endangered
Date of Listing: March 11, 1967
Critical Habitat: September 24, 1967

3.1.1 Description and Life History

MYSO is a medium-sized bat that closely resembles the MYLU but has a chestnut brown to dark gray pelage. MYSO average life span is 5-10 years, but recapture of banded individuals has documented MYSO up to 15 years old (Humphrey and Cope 1977). Hall (1962), Myers (1964), and LaVal and LaVal (1980) report sex ratios of 1:1 for the MYSO. MYSO is an insectivorous migratory species that hibernates in caves and mines during winter and forages in wooded areas, particularly riparian areas (LaVal *et al*. 1977), during summer. Foraging activity and travel is mostly nocturnal. The key phases in the MYSO annual life cycle, with dates applicable to western North Carolina (Susan Cameron, personal communication, 2023) are: Hibernation, inactive season: Oct 15 to April 1; Spring staging and migration, active season: April 1 to May 15; Pregnancy and lactation, maternity season: May 15 to August 15; Pup volancy (able to fly), maternity season: July; Fall migration and mating (swarming), active season: August 15 to October 15.

MYSO generally hibernates from mid-fall to mid-spring each year in caves and mines, though timing varies with latitude and weather conditions. Upon emerging from hibernation, bats forage for a few days or weeks near their hibernaculum (spring staging). During spring staging, MYSO roost in trees and forage in habitats that are similar to their summer habitats, within five miles of their hibernaculum. Female MYSO commonly migrate hundreds of miles from their hibernacula and are pregnant when they reach summer areas (Service 2007). Males tend to stay closer to hibernacula during summer. Spring migration occurs when fat reserves are depleted from hibernation, prey abundance is low, and females are pregnant; therefore, spring migration is possibly the most stressful period in the MYSO's life cycle.

Most MYSO maternity colonies contain fewer than 100 adult females (Service 2007). A MYSO maternity colony in Indiana averaged 50 to 80 adult females (Whitaker and Brack 2002). A study by O'Keefe and Loeb (2017) suggests maternity roosts in the Appalachian Mountains may be smaller, typically less than 25 bats (range 1-126 bats), with an average of 18.4 bats emerging from a maternity roost each night. Adult females give birth to a single pup in late May to early June (Humphrey *et al*. 1977). Pups are weaned from nursing shortly after, becoming volant in mid- to late-July.

In summer, most reproductive females occupy roost sites under the exfoliating bark of dead trees that retain large, thick slabs of peeling bark. Primary roosts usually receive direct sunlight for more than half the day. Roost trees are typically within canopy gaps in a forest, on a fence line, or along a wooded edge (Service 2007). MYSO maternity colonies have been reported to switch between roosts every two to three days (Foster and Kurta 1999; Kurta et al. 2002; Carter and Feldhamer 2005; Kurta 2005; O'Keefe and Loeb 2017). The species exhibits a high degree of inter-annual fidelity to particular roost trees, maternity areas, or both (Humphrey *et al.* 1977; Gardner *et al.* 1991a, 1991b, 1996; Callahan *et al.* 1997). Males are rarely found roosting with females in MYSO maternity colonies.

Summer habitats for the MYSO consists of a wide variety of forested areas where they roost, forage, and travel. These habitats may include portions of adjacent and interspersed non-forested areas such as wetlands, the edges of agricultural fields, old fields, and pastures. Areas containing potential roosts include forests and woodlots, as well as linear features such as fencerows, riparian forests, and other wooded corridors. Tree density and canopy cover in areas used for roosting or foraging is variable. MYSOs are known to use a wide variety of tree species ≥ 5 inches diameter at breast height (DBH) that have cracks, crevices, or peeling bark for roost trees. A typical MYSO primary roost is located under the exfoliating bark of a dead ash (*Fraxinus* spp.), elm (*Ulmus* spp.), hickory (*Carya* spp.), maple (*Acer* spp.), oak, or poplar (*Populus* spp.), but any tree that retains large, thick slabs of peeling bark is potentially suitable. MYSOs in a study located in the Appalachians primarily used yellow pine snags O'Keefe et al. 2017), which is a departure from what has been observed for MYSO maternity colonies in the Midwest and Northeast . Primary roosts are usually in trees that are in early-to-mid stages of decay (Gardner *et al*. 1991a).

Adult and juvenile MYSOs have been found roosting in human-made structures including bridges (Joey Weber, personal communication, 2019; Service 2007), buildings, utility poles, bat houses (Service 2007), and culverts (Service 2022). Use of only two culverts has been documented. MYSO were found in an Indiana culvert in September 2014 and were more recently found winter roosting in a triple box culvert in Georgia (Service 2022).

While wing morphology of the MYSO suggests that the species is adapted to moving in and tolerating some cluttered habitats (Norberg and Rayner 1987), it is more often detected along forest edges, forest openings, and corridors (Sparks *et al*. 2005). Many species of bats, including the MYSO, consistently avoid crossing or foraging in large open areas, choosing instead to use tree-lined pathways or small openings (Patriquin and Barclay 2003; Yates and Muzika 2006).

Fall migration occurs following summer months spent foraging and building up fat reserves. Upon arriving at their winter hibernaculum from summer habitats, the species exhibits swarming behavior in the vicinity of the hibernaculum. MYSOs roost in trees and forage in habitats that are similar to their summer habitats, typically within five miles of their hibernaculum. Fall swarming continues for several weeks and mating occurs during the latter part of the period. After mating, females enter hibernation, but not necessarily at the same hibernaculum where mating occurred.

Home range, the area in which an MYSO forages, commutes, and roosts, may vary in size between seasons, sexes, and reproductive status of the females (Lacki *et al*. 2009). Observed home ranges from studies tracking individual MYSOs associated with maternity colonies vary widely (205.1 to 827.8 ac) (Menzel et al. 2005; Sparks et al. 2005; Watrous et al. 2006; Jachowski et al. 2014; Kniowski and Gehrt 2014). Colonies have larger home ranges than individual bats with areas of overlapping core roosting and foraging areas and areas that do not overlap. Since early radio-tracking studies in Illinois, it has become standard practice for Service Field Offices to assume that a MYSO maternity colony will utilize suitable habitat within about 2.5 miles of its primary roost tree(s)/focal roosting area (Service 2020), an area of 12,563 acres. Based on data provided in the MYSO draft revised recovery plan (Service 2007), a maternity colony needs at least 10 percent suitable habitat (*i.e*., forested habitat that provides adequate roost sites and foraging areas) to exist at a given point on the landscape.

3.1.2 Population Size

The 2019 (most current) range-wide MYSO population estimate was approximately 537,297 bats with 71% of these bats hibernating in sites located in Missouri and Indiana (36.3% and 34.4%, respectively). The 2019 range-wide population declined an additional 4% from the 2017 estimate and represented a 19% decline since the arrival of WNS in New York in 2007. As of 2022, the population in the

Appalachian Mountain Recovery Unit was 1,464 individuals. As of 2022, the Service estimates the winter range-wide population at 596,431 MYSO. MYSO are concentrated in relatively few hibernacula during the winter. Biennial winter surveys in 2019 estimated MYSO in 223 hibernacula in 16 states, which decreased in 2022, to 166 hibernacula in 15 states. Four states accounted for over 95% of the total population estimate: Missouri, Indiana, Illinois, and Kentucky (Service 2019a, Service, unpublished data, February 2, 2023).

Using a 1:1 female to male sex ratio and an average maternity colony size of 50 adult females, the 2019 winter survey population estimate yields an estimate of 5,370 maternity colonies (Service 2019b). The 269 MYSO maternity colonies known as of 2007 represent only five percent of the possible total. While additional maternity colonies have been found since that time, known colonies still represents a small percentage of what exists.

Range-wide population data based on winter hibernacula counts are completed every two years. The biennial population estimates increased from 2001 to 2007, suggesting that the species' long-term decline had been reversed (Service 2017). The decline since 2007 is likely attributable to WNS. The estimated population in the Appalachian Mountain Recovery Unit decreased by 26.7% from 2019 estimates and has declined by 93.4% since 2007. The most dramatic declines in the number of occupied hibernacula have occurred in the Northeast and Appalachia Mountain Recovery Units (Service 2019b, Service, unpublished data, February 2, 2023).

3.1.3 Distribution

The overall geographic range and distribution of winter habitat has changed relatively little since the MYSO was first listed. "Extant" winter populations presently occur in 18 states (Service 2019a, Service 2019b). The species has shown some expansion in its winter range beyond its historical winter limits as a result of occupying human-made hibernacula (for example, mines, tunnels, and a dam) (Service 2019b). There are five priority four hibernacula in North Carolina though several are historic and only one has been used by MYSO since the arrival of WNS in the winter of 2010 and 2011 in Western North Carolina (Service, unpublished data, February 2, 2023).

Because maternity colonies are widely dispersed during the summer and difficult to locate, all the combined summer survey efforts have found only a fraction of the colonies presumed to exist (based on range-wide population estimates derived from winter hibernacula surveys). Surveys continue to discover maternity colonies. Biologists in North Carolina documented two adult and one juvenile MYSO under a bridge in Haywood County, North Carolina in July 2021 (Mary Frazer, personal communication, July 16, 2021). However, the Service has not compiled a range-wide estimate of maternity colonies or summer populations since 2007.

The 2007 recovery plan established four Recovery Units for the species: Ozark Central, Midwest, Appalachian Mountains, and Northeast. The proposed delineation of the Appalachian Mountain Recovery Unit is based on Bailey's Central Appalachian Broadleaf Forest Province with some exceptions in the eastern-most counties in Tennessee (Service 2007). All of the MYSO's current range in Western North Carolina is part of the Appalachian Mountain Recovery Unit.

3.1.4 Threats

The conservation needs of and threats to the MYSO are discussed in detail in the 2007 Draft Recovery Plan (Service 2007) and the most recent 5-year review (Service 2019b). These documents describe WNS, forest fragmentation, habitat modification, habitat loss and degradation, hibernacula disturbance and alteration, environmental contaminants, and collisions with wind turbines as threats to MYSOs. While those threats related to or having the potential to occur as a result of the proposed project are the focus of the review, the threats of WNS and climate change are also briefly discussed. All of these threats are

described in the 2020 Opinion *Threats section* for the MYGR and are similar for MYSO except for the threats from WNS and forest modifications and some species-specific information, further discussed below.

White-nose Syndrome

In recent years, no other threat is more severe and immediate for the MYSO than WNS. WNS was first documented in North Carolina in 2010-2011 in multiple counties. Since first observed in New York in 2006, WNS has spread rapidly in bat populations. As of winter 2023, the causative WNS fungal pathogen, *Pseudogymnoascus destructans* (Pd), has spread to 43 states and eight Canadian provinces. WNS currently affects 12 species of bat (Service 2019b). The range-wide MYSO population has decreased by 19.2 percent from 2007 (that is, since arrival of WNS in New York State) to 2019 (Service 2019b).

WNS is the clear cause of the recent declines in MYSO numbers. In areas with WNS, there are additional energetic demands for MYSOs. For example, WNS-affected bats arouse more frequently than normal and, as a result, have fewer fat reserves than non-WNS-affected bats when they emerge from hibernation (Reeder et al. 2012, Warnecke et al. 2012) and have wing damage (Meteyer et al. 2009; Reichard and Kunz 2009) that makes flight (migration and foraging) more challenging. Females that survive the migration to their summer habitat must partition energy resources between foraging, keeping warm, successful pregnancy, pup-rearing, and healing.

Other stressors that had no discernable population-level impacts previously, combined with the impact of this disease, could become factors influencing MYSO probability of persistence in particular areas or regions. In general, smaller populations are more vulnerable to extirpation resulting from direct impacts or adverse habitat changes than larger populations, especially those that rely on colonial behaviors for critical life history functions. A single bat maternity colony, for example, reduced in size by WNS-related mortality and with the remaining individuals weakened by the disease, is much less likely to adapt to the loss or reduction of suitable roosting trees and foraging habitat in its traditional home range than a larger and healthier colony. Repeating this scenario with multiple colonies across a landscape could accelerate the population-level declines caused by WNS alone (Service 2019b).

Across the range of MYSO, it is critical to protect all WNS survivors. Surviving MYSO are emerging from hibernation in very poor condition and need every opportunity to clear themselves of infection to be able to survive and reproduce.

Forest Fragmentation and Habitat Modification

Forests used by foraging and roosting MYSO during spring, summer, and autumn have changed dramatically from pre-settlement conditions (Service 1999). The U.S. Forest Service summary of forest trends (USFS 2014) reported a decline in forest acreage from 1850 to the early 1900s, when forests were converted to other land cover types or many native plant communities were altered. Over the next century, other land cover types (mostly cropland) were converted to forest through tree planting or pioneer-field succession. From 2001 to 2006, the U.S. lost 1.2 percent of its total forest acreage, mostly in the Southeast and West. Interior forest (40-acre parcels comprised of at least 90 percent forest cover) experienced a net loss of 4.3 percent. Although it is difficult to quantify the resultant impacts, this forest fragmentation has resulted in modifications to MYSO habitat, especially summer habitat, and is suspected in contributing to the decline of MYSO populations (Service 1999).

Summer habitat can include extensive forests or small woodlots connected by hedgerows. The removal of such habitats is occurring rapidly in some portions of the MYSO's range due to residential and commercial development, mining, oil and gas development, and infrastructure development, including roadways and utility corridors. Even in areas of relatively abundant habitat, permanent and temporary

impacts to forest habitat pose mortality risks to MYSOs during tree felling activities. Furthermore, the ongoing, permanent loss of forests and woodlots may have a significant cumulative effect on the species, as habitat is lost, fragmented, or degraded and as maternity colonies are displaced from habitat to which they exhibit fidelity (Service 2012).

Climate Change

The capacity of climate change to result in shifts in the range and distribution of wildlife species is recognized, but detailed assessments of how climate change may affect specific species, including MYSO, are limited. Bats are sensitive to changes in temperature, humidity, and precipitation (Adams and Hayes 2008). During winter, for example, only a small proportion of caves provide the right conditions for hibernating MYSO because of the species' very specific temperature and humidity requirements.

Climate change may affect bats through changes in food availability, timing of hibernation and reproductive cycles, frequency and duration of torpor, rates of energy expenditure, and rates of juvenile bat development (Sherwin *et al.* 2013). Surface temperature is directly related to cave temperature, so climate change that involves increased surface temperatures may affect the suitability of hibernacula. Climate change may, therefore, shift MYSO from southern to northern hibernacula (Clawson 2002). Loeb and Winters (2013) noted that while areas suitable for MYSO summer maternity colonies have been forecasted to decline significantly due to climate change, the northeastern and Appalachian regions of the U.S. have the potential to serve as climate refugia for MYSO and are predicted to continue to support the species. Impacts on the availability and timing of insect prey are also likely. Currently, however, the Service has no evidence demonstrating climate change impacts at a population-level to MYSOs. However, the rapid spread of WNS across the range of the species is likely to mask any effects of climate change on their status.

Lighting

The 5-Year Review (Service 2019b) lists light pollution as an emerging man-made threat to the MYSO.

Noise and Vibration

While noise and vibration are not mentioned in the 5-Year Review (Service 2019b) as threats to the MYSO, significant changes in noise levels in an area may result in temporary to permanent alteration of bat behaviors and their use of certain areas. Bats are also believed to habituate to noise (Service 2002, Service 2018). While roosts are typically located further from paved highways than from non-paved roads (Garner and Gardener 1992), MYSO tree roosts have been found within 213 feet (Service 2008) and 81 feet (Matthew Mangan and Catherine Liller, personal communication, July 27, 2022) of multi-lane paved interstates. Additionally, MYSO can continue to roost and forage in areas with active timber harvest operations (Gardner et al. 1991), and continue to occupy Fort Drum in areas located 400 to 800 m from multi-year construction projects (Service 2018).

3.2 Northern Long-eared Bat

Scientific Name: *Myotis septentrionalis*
Status: Endangered
Date of Listing: Listed Threatened: May 4, 2015; Listed Endangered: November 29, 2022
Critical Habitat: None Designated

3.2.1 Description and Life History

MYSE typically overwinters in caves or mines and spends the remainder of the year in forested habitats. The active season for MYSE in Western North Carolina is April 1 through October 15. While information is lacking, short regional migratory movements between seasonal habitats (summer roosts and winter hibernacula) of 35-55 miles have been documented (Griffin 1940, Caire et al. 1979, Nagorsen and Brigham 1993) and occur during the first part and last part of the active season outside of the

maternity season. The maternity season is May 15 through August 15 in Western North Carolina (Susan Cameron, personal communication). Adult females give birth to a single pup. Parturition (birth) may occur as early as late May or early June (Easterla 1968, Caire et al. 1979, Whitaker and Mumford 2009) and may occur as late as mid-July (Whitaker and Mumford 2009). Juvenile volancy (flight) often occurs 21 days after birth (Kunz 1971; Krochmal and Sparks 2007).

MYSE typically roost singly or in maternity colonies underneath bark or more often in cavities or crevices of both live trees and snags (Sasse and Pekins 1996, Foster and Kurta 1999, Owen et al. 2002, Carter and Feldhamer 2005, Perry and Thill 2007, Timpone et al. 2010). Males' and non-reproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis 1969, Amelon and Burhans 2006). MYSEs switch tree roosts often (Sasse and Pekins 1996), typically every two to three days (Foster and Kurta 1999, Owen et al. 2002, Carter and Feldhamer 2005, Timpone et al. 2010). Suitable summer habitat is extensively defined in the *Range-wide MYSO and MYSE Survey Guidelines*, which is updated annually (https://www.fws.gov/library/collections/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines).

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009, p. 212) to 60 individuals (Caceres and Barclay 2000, p. 3); however, larger colonies of up to 100 adult females have been observed (Whitaker and Mumford 2009, p. 212). Summer home range includes both roosting and foraging areas, and range size may vary by sex). Minimum summer roosting areas range from 13-65 acres (Service 2022). Foraging areas are six or more times larger (Broders et al. 2006; Henderson and Broders 2008). The distance traveled between alternate roosts varies widely from 20 ft (Foster and Kurta 1999) to 2.4 mi (Timpone et al. 2010). Likewise, the distance traveled between roost trees and foraging areas in telemetry studies varies widely, e.g., a mean of 1,975 feet (Sasse and Perkins 1996) and a mean of 3,609 feet (Henderson and Broders 2008). Circles with a radius of these distances have an area of 281 and 939 ac, respectively.

MYSEs are nocturnal foragers and use hawking (catching insects in flight) and gleaning (picking insects from surfaces) behaviors in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, Ratcliffe and Dawson 2003). The MYSE has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles (Griffith and Gates 1985, Nagorsen and Brigham 1993, Brack and Whitaker 2001), with diet composition differing geographically and seasonally (Brack and Whitaker 2001). Most foraging occurs above the understory, one to three m (3 to 10 ft) above the ground, but under the canopy (Nagorsen and Brigham 1993) on forested hillsides and ridges, rather than along riparian areas (LaVal et al. 1977, Brack and Whitaker 2001). This coincides with data indicating that mature forests are an important habitat type for foraging MYSEs (Caceres and Pybus 1997, White et al. 2017). Foraging also takes place over small forest clearings and water and along roads (van Zyll de Jong 1985). MYSEs seem to prefer intact mixed-type forests with small gaps (that is, forest trails, small roads, or forest-covered creeks) in forests with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clear cut (Service 2015).

Artificial Roosts

MYSE have been observed roosting in human-made structures, such as buildings, barns, utility poles, , bridges, culverts, and bat houses (Mumford and Cope 1964, Barbour and Davis 1969, Cope and Humphrey 1972, Burke 1999, Sparks et al. 2004, Amelon and Burhans 2006, Whitaker and Mumford 2009, Timpone et al. 2010, Bohrman and Fecske 2013, Feldhamer et al. 2003, Sasse et al. 2014, Service 2015, Dowling ad O'Dell 2018). It has been hypothesized that use of human-made structures may occur in areas with fewer suitable roost trees (Henderson and Broders 2008, Dowling and O'Dell 2018). In northcentral West Virginia, MYSEs were found to more readily use artificial roosts as distance from large forests (greater than 494 acres) increased, suggesting that artificial roosts are less likely to be selected when there is greater availability of suitable roost trees (De La Cruz et al. 2018).

A July 2014 survey in Missouri found two MYSE in a culvert with an entrance measuring approximately 9 ft in diameter and 250 ft long (Droppelman 2014, L. Droppelman, personal communication, February 24, 2022). Winter 2014 surveys in Louisiana documented MYSE in seven concrete tube and box culverts ranging in size from 4.5 ft to 10.5 ft tall and 131 ft to 476 ft long. MYSE co-occurred in these culverts with southeastern myotis, PESUs, Rafinesque's big-eared bat, and big brown bats (Nikki Anderson, unpublished data, March 23, 2022). The species has not been found in culverts in Georgia (Emily Ferrall, personal communication, April 7, 2022), North Carolina (NCDOT 2022b), or Mississippi (Katelin Cross, personal communication, March 23, 2022). Published culvert records are limited for this species.

3.2.2 Population Size

Prior to 2006 (that is, before WNS was first documented), MYSE was abundant and widespread throughout much of its range (despite having low winter detectability) with 737 occupied hibernacula and a maximum count of 38,181 individuals (Table 1; Service 2022c). According to the SSA (Service 2022c), in 2020, the MYSE was projected to be detected in 139 hibernacula, with a median winter abundance of 19,356 individuals (Table 1; Service 2022c).

Available evidence, including both winter and summer data, indicates MYSE abundance has and will continue to decline substantially over the next ten years under current demographic conditions. Winter abundance (from known hibernacula) has declined range-wide (49%) and across most Representation Units (RPUs) (0–90%). In addition, the number of extant winter colonies declined range-wide (81%) and across all RPUs (40–88%). There has also been a noticeable shift towards smaller colony sizes, with a 96–100% decline in the number of large hibernacula (≥100 individuals). Declining trends in abundance and occurrence are also evident across much of the MYSE's summer range. Range-wide summer occupancy declined by 80% from 2010–2019. Data collected from mobile acoustic transects found a 79% decline in range-wide relative abundance from 2009–2019 and summer mist-net captures declined by 43–77% compared to pre-WNS capture rates (Service 2022c).

Table 1. Numbers of MYSE Adapted from Service (2022c)

Year	Range	# States	Spatial Extent	# Hibernacula	Winter Abundance
Prior to 2006 (Historical Condition)	Range-wide	29	1.2 billion acres	737	38,131 (max)
2020 (Projected)	Range-wide	18	644 million acres	139	19,356 (median)
Prior to 2006 (Historical Condition)	Southeast Unit			50	393 (max)
2020 (Projected)	Southeast Unit			1	Probability of population growth = 0

3.2.3 Distribution

MYSEs occur over much of the eastern and north-central U.S., and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993, Caceres and Pybus 1997, Environment Yukon 2011). In the U.S., the species' range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to South Carolina (Whitaker and Hamilton 1998, Caceres and Barclay 2000, Simmons 2005, Amelon and Burhans 2006). The species' range includes all or portions of 37 states and the District of Columbia. The species' range extends into the mountains of Western North Carolina but does not appear to include most of the Piedmont Ecoregion in

the state. The SSA splits the MYSE range-wide population into five representation units (RPUs), three of which occur in North Carolina: 1) Eastern Hardwoods RPU, 2) Southeast RPU, and 3) East Coast RPU. A population of MYSE was discovered in coastal North Carolina (East Coast RPU) in 2007 and has since been documented to extend into at least 27 coastal North Carolina counties.

3.2.4 Threats

Although there are countless stressors affecting MYSE, the primary factor influencing the viability of the species is WNS. Other primary factors that influence MYSE viability include wind energy mortality, effects from climate change, and habitat loss. Additional concerns relate to development and include roads, lighting, noise, and vibration (Rowse et al. 2016, Ramalho and Aguiar 2020). Lighting is increasingly being associated with negative outcomes for many species, including bats (Rowse et al. 2016), and has been "acknowledged as a threat to biodiversity" (Rowse et al. 2016 citing Hölker et al. 2010). These threats are discussed in the 2020 BO for MYGR and above for MYSO and can similarly apply to MYSE.

3.3 Tricolored bat

Scientific Name: *Perimyotis subflavus*
Status: Proposed Endangered
Date Proposed for Listing: September 14, 2022
Critical Habitat: None Proposed

A petition to list the PESU as threatened was received by the Service on June 16, 2016. On December 20, 2017, the Service found that the petition presented substantial scientific or commercial information indicating that the petitioned action may be warranted. The Service commenced a review (known as a 12-month finding) to determine if listing of the PESU is warranted. The Service proposed to list the species at endangered under the Endangered Species Act on 14 September 2022. The Service completed an SSA (Service 2021) but no conservation or recovery plans yet exist for this species.

3.3.1 Description and Life History

Migration

PESU have been documented to migrate between 13 and 149 miles (21 and 240 km) between winter and summer habitat (Griffin 1940; Griffin 1945; Cockrum 1956; Barbour and Davis 1969; Samoray et al. 2019; Wisconsin DNR 2017a). Species engaging in regional migration travel annually from hibernaculum to summer roosting sites, and then move among swarming locations in the autumn (Fenton 1969; Fraser et al. 2012; Hitchcock 1965). Recent research has led to some speculations that some individuals migrate farther distances than previously suspected, and that migratory behavior may differ between males and females (Davis 1959; Fraser et al. 2012). Fraser et al. (2012) investigated PESU migration by conducting stable hydrogen isotope analyses of 184 museum specimen fur samples and compared the results to published values of collection site growing season precipitation. Their results suggested that 33% of males and 16% of females collected during the postulated non-molt period were south of their location of fur growth. Fraser et al. (2012) also noted that if PESUs only engaged in regional migration, then evidence would be expected to show equal numbers of bats migrating north and south during the non-molt period. Respectively, Fraser et al. (2012) concluded that at least some PESUs, of both sexes, engage in latitudinal migration.

Hibernation

As cited in SSA (Service 2021), PESU are one of the first cave-hibernating species to enter hibernation in the fall and one of the last to leave in the spring in Missouri and Pennsylvania (LaVal and LaVal 1980, p. 29; Merritt 1987, p. 102). In the southern U.S., hibernation length is shorter compared to northern portions of the range and some PESU exhibit shorter torpor bouts and remain active and feed during the

winter (Layne 1992, pp. 43–44; Grider et al. 2016, p. 8; Limon et al. 2018, p. 219; Newman 2020, pp. 13–17; Stevens et al. 2020, p. 528). In addition to caves, PESUs use a wide variety of other hibernacula including mines (Whitaker and Stacy 1996, Brack 2007), storm sewers (Goehring 1954), box culverts (Sandel et al. 2001, Lutsch et al. 2022), and surge tunnels at quarries (Slider and Kurta 2011). Recent evidence indicates that PESUs also hibernate in rock faces in Nebraska (Lemen et al. 2016) and suggests that the species may have a wider winter range than previously suspected. Hibernating PESUs roost mostly singly but will form small clusters and often select a roost on the walls as opposed to the ceiling of the hibernaculum (Brack 1979, Kurta 2008). During hibernation, individuals arose every 15-25 days on average (Brack and Twente 1985). Throughout most of the range, they select relatively warm, stable sites often located further from the hibernaculum entrance than other bat species (Brack 2007).

Summer Habitat Use

PESUs primarily roost in trees during the active season, considered to be April 1 to October 15 in Western North Carolina. Maternity colonies are most likely to be found roosting in umbrella-shaped clusters of dead leaves, but may also be found in live leaf foliage, lichens, patches of pine needles caught in tree limbs, buildings, caves, bridges, culverts, and rock crevices (Humphrey 1975, Veilleux et al. 2003, Veilleux and Veilleux 2004a; b, Veilleux et al. 2004, Perry and Thill 2007, Newman et al. 2021). Perry and Thill (2007) suggest that PESU's yellow-brown coloration allows them to blend in with brown, dead leaf clusters imparting protection from visual predators. Oak (genus *Quercus*) and maple (*Acer*) trees are preferred by maternity colonies of PESUs presumably because the ends of the branches tend to have many leaves (Veilleux et al. 2003; 2004, Perry and Thill 2007), and thus maternity colonies are more often associated with uplands than bottomland forest. O'Keefe (2009) found male PESUs primarily in hickories, maples, and birches and not oaks. Veilleux et al. (2003) found 27% of PESU roosts in oak trees when oaks compromised only 3% of the available trees; others found at least 80% of PESU roosts in oaks (Leput 2004, Perry and Thill 2007). PESUs are known to forage near trees, as well as forest perimeters, and along waterways (Fujita and Kunz 1984).

Use of trees by PESU may occur in a relatively small area. One study found that the average distance between roost trees was 86 meters (m) (range 5-482 m) and between capture locations and roost trees was 2.5 kilometers (km) (range 165 to 2,290 m) (Schaefer 2016). "Roosting range" was between 0.005 acres (ac) and 10.9 ac for seven individuals (average=1.95 acres) (Schaefer 2016, p. 49). "Roost habitat area" or "minimum roost area" was 0.25 to 5.7 ac for four individuals (Veilleux and Veilleux 2004b). In Indiana, Veilleux and Veilleux (2004b) radio-tracked four PESUs to their respective roost trees and found that the minimum and maximum distances between roosts trees was 13 m and 926 m. A study in Nova Scotia found that the "roost area" for five maternity colonies using more than five trees (12 to 31 trees) varied from 4 - 191 ac, with a mean of 67.5 ac (Table 4 in Poissant 2009). In summary, a PESU maternity colony could have a roost area between 0.005 and 191 acres (Schaefer 2016, Veilleux and Veilleux 2004, Poissant 2009).

A study conducted in Arkansas radio-tagged 28 male and nine female PESUs and found that roost trees varied from one to three roost trees for males and one to five roost trees for females (Perry and Thill 2007b). Seven of 14 female roosts were colonies and based on exit counts and visible pups; the estimated number of bats (adults and pups) in colonies was three to 13, with an average of 6.9 bats (±1.5) (Perry and Thill 2007b). Other studies report maternity colony sizes of 3.7 individuals (Veillieux and Veillieux 2004b), 15 individuals (Whitaker and Hamilton 1998), and 18 individuals with an average of ten individuals (Poissant 2009). Perry and Thill (2007b) found males roosting in forested habitats also occupied by females, but primarily in solitary roosts. One study found that individuals within a roosting area or colony did not switch or overlap other roost areas or colonies though all individuals from all colonies shared foraging space (Poissant 2009).

In Indiana, female PESU maternity roosts occurred mostly in upland habitats (9.4%) as opposed to riparian (0.8%) and bottomland (0.2%) habitats (Veilleux et al. 2003). Preferred upland habitat by this species could be related to the greater availability of preferred roost tree species: white oak (Quercus alba), bur oak (*Quercus macrocarpa*), and red oak (*Quercus rubra*) (Veilleux et al. 2003). O'Keefe (2009) found that non-reproductive PESUs in North Carolina only roosted in forest stands older than 72 years, and preferentially roosted at lower elevations, closer to non-linear openings, and closer to streams than expected by random chance. Other researchers have found that at the stand level or greater, PESUs seem to roost selectively in more mature forest within riparian buffers or corridors (Perry and Thill 2007, O'Keefe 2009), within a diversity of patch types, farther than expected from roads (Perry et al. 2008), and in unharvested pine or pine-hardwood stands greater than or equal to 50 years old (94% of female roosts and 52% of male roosts, Perry and Thill 2007b). One small study in the Nantahala National Forest in Macon County, North Carolina found male PESU roosts were on average 136 m from roads or trails, and while the distance ranged from 4 to 285 m, 75% of the roads in the study area were gated grass-covered U.S. Forest Service roads with virtually no vehicular traffic (O'Keefe 2009). Other studies found PESU roosts on average 70 m and 52 m from edges (Leput 2004, Veilleux et al. 2003, respectively).

PESUs vary their roost position in the canopy and landscape depending on reproductive conditions. Reproductive female bats roost lower in the canopy and farther from forest edges than non-reproductive females. Veilleux and Veilleux (2004b) speculated that lower position in the canopy and greater distances from the forest edge may reduce wind exposure and allow for more stable temperatures. Gestation is typically 44 days (Wimsatt 1945), and females produce twin pups whose mass is approximately 44-54% of the size of the mother, a higher ratio than most Vespertilionid bats (Kurta and Kunz 1987). Young are volant at 3 weeks and act as adults around 4 weeks old (Hoying and Kunz 1998). Post-natal growth rates slow during cold snaps because the mothers cannot eat, and available energy is used for thermoregulation (Hoying and Kunz 1998). As with other species of bats, some male PESUs remain at hibernacula year-round (Whitaker and Rissler 1992). Most males roost in the same types of leaf clusters used by female PESUs (Veilleux and Veilleux 2004a), although they return to the same roost for multiple days, with one individual in Arkansas roosting in the same cluster for 33 days (Perry and Thill 2007). Male bats also select roosts in the same species of trees, although males tend to use thinner and shorter trees (Veilleux and Veilleux 2004a). Males also tend to roost at lower heights than females; often 16.4 feet (ft) (5 m) from the ground (Perry and Thill 2007).

Structures

There are numerous culvert records for this species across multiple states (NCDOT 2022b, Walker et al., 1996; Martin et al., 2005; Katzenmeyer, 2016, L. Smith, personal communication, 2022, Nikki Anderson, unpublished data, March 24, 2022). Katzenmeyer (2016), conducting winter surveys in Mississippi over five years, found PESUs in culverts as small as 2 ft tall and 30 ft long. PESUs use culverts in Florida as small as 3 ft tall by 60 ft long though smaller culverts are not surveyed. Preliminary analysis did not find an effect of culvert height or length on PESU presence in Florida (Smith, L. personal communication, March 9, 2022). The Louisiana Department of Wildlife and Fisheries has surveyed more than 1,000 culverts over three winters and found PESUs in 21% of them. Summer surveys of a much smaller number of culverts found the species in about 4% of surveyed culverts. The smallest culvert used by the species in Georgia is a 3 ft tall pipe culvert that is 388 ft long (Emily Ferrall, personal communication, April 7, 2022).

As of January 2023, NCDOT had 23 records of PESUs using 20 bridges and 7 culverts in western NC during the active season (April 1 to October 15). Of these 23 records, one was a maternity roost (1 female and 1 pup at a bridge between May 15 to Aug 15). The average roost size was 1.6 bats though 75% of the roost checks recorded just one PESU. The maximum summer roost size detected in North Carolina is seven PESUs. NCDOT had 17 records of PESU using 2 bridges and 11 culverts in western NC during the inactive season (October 16 – March 31). The maximum winter roost size detected was 12 in a culvert

(Sue Cameron, personal communication, January 10, 2023). In North Carolina, PESUs have been found in culverts with an opening as small as 29 inches tall (36-inch diameter culvert with 7 inches of fill and water; winter record) (Katherine Etchison, personal communication, January 24, 2023) by 46.4 ft long (winter record; Lauren Wilson, personal communication, February 23,2023).

3.3.2 Population Size

WNS has recently decimated PESU populations in several states. Before the onset of WNS, PESU was generally believed to be common and secure throughout most of its range in the eastern US (Benedict et al. 2000, Sparks and Choate 2000, Geluso et al. 2004). Prior to 2006, PESU was highly abundant and widespread, with over 140,000 bats observed hibernating in 1,951 known hibernacula spread across > 1 billion acres in 34 states and 1 Canadian province (Service 2021). Since the arrival of WNS, Cheng et al. (2021) estimates range-wide declines of 93% from 1995 to 2018 and a 59% overlap of species and WNS occurrence ranges. The range-wide population of PESUs is estimated to be 67,898 individuals as of 2020 (Service 2022b).

3.3.3 Distribution

PESUs are known from 39 States (from New Mexico north to Wyoming and all states to the east), Washington D.C., 4 Canadian Provinces (Ontario, Quebec, New Brunswick, Nova Scotia), and Guatemala, Honduras, Belize, Nicaragua, and Mexico. The species current distribution in New Mexico, Colorado, Wyoming, South Dakota, and Texas is the result of westward range expansion in recent decades (Geluso et al. 2005, Adams et al. 2018, Hanttula and Valdez 2021). They have also expanded into the Great Lakes Basin (Kurta et al. 2007; Slider and Kurta 2011). This expansion is largely attributed to increases in trees along rivers and increases in suitable winter roosting sites, such as abandoned mines and other human-made structures (Benedict et al. 2000, Geluso et al. 2005, Slider and Kurta 2011).

3.3.4 Threats

WNS is a threat to many bat species throughout North America. While WNS has been assumed to be the primary driver of bat population declines for many species in recent years, new research indicates that many factors are likely acting synergistically (Ingersoll et al. 2016). Bats are subject to a suite of severe threats (Mickleburgh et al. 1992, Hutson et al. 2001, Pierson 1998), including disturbance and altered microclimates of critical hibernacula and day roosts (Tuttle 1979, Neilson and Fenton 1994, Thomas 1995), loss and modification of foraging areas (Pierson 1998, Hein 2012, Jones et al. 2009), toxicity and changed prey composition and abundances from pesticide use and other chemical compounds (Shore and Rattner 2001, Clark 1988), direct or indirect chemical exposure leading to lethal or sublethal effects that eventually lead to death or reduced reproduction (Clark et al. 1978, Clark et al. 1980, Clark et al. 1982, Eidels et al. 2016), climate change primarily because temperature is an essential feature of both hibernacula and maternity roosts (Frick et al. 2010, Rodenhouse et al. 2009), and in-flight collisions with vehicles, buildings, and wind turbines (Russell et al. 2009, Arnett et al. 2008, Kunz et al. 2007). Bats are often subject to more than one of these threats simultaneously; such co-occurring threats may result in synergistic or interacting effects, with impacts more severe than from any single threat in isolation (Crain et al. 2008, Kannan et al. 2010, Laurance and Useche 2009, Harvell et al. 2002). Additional concerns relate to development and include roads, lighting, noise, and vibration (Rowse et al. 2016, Ramalho and Aguiar 2020). Lighting is increasingly being associated with negative outcomes for many species, including bats (Rowse et al. 2016), and has been “acknowledged as a threat to biodiversity” (Rowse et al. 2016 citing Hölker et al. 2010). These threats are discussed in the 2020 BO for MYGR and above for MYSO and can similarly apply to PESU.

3.4 Little Brown Bat

Scientific Name: *Myotis lucifugus*

Status: Under Review
Date Petitioned for Listing: Not Applicable
Critical Habitat: Not Applicable

This section summarizes best available data about the life history, population size, and distribution of and threats to the MYLU throughout its range that are relevant to formulating an opinion about the action. MYLU is currently undergoing a discretionary status review by the Service as listed on the Service's National Listing Workplan (Workplan). The Service anticipates determining if the species warrants listing under the Act in fiscal year 2024. Currently, no conservation or recovery plans exist for this species. Given the Workplan's information on a listing proposal timeline for MYLU, and considering the proposed multi-year timeline for construction of the subject project, NCDOT requested to include MYLU in this formal consultation.

3.4.1 Description and Life History

Migration

MYLUs migrate between subterranean habitats in winter to trees, anthropogenic structures (for example, buildings and woodpiles) (Humphrey and Cope 1976), and natural structures (for example, under rocks, in caves) during summer (Fenton and Barclay 1980). Spring migration occurs in parallel with staging with most bats moving from the hibernacula to the summer range in April and May. In the late summer and fall, individual MYLUs depart from summer roosts and migrate to a variety of transient roosts (Fenton and Barclay 1980) before arriving at winter hibernacula, between September and October (Saunders 1988).

As summarized in Kuntz and Reichard (2010), MYLU travel up to 186.4 miles from summer roosts (Davis and Hitchcock 1965; Fenton 1970; Griffin 1970; Humphrey and Cope 1976) or perhaps as far as 621.4 miles (Wilson and Ruff 1999). LaVal and LaVal (1980) found that of approximately 1,600 banded MYLUs, six bats made short migrations of approximately 25 miles (40.23 km), but two migrated approximately 150 miles (241.40 km). Myers (1964) banded 4,427 MYLUs in Missouri and adjacent states, 20 of which provided information on migration. Average migration distance was 94.3 miles (151.76 Km) with extremes of 18 (28.97 km) and 240 miles (386.24 km). Several other studies found hibernacula located up to 186 miles from summer roosts (Davis and Hitchcock 1965, Fenton 1970, Griffin 1970, Humphrey and Cope 1976) or perhaps as far as 621 miles (Wilson and Ruff 1999).

Summer Habitat

Most MYLUs roost in buildings, other anthropogenic structures such as bridges and bat boxes, tree cavities, and under exfoliating bark (Boyles et al. 2009). Maternity colonies typically contain 300 to 1,200 individuals (adults and offspring) (Wisconsin DNR 2013 citing Humphrey and Cope 1976), though a colony of 6,700 MYLUs was found in a barn in Indiana (Whitaker and Hamilton 1998). No records of MYLUs using culverts are known at this time. The ability to use a variety of summer habitats is also key to understanding a large and diverse geographic range (Bergeson et al. 2015). Bats using the interface between developed lands (that provide roosts) and undeveloped lands and water (that provide foraging habitat) tend to be healthier and have higher reproductive rates (Coleman and Barclay 2011). Female MYLUs use warm roosts (Burnett and August 1981). MYLUs select roost trees that are large, dead, or dying and that have substantial solar exposure (Crampton and Barclay 1998, Bergeson et al. 2015). MYLUs make frequent use of cracks and hollows in trees as well as sloughing bark (Crampton and Barclay 1998, Bergeson et al. 2015). Randall (2014) found that data collected during their telemetry study in 2007 agreed with Broders and Forbes (2004), who reported that all female MYLUs captured in forests were found to roost in nearby buildings, whereas the males roosted in nearby trees. Minimum roosting areas for MYLUs have a mean of 9.6 acres; minimum foraging areas have a mean of 129 acres (Broders et al. 2006). Other home range estimates differ by life stage, with pregnant MYLU home ranges

averaging 74 acres and lactating MYLU home ranges averaging 44 acres (Henry et al. 2002). Coleman et al. (2014) estimated mean home range at 353 acres.

Barbour and Davis (1969) noted that females are pregnant when they arrive at maternity roosts in early- to mid-April, with individuals arriving throughout May and into June. In Indiana (Krochmal and Sparks 2007), females in one colony gave birth to a single pup between 3 June and 15 July. These pups began fluttering at two days of age, could complete coordinated wing strokes by 15 days and could fly by 21 days. Most pups are likely volant by the end of July or mid-August in North Carolina. Maternity colonies begin to break up as soon as the young are weaned; few remain by September (Barbour and Davis 1969).

3.4.2 Population Size

Long-term monitoring of 22 prominent MYLU hibernacula in the core of their range provided the basis for cave survey data from 1985 to predict a population of 6.5 million MYLUs as of 2006 (Frick et al. 2010b). This estimate was presumed to account for the vast majority of the species' overall population at the time. As of 2006, regional mean growth suggested that the northeastern core population of this species was stable or slightly increasing (Frick et al. 2010b). Thus, the pre-WNS population of this species – both throughout its range and within its core northeastern range – was viable and did not face imminent risk of extinction.

The appearance of WNS in 2006 dramatically altered the population balance, which in turn has substantially impaired the ability of MYLUs to adapt to other cumulative threats looming against a rapidly declining species baseline. In four years, this lethal fungal pathogen summarily killed at least one million MYLUs in the northeastern core range, and all efforts undertaken thus far to contain its south and westward spread and rate of infection have proven ineffective. As the disease spreads geographically and regionally, population collapse has been observed and, in some cases, local species extinction has been predicted, suggesting that even limited take may have the potential for population-level effects (MidAmerican Energy Company [MEC] 2019, Frick et al. 2010, Ingersoll et al. 2013). Of winter hibernacula examined where WNS has been confirmed or suspected for two or more years, survey data indicates that winter populations at 36 of 38 sites had declined compared to their 10-year pre-WNS average estimates (Kuntz and Reichard 2010). Of hibernaculum that averaged greater than 50 MYLUs prior to the discovery of WNS, four hibernacula (North Carolina [3], Tennessee [1]) declined to zero MYLUs in the most recent post-WNS surveys (Kuntz and Reichard 2010). Die-offs of MYLUs at hibernacula have been associated with declines in summer activity (Dzal et al. 2011). Cheng et al. (2021) estimates a 98% decline at hibernacula with WNS establishment from 1995 to 2018 and a 36% overlap of species and WNS occurrence ranges for MYLU.

4.4.3 Distribution

The MYLU is widely distributed across North America. Their geographic distribution ranges from central Alaska to northern Florida and into southern California and central Mexico (Harvey et al. 1999). They are absent from the middle plains region (for example, New Mexico, Texas, and southern Florida). Prior to the arrival of WNS, the largest colonies were found in the Northeastern and Midwestern U.S. where some hibernacula contained tens to hundreds of thousands of individuals (Kunz and Reichard 2010). The southern edge of their distribution is limited by the lack of suitable caves and mines, whereas the northern edge of the range is likely defined by a limited number of suitable hibernacula and the longer length of the hibernation season (Humphries et al. 2002, Humphries et al. 2006).

3.4.4 Threats

Tinsley (2016) reviewed potential threats to the MYLU and determined WNS as the greatest threat faced by the species; without WNS it is unlikely the MYLU would be a conservation priority. Other stressors

of importance include deaths from other diseases, losses at wind energy sites, environmental contaminants, climate change, and loss and adverse modification of both summer and winter habitat. Like other bats, the MYLU is frequently the subject of persecution by people. Because MYLUs can form large maternity colonies in man-made structures, they are often the target of exclusion efforts (Cope et al. 1991). Additional concerns relate to development and construction and include roads, lighting, and noise and vibration (Rowse et al. 2016, Ramalho and Aguiar 2020). Lighting is increasingly being associated with negative outcomes for many species, including bats (Rowse et al. 2016), and has been "acknowledged as a threat to biodiversity" (Rowse et al. 2016 citing Hölker et al. 2010). These threats are discussed in the 2020 BO for MYGR and above for MYSO and can similarly apply to PESU.

4. Environmental Baseline in the Action Area

In accordance with 50 CFR 402.02, the 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*."

The four bat species addressed in this Opinion, MYSO, MYSE, PESU, and MYLU, are all assumed to be present within the action area. While no known caves or mines, which could be used as winter hibernacula, are present within the action area, forested habitat (for roosting, foraging, and commuting), riverine and riparian habitat (for commuting and foraging), and man-made structure habitat (for roosting) are present within the action area. Additionally, acoustic records obtained during a study on MYGR indicated presence of PESU and possible presence of MYSO in the action area. As of the time of this Opinion, the manual vetting of MYSO and MYSE acoustic records is ongoing but has not yet been completed. These species are considered likely within the action area.

Structure surveys on bridges and culverts within the action area have been conducted to identify evidence of bat use. A survey history from the 2019 BA (July 2017-August 2018) is included in Appendix B of the 2020 BO. A summary of the structure surveys in the action area that have been conducted and or submitted to NCDOT after the original 2020 BA was completed are summarized in Appendix C. No evidence of bat use was found on the surveyed bridges. Surveys of the culvert at Hill Street and Riverside Drive near the French Broad River and the culvert that carries Smith Mill Creek under Patton Avenue revealed bats or evidence of bat use.

4.1 Indiana Bat Environmental Baseline

MYSO are known to roost in man-made structures, and several records exist for the species roosting in NC bridges (NCDOT, 2022a), though no records exist in NC for culvert roosts. It is difficult to estimate population numbers for MYSO in the action area as summer maternity colonies are widely dispersed, with most locations unknown (USFWS 2019). There are 20 element occurrences of MYSO in western NC based on NC Natural Heritage Program (NCNHP) records (April 2023). Five of the records are considered historical and most of the records are of tree-roosting individuals or of mist-net captures. The closest known roosting occurrences of MYSO are multiple records of a single hibernating bat at locations approximately 19 miles east of the project site and a 2021 summer survey location at a bridge site 25 miles west of the project site. Summer maternity colonies are difficult to locate and not widely known, especially in the southernmost portion of the MYSO's range. The first documented maternity colony in NC was found by Britzke et al. (2003) in the Nantahala National Forest, though researchers were unable

to re-locate it in subsequent years. MYSO maternity colonies were also documented during studies in the Nantahala National Forest by O'Keefe and Loeb (2017). The closest active hibernaculum to NC is found in the Tennessee portion of the Great Smoky Mountains National Park (GSMP), with the most recent population estimate being 736 bats (USFWS 2019).

4.2 Northern Long-eared Bat Environmental Baseline

MYSE are also known to roost in NCDOT bridges (NCDOT, 2022a). There are no records in NC of MYSE roosting in culverts (NCDOT 2022b). According to the NCNHP Biotics Database and the NCDOT Bat Structure Survey Databases, most recently updated in April 2023 and February 2023 (respectively), the closest known winter roosting occurrence of MYSE is in a cave site approximately 16.75 miles southeast of the project site. The closest summer capture occurrences of MYSE are a 2018 mist net location approximately 6 miles southwest of the project location and a 2022 mist net location 12 miles southeast of the project location.

Reliable numbers of MYSE in the action area are not available. There are approximately 171 occurrences of MYSE in western NC based on NCNHP element occurrence records, 19 of which are considered historical; most observations are from mist-netting efforts, as well as individuals roosting in caves. The number of bats found at each occurrence range from 1 to over 80 bats (note that some sites have multiple data collection events). According to NCNHP data (April 2023), evidence of MYSE reproduction in western NC, including capture/tracking of pregnant or lactating bats, or discovery of maternity trees, has been found in 11 western NC counties. Work has not been conducted to track MYSE in Buncombe County, but a lactating female was captured in the county in 2022. There have been 22 documented MYSE hibernacula in western NC, all in caves or mines. There are no known MYSE hibernacula in Buncombe County. MYSE have not been observed using hibernacula in North Carolina since 2014 (NCWRC email comm. November 17, 2022). However, the species is hard to detect given its use of small cracks and crevices in hibernacula.

4.3 Tricolored Bat Environmental Baseline

PESU are also known to roost in NCDOT structures, both bridges (NCDOT, 2022a) and culverts (NCDOT, 2022b). All records are associated with a water crossing. According to the NCNHP Biotics Database and the NCDOT Bat Structure Survey Databases, most recently updated in April 2023 and February 2023 (respectively), the closest known roosting occurrence of PESU is in a bridge site approximately 3 miles south of the project location. The closest summer capture record of PESU is a 2015 mist net location 6 miles southwest of the project site.

Reliable numbers of PESUs in the Action Area are not available. There are 163 element occurrences of the PESU in western NC based on NCNHP records, 7 of which are considered historical; most observations are from mist-netting, as well as cave/mine and bridge/culvert roosting individuals. The number of bats found at each occurrence range from 1 to 70 to several thousand bats (note that some sites have multiple data collection events). Maternity and other summer roosts are mainly in dead or live tree foliage (Carter and Menzel 2007, Poissant et al. 2010) but can also be found in human-made structures such as bridges (Ferrara and Leberg 2005). PESU are present in western NC during pupping season and are reproducing, but work has not been done to locate maternity colonies. There have been 79 PESU hibernacula documented in western NC, including caves (50), mines (22), root cellars (4), and culverts (3). While there are no known PESU hibernacula in Buncombe County (WRC email comm. November 17, 2022), swarming/staging areas from hibernacula in Henderson, Yancey, and Rutherford Counties fall within Buncombe County.

4.4 Little Brown Bat Environmental Baseline

MYLU are also known to roost in bridge structures (NCDOT 2022a). Current records, with the exception of one bridge, are associated with a water crossing. There are no records in NC of MYLU roosting in culverts (NCDOT 2022b). According to the NCNHP Biotics Database and the NCDOT Bat Structure Survey Databases, most recently updated in April 2023 and February 2023 (respectively), the closest known roosting occurrence of MYLU is in a barn site approximately 9 miles north of the project location. The closest summer capture record of MYLU is from a 2011 mist net survey 6 miles southwest of the project location.

Reliable numbers of MYLU in the action area are not available. There are 136 element occurrences of MYLU in western NC based on NCNHP records, 10 of which are considered historical. Most observations are from mist-netting, as well as from bats roosting in small caves, bridges, and other human-made structures. The number of bats found at each occurrence range from 1 to 350 bats. Maternity colonies of MYLU have been found in 11 western NC counties including Buncombe County. Six maternity colonies were found under NCDOT bridges while others were found in buildings, artificial roosts, and caves. MYLU hibernacula (caves/mines) have been found in 9 NC counties. While there are no known MYLU hibernacula in Buncombe County (WRC email comm. November 17, 2022), swarming/staging areas from hibernacula in Henderson, Yancey, and Rutherford Counties fall within Buncombe County.

4.5 Factors Affecting MYSO, MYSE, PESU, and MYLU in the Action Area

The main factors that could adversely affect the four subject species in the action area are similar to those discussed in the 2020 BO for MYGR. That is, increasing urbanization and development directly adjacent to the French Broad River. Activities associated with residential, commercial, and industrial development and the supporting infrastructure result in the fragmentation of intact portions of forested riparian habitat and increased lighting and noise on the landscape. For the subject bats within the action area, these conditions can be expected to negatively impact necessary roosting, foraging, and commuting conditions.

5. Effects of the Action

In accordance with 50 CFR 402.02, the 2019 regulatory definition of effects of the action is "*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*."

This section analyzes the direct and indirect effects of the Action on MYSO, MYSE, PESU, and MYLU. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action but are later in time and reasonably certain to occur. The effects of the action are added to the environmental baseline and, after taking into consideration the status of the species and cumulative effects, serve as the basis for the determinations in this Opinion (50 CFR 402.14(g)(4)).

5.1 Stressors

Based on the description of the Action and the species' biology, the following stressor to the MYSO, MYSE, PESU, MYLU has been identified that may result from the Action: tree removal. The ways in which lighting (temporary and permanent), noise and vibration, changes to hydrology and water quality impacts, and highway operation activities are understood to affect MYGR are also understood to affect MYSO, MYSE, PESU, and MYLU based on current knowledge of species life histories and are addressed in the 2020 BO for MYGR, therefore, those stressors are not further addressed here but can be

referenced in the 2020 BO and applied to these four species. Below, tree removal is described and associated responses and rationale for the determination of effects are provided.

5.1.1 Stressor: Tree Removal

Tree-clearing activities are anticipated to take place any time of year within the action area, with up to 211 acres cleared. Clearing will occur in riparian and upland, fragmented and intact swaths of forest (Appendix B, Figures 1-19). MYSO, MYSE, PESU, and MYLU are active on the landscape from April 1 to October 15, meaning that tree clearing activities are expected to occur when these species are utilizing forested portions of the action area for roosting, foraging, and commuting.

The 2020 BO, specifically section 5.1.2.2.1.3, addresses tree clearing effects on MYGR foraging and commuting habitat. While MYGR, MYSO, MYSE, PESU, and MYSE all have species-specific variations in foraging and commuting habitat and associated behavior, the analysis of impacts from tree removal on these species' foraging and commuting habitat throughout the action area, as discussed in the 2020 BO, is applicable for the four subject species covered in this Opinion. Therefore, the stressors of tree removal on foraging and commuting are not discussed further here other than to reiterate the following: These stressors are expected to result in increased energy expenditure and reduced fitness, which equates to harm; as well as increased risk of exposure to predators, which equates to wounding and death.

Unlike MYGR, which is generally not considered a tree-roosting species, MYSO, MYSE, PESU, and MYLU roost in trees during the active season and are expected to be adversely affected by the loss of roosting habitat through the project's tree clearing activities. Direct and indirect effects from the loss of forested roosting habitat are expected.

While bats can flee during tree removal, removal of occupied roosts (spring through fall) is likely to result in direct injury or mortality to some percentage of bats. This percentage would be expected to be greater if flightless pups or inexperienced flying juveniles were also present. Felling roost trees during the active season may result in adverse effects to any of the four subject bat species. If a bat is in the tree and a tree is cut down, the bat may either stay in the tree and potentially be crushed or fly out (adults or volant pups) during the day and be more susceptible to predation (e.g., by raptors) and have to expend energy to find a new roost. The risk is also greater to adults during cooler weather when bats periodically enter torpor and would be unable to arouse quickly enough to respond.

The removal of roost trees, even while unoccupied, is expected to indirectly affect MYSO, MYSE, PESU, and MYLU. Removal of roost trees would likely result in increased energy expenditures for affected bats. Increased flight distances or smaller colonies are expected to result in some percentage of bats having reduced pregnancy success, and/or reduced pup survival. The impact of shifting flight patterns and foraging areas on individual bats varies. Recovery from the stress of hibernation, WNS, and migration may be slower as a result of the added energy demands of searching for new roosting habitat, especially in an already fragmented landscape where forested habitat is limited. Pregnant females, known to exhibit roost site fidelity, displaced from preferred roosting areas will have to expend additional energy to search for alternative habitat; which would likely result in reduced reproductive success (failure to carry to full term or failure to raise pup to volancy) for some females. Females that do give birth may have pups with lower birth weights given the increased energy demands associated with longer flights, or their pups may experience delayed development. These longer flights would also be experienced by pups once they become volant which could affect the survival of these pups as they enter hibernation with potentially reduced fat reserves. Overall, the removal of roost trees from the landscape could cause varying degrees of harm depending on individual bats' conditions and the habitat provided in the surrounding landscape.

5.1.2 Summary of Stressors and Effects Determinations

In summary, the anticipated stressor and effects discussed above are expected to adversely affect MYSO, MYSE, PESU, and MYLU. The felling of occupied roost trees could result in the death, wounding, and harm of the subject bats, while the loss of roost trees in general could result in harm via increased energy expenditures from the search for alternative roosts and subsequent reduced fitness and/or maternity success.

5.2 Beneficial Effects

Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat.

No changes from 2020 BO.

5.3 Cumulative Effects

Cumulative effects include the "*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, 2019 Regulations). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act.

No changes from 2020 BO.

6. Conclusion

After reviewing the current status of MYSO, MYSE, PESU, and MYLU, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the four considered species. No critical habitat has been designated for these species; therefore, none will be affected. This opinion is based on the following:

1. Although the proposed action is expected to result in adverse effects to MYSO, MYSE, PESU, and MYLU from year-round tree removal, lighting (temporary and permanent), noise and vibration, alterations to hydrology, water quality impacts, and highway operation; we have determined that the species' reproduction, numbers, and distribution will not be appreciably reduced as a result of the proposed action. We do not know how many MYSO, MYSE, PESU, or MYLU may be using the action area but are able to produce estimations based on existing data.
    a. The projected range-wide MYSO population is 596,431 as of 2022. Assuming one maternity colony of up to 126 bats within the action area, a maximum expected number as a worst-case scenario, the project will impact 0.02% of the estimated range-wide population.
    b. The Service projected the range-wide MYSE population to be 19,356 individuals in 2020. Based on mean home-range sizes (21 – 179 acres), distances between roosts (20 feet to 2.4 miles), and the typical foraging range of MYSE maternity colony (1.5 miles = 4,522 acres), if we assume the presence of one maternity roost of up to 60 individuals within the action area, the project will impact less than 0.31% of the range-wide population.
    c. The PESU range-wide population is estimated to be 67,898 individuals (Service 2022b). If a maternity colony will occupy an area of 5 acres, and each colony has a mean of 7 bats, we estimate the presence of 42 maternity colonies. This is based on an estimate that approximately 211 acres within the action area may be suitable for supporting several maternity colonies, a maximum expected number as a worst-case scenario. At 211 acres /

5 = 42 colonies, and at a mean of 7 bats per colony, that equates to 295 bats. Following this estimate, the project could impact 0.4% (= 295/ 67,898) of the range-wide population.

d. While the current range-wide population of MYLU is unknown, populations within WNS-impacted areas (36% of the little brown population) have declined 98% (Cheng et al. 2021). Assuming the range-wide population of MYLU is evenly distributed across its range, thirty-six percent of the 2006 estimated population of 6.5 million bats is 2.34 million individuals. If the 2.34 million bats declined by 98%, that leaves 46,800 bats in WNS-impacted areas. Based on home range sizes, if we assume that one maternity colony with 1,200 MYLU occurs within the action area, 2.6% of the WNS-impacted portion of the population (=1,200/46,800) and a much smaller fraction of the range-wide population would be impacted.

7. Incidental Take Statement

Section 9 of the Endangered Species Act and Federal regulations pursuant to section 4(d) of the Endangered Species Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take "*means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct*" (16 U.S.C §1532). Harm is further defined by the Service as "*an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering*" (50 CFR 17.3). Incidental taking "*means any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity*" (50 CFR 17.3). Harass is defined by the Service as "*an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering*" (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered to be prohibited under the Endangered Species Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

7.1 Amount or Extent of Take

The Service anticipates incidental take of MYSO, MYSE, PESU, and MYLU may occur as a result of the proposed action. Specifically, take of the species may occur as a result of tree removal (year round), lighting (temporary and permanent), noise and vibration, changes to hydrology, water quality impacts, and highway operation. During these activities, individual bats may be crushed, flushed, struck, exposed to higher energy expenditure and/or predation, or experience reduced quality of foraging habitat and prey base.

The Service anticipates the incidental taking of MYSO, MYSE, PESU, and MYLU associated with this project will be difficult to detect because: 1) the individuals are small, mostly nocturnal, and occupy trees or structures where they are difficult to observe, 2) finding dead or injured bats during or following project implementation is unlikely, and 3) most incidental take is in the form of non-lethal harm and not directly observable. Also, there is no data from the action area that estimates the numbers of the four subject species in the action area, and 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 for these species. Given this, the extent of take will be monitored for MYSO, MYSE, PESU, and MYLU using three surrogate measures:

1. Construction operations and project disturbance, which will not occur outside of the established action area (Appendix A, Figure 3).
2. Tree clearing acreage, which will not exceed 211 acres.
3. The duration of activities, which will not exceed five maternity seasons (May 15 – August 15).

These surrogate measures are appropriate because the anticipated taking will result from the removal of forested habitat, noise and vibration effects to suitable roosting trees and structures in the action area, and the timing of these activities. These surrogate measures serve to set a clear limit for determining when take has been exceeded for MYSO, MYSE, PESU, and MYLU. In this Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to these four species.

Therefore, the incidental take exempted by the Opinion would be exceeded if:

1. The construction footprint and associated activities exceed the establish boundaries of the action area.
2. Tree clearing acreage exceeds 211 acres.
3. Project construction exceeds five maternity seasons from start to completion.

Exceedance of take as defined by 1 – 3 above will represent new information that was not considered in this Opinion and shall result in reinitiation of this consultation. The incidental take of MYSO, MYSE, PESU, and MYLU is expected to be in the form of harm, wounding, or death. In this Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species.

7.2 Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize take of MYSE, MYSO, and PESU. These non-discretionary measures reduce the level of take associated with project activities and include only actions that occur within the action area.

1. NCDOT shall ensure that the contractor(s) understands and follows the measures listed in the "Conservation Measures", "Reasonable and Prudent Measures," and "Terms and Conditions" sections of this Opinion.
2. NCDOT shall monitor and document any take numbers and the surrogate measures of take and report those to the Service.

7.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Applicant must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and/or monitoring requirements. When incidental take is anticipated, the terms and conditions must include provisions for monitoring project activities to determine the actual project effects on listed fish or wildlife species (50 CFR §402.14(i)(3)). These terms and conditions are nondiscretionary.

1. Ensure that the procedures listed in the "Conservation Measures", "Reasonable and Prudent Measures", and "Terms and Conditions" sections of this Opinion are being implemented and that all project plans are being implemented in a manner that ensures the conditions of this Opinion are met.
2. NCDOT shall ensure that the Service and NCWRC are fully involved and in agreement with the design of the telemetry study. The study design process and subsequent data sharing shall be inclusive of and transparent to the involved agencies. Language will be included in any agreement requiring group consensus on any changes or contract and funding extensions, data sharing, and about following WNS decontamination protocols when working in western NC. Prior to funding approval, the study shall be approved by the Service and NCWRC.

3. Ensure that the telemetry study project description includes a specified minimum level of effort, e.g. minimum number of nights of netting, and/or number and size of culverts/bridges to check, and/or number of acoustic stations.
4. NCDOT shall provide oversight and monitoring to ensure that construction contractors abide by all design plans.
5. NCDOT shall monitor the surrogate measures of take to ensure that any exceedances are detected in a timely manner.
6. NCDOT shall immediately notify the Service's Asheville Field Office should live or deceased MYSO, MYSE, PESU, or MYLU be discovered during project work.

8. Conservation Recommendations

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

1. **Tree Clearing**: Avoid tree clearing activities during the most sensitive bat seasons, notably the pup season of May 15 – July 31. During this time, pups are non-volant and unable to fly away from clearing activities.
2. **Habitat Protection**: Continue pursuit of property acquisition adjacent to the Hill Street culvert.
3. **Lighting**: Implement additional reductions in high mast poles throughout the action area, especially near waterbodies and riparian areas.
4. **Canton Bridge**: Investigate the light that is illuminating one side of the Pigeon River where bats historically traveled and emerged from the bridge, but are now avoiding. The goal of this is to remove or modify the light in a way that removes illumination from the river and riparian corridor.
5. **Riparian Planting**: Replant disturbed riparian areas with native, fast-growing trees and shrubs that would serve to stabilize the stream bank, filter runoff and reduce erosion and sedimentation, block light pollution, and generally improve the quality of the habitat for bats and aquatic species. Examples of potential native tree species to plant include: sycamore, tulip poplar, black cherry and river birch. Planting with established (e.g. containerized) young trees can increase the survival rate of plantings and contribute to faster improvement of riparian habitat.
6. **Noise Considerations for Bats**: If suitable roost trees are present near high-decibel activity (81 – 162 dBA) and would experience noise above background levels (41 – 70 dBA), avoid conducting those high-decibel activities during the bat maternity season (May 15 – August 15). Alternatively, activity could avoid the pup season (May 15 - July 31). To minimize noise levels, incorporate sound-dampening devices such as noise shrouds for pile driving.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

9. Monitoring and Reporting

No changes from 2020 BO, with the exception of the following which provides further specifics:

- Yearly monitoring summaries will be cumulative. That is, take the first year's report and add data from year two. In year three, add data to the report that has years 1 and 2. Update the methods, results, and discussion each year as needed. In this way, the subsequent reports add to and supersede the older reports and provide updated context. The last report will serve as the

final report.
- Include annual updates on the amount of tree clearing throughout the construction project in each year's report.

10. Reinitiation Notice

This concludes formal consultation on the action(s) outlined in the consultation request dated July 24, 2023. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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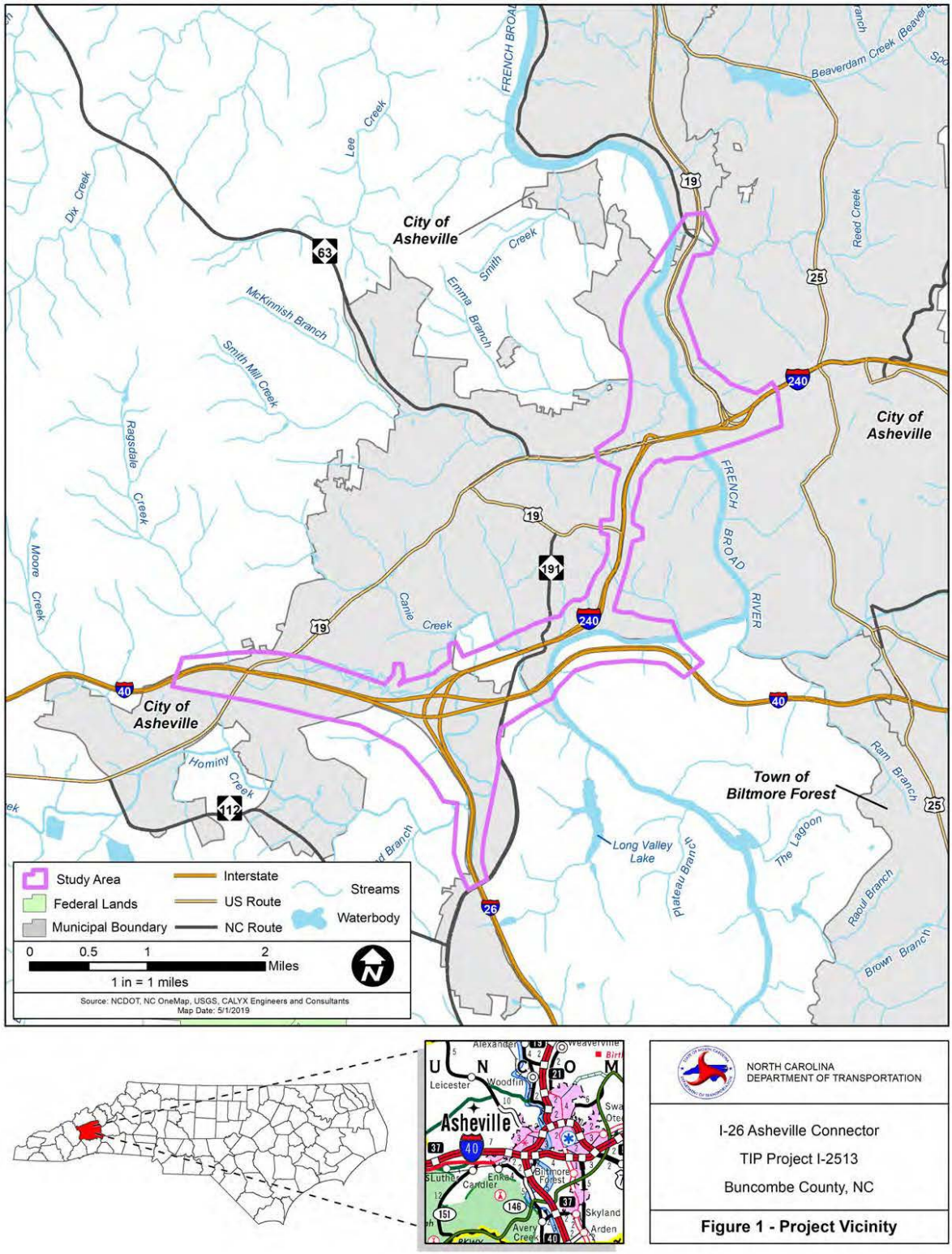
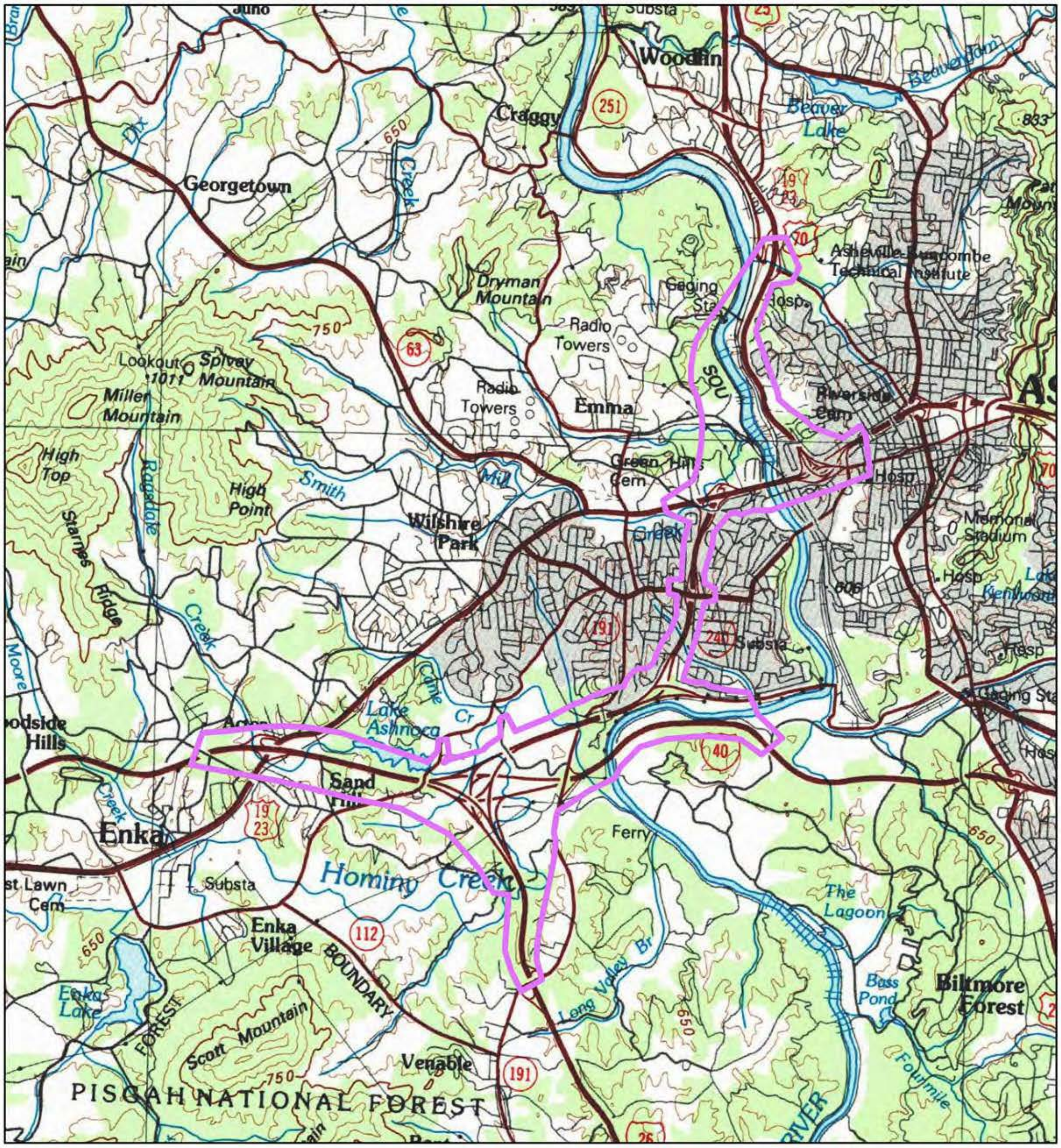
Appendix A. Vicinity and Project Areas





NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Legend

Study Area

0 0.5 1 2 Miles

1 in = 1 mile

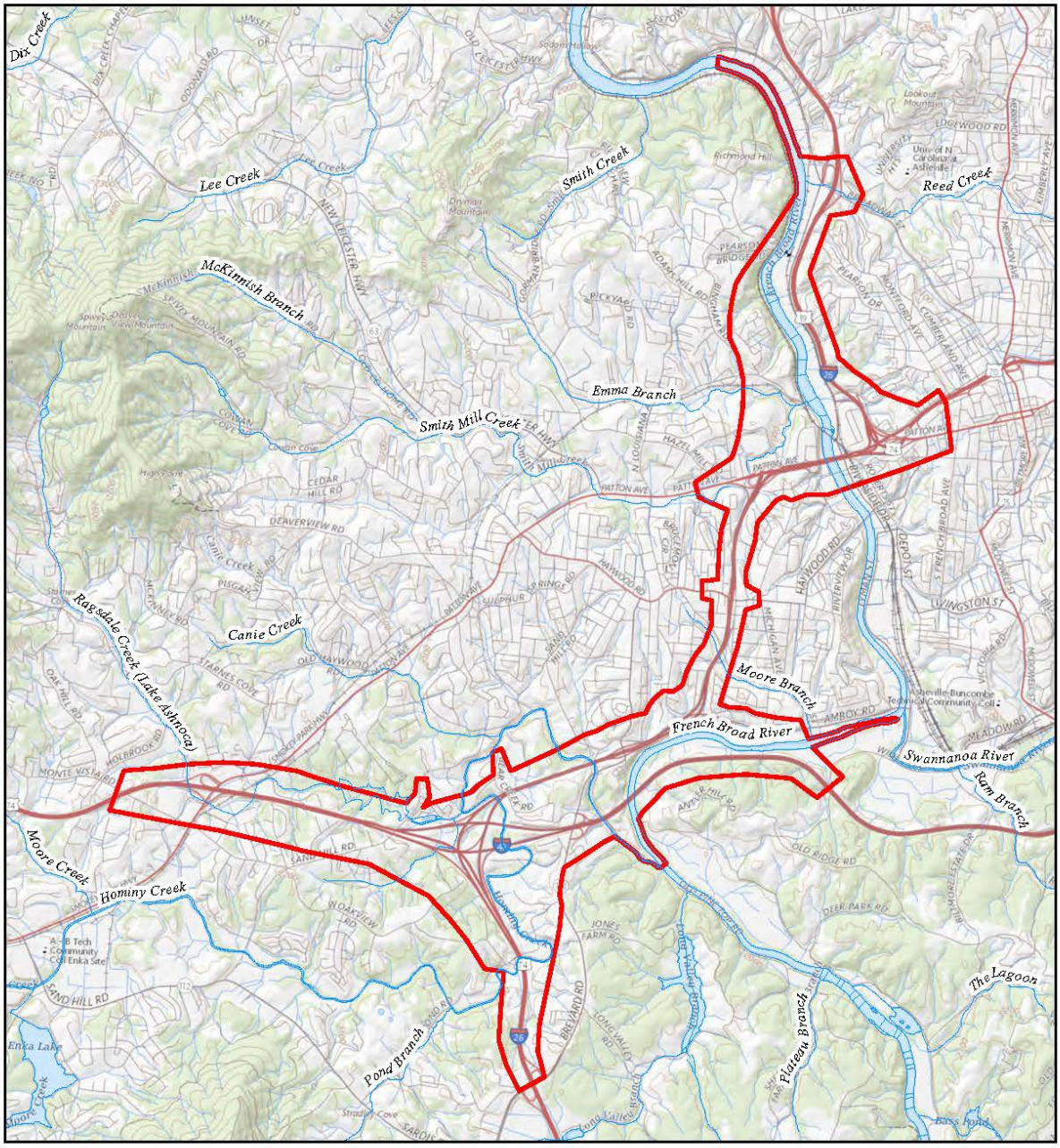
I-26 Asheville Connector

TIP Project I-2513

Buncombe County, NC

Figure 2 - Landscape Position

Source: NC OneMap, CALYX Engineers and Consultants
Map Date: 1/14/2019



NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

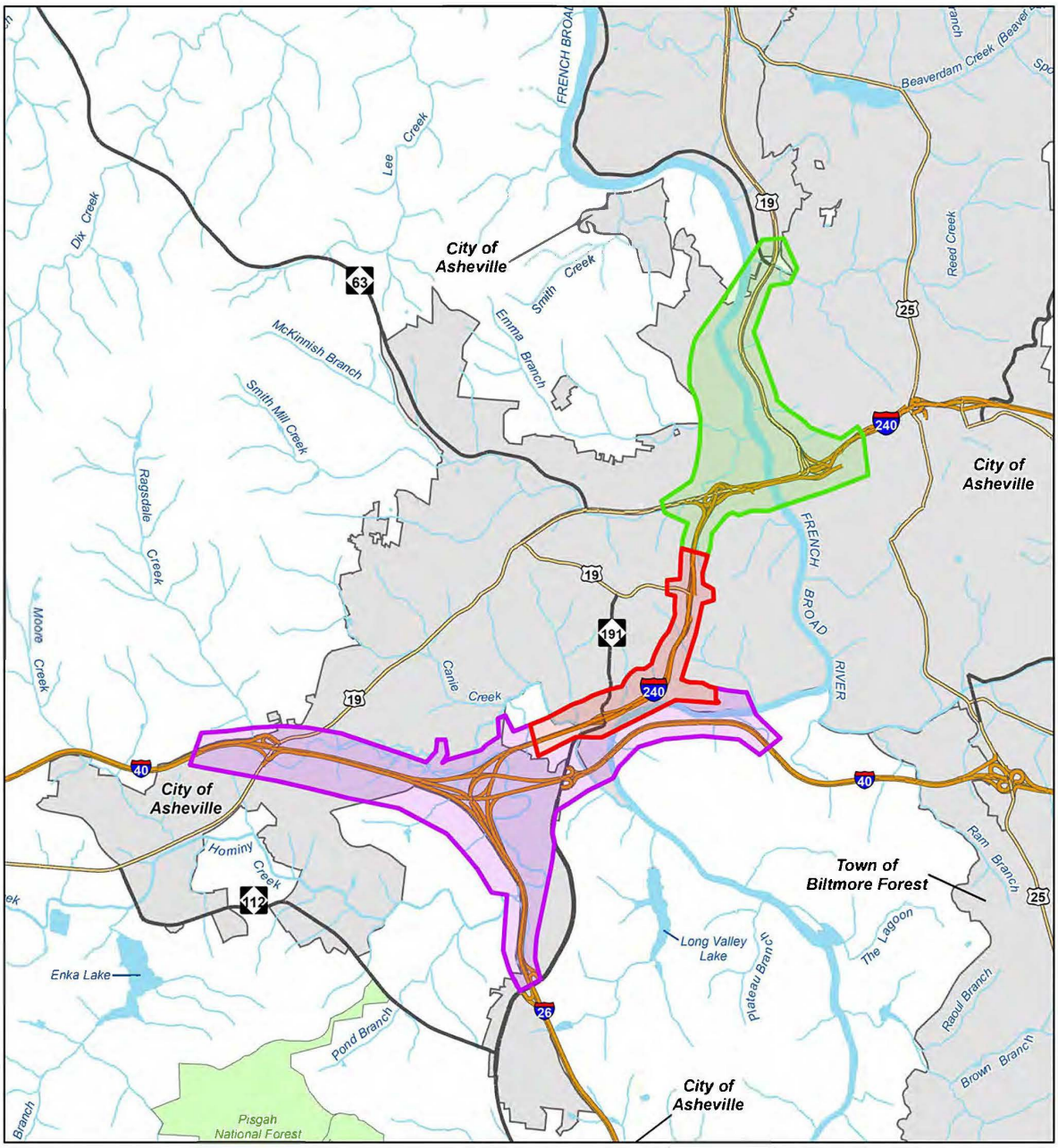
I-26 Asheville Connector

TIP Project I-2513

Buncombe County, NC

Figure 3 - Action Area Streams

Source: Three Oaks Engineering
Map Date: 3/6/2019



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

I-26 Asheville Connector
TIP Project I-2513
Buncombe County, NC

Legend

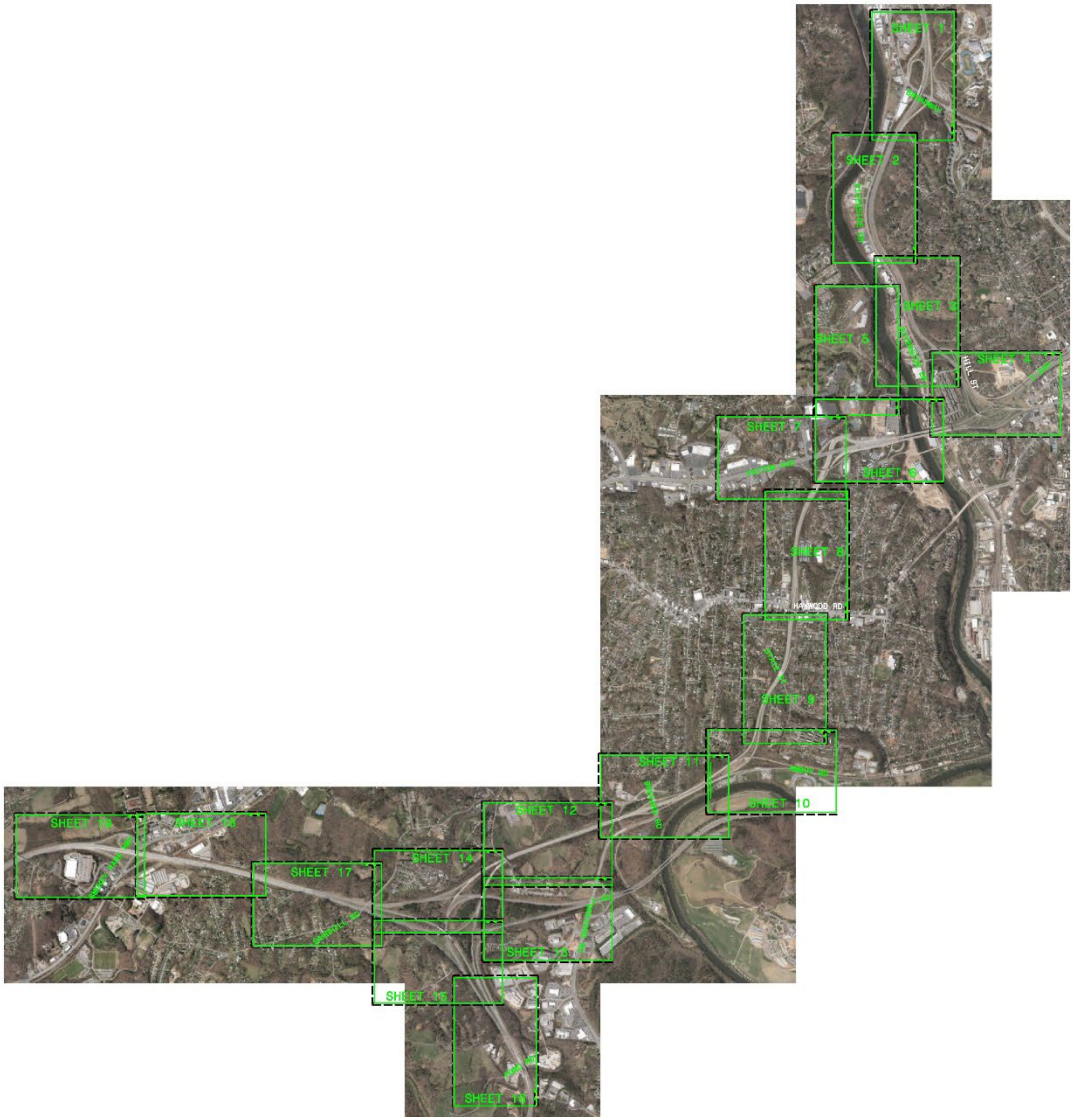
- Section A
- Section B
- Section C
- Interstate
- US Route
- NC Route
- Federal Lands
- Streams
- Waterbody

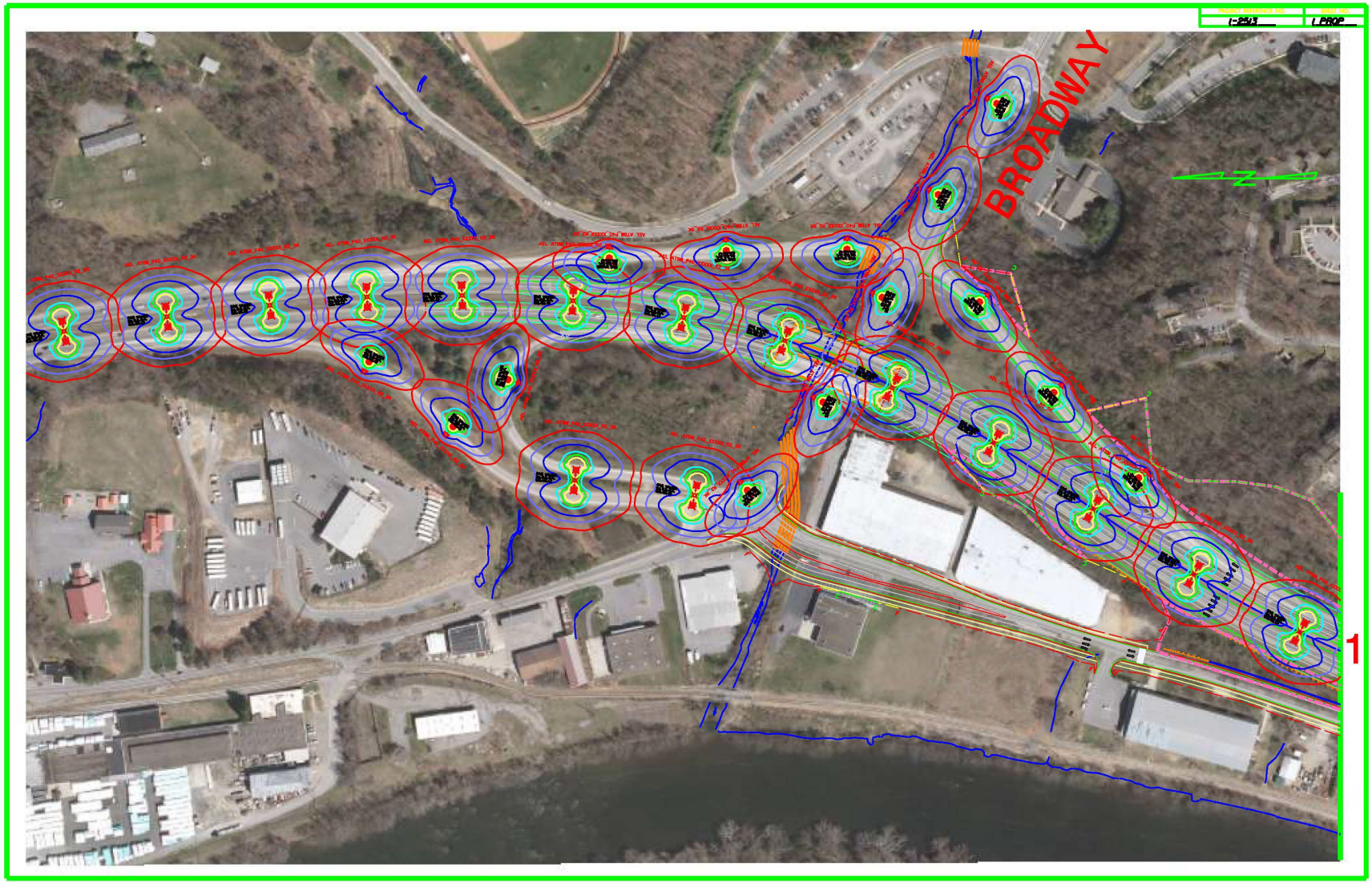
0 0.5 1 2 Miles
1 in = 1 mile

Figure 4
Project Study Area and Sections

Source: NCDOT, NC OneMap, USGS, CALYX Engineers and Consultants
Map Date: 1/14/2019

Appendix B. Proposed Lighting and Clearing

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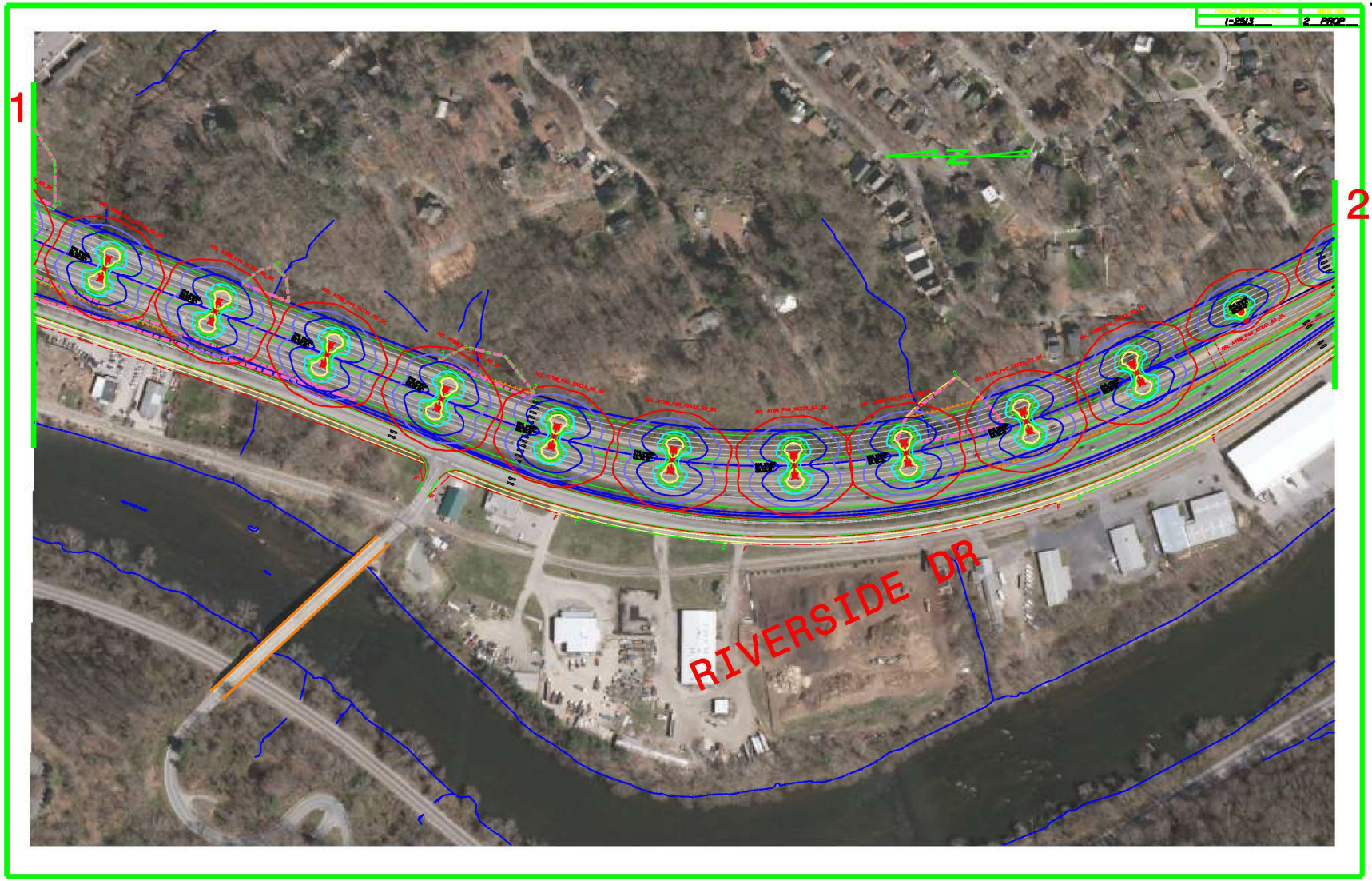
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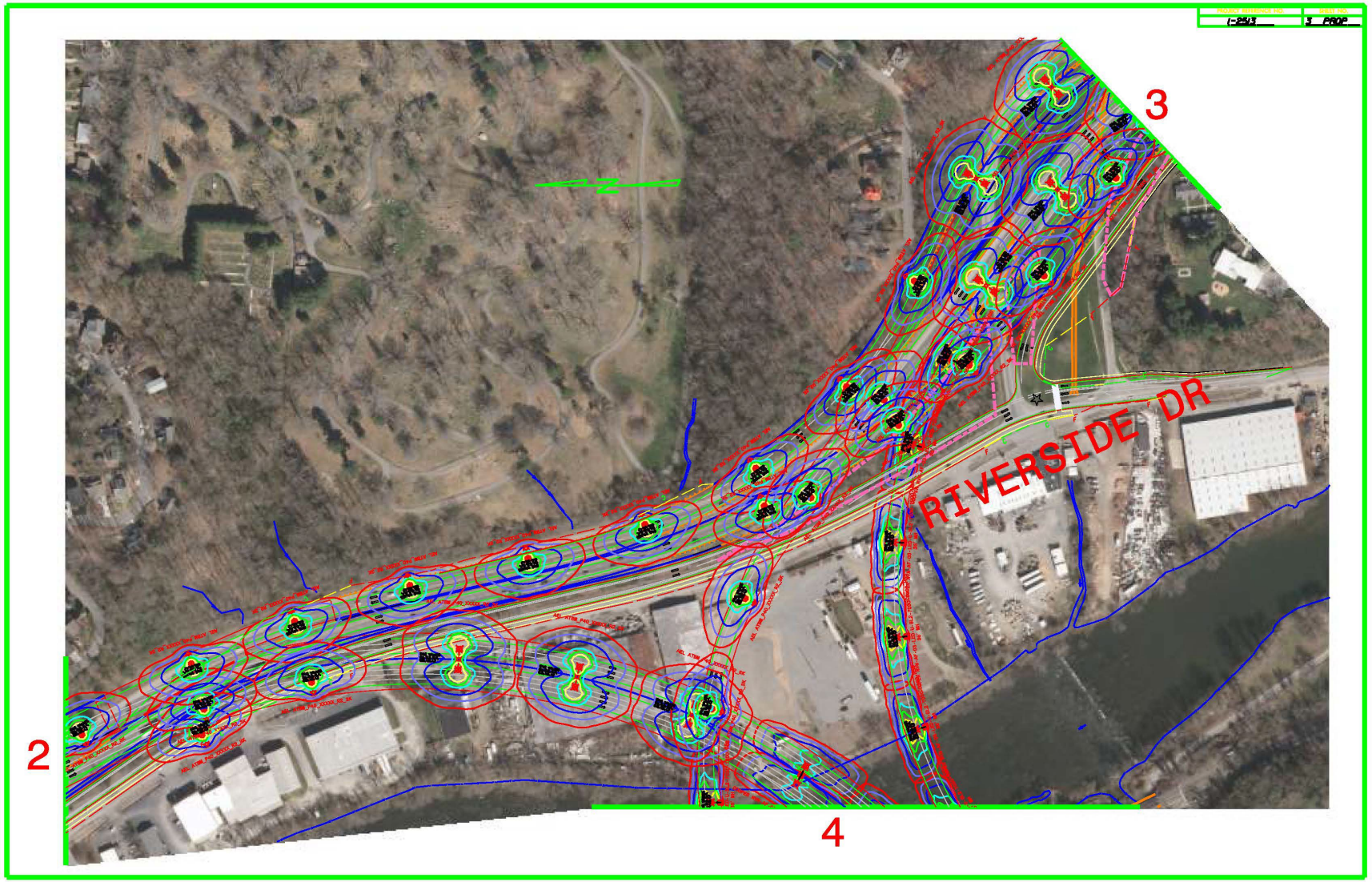
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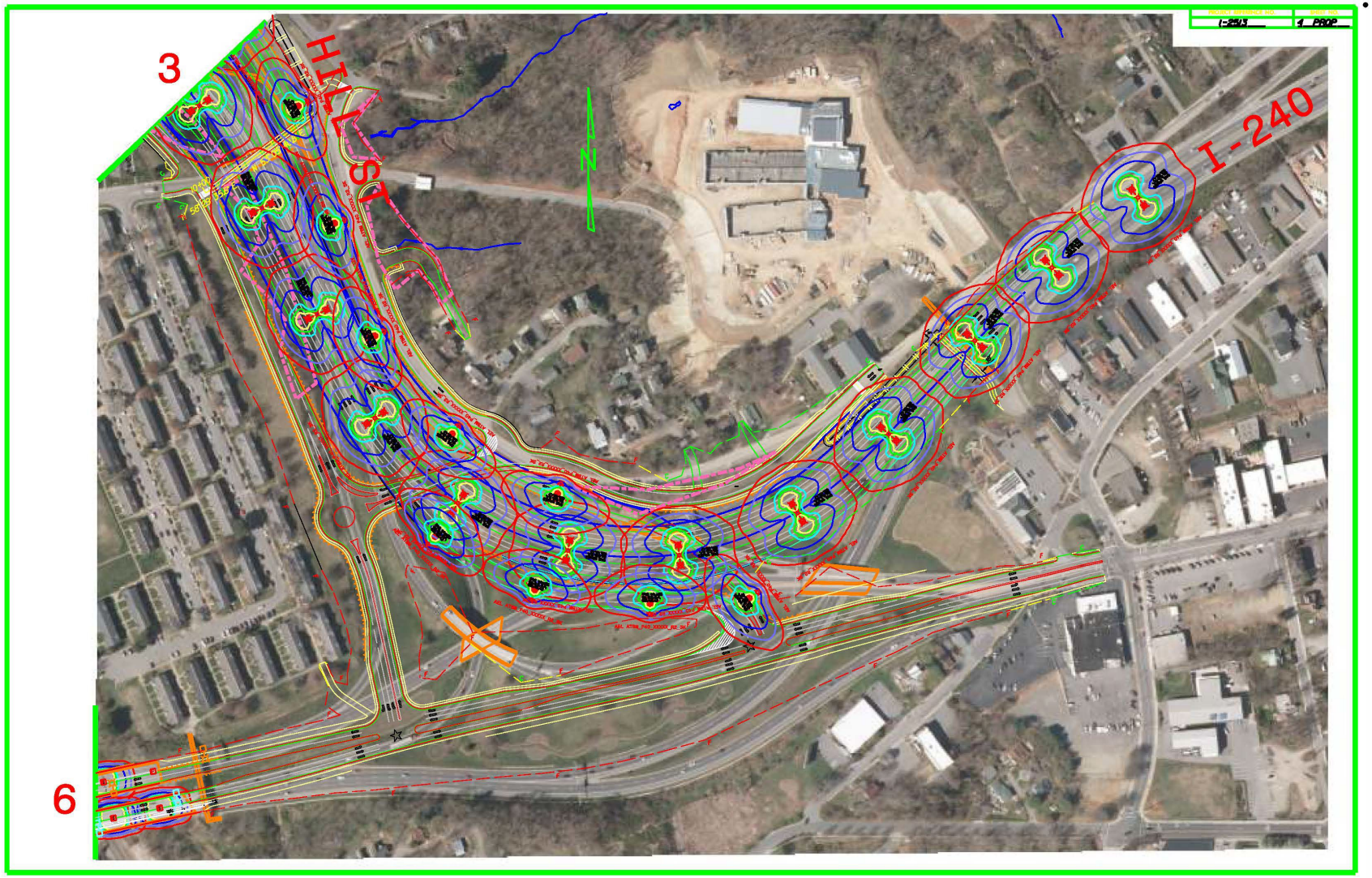
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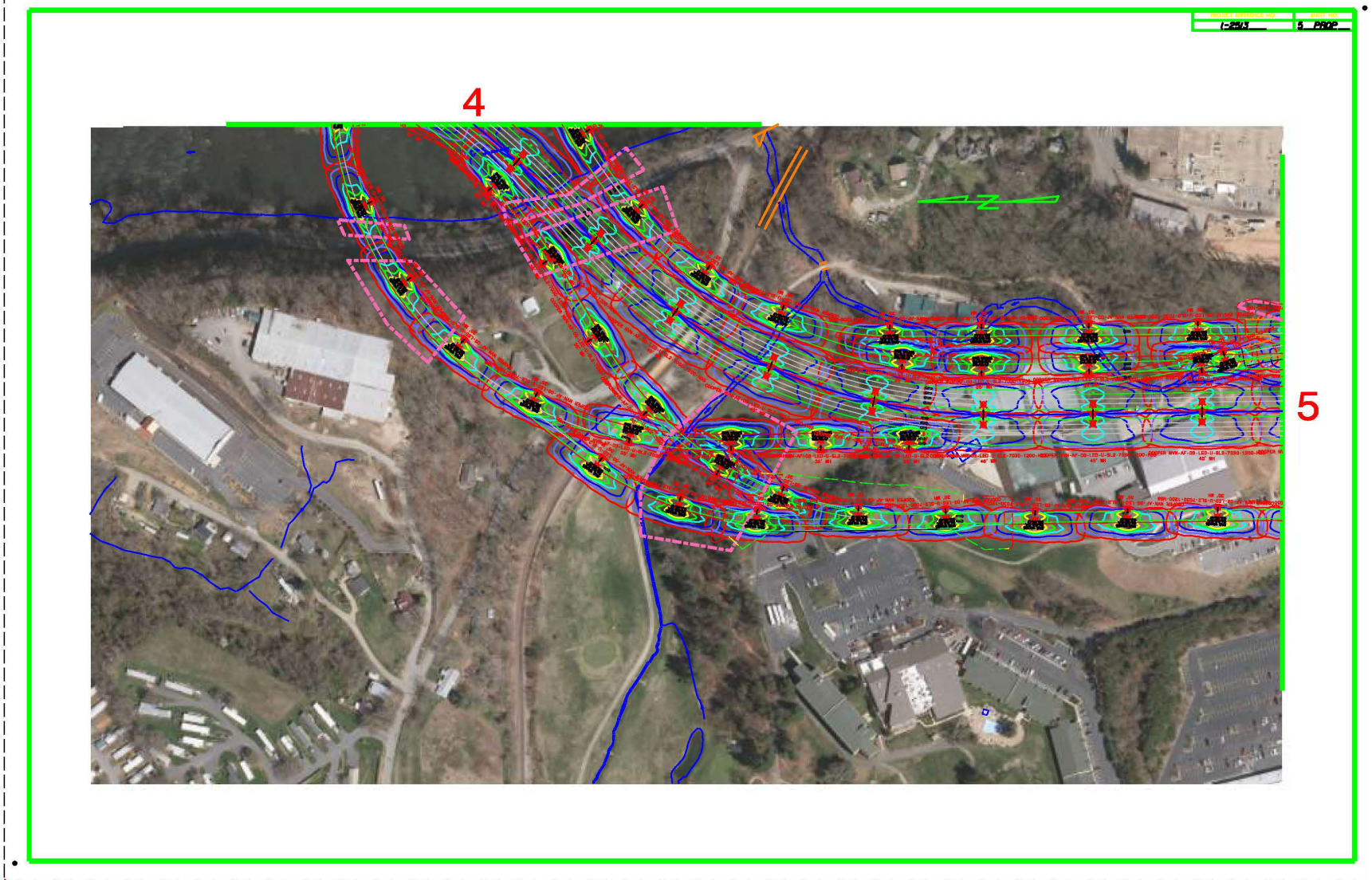
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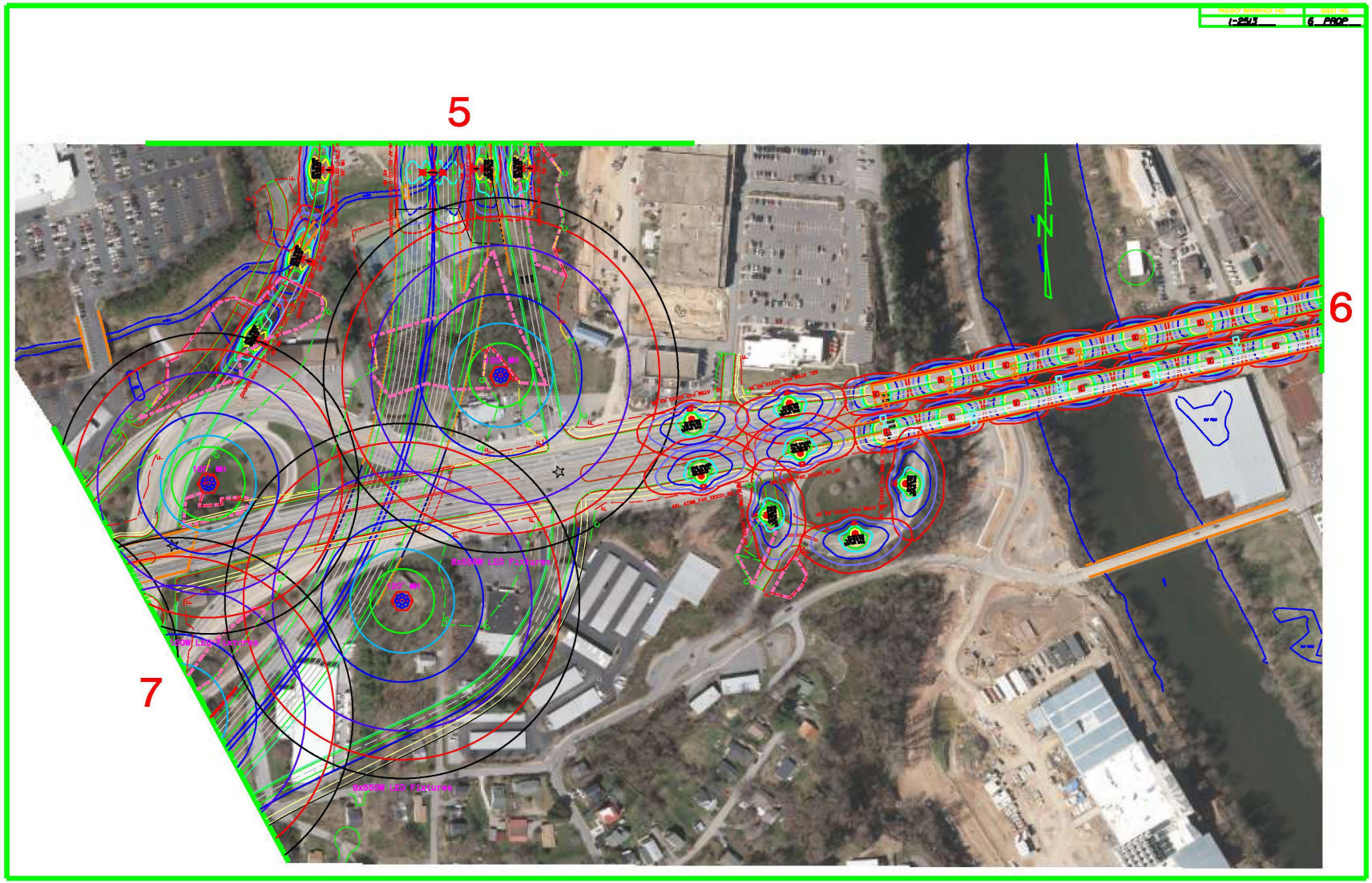
5 PROP
4
5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PATTON AVE
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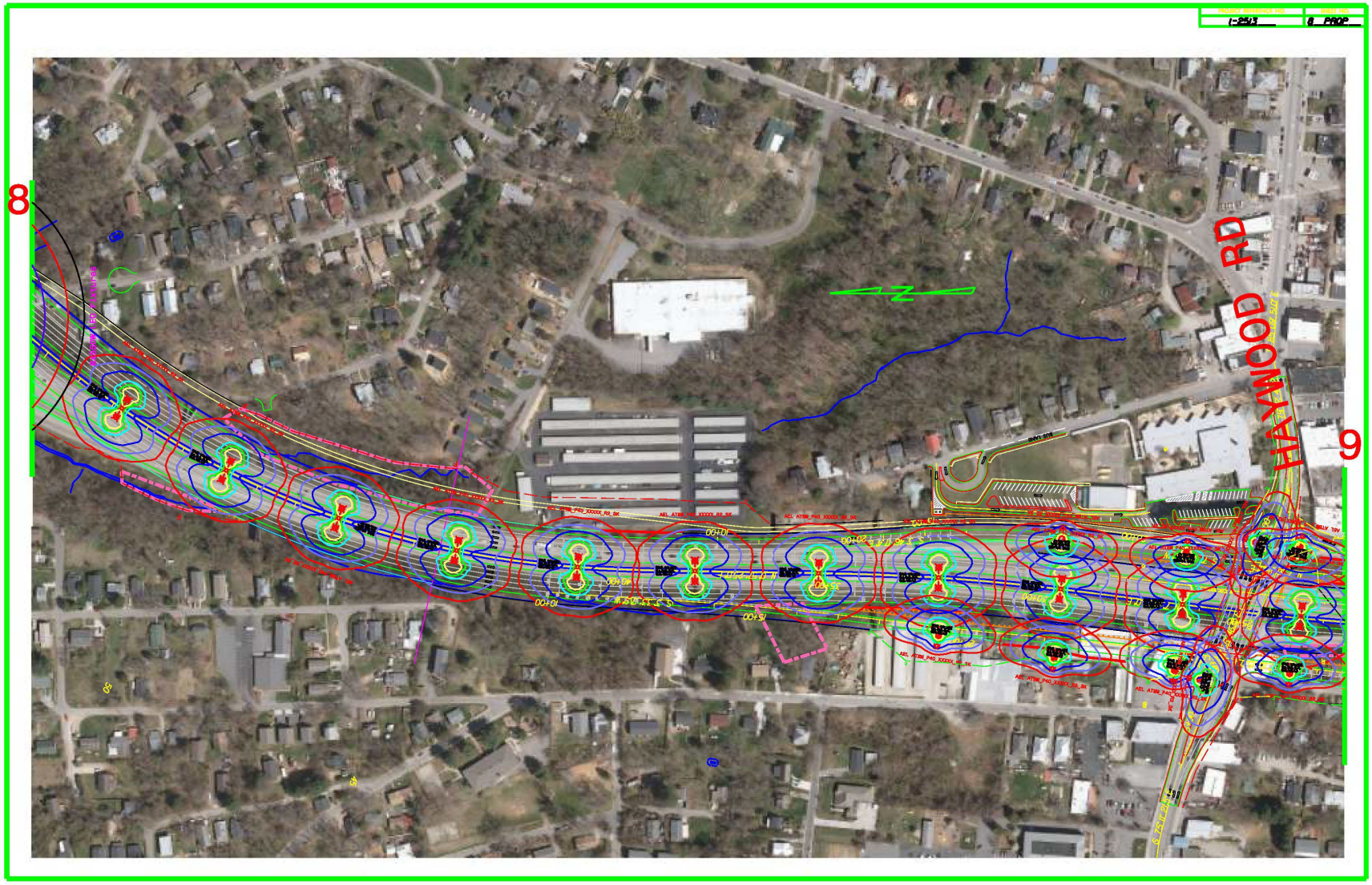
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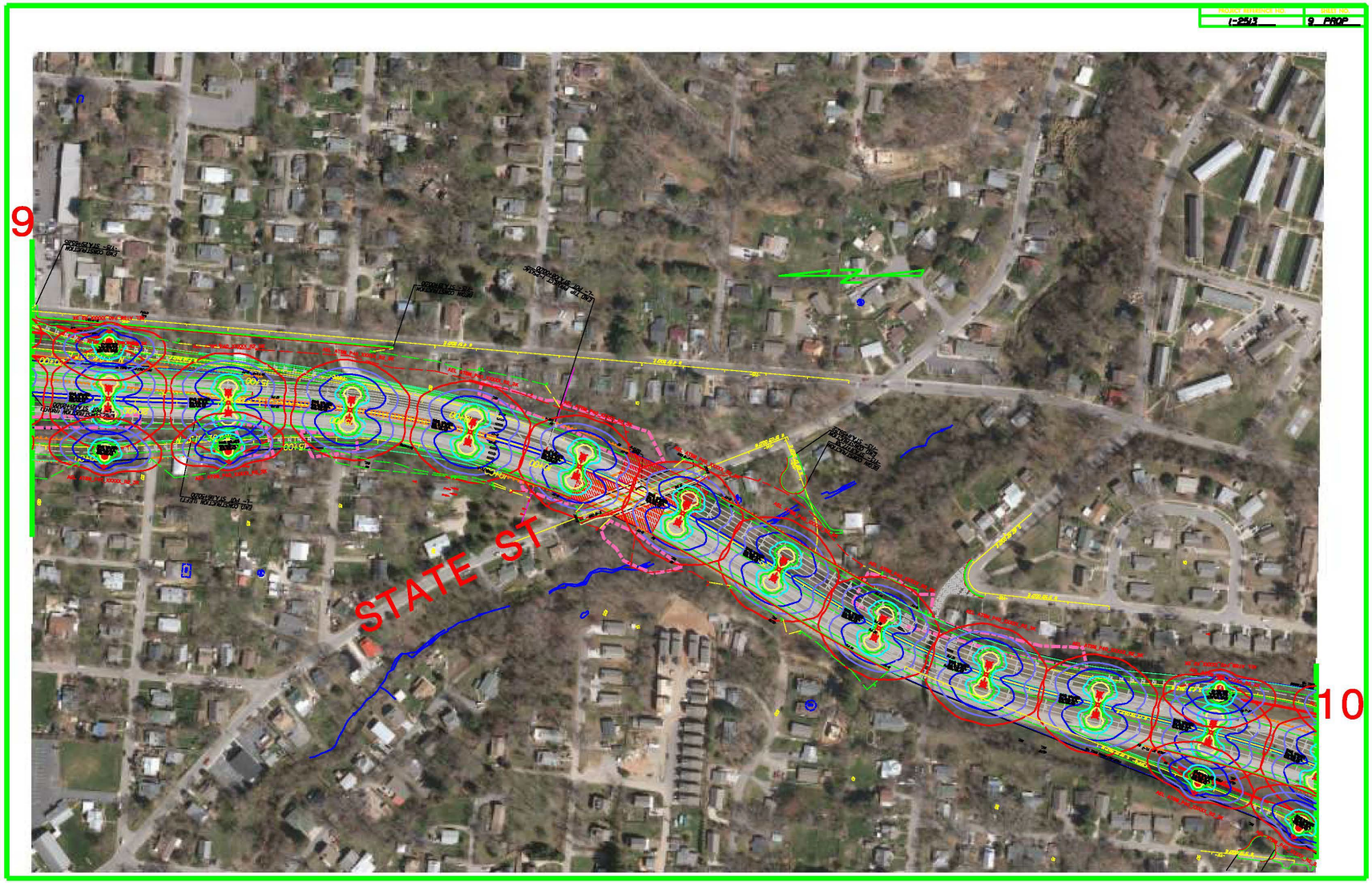
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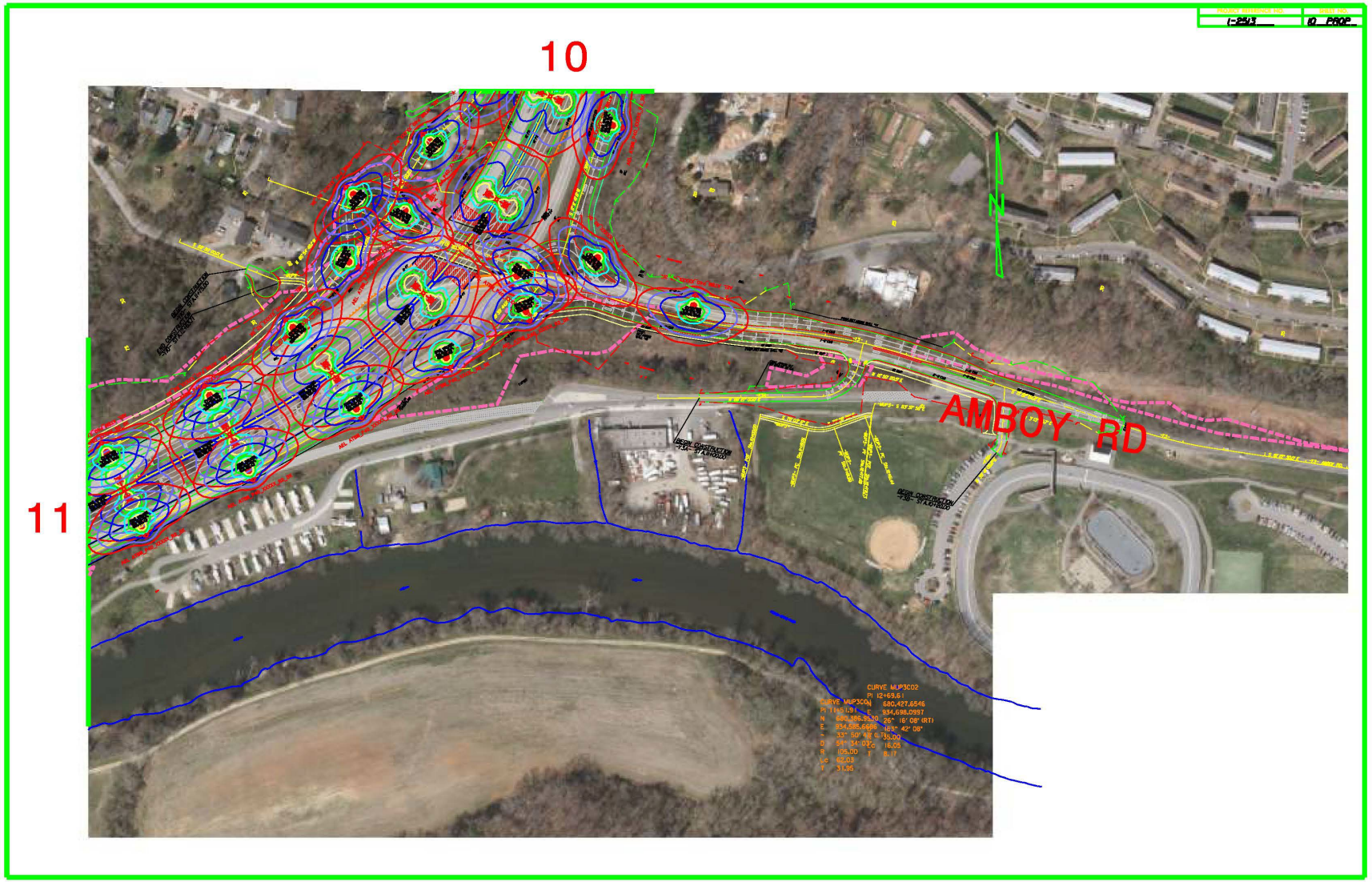
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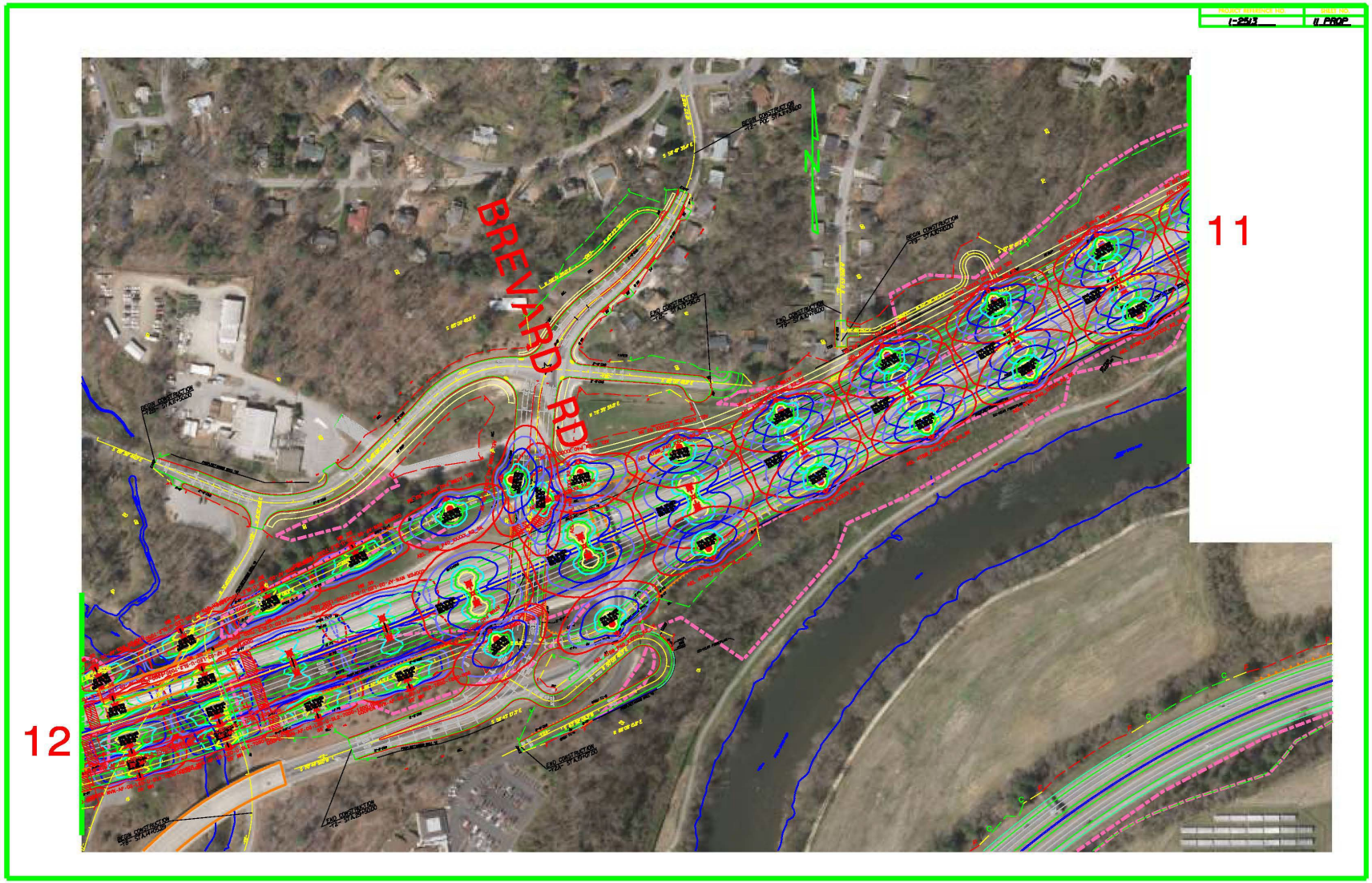
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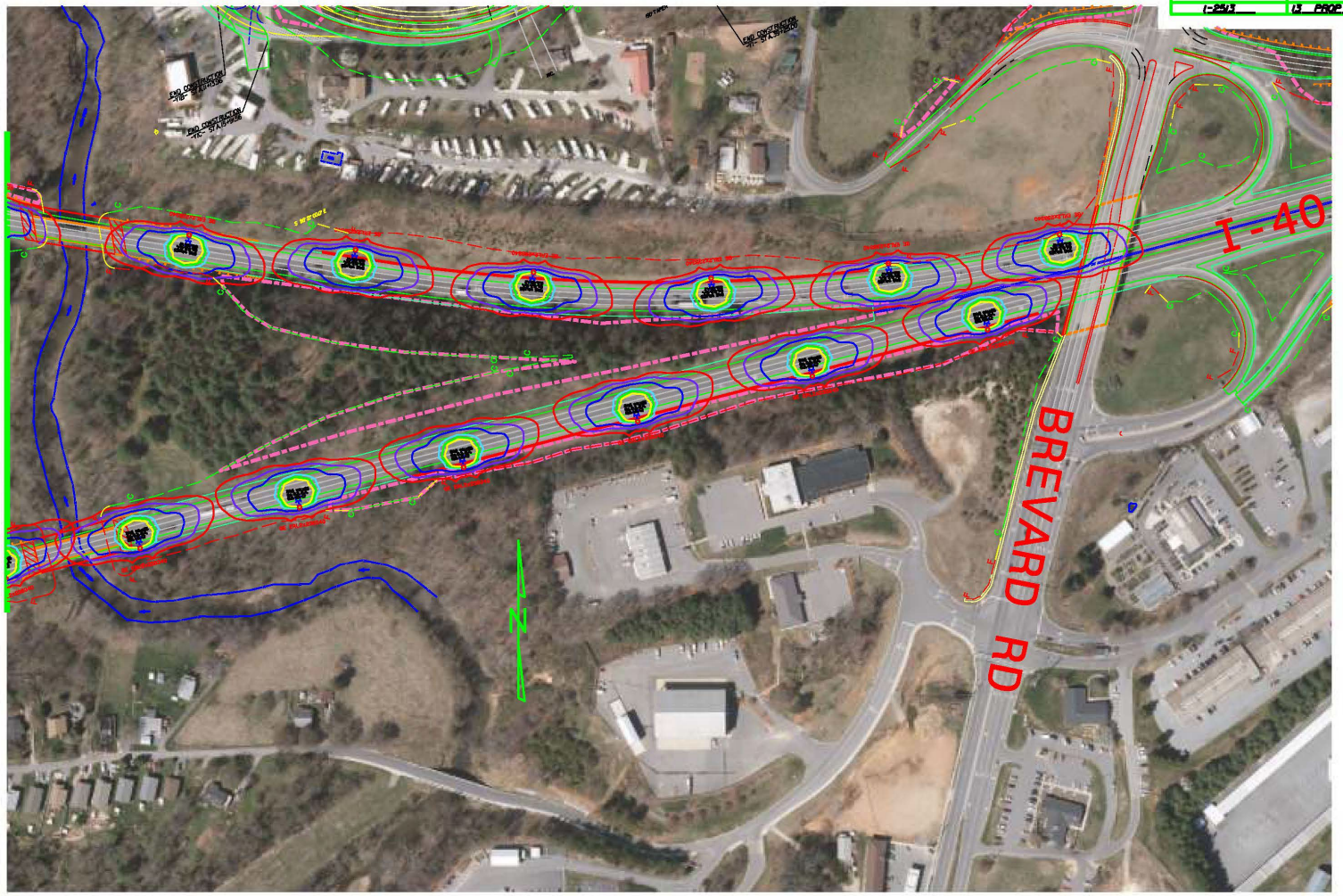


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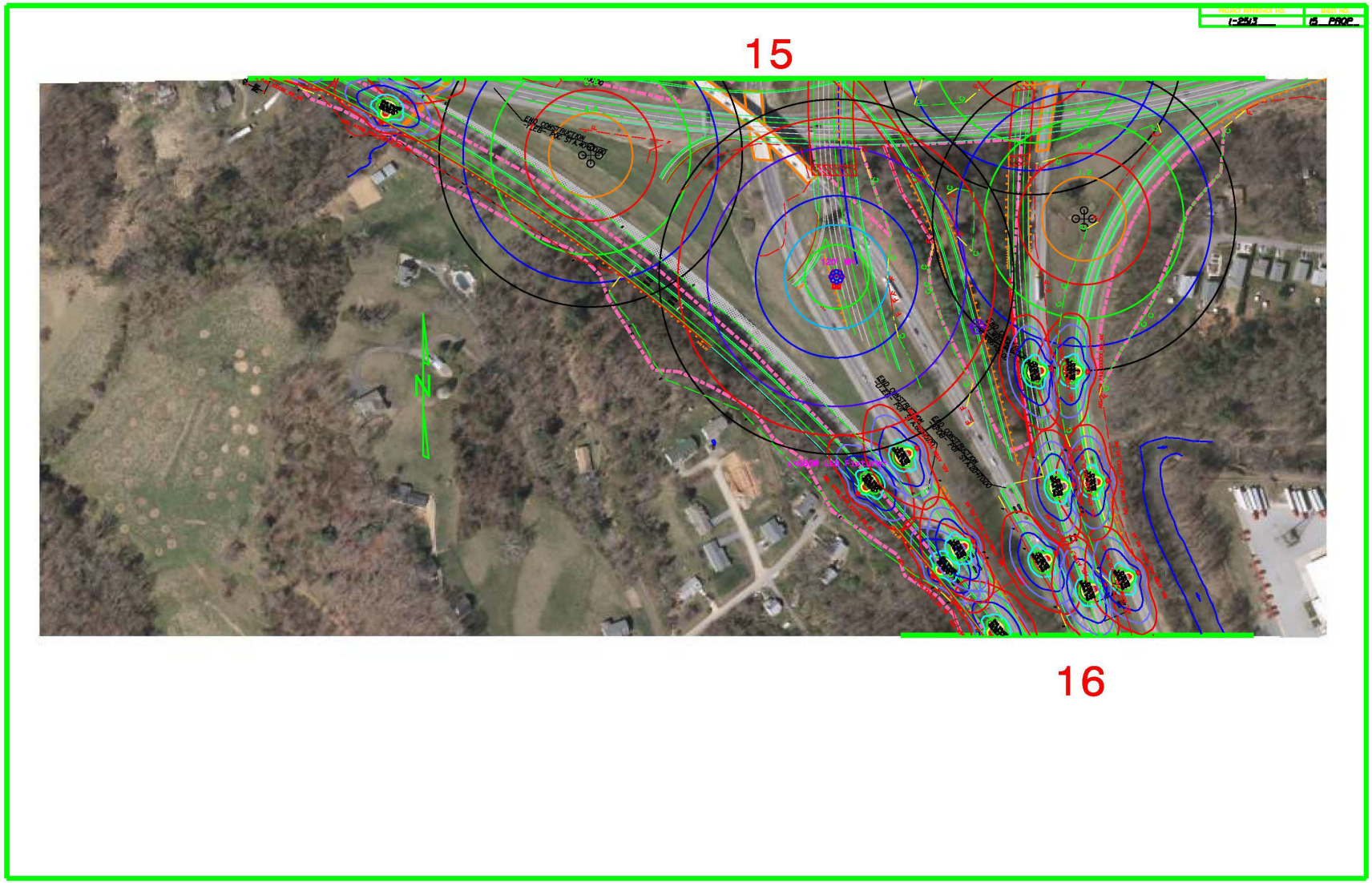
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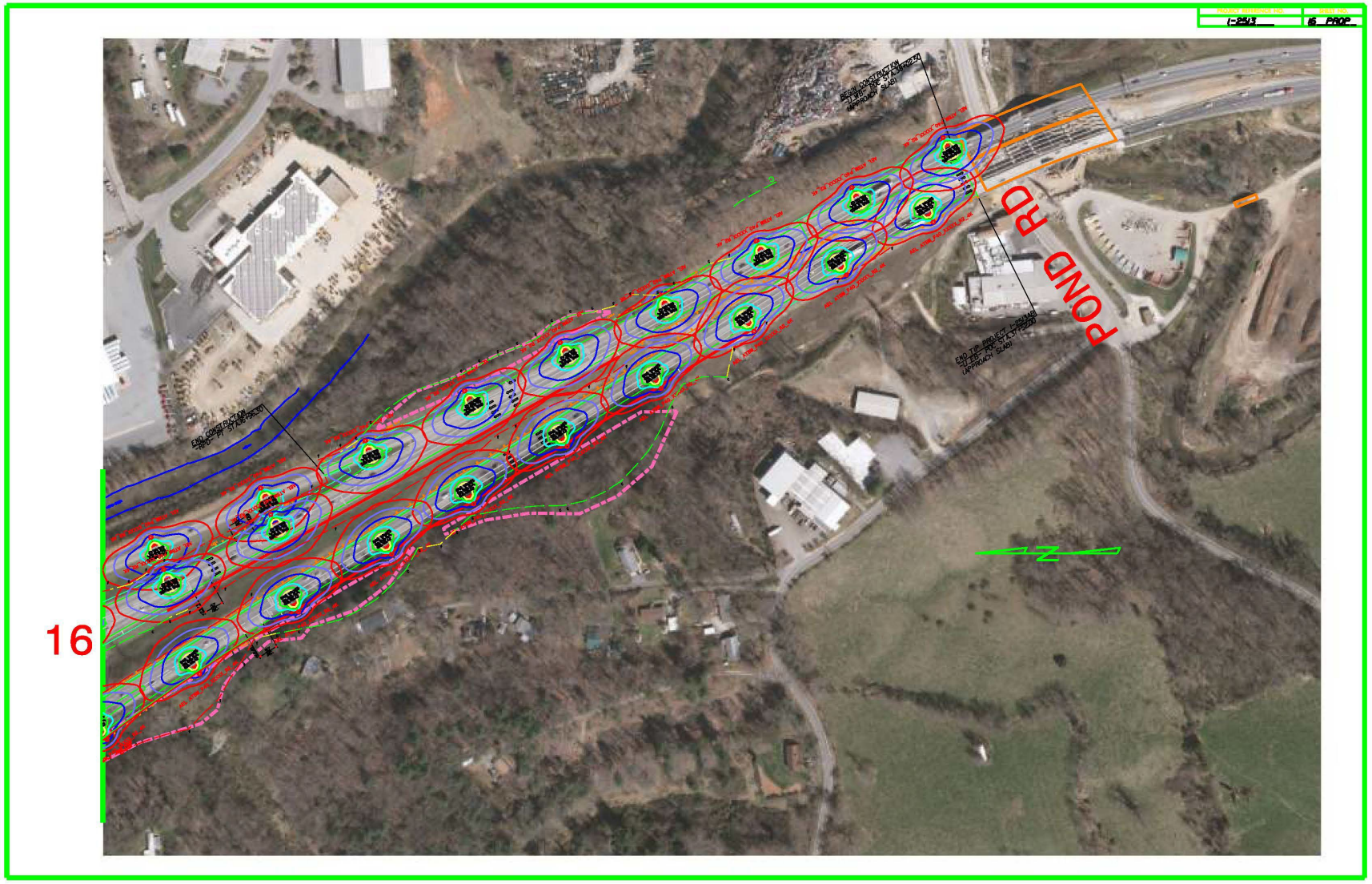
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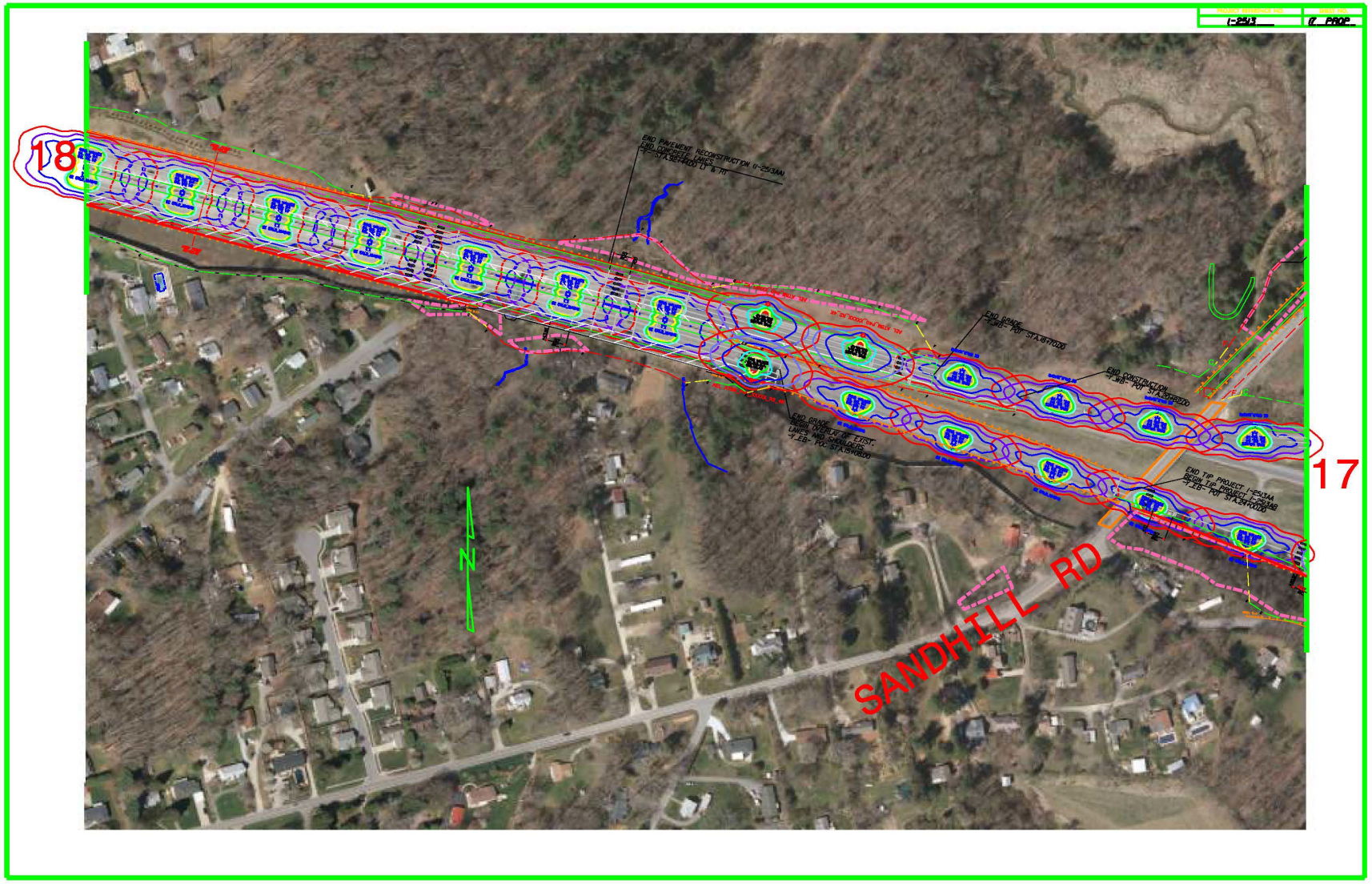
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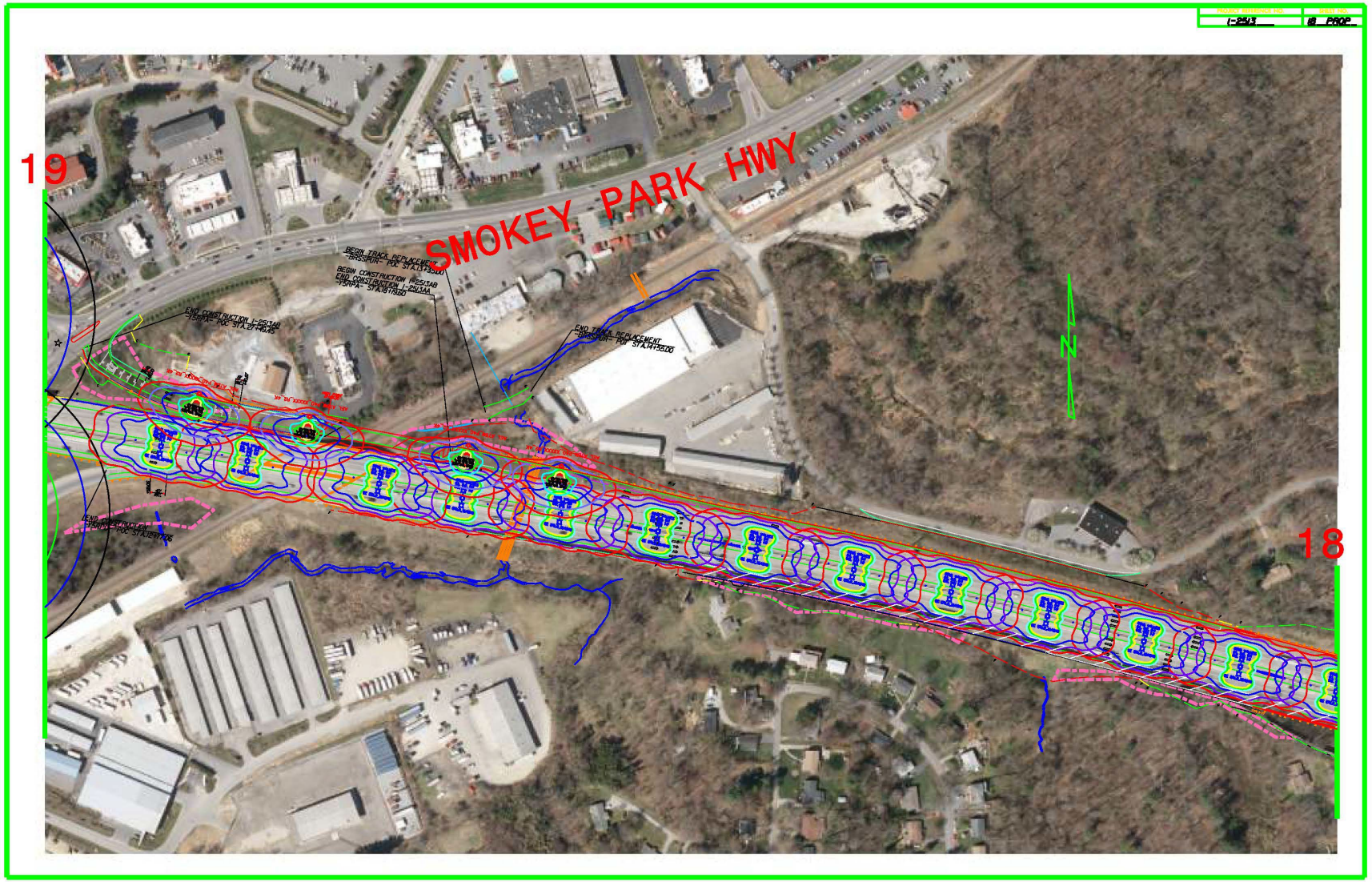
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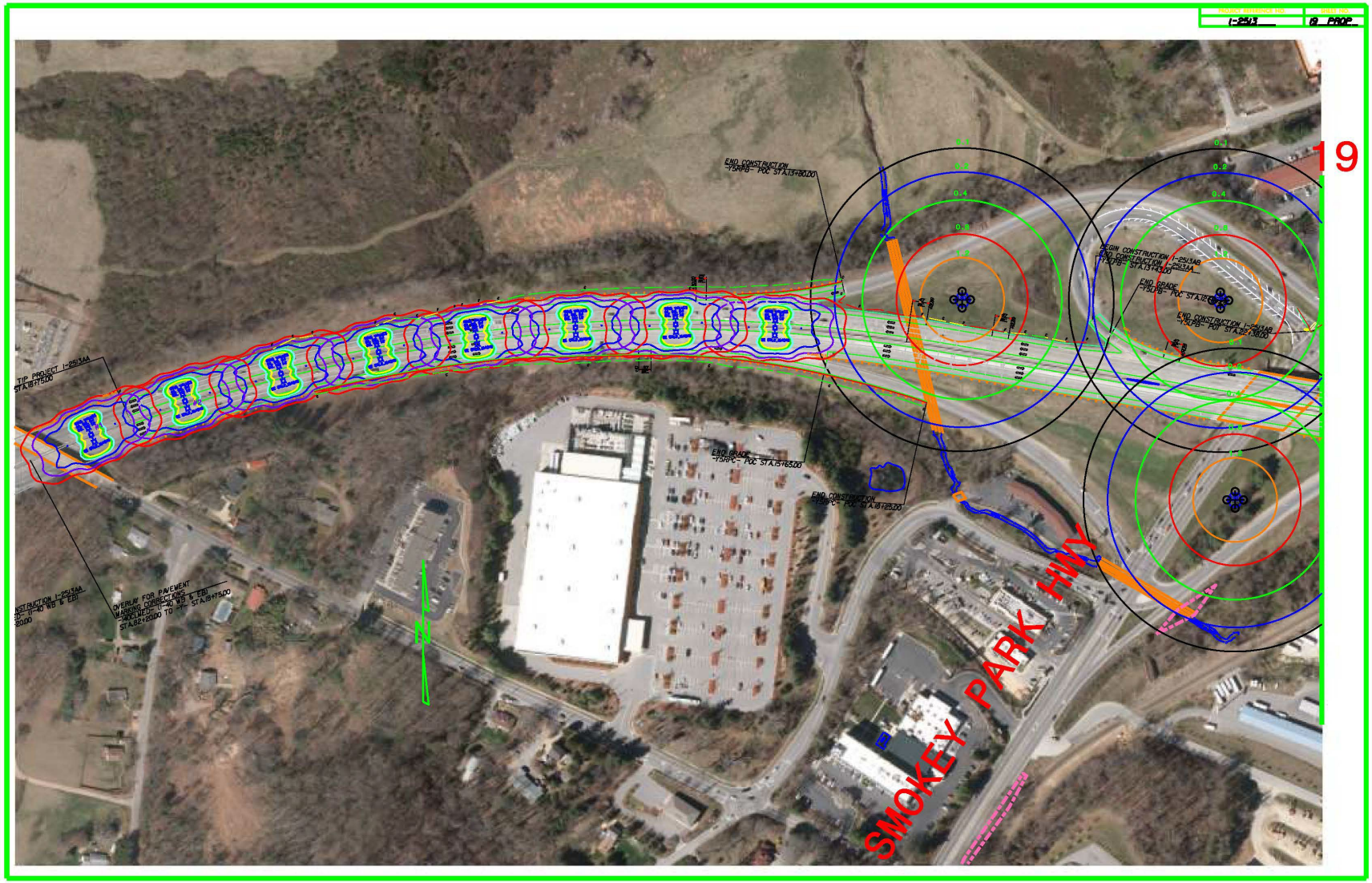
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Appendix C. Structure Survey Post 2020 BA Submittal

Survey history of bridges in the I-2513 Action Area obtained after original BA submittal

Structure Number	Type (Culvert/Bridge)	Description	Survey date(s)	Results	Survey Reason
100334	Bridge	Hominy Creek and I-40 Bifurcated EBL	6/26/2019	No evidence	ISU*
100339	Bridge	Hominy Creek and I-40 Bifurcated WBL	6/26/2019	No evidence	ISU
100352	Bridge	FBR and I-40 EBL	6/27/2019	No evidence	ISU
None	Culvert	UT FBR and I-26 (near Burnsville Hill Rd.)	5/30/2019	No evidence	A-0010 Action Area overlap
100302	Bridge	Lookout Rd and I-26 WBL	5/27/2019	No evidence	A-0010 Action Area overlap
100303	Bridge	Lookout Rd and I-26 EBL	5/27/2019, 6/18/2019, 5/15/2020	No evidence	A-0010 Action Area overlap & ISU
100314	Bridge	Burnsville Hill Rd and I-26 WBL	5/27/2019, 6/18/2019	No evidence	A-0010 Action Area overlap & ISU
100316	Bridge	Burnsville Hill Rd and I-26 EBL	5/27/2019	No evidence	A-0010 Action Area overlap
100774	Culvert	Reed Creek and Broadway/ NC 251	6/1/2018, 5/27/2019	No evidence	ISU & A-0010 Action Area overlap
100284	Bridge	Reed Creek Broadway and I-26 WBL	5/27/2019	No evidence	A-0010 Action Area overlap
100289	Bridge	Reed Creek Broadway and I-26 EBL	5/27/2019	No evidence	A-0010 Action Area overlap
100278	Bridge	FBR and SR1348/Pearson Bridge Rd.	7/13/2019	No evidence	ISU
100769	Culvert	Smith Mill Creek and US19/23/Patton Ave	6/1/2019	5 MYGR	ISU, NCDOT BSG survey
None	Culvert	UT FBR and Hill St. at Southern States	6/1/2018, 8/28/2019, 3/9/2021, 2/24/2022, 9/22/2022	1-35 MYGR, except the 2/24/2022 survey-no bats	ISU, WRC winter culvert blitz, NCDOT BSG guano research
100771	Culvert	Ragsdale Creek and US19/23	6/1/2018	No evidence	ISU
100297	Culvert	Ragsdale Creek and I-40	6/1/2018	No evidence	ISU
100066	Bridge	Hominy Creek and I-240E	4/14/2019	No evidence	ISU
100182	Bridge	S. Bear Creek Rd. and I-240	6/25/2018	No evidence	ISU

Structure Number	Type (Culvert/Bridge)	Description	Survey date(s)	Results	Survey Reason
100194	Bridge	NC191/Brevard Rd and I-40	7/8/2019	No evidence	ISU
100206	Bridge	Hominy Creek and I-240 EBL	7/8/2019	No evidence	ISU
100208	Bridge	Hominy Creek and I-240 WBL	7/8/2019	No evidence	ISU
None	Bridge	Hominy Creek pedestrian walkway and I-240 WBL	7/8/2019	No evidence	ISU
100242	Bridge	NC191/Brevard Rd and I-240	6/27/2019	No evidence	ISU
100248	Bridge	Amboy Rd. ramp and I-240	6/25/2018, 5/15/2020	No evidence	ISU
100253	Bridge	I-240 ramp and I-26	7/14/2018, 6/26/2019	No evidence	ISU
100273	Bridge	I-240/I-40 ramp and I-26 WBL Smokey Park	6/26/2019	No evidence	ISU
100051	Bridge	Hominy Creek and Pond Rd. SR 3431	7/8/2019	No Evidence	ISU
100521	Bridge	FBR and Amboy Rd (just outside Action Area)	7/8/2019	No Evidence	ISU

*ISU – Indiana State University, contracted by NCDOT to conduct research on MYGRs in the French Broad River Basin as part of conservation measures for area NCDOT roadway projects.

Appendix D. Conservation Measures for MYGR from 2020 BO

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

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