

## 2. PREFERRED ALTERNATIVE



*Section 2 describes the Preferred Alternative and reasons for selecting DSA D as the Preferred Alternative. This section also describes additional design work and other studies completed for the Preferred Alternative and presents updated impacts associated with the Preferred Alternative.*

### 2.1 DESCRIPTION OF THE PREFERRED ALTERNATIVE

The FHWA and NCTA (a division of NCDOT as of July 27, 2009) have identified DSA D as the Preferred Alternative, based on the information in the Draft EIS and input received during the public comment period (**Section 3**). The Preferred Alternative is shown in **Figure 2-1**. DSA D was identified as the Recommended Alternative in the Draft EIS. DSA D in relation to the other Detailed Study Alternatives is shown in **Figure 1-2a-c**.

#### 2.1.1 GENERAL DESCRIPTION

The Preferred Alternative is proposed as a four to six-lane controlled-access toll facility. The Preferred Alternative follows existing US 74 for approximately one mile from just east of I-485 to east of Stallings Road (SR 1365) and then proceeds on a new location alignment from east of Stallings Road (SR 1365) to the project terminus at existing US 74 between the towns of Wingate and Marshville. The total length of the Preferred Alternative is approximately 19.7 miles.

From west to east, interchanges are located at US 74, Indian Trail-Fairview Road (SR 1520), Unionville-Indian Trail Road (SR 1367), Rocky River Road (SR 1514), US 601, NC 200, and Austin Chaney Road (SR 1758). Partial interchanges are located at Forest Hills School Road (SR 1754) and US 74 at the eastern end of the project.

The Preferred Alternative would include upgrading an approximately one-mile segment of existing US 74 at the western end of the project to a controlled-access highway facility with frontage roads. For this segment, the toll road would be six lanes wide and elevated on retained fill, with one-way frontage roads of two to three lanes on either side, for a total of ten to twelve lanes. For the remaining new location portion, the Preferred Alternative would have four lanes and a 70-foot median.

Design refinements to the Preferred Alternative incorporated since the Draft EIS are discussed in **Section 2.3.1** and generally include modifications to improve access to neighborhoods, reduce visual impacts and relocations, and maintain local connectivity.

#### 2.1.2 DESIGN CRITERIA

The design speed for the tolled highway segments is 70 miles per hour (mph), which would accommodate a posted speed limit of 65 mph. The design speed for the frontage roads on reconstructed US 74 is 40 mph, which would allow for a posted speed limit of 35 mph. The general design criteria for the project are presented in Appendix B of the Draft EIS.

Two typical sections were developed for the Preferred Alternative – one for the segment on new location and one for the segment that includes upgrading an approximately one-mile portion of existing US 74. These typical sections are depicted in **Figure 2-2**. The typical section for the new location roadway has four 12-foot travel lanes with a 70-foot median and 12-foot inside and outside paved shoulders. The right of way needed for this typical section would be approximately

300 feet, with additional right of way required for interchanges, frontage roads, and improvements to intersecting roads.

The typical section for the upgraded portion of existing US 74 includes a six-lane tolled highway elevated on fill with retaining walls. One-way frontage roads of two to three lanes would be built immediately at the base of the retaining walls to carry local traffic on either side of the elevated toll road. The number of lanes on the frontage roads would vary depending on the proximity to u-turn locations, along with on and off ramps. In areas where ramps are present, three lanes are necessary to provide adequate distance to allow vehicles to merge into traffic. The right of way required for this section would be approximately 260 feet.

### 2.1.3 TOLLING INFORMATION

**Planning for Tolls.** As shown in Table 6-2 of the MUMPO 2030 LRTP, tolls were indicated as the funding source for the Monroe Connector (I-485 to US 601) portion of this project, but not for the Monroe Bypass portion of the project (US 601 to US 74). On March 24, 2010, MUMPO endorsed its 2035 LRTP, which includes tolls as a funding source for the entire project.

**Toll Collection System.** Tolls would be collected by an electronic toll collection (ETC) system. There would be no cash toll booths. The primary means of ETC involves setting up an account with NCTA and using a transponder/receiver system. The transponder is a small device usually mounted on the windshield of a vehicle. The receiver is typically mounted over the roadway, and it electronically collects tolls from a driver's account as the vehicle travels under it at highway speed.

The NCTA will work with other toll authorities to enable, where possible, other systems' transponders to work on the Monroe Connector/Bypass. Toll road users also will have the option of acquiring transponders with prepaid tolls. For travelers who do not have a transponder, a video system will capture license plate information and NCTA will bill the vehicle's registrant.

In addition, in accordance with NC § 136-89.213(b), NCTA will operate a facility in the immediate vicinity of the project that accepts cash payments for prepaid tolls, so establishing an account is not required. It is anticipated that this storefront-type facility would operate from an existing commercial building or strip shopping center within the project area. The facility is not expected to generate a high volume of traffic that would impact local streets.

**Incorporating Tolls into Functional Engineering Designs.** There are minimal differences between a roadway design with and without an ETC system. The ETC equipment, which is primarily mounted on an overhead structure, takes up little space, and would not require additional right of way. While the right-of-way requirements may not differ between a non-toll facility and a toll facility, the alignment of loop ramps that have ETC equipment may slightly differ. At these locations, the loop ramp is modified slightly to provide a tangent section that facilitates accurate video capture of license plates.

**Financial Feasibility of Tolling and Toll Rates.** The financial feasibility of tolling the proposed project was evaluated in progressively more detail in the following documents. These documents are incorporated by reference into this Final EIS and are available for review and download on the NCTA Web site: [www.ncturnpike.org/projects/monroe](http://www.ncturnpike.org/projects/monroe).

- *Proposed Monroe Connector Preliminary Traffic and Revenue Study* (Wilbur Smith Associates, October 2006). This document was included by reference into the Draft EIS. This preliminary study concluded that tolling the entire Monroe Connector/Bypass project would generate significant revenue to help relieve congestion in the study area.

- *2009 Update for Monroe Connector/Bypass Preliminary Traffic and Revenue Study* (Wilbur Smith Associates, April 2009). The update was conducted at a preliminary level of study. Updates from the 2006 study included toll collection methods and alignment and interchange configurations.
- *Investment Grade Traffic and Revenue Study* (Wilbur Smith Associates). This detailed is currently being developed and will produce certified revenue for use by bond rating agencies and investors to evaluate financial return on the project.

The initial price of the toll will be determined as part of the *Investment Grade Traffic and Revenue Study* (Wilbur Smith Associates). The price of the toll likely will vary over time, based upon variables such as managing demand, financing the initial construction of the project, and paying for roadway operations and maintenance. The toll rate will differ for cars and trucks and will also be dependent on the collection method, i.e., transponder, registered license plate, or bill via US Mail. Initial toll rates for those utilizing a transponder for other similar type facilities in the state are approximately \$0.13 per mile for cars and \$0.51 per mile for trucks.

## 2.2 REASONS FOR SELECTING DSA D AS THE PREFERRED ALTERNATIVE

According to FHWA regulations (23 CFR 771.125) and Council on Environmental Quality regulations (40 CFR 1502.14), the lead agency(ies) should identify a Preferred Alternative in a Final EIS. This is the alternative the lead agency(ies) believes would fulfill its statutory mission and responsibilities, giving consideration to social, economic, environmental, technical and other factors.

The FHWA and NCTA (a division of NCDOT since July 27, 2009) have identified DSA D as the Preferred Alternative, for the reasons listed below. DSA D was identified by the FHWA, NCTA, and NCDOT as the Recommended Alternative in the Draft EIS (Section 2.8). The reasons cited in the Draft EIS for selecting DSA D as the Recommended Alternative still apply to its selection as the Preferred Alternative. This decision was made prior to the design refinements described in **Section 2.3**. The relative comparisons listed below still apply, since it is expected that if designs were refined for each DSA similar to those described in **Section 2.3**, the relative values would remain similar.

Additional information regarding input received during the Draft EIS public review period is included at the end of this section under “Public Involvement.” Please note this list is not in order of importance and does not represent all benefits or impacts of DSA D, just those elements that differentiated DSA D when compared to the other DSAs.

### Cost and Design Considerations

- DSA D is one of the shortest alternatives at 19.7 miles (all alternatives range from 19.6 to 20.6 miles).
- DSA D is one of the eight alternatives that would not require the relocation of Rocky River Road and the associated wetland impacts. The relocation of Rocky River Road is required for the eight alternatives that include DSA Segment 22A.
- DSA D is higher in the range of median total project costs with a median cost of \$777.4 million (the median costs of the DSAs range from \$752.5 million for DSA A2 to \$785.3 million for DSA D1). The higher cost of the Recommended Alternative is offset by lower impacts in several other areas as described below. Updated cost estimates for the

Preferred Alternative which incorporate design refinements discussed in **Section 2.3** are provided in **Section 2.3.4**. It is expected that relative costs amongst the DSAs would remain similar if updated costs were provided for all DSAs, and therefore the conclusions listed in this bullet would not change.

### **Human Environment Considerations**

- DSA D is one of the four DSAs with the fewest residential relocations at 107 (the range being 94 to 149 residential relocations). Through design refinements for the Preferred Alternative, this number has been reduced by 12 residential relocations for a total of 95 residential relocations.
- Although DSA D is higher in the range of business relocations at 48 (the range being 14 to 49 business relocations), this number has been reduced from preliminary estimates by one business relocation through design refinements for a total of 47 business relocations. Most of the impacted businesses are located along existing US 74 at the western end of the project. The relocation of these businesses is in exchange for the other positive factors associated with DSA D, including having the roadway located farther away from densely developed residential subdivisions and farther from Stallings Elementary School.
- DSA D would have no direct impacts to schools and would avoid any indirect impacts to Stallings Elementary School. DSA D is one of eight alternatives that would have no direct impacts to schools. The other eight alternatives would have a direct impact to Central Piedmont Community College and would be adjacent to Stallings Elementary School.
- DSA D is one of the four alternatives that would impact only three church properties (other DSAs impact four or five church properties). None of the DSAs would impact church buildings.
- DSA D is one of the eight alternatives that would avoid impacts to the proposed Matthews Sportsplex property, a public park to be developed by the Mecklenburg County Park and Recreation Department. Also see Cultural Resource Considerations below.

### **Physical Environment Considerations**

- DSA D is one of the alternatives that have the least impacts to active agricultural lands at 499 acres. Impacts range from 494 acres for DSA C to 627 acres for DSA B3.
- DSA D is one of eight DSAs (DSAs C, D, C1, D1, C2, D2, C3, and D3) that would potentially impact the most hazardous materials sites (11-12 sites impacted, with the lowest impacts being 6-7 sites). However, the anticipated impact severity is “low” for all potentially impacted sites. An updated survey of potentially contaminated sites conducted for the Preferred Alternative revealed only five potentially contaminated sites, as discussed in **Section 2.5.2.6**.

### **Cultural Resources Considerations**

- DSA D is one of eight alternatives that would not have impacts on the proposed Matthews Sportsplex property, a future public park and Section 4(f) resource. The other eight alternatives would affect this proposed park.

### **Natural Resources Considerations**

- DSA D is in the middle range of impacts to upland forest at 450 acres (all alternatives range from 365 to 514 acres).

- DSA D is lower in the range of impacts to ponds at 2.6 acres (all alternatives range from 2.5 to 3.8 acres).
- DSA D is in the middle range of impacts to wetlands at 8.1 acres (all alternatives range from 6.2 to 11.0 acres).
- DSA D would have the least impacts to perennial streams with 9,794 linear feet of impact (all alternatives range from 9,794 to 12,383 linear feet).
- DSA D is lower in the range of impacts to intermittent streams at 11,915 linear feet (all alternatives range from 10,767 to 13,020 linear feet).
- DSA D would have the least linear feet of streams requiring mitigation at 12,550 linear feet (all alternatives range from 12,550 to 16,387 linear feet). While final decisions with respect to mitigation requirements have not been made by the regulatory agencies, for estimation purposes, streams were considered to require mitigation if they were perennial or if they were intermittent and had a stream rating issued by the NCDENR-DWQ of greater than or equal to 26. This implies that streams impacted by DSA D are of lower quality than those impacted by other DSAs.
- DSA D is one of eight alternatives that would cross only two 303(d)-listed streams, while the other eight alternatives would cross four. Both 303(d)-listed streams are proposed to be bridged.

#### **Public Involvement Prior to Publication of the Draft EIS**

- Substantial public input regarding the DSAs, particularly at the western end of the project (DSA Segment 2 versus DSA Segment 18A), was received throughout the alternatives screening process. Much of this public input has been generated by C.A.R.E., a community-based group focused on informing and mobilizing residents against DSA Segment 18A of the Monroe Connector/Bypass (included in DSAs A, B, A1, B1, A2, B2, A3, and B3). C.A.R.E. has submitted more than 2,000 signatures in opposition to DSA Segment 18A. Specifically, the group is concerned about noise, visual, and air quality impacts to the new Stallings Elementary School and adjacent neighborhoods, as well as impacts to North Fork Crooked Creek, which is a 303(d)-listed stream. While this input was a factor in the decision to recommend DSA D, the recommendation was based on a wide range of factors included in the comprehensive review and analysis of the potential impacts of all DSAs, as described above.

#### **Public Involvement after Publication of Draft EIS**

- The formal public review period for the Draft EIS was from May 1, 2009 (the day the Notice of Availability of the Draft EIS was published in the Federal Register [Vol. 74, No. 83, Page 20297]) to June 15, 2009. However, the Draft EIS was available on the NCTA Web site beginning April 2, 2009, and a press release was issued that day announcing the document's availability for public review.
- A series of Public Hearings and Open Houses was held the week of May 18, 2009. The purpose of the public review period and the Pre-Hearing Open Houses/Public Hearings was to receive input on the Draft EIS and project corridors and design, as well as the selection of DSA D as the Recommended Alternative. **Section 3.1.2** of the Final EIS has additional information on this topic. Of the comments received during the public review period that expressed an opinion on the selection of DSA D as the Recommended Alternative, 382 were in favor of DSA D and 50 were opposed to it. An additional 150

names were submitted on an electronic petition opposing DSA D; however, NCTA cannot verify the validity of the signatures on this petition.

- None of the public comments received resulted in changes to any of the reasons listed above for selecting DSA D as the Preferred Alternative. Most comments favored the selection of DSA D as the Preferred Alternative. Detailed information regarding comments received from the public, as well as local, state, and federal agencies, is presented in **Section 3** of this Final EIS. Substantive comments on the Draft EIS and responses to those comments are included in **Section 3.3**. All comments received on the Draft EIS and responses to the comments are included in **Appendix B**.

## 2.3 DESIGN REFINEMENTS TO THE PREFERRED ALTERNATIVE

The following sections discuss design refinements to the Preferred Alternative since the Draft EIS was published. The refinements include design modifications made as a result of public involvement activities since publication of the Draft EIS, avoidance and minimization of impacts to Waters of the US, and proposed service roads based on the results of the *Final Monroe Connector/Bypass Service Road Study* (PBS&J, April 2010). This section also presents updated cost estimates, traffic forecasts, and operational analysis for the Preferred Alternative.

**Figure 2-3a-t** shows the refined functional design for the Preferred Alternative that incorporates the design modifications, minimization efforts, and service roads discussed below.

### 2.3.1 DESIGN REFINEMENTS

As a result of the public involvement activities and public review period associated with this project after the Draft EIS was published, six areas of concern regarding the functional design were raised by the members of the public, local municipalities, and regulatory agencies.

Design modifications described below were made in the following areas: Forest Park subdivision, Beverly Drive, Bonterra Village, Unionville-Indian Trail Road interchange, and Austin Chaney Road interchange/McIntyre Road. Design revisions also were considered for the Maple Hill Road area, but were not implemented as discussed below.

#### 2.3.1.1 Forest Park Subdivision

The Forest Park subdivision is a neighborhood of approximately 216 homes in the Town of Stallings. The development is located north of US 74 between Stallings Road (SR 1365) and Indian Trail-Fairview Road (SR 1520). The subdivision currently has two entrances, both connecting directly to existing US 74: Forest Park Road and Union West Boulevard.

As shown in Figure 2-10c-d of the Draft EIS and on the Corridor/Design Public Hearing Maps (March 30, 2009, available for review and download on the NCTA Web site:

[www.ncturnpike.org/projects/monroe](http://www.ncturnpike.org/projects/monroe)), both of these connections to US 74 were proposed to be eliminated as part of DSA D (and also DSAs C, C1, D1, C2, D2, C3, and D3), and replaced with a new connection to Forest Park Road and Stallings Road along the southern limits of the subdivision onto Stallings Road. This new access would be shared by the Forest Park subdivision and the Union West Business Park, whose existing entrance also would be severed. Several residents of Forest Park, as well as the Town of Stallings, expressed concern that the entire subdivision and business park would be served by only one access point. A second

entrance to Forest Park near the northern limits of the subdivision was planned and platted by the developer but never constructed.

In response to the concerns expressed during the public review period for the Draft EIS, the functional design for the Preferred Alternative includes two entrances to the Forest Park neighborhood. One will be from Forest Park Road to a service road on the south side of the neighborhood that will connect to Stallings Road and will also serve the Union West Business Park. The second will be the platted but never constructed entrance that will connect Meadowbrook Drive on the north side of the neighborhood to Stallings Road, just south of North Fork Crooked Creek. The two entrances to Forest Park are shown on **Figure 2-3b-c**.

### 2.3.1.2 Beverly Drive

The functional designs for all DSAs shown on Figure 2-10h in the Draft EIS and on the Corridor/Design Public Hearing Maps (March 30, 2009) included a grade separation of Beverly Drive over the Monroe Connector/Bypass. During the Pre-Hearing Open Houses, several comments were received from residents along Beverly Drive expressing their desire to remove this bridge in order to eliminate cut-through traffic trying to avoid Indian Trail-Fairview Road (SR 1520).

In response to these comments, the functional design for the Preferred Alternative would sever Beverly Drive and include cul-de-sacs on either side of the Monroe Connector/Bypass, eliminating the previously proposed bridge. These design modifications would reduce the number of residential relocations in this area by seven relocations. The modified functional design is shown in **Figure 2-3f**.

### 2.3.1.3 Bonterra Village

The functional designs for all DSAs in the vicinity of Bonterra Village shown on Figure 2-10i in the Draft EIS and on the Corridor/Design Public Hearing Maps (March 30, 2009) showed the Monroe Connector/Bypass passing over the Secrest Shortcut Road (SR 1501) entrance to Bonterra Village (Saratoga Boulevard). A total of 309 letters received from residents of the Bonterra subdivision requested that alternatives be investigated to eliminate the need to elevate the Monroe Connector/Bypass, which residents fear would have adverse noise and visual impacts to the community. Suggestions included 1) shifting Secrest Shortcut Road southward to provide additional distance to allow Bonterra's entrance to bridge over the Monroe Connector/Bypass and the Monroe Connector/Bypass to remain at grade; 2) providing a frontage road from Faith Church Road to Poplin Road with a connection to this entrance; and 3) providing a frontage road from Faith Church Road to their entrance.

Members of the project team met with representatives from the Bonterra Village Homeowners Association on May 20, 2009, to discuss their concerns. In coordination with the Bonterra Village Homeowners Association, NCTA revised the design for this area to allow the Monroe Connector/Bypass to remain at grade. The connection between Saratoga Boulevard and Secrest Shortcut Road will be severed, and a new frontage road will parallel the Monroe Connector/Bypass and connect Saratoga Boulevard to Faith Church Road (SR 1518) to the west and Poplin Road (SR 1508) to the east. These design revisions would reduce the potential for visual impacts and perceived noise impacts to the surrounding community, and are shown on **Figure 2-3f** and **Figure 2-3g**.

#### 2.3.1.4 Unionville–Indian Trail Road Interchange

A diamond type interchange at Unionville-Indian Trail Road (SR 1367) was proposed in the functional designs shown on Figure 2-10j in the Draft EIS and on the Corridor/Design Public Hearings Maps (March 30, 2009). The functional design for this interchange provided accommodations for a future loop in all quadrants and access control along Unionville-Indian Trail Road extending 1,000 feet beyond the interchange ramps, consistent with current NCDOT design guidelines. Due to the proximity of the interchange to existing Secrest Shortcut Road (SR 1501), the functional design included a realignment of Secrest Shortcut Road to the south, utilizing Scott Long Road and connecting back to the existing Secrest Shortcut Road alignment east of Unionville-Indian Trail Road.

The Town of Indian Trail expressed concern that the relocation of Secrest Shortcut Road and the limitation of access to both Unionville-Indian Trail Road and Secrest Shortcut Road would be inconsistent with their comprehensive plan and plans for commercial development in the southeast corner of the Secrest Shortcut Road/Indian Trail-Fairview Road intersection. In addition, several residents along Scott Long Road raised concerns during the Draft EIS review period regarding the use of that road as a major east-west route given its width and curves.

In the functional engineering design for the Preferred Alternative, the Unionville-Indian Trail Road interchange has been revised to a tight diamond type interchange to eliminate the need to realign Secrest Shortcut Road and to minimize impacts to the adjacent land owners. The traffic analysis performed in *Final Addendum to Year 2035 Build Traffic Operations Technical Memorandum* (PBS&J, December 2009), incorporated by reference, showed that accommodations for future loop ramps were not necessary.

NCTA is no longer proposing to cul-de-sac Secrest Shortcut Road on either side of Unionville-Indian Trail Road nor to use Scott Long Road. These design revisions reduced the number of relocations in the area by eight residences and one business, and will maintain access to planned commercial development in the southeast corner of the Secrest Shortcut Road/Indian Trail-Fairview Road intersection. The updated functional design is shown in **Figure 2-3g-h**.

#### 2.3.1.5 Maple Hill Road

The functional designs for all DSAs shown on Figure 2-10p in the Draft EIS and on the Corridor/Design Public Hearings Maps (March 30, 2009) showed Maple Hill Road being severed just east of Fowler Road (SR 1503) at the Monroe Connector/Bypass. The City of Monroe has expressed, in writing, concerns with this plan to sever Maple Hill Road (SR 1502). The City of Monroe currently operates a fire station on the corner of Maple Hill Road and US 601 (Concord Highway). The City's concerns were a result of anticipated increased response times from this station to calls near the intersection of Fowler Road and Secrest Shortcut Road (SR 1501).

This issue was considered, but was not found to be cost effective. Severing Maple Hill Road would result in a detour of only about 3,000 feet, or approximately 40 seconds of travel time. The designs for the Preferred Alternative near Maple Hill Road are shown on **Figure 2-3l**.

#### 2.3.1.6 Austin Chaney Road Interchange/McIntyre Road

The functional designs for DSAs A, B, C, D, A2, B2, C2, and D2 shown on Figure 2-10y in the Draft EIS and on the Corridor/Design Public Hearing Maps (March 30, 2009) included severing McIntyre Road (SR 1631) at the Monroe Connector/Bypass, resulting in traffic being rerouted to Austin Chaney Road (SR 1758) and Monroe-Ansonville Road (SR 1571). As part of the first

Monroe Bypass (R-2559) project (circa 1997), McIntyre Road was to be realigned to connect with Austin Chaney Road north of the Monroe Bypass. However, current design standards do not allow this connection so close to the proposed interchange of the Monroe Connector/Bypass and Austin Chaney Road. MUMPO expressed concerns, in writing (**Appendix B-2**, Document g002), with terminating McIntyre Road because it is currently listed as a thoroughfare on their Thoroughfare Plan (MUMPO 2004). The Town of Wingate and local residents also requested that this connection be maintained at the Public Hearings held in May 2009 (**Appendix B-8**, May 21, 2009 Transcript, lines 520-532 and lines 616-618).

Based on MUMPO's concerns and comments received during the public comment period, the Austin Chaney Road interchange has been redesigned to allow McIntyre Road to maintain its existing connection to Austin Chaney Road. The design modification relocates the loop ramp to the west side of Austin Chaney Road and extends the Meadow Branch bridge over McIntyre Road as well. These design modifications resulted in one additional residential relocation. This design modification is shown on **Figure 2-3r**.

### 2.3.2 SERVICE ROADS

The *Final Monroe Connector/Bypass Service Road Study* (PBS&J, April 2010) was prepared for the Preferred Alternative. This document is incorporated by reference and available on the NCTA Web site ([www.ncturnpike.org/projects/monroe](http://www.ncturnpike.org/projects/monroe)). The objective of this study was to identify and evaluate parcels whose access would be eliminated by the Preferred Alternative (i.e., land-locked parcels) and to evaluate the feasibility and reasonableness of providing service roads to restore access to those parcels.

#### 2.3.2.1 Service Road Evaluation Methodology and Design Assumptions

The refined functional design for the Preferred Alternative was reviewed to identify those parcels that would likely have their access eliminated with implementation of the project. Once the impacted parcels were identified, they were then evaluated to estimate the cost of constructing a service road to the property from existing roadways near the project. This cost was then compared to an estimate of the total acquisition cost, based on tax value, for the isolated or remnant portions of the parcel. Several factors were used in formulating approximate costs to provide service roads. These factors include the cost associated with constructing the service road, any major hydraulic structures that may be necessary, environmental mitigation costs, and additional right of way necessary to develop the service road.

In addition, design criteria were developed to guide the design of each service road. These criteria were developed to serve the land-locked parcels with safe and cost-effective access. The intended use and expected traffic volumes, including vehicle mix, were major considerations in developing the following design criteria.

**Design Speed.** The design speed selected for the service roads is 30 miles per hour (mph) with an anticipated posted speed of 25 mph. These facilities are intended to be low volume roadways providing access only to local, mainly residential, properties. Some of the service roads would provide access to only one parcel, but others could potentially serve two or more adjacent parcels. Design speed adjustments were made for unusual circumstances and unique property use situations, as necessary.

**Typical Section.** The service road typical section consists of two 11-foot lanes with 2-foot unpaved shoulders on each side. Depending on the profile, roadside ditches would be provided to convey drainage away from the roadway facility and reduce future maintenance costs.

**Alignment and Grade.** The alignments of the individual service roads vary based on property configurations. Each situation was unique and treated as such to develop the best design solution. The goal was to minimize the loss of adjacent properties by paralleling the control of access portion of the facility as closely as possible. Where following the control of access was not an option or would result in an unusually long service road, the alignment typically paralleled or straddled the property line to balance the loss of property between the adjacent parcels. The grades of the proposed service roads were dictated by existing topography to reduce cut and fill.

**Hydraulic/Environmental Feature Crossings.** Some of the service roads cross drainage features, as well as streams and wetland areas. In these cases, efforts to avoid impacting these resources were made by adjusting the horizontal alignments and/or reducing “footprint” impacts to these environmental features to the extent possible by tightly controlling the profile and steepening side slopes as necessary through these areas. Details regarding impact calculations associated with the service roads are included with the impacts of the Preferred Alternative provided below in **Section 2.5**.

### 2.3.2.2 Proposed Service Roads

The service road study identified areas with land-locked parcels outside of the proposed right of way and control of access for the project. Based on the analysis conducted as described in **Section 2.3.2.1**, fourteen areas (including 89 parcels) were recommended for preliminary service roads. These are listed in **Table 2-1** and shown in **Figure 2-4a** through **Figure 2-4h**.

**TABLE 2-1: Service Road Recommendations**

Service Road Label	Number of Parcels Served	Figure Reference
A	1	Figure 2-4a
B	10	Figure 2-4a
D	12	Figure 2-4a
M	8	Figure 2-4b
N	10	Figure 2-4b-c
R	5	Figure 2-4d
T	5	Figure 2-4d
U	5	Figure 2-4d
AA	5	Figure 2-4e
BB	6	Figure 2-4e
CC	8	Figure 2-4e
DD	5	Figure 2-4f
EE	4	Figure 2-4g
GG	5	Figure 2-4h

Source: *Final Monroe Connector/Bypass Service Road Study* (PBS&J, April 2010).

Service roads were recommended where the cost of purchasing the isolated or remnant parcels was greater than the cost associated with providing the service road. Service Roads DD and GG were exceptions to this provision. These Service Roads were originally evaluated and approved by NCDOT under the Monroe Bypass project (R-2559). New cost data indicates that the service roads are not cost effective. However, the right of way in these areas was previously acquired by NCDOT and draft designs for these service roads were presented to the public as part of the previous studies. For these reasons, NCTA will retain Service Roads DD and GG as part of the project.

It should be noted that the layout and design of these service roads may be modified during final design based on potential cost and material savings, on final design service road needs or to suit modifications requested by individual land-locked property owners. However, this should not be construed as a commitment to provide a service road to any particular property.

### 2.3.3 AVOIDANCE AND MINIMIZATION OF IMPACTS TO WATERS OF THE US

Throughout the alternatives development process, the alternative corridors and engineering designs were developed considering avoidance and minimization of impacts to Waters of the US (wetlands, streams and ponds) where possible. As part of the Draft EIS, a preliminary hydraulic analysis was performed to identify preliminary sizes and locations of major drainage structures along the DSAs that would be needed to adequately carry floodwaters. Major drainage structures are bridges, box culverts, or pipe culverts greater than 72 inches in diameter.

As discussed in Section 4.7.3 of the Draft EIS, major drainage structures and crossings were reviewed by the environmental resource and regulatory agencies at the TEAC meeting on October 7, 2008, and at a bridging location field review on October 21, 2008. As a result of these meetings, the agencies agreed on several recommended bridge and culvert locations, and NCTA agreed to include bridges at several locations previously recommended for culverts in order to avoid or minimize stream and wetland impacts. Locations where NCTA agreed to include bridges to avoid or minimize impacts to streams and wetlands along the Preferred Alternative were as follows:

- Crossing 19– recommended twin 150-foot bridges to avoid 307 linear feet of impacts to South Fork Crooked Creek (Stream S047).
- Crossing 20– recommended 75-foot bridge to avoid 196 linear feet of impacts to South Fork Crooked Creek (Stream S047).
- Crossing 30– recommended twin 240-foot bridges to avoid 519 linear feet of impacts to Stewart’s Creek (Stream S082).
- Crossing 37– recommended twin 320-foot bridges to avoid 522 linear feet of impacts to Richardson Creek (Stream S111).
- Crossing 38– recommended twin 280-foot bridges to avoid 378 linear feet of impacts to Ray’s Fork (Stream S112).
- Crossing 47– replace culvert with twin 575-foot bridges to avoid 2.28 acres of impacts to Wetlands W170 and W167 and 395 linear feet of impacts to Meadow Branch (Stream S152).

The Preferred Alternative was selected, in part, because it had the least perennial stream impacts among all the DSAs and the second least total stream impacts. All 303(d)-listed streams are proposed to be bridged. Strict adherence to standard Best Management Practices (BMPs), including those for sedimentation and erosion control and the NCDOT *Design Standards in Sensitive Watersheds*, will minimize project impacts.

In addition to the measures listed above, specific areas where design refinements for the Preferred Alternative resulted in net reductions to stream impacts include:

- The area around Beverly Drive where a bridge was removed, resulting in an impact reduction of approximately 109 linear feet to Stream S036, which was anticipated to require mitigation;

- The area around Bobwhite Circle where a service road was removed and a bridge was modified, resulting in an impact reduction of approximately 189 linear feet to Streams S114b, S140f and S140g, all of which were anticipated to require mitigation;
- The area surrounding the Austin Chaney Road interchange where design modifications resulted in a net impact reduction of approximately 423 linear feet to Streams S156b, S157a and S157b, 344 linear feet of which were anticipated to require mitigation; and
- The area east of the Forest Hills School Road interchange where a previously shown NCDOT service road was shortened, resulting in an impact reduction of approximately 67 linear feet to Stream S169a, which was anticipated to require mitigation.

The changes in jurisdictional resource impacts resulting from the individual refinements to the Preferred Alternative are listed in **Table 2-2**. A summary of changes in jurisdictional resource impacts to the Preferred Alternative since the Draft EIS are summarized in **Table 2-3**, and include the impacts from service roads. Updated wetland and stream impacts based on the refined design for the Preferred Alternative are described in **Section 2.5.4.4**.

**TABLE 2-2: Changes in Jurisdictional Resource Impacts Due to Design Refinements**

Design Refinement	Change in Impact to Resource Compared to Draft EIS DSA D Conceptual Design <sup>1</sup>				
	Perennial Streams (linear ft)	Intermittent Streams (linear ft)	Total Streams (linear ft)	Wetlands (acres)	Ponds (acres)
Eliminate Beverly Drive Bridge	-109	0	-109	0	0
Secrest Shortcut crossing	+196	0	+196	-0.1	0
Compress Unionville-Indian Trail Road Interchange	-116	+127	+11	+0.1	0
Re-Design Austin Chaney Road Interchange	-285	-138	-423	0	+0.3
<b>TOTAL CHANGE (from design refinements listed above)</b>	<b>-314</b>	<b>-11</b>	<b>-325</b>	<b>0</b>	<b>+0.3</b>

Source: *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008) with updated y-line and service road information provided October 2009.

Notes: <sup>1</sup>Impacts calculated based on slope stake limits plus a 40-foot buffer. <sup>2</sup>Based on assumption that all perennial stream impacts require mitigation as well as any impacts to intermittent streams with NCDWQ stream ratings greater than 26.

**TABLE 2-3: Changes in Jurisdictional Resource Impacts Since the Draft EIS**

Impacts	Perennial Streams (linear ft)	Intermittent Streams (linear ft)	Total Streams (linear ft)	Wetlands (acres)	Ponds (acres)	Stream Impacts Requiring Mitigation <sup>2</sup>
Impacts Reported in Draft EIS for DSA D	9,794	12,269	22,063	8.1	2.6	12,550
Impacts for Preferred Alternative (no service roads)	9,205	12,389	21,594	8.0	3.1	11,975
Add Service Road Impacts	+1,148	+341	+1,489	+0.1	+0.0	+1,260
<b>TOTAL IMPACTS FOR PREFERRED ALTERNATIVE</b>	<b>10,353</b>	<b>12,729</b>	<b>23,083</b>	<b>8.1</b>	<b>3.1</b>	<b>13,235</b>
Change from Draft EIS to Preferred	+559	+460	+1,020	0	+0.5	+685

Source: *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008) with updated y-line and service road information provided October 2009.

Notes: <sup>1</sup>Impacts calculated based on slope stake limits plus a 40-foot buffer. <sup>2</sup>Based on assumption that all perennial stream impacts require mitigation as well as any impacts to intermittent streams with NCDWQ stream ratings greater than 26.

### 2.3.4 COST ESTIMATES FOR THE PREFERRED ALTERNATIVE

Cost estimates for the Preferred Alternative are presented in **Table 2-4**. Cost estimates are based on the Preferred Alternative refined functional engineering design, as described in **Sections 2.3.1** and **2.3.2**. The estimates are in year-of-expenditure dollars, as described in the table notes. Cost estimates are provided as a range of probable project costs for construction, right-of-way acquisition, and environmental mitigation (mitigation of impacts to streams and wetlands). The Total Project Cost provided represents the 70 percent confidence level. This means that there is a 70 percent probability that the construction phase of the project will cost less than or equal to \$802.0 million.

**TABLE 2-4: Cost Estimates for Preferred Alternative**

	Approximate Length (miles)	Probable Range of Costs Through Year of Expenditure (millions \$)*				Project Cost (millions \$) (70% chance costs will be less)
		Construction Cost	Environmental Mitigation Cost	ROW & Utility Cost	Total Cost	
Preferred Alternative	19.7	558.0 to 616.7	9.5 to 10.1	181.6 to 197.5	749.1 to 824.3	802.0

Source: HNTB, April 13, 2010.

Notes: \* Assumptions and notes regarding costs:

1. Construction cost includes construction, utilities, engineering, and administrative costs.
2. Year of expenditure costs were modeled using a range of possible inflation rates.
3. Future construction costs were modeled to mid-point of construction using inflation rates ranging from 2.5% to 4%, with 3% being most likely.
4. Future right-of-way costs were modeled to anticipated year of acquisition using inflation rates ranging from 0% to 4%, with 2% being most likely.
5. Future administrative costs were modeled to anticipated year of expenditure using inflation rates ranging from 2.5% to 4.5%, with 4% being most likely.
6. Ranges of costs are based on cost projections in which the lowest 10% and highest 10% were discarded.
7. Year of expenditure costs assume an award date of December 2010 and an opening in December 2014.
8. Environmental mitigation costs are based on NCEEP fee schedule dated July 1, 2009 for estimated impacts to streams and wetlands and assume mitigation for impacts to all wetlands, all perennial streams, and intermittent streams with a NCDENR-DWQ stream rating greater than or equal to 26.
9. Right-of-way costs were provided by Carolina Land Acquisitions in January 2009. The cost estimate was updated in March 2010 to reflect new assumptions.

A cost estimate review was held in March 2010 that included individuals from FHWA, NCTA, and the project study team to review the cost and schedule estimates for the Preferred Alternative. The objective of the review was to verify the accuracy and reasonableness of the total cost estimate and schedule, and to develop a probability range for the cost estimate that represents the project's current stage of development. The costs provided in this table represent those costs.

In addition, prior to completing the Preferred Alternative cost estimate, an additional meeting was held to discuss factors that could influence the project's costs and the schedule. A workshop was held in January 2010 with NCTA, NCDOT, FHWA, and the project study team. The purpose was to identify, assess, and rank cost and schedule risks and opportunities, and to identify and evaluate cost-effective risk-management actions. This information was then utilized as part of the cost estimate review.

### 2.3.5 UPDATED TRAFFIC FORECASTS AND OPERATIONS ANALYSIS

Since the publication of the *Traffic Operations Technical Memorandum* (PBS&J, April 2009), which presented traffic operations information used in the Draft EIS, an addendum was

prepared to re-evaluate traffic conditions. The re-evaluation analyzed traffic volumes and operations based on the refined functional design of the Preferred Alternative's interchanges with the US 74 Frontage Road, Unionville-Indian Trail Road, and Austin Chaney Road (SR 1758).

Detailed information on the revised traffic operations analysis is presented in the *Final Addendum to Year 2035 Build Traffic Operations Technical Memorandum* (PBS&J, December 2009). This document is incorporated by reference into the Final EIS and is available for review and download on the NCTA Web site: [www.ncturnpike.org/projects/monroe](http://www.ncturnpike.org/projects/monroe).

**Interchange with the US 74 Frontage Road.** In the time since the Draft EIS was published, a revised toll collection plan was developed for the Monroe Connector/Bypass interchange with the US 74 Frontage Roads on the western end of the project. Electronic toll collection points were added at the eastbound off ramp from the Monroe Connector/Bypass to existing US 74 and at the westbound on ramp from the US 74 frontage road. A change in technology allowed for the collection points to be modified to maximize toll revenues. This toll collection plan is shown in **Figure 2-5a-f** of this Final EIS.

The new toll collection plan altered the traffic patterns within this area, requiring a revised traffic forecast to be developed to redistribute the projected traffic volumes. The overall traffic volumes used in the analysis reported in the Draft EIS did not change.

The revised traffic forecast was used to reevaluate traffic operations at the Monroe Connector/Bypass interchange with the US 74 Frontage Roads. The results of the re-evaluation indicate that the mainline of the Monroe Connector/Bypass would still operate at a desirable level of service (LOS) (LOS D or better) in 2035. The interchange would also operate at an acceptable LOS in 2035. The four ramp terminal intersections of the split diamond interchange formed by McKee Road, Stallings Road, and the US 74 frontage road would all operate at an acceptable LOS.

**Unionville-Indian Trail Road Interchange.** Based on input from the public meetings held during the Draft EIS review period, the design of the interchange between the Monroe Connector/Bypass and Unionville-Indian Trail Road was revised to eliminate the need to realign Secret Shortcut Road and allow for a reduced interchange footprint (**Section 2.3.1.4**). The proposed interchange form remains a diamond, but the spacing between the ramp terminal intersections was reduced to 350 feet, and the interchange was shifted slightly to the north.

The traffic operations re-evaluation indicates that there would be no change to the LOS along the mainline of the Monroe Connector/Bypass in this area and that it would still operate at LOS D or better in 2035. The interchange would also operate at an acceptable LOS, but signals may be required in the design year at the ramp terminals. Peak hour travel speeds in 2035 are anticipated to be 65 miles per hour along this portion of the Monroe Connector/Bypass mainline.

**Austin Chaney Road Interchange.** Additional input from the public meetings during the Draft EIS review period led to a redesign of the Monroe Connector/Bypass / Austin Chaney Road interchange. The interchange was altered to avoid terminating McIntyre Road at the Monroe Connector/Bypass and severing the connection it provides between Austin Chaney Road and Monroe Ansonville Road (**Section 2.3.1.6**).

The traffic operations re-evaluation indicates that the mainline of the Monroe Connector/Bypass would still operate at a desirable LOS D or better in 2035. The revised designs in this area resulted in a reduction in LOS along only one segment in the design year – the westbound mainline at the west bound on-ramp. However, this reduction was only from a LOS A to LOS B

in the AM peak hour and would have negligible effect on the operations in this area. Peak hour travel speeds in 2035 are anticipated to be 65 miles per hour along this portion of the Monroe Connector/Bypass mainline. The interchange would also operate at an acceptable LOS. The south ramp terminal intersection on Austin Chaney Road would be unlikely to meet signal warrants but would still operate at an acceptable LOS with a stop sign control in 2035. The north ramp terminal intersection would likely meet signal warrants and would operate at an acceptable LOS.

## 2.4 ADDITIONAL STUDIES OF THE PREFERRED ALTERNATIVE

The following sections discuss additional environmental impact studies prepared for the Preferred Alternative since the Draft EIS was published. The results of these studies, along with the design changes described in **Section 2.3**, were used in calculating updated impacts for the Preferred Alternative as presented in **Section 2.5**. The documents cited below are all incorporated by reference into this Final EIS and are available for review and download on the NCTA Web site: [www.ncturnpike.org/projects/monroe](http://www.ncturnpike.org/projects/monroe).

**Traffic Noise Study Addendum.** A noise study was prepared for all DSAs as part of the Draft EIS, and documented in the *Final Traffic Noise Technical Memorandum for Administrative Action Environmental Impact Statement* (PBS&J, March 2009). Since that time, design modifications were made to the Preferred Alternative, and projected traffic volumes were updated (**Section 2.3.5**). Therefore, an updated noise study for the Preferred Alternative was prepared, as documented in the *Addendum Traffic Noise Technical Memorandum* (PBS&J, January 2010). Results of the updated study are presented in **Section 2.5.2.1**.

**Hazardous Materials Study Update.** An updated hazardous materials evaluation was prepared for the Preferred Alternative to investigate potentially contaminated parcels in the project corridor. The results were reported in a memorandum from the NCDOT Geotechnical Engineering Unit dated December 11, 2009, and are presented in **Section 2.5.2.6**.

**Archaeological Assessment.** An additional intensive archaeological assessment was prepared for the Preferred Alternative to identify archaeological resources that may be impacted. The *Final Archaeological Inventory and Evaluation for the US 74 Monroe Connector* (New South Associates, March 2010) examined archaeological resources within the 11.4-mile Monroe Connector portion of the project, between I-485 and US 601. In total, the Area of Potential Effects (APE) encompassed 696 acres. A total of 1,034 shovel tests and eight test units were excavated for the evaluation. The results of the updated archaeological assessment are presented in **Section 2.5.3.2**.

**Biological Assessment.** A Biological Assessment was prepared to evaluate protected species that may be impacted by the Preferred Alternative. The Biological Assessment addresses endangered plant species and freshwater mussels.

Results of the *Biological Assessment for the Monroe Connector-Bypass Project (R-3329/R-2559)* (The Catena Group, May 2010), which examined Michaux's Sumac (*Rhus michauxii*), Schweinitz's Sunflower (*Helianthus schweinitzii*), and Smooth Coneflower (*Echinacea laevigata*) are presented in **Section 2.5.4.5**.

The Biological Assessment also addressed freshwater mussels, in particular the federally endangered Carolina heelsplitter (*Lasmigona decorate*). The *Freshwater Mussel Survey Report*

(The Catena Group, June 2009) identified existing populations of freshwater mussels within the project study area and is discussed in **Section 2.5.4.5**.

**Quantitative Indirect and Cumulative Effects Study.** A quantitative indirect and cumulative effects study was prepared for the Preferred Alternative to expand on the qualitative analysis previously prepared for the project. The *Monroe Connector/Bypass (R-3329/R-2559 Indirect and Cumulative Effects Quantitative Analysis* (Michael Baker Engineering, Inc., April 2010) examined potential indirect and cumulative effects with respect to land use changes in more detail for the Preferred Alternative, particularly for the Goose Creek Watershed area (critical habitat for the endangered Carolina heelsplitter). The analysis is summarized in **Section 2.5.5**.

In additions, a water quality modeling analysis was prepared to determine if induced land use change resulting from the project would affect water quality within the project study area. The results of this analysis are presented in the *Monroe Connector/Bypass (STIP R-3329/R-2559 Indirect and Cumulative Effects Water Quality Analysis* (PBS&J, April 2010) and summarized in **Section 2.5.5**.

## 2.5 IMPACTS OF THE PREFERRED ALTERNATIVE

This section presents updated impacts for the Preferred Alternative based on the studies and design refinements discussed in the previous sections. The sections below follow the same order as presented in the Draft EIS.

Existing conditions and background information on regulations and policies are included in **Section 1** and in the Draft EIS. For some resources, the impacts documented in the Draft EIS have not changed. These are noted where applicable and are included in this section so that all the impacts of the Preferred Alternative can be reviewed in one section.

### 2.5.1 HUMAN ENVIRONMENT

#### 2.5.1.1 Socio-Economic Resources

The impacts of the Preferred Alternative are the same as documented in the Draft EIS and in **Section 1.3.1.1**.

The Monroe Connector/Bypass project would not serve a specific economic development purpose, but local planners believe that the project is vital to the economic well-being of Union County, and will assist in attracting more non-residential uses to Union County.

#### 2.5.1.2 Community Resources

This section discusses impacts to neighborhoods and community facilities.

**Neighborhoods.** In the Draft EIS, DSA D was reported to impact nine neighborhoods. Updated impacts to neighborhoods from the Preferred Alternative are listed in the matrix in **Table 2-5**. Using impact category “c2” as an example, the “c” indicates that homes would be relocated and the “2” indicates that there would be a change in access to the neighborhood associated with a particular DSA.

As a result of the design refinements of the Preferred Alternative, potential impacts to the Suburban Estates and Windward Oaks subdivisions have been eliminated. Impacts to Bonterra Village changed from category “b1” to “b2”.

The impacts to Bonterra Village changed to category “b2” (no relocations, but change in access) as a result of responding to the residents’ request for revised access (**Section 2.3.1.3**). The connection between Saratoga Boulevard and Secrest Shortcut Road will be severed, and a new frontage road will parallel the Monroe Connector/Bypass and connect Saratoga Boulevard to Faith Church Road (SR 1518) to the west and Poplin Road (SR 1508) to the east.

**TABLE 2-5: Potential Neighborhood Impacts for the Preferred Alternative**

Affected Neighborhood (from west to east)	Preferred Alternative Type of Effect
Forest Park	c2
Acorn Woods	d2
Bonterra*	b2
Suburban Estates*	None
Poplin Farms	d1
Avondale Park	b1
Silverthorn	b1
Windward Oaks*	None
Glencroft	b1
<b>Total Number of Category b Impacts</b>	4
<b>Total Number of Category c Impacts</b>	2
<b>Total Number of Category d Impacts</b>	1
<b>Total Number of Neighborhood Impacts</b>	7

Sources: GIS data (PBS&J, December 2009). Refined functional engineering designs for the Preferred Alternative, November 2009; *Community Impact Assessment* (PBS&J, February 2009).

TYPE OF EFFECT: b1 – No relocations, but right-of-way encroachment and existing access maintained. b2 – No relocations, but change in access (could include right-of-way encroachment). c1 – Relocation of homes on end of road or at edge of neighborhood. c2 – Relocation of homes on end of road or at edge of neighborhood and change in access. d1 – Relocation of homes in midst of neighborhood. d2 – Relocation of homes in midst of neighborhood and change in access.

Notes: Letter denotes type of direct impact; number denotes access change. The letter designation “a” was used in the Community Impact Assessment to account for neighborhoods that are located within DSA corridor boundaries, but are not impacted by the functional design. \* Revised since publication of the Draft EIS.

Impacts to Suburban Estates were eliminated as a result of revising the Unionville-Indian Trail Road (SR 1367) interchange to a tight diamond type facility, thus eliminating the need to relocate Secrest Shortcut Road (SR 1501). The impacts previously identified for this neighborhood were from the relocation of Secrest Shortcut Road.

Impacts to Windward Oaks associated with DSA D involved a change in access to the neighborhood as a result of terminating McIntyre Road. Design refinements to the Preferred Alternative now allow for McIntyre Road to remain open, which results in no changes to the access of Windward Oaks.

Generally, more neighborhood impacts would occur in the western portion of the Preferred Alternative between Stallings and Indian Trail. This area is generally more densely developed and suburban in nature than the eastern portion of the project. Community cohesion impacts may occur and could include the effects of neighborhood division, social isolation, changes in community character, increased/decreased neighborhood or community access, and shortened travel times. The majority of the neighborhoods in the project study area have a suburban or agrarian visual character. The character of neighborhoods within the study corridor could be altered by the presence of a major toll facility.

Indirect effects could occur to neighborhoods under the Preferred Alternative. The project could accelerate land use changes to non-residential uses, causing changes in the character of neighborhoods.

**Community Resources.** Community resources in the project study area near the Preferred Alternative include schools and colleges, churches and cemeteries, and parks and recreational facilities.

**Schools and Colleges.** The Preferred Alternative would not directly impact any schools in the project study area. However, implementation of the Preferred Alternative would alter access to Central Piedmont Community College (CPCC). CPCC Lane, which provides access to the campus from existing US 74, would be closed to allow for control of access in the vicinity of the I-485 interchange. New access would be provided from existing US 74 via the proposed McKee Road. The Preferred Alternative also may alter traffic patterns on existing US 74 and Forest Hills School Road in the vicinity of Forest Hills High School.

Construction of the Preferred Alternative may temporarily impact school bus routes during construction, as well as result in modifications of existing routes and/or promotion of new bus routes. Prior to construction, the NCTA would coordinate with Mecklenburg County Public Schools and Union County Public Schools to share information to minimize impacts to school bus routes.

**Churches and Cemeteries.** The Preferred Alternative would impact three church properties, as shown in **Table 2-6**. No church buildings would be taken with implementation of the Preferred Alternative, nor would any marked cemeteries be impacted. There is no change in impacts since the Draft EIS was published.

**TABLE 2-6: Impacts to Churches for the Preferred Alternative**

Name	Address	Corridor Segment	Impacted Acres (% of Total Parcel)	Impact Description
Benton Heights Presbyterian Church	2701 Concord Hwy (US 601) Monroe, NC	31	2.1 (27%)	Right of way required along US 601 to accommodate improvements associated with the proposed US 601 interchange. Control of access requirements may necessitate altering existing entrances.
Trinity Baptist Church	2613 Concord Hwy (US 601) Monroe, NC	31	0.27 (5%)	Right of way required along US 601 to accommodate improvements associated with the proposed US 601 interchange.
Morgan Mill Road Baptist Church	2505 Morgan Mill Rd Monroe, NC	36	0.54 (5%)	Right of way required along NC 200 (Morgan Mill Rd) to accommodate improvements associated with the proposed NC 200 interchange.

Source: *Community Impact Assessment* (PBS&J, February 2009).

**Parks and Recreational Facilities.** In January 2009, Carolina Courts, a private recreation facility, opened a 44,000 square-foot facility at 7210 Stinson-Hartis Road in Indian Trail. This privately-owned facility offers a variety of indoor sports programs for all age groups (Carolina Courts Web site: [www.carolinacourts.com](http://www.carolinacourts.com)). At the time the Draft EIS was being finalized, the study team was not aware of Carolina Courts. This facility plays a role in the image the Town of Indian Trail is attempting to build as a family-friendly sports destination.

This facility was approved by the Town of Indian Trail with the knowledge that it was within an alternative corridor that was still under consideration. Initial study alternatives were developed

in the spring of 2007 and presented to local planners on May 24, 2007 at the Indian Trail Town Hall. It was brought to the study team's attention that alternatives in this area would impact future phases of the Old Hickory Business Park. On November 16, 2007, Town of Indian Trail officials requested that DSA Corridor Segment 2 be shifted northwest to minimize impacts to the business park. NCTA shifted the alignment of DSA Corridor Segment 2 as requested, and presented the new alignment at a meeting with Indian Trail officials and local business leaders on March 17, 2008.

Shortly after this announcement, Carolina Courts began construction in the center of the proposed corridor. In presentations to the Town of Indian Trail Town Council as late as October 2008, the construction of the future Carolina Courts facility was never brought to the attention of NCTA. Because of the rapidly developing area, any attempts to avoid Carolina Courts at that time would have resulted in impacts to other businesses in the immediate area. There are adequate comparable properties in proximity to the facility that may allow the business to relocate nearby.

### 2.5.1.3 Land Use and Transportation Planning

The information in this section is summarized from Section 3.3 of the Draft EIS, with updates on local land use plans and the MUMPO 2035 LRTP described in **Section 1.3.1.3**.

**Land Use and Transportation Plans.** The Preferred Alternative would be generally consistent with local land use plans and regional, state, and local transportation plans.

More detailed information regarding local land use planning and changes in land use as a result of the Preferred Alternative is provided in the *Monroe Connector/Bypass (R-3329/R-2559 Indirect and Cumulative Effects Quantitative Analysis* (Michael Baker Engineering, Inc., April 2010) and **Section 2.5.5** of this Final EIS.

Section 3.3.2 of the Draft EIS discusses the inclusion of the Monroe Connector and Monroe Bypass projects in the MUMPO 2030 LRTP. Both projects were included in the MUMPO 2030 LRTP as regionally significant projects. The only inconsistency was that the Monroe Bypass portion of the project was not shown as a toll facility. The Monroe Connector/Bypass is included in the updated MUMPO 2035 LRTP as a toll facility.

**Land Use.** The Union County portion of the project study area is predominantly rural and suburban, while the Mecklenburg County portion is more urbanized. Single-family residential is the most common type of residential development in the project study area. Most of the commercial development in the project study area is located along US 74, and is comprised of strip shopping centers, auto-oriented businesses, and service and retail businesses.

Since the Preferred Alternative is primarily on new location, direct land use changes would include converting the land needed for right of way from its existing use to transportation use. This land includes a wide variety of uses, such as industrial, commercial, residential, recreational, agricultural, and undeveloped.

In addition to the changes that would occur due to right-of-way acquisition, other land use changes are likely due to the nature of the facility. Since this new roadway would enhance access to eastern Union County, it would provide opportunities for increased intensity of development. For example, the interchange locations may be developed with commercial uses (e.g., gas stations and convenience stores) to serve travelers. With the potential access improvements, there is also the possibility of increased residential suburbanization. However,

this will be limited by the existing water and sewer availability within the counties and municipalities. Indirect land use impacts are discussed in more detail in **Section 2.5.5**.

#### 2.5.1.4 Right-of-Way Acquisition and Relocations

The Preferred Alternative would require relocation of residences and businesses. The total estimated number of residential relocations was updated based on the refined functional design for the Preferred Alternative (November, 2009). The Preferred Alternative would relocate approximately 95 residences, 47 businesses, and 3 farms. Business relocations are concentrated along existing US 74.

According to the *Relocation Reports* in Appendix C of the Draft EIS, there is comparable replacement housing within the project study area for displaced homeowners and tenants.

As discussed in Section 3.4.3 of the Draft EIS, the NCTA will follow the state and federal regulations and NCDOT policies for right-of-way acquisition and relocation. The policies ensure that comparable replacement housing is available for relocatees prior to construction of state and/or federally assisted projects. Furthermore, the NCTA will use three programs NCDOT has to minimize the inconvenience of relocation: Relocation Assistance, Relocation Moving Payments, and Relocation Replacement Housing Payments or Rent Supplement. The relocation program for the Preferred Alternative will be conducted in accordance with the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646) and the North Carolina Relocation Assistance Act (NCGS 133-5 through 133-18).

More information on right-of-way acquisition and relocation is available in the following two NCDOT brochures: *Answers to the Questions Most Often Asked About Right of Way Acquisitions* and *Relocation Assistance* (NCTA Web site: [www.ncturnpike.org/projects/monroe/documents.asp](http://www.ncturnpike.org/projects/monroe/documents.asp))

#### 2.5.1.5 Environmental Justice

There have been no updates to environmental justice information since the Draft EIS was published. The discussion summarized in **Section 1.3.1.5** applies to the Preferred Alternative.

Based on information presented in Section 3.5 of the Draft EIS and **Section 1.3.1.5**, the construction of the Preferred Alternative was determined not to have a disproportionately high and adverse impact on minority and low-income populations.

### 2.5.2 PHYSICAL ENVIRONMENT

#### 2.5.2.1 Noise

As a result of the design changes described in **Section 2.3.1**, and the redistribution of year 2035 traffic along the western end of the Preferred Alternative alignment (**Section 2.3.5**), an updated noise analysis was prepared for the Preferred Alternative (*Addendum Traffic Noise Technical Memorandum*, PBS&J, February 2010).

**Analysis Methodology.** The evaluation and modeling methodology used in the *Addendum Traffic Noise Technical Memorandum* (February 2010) is the same as that used in the *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009), as summarized in Section 4.1.4 of the Draft EIS. The FHWA Noise Abatement Criteria and NCDOT's policies for identifying noise impacted receptors described in Section 4.1.2 of the Draft EIS are the same.

**Identification of Additional Noise Sensitive Receptors.** Building permits were researched to determine if any additional noise sensitive receptors have been constructed near

the Preferred Alternative since the *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009) was prepared. None were identified.

The redesign of the Preferred Alternative's Unionville-Indian Trail Road (SR 1367) interchange (**Section 2.3.1.4**) left in place one additional commercial receptor and six additional residential receptors that would have been relocated under the previous designs. The redesign of the Austin Chaney Road (SR 1758) interchange (**Section 2.3.1.6**) left in place four additional residential receptors that would have been relocated under the previous design.

**Year 2035 Noise Contours.** The FHWA Traffic Noise Model (TNM), Version 2.5, was used to develop year 2035 noise contours along the mainlines of the DSAs, as described in Section 4.1.5.1 of the Draft EIS. The noise contours were updated at the western end of the Preferred Alternative, where traffic volume distributions were updated based on the change in the tolling plan (**Section 2.3.5**).

**Table 2-7** shows the updated year 2035 traffic noise contours and the numbers of receptors predicted to be impacted by noise in each Activity Category (see table footnote for definitions). As listed in the table, the number of impacted receptors is estimated to be 124 Category B receptors (all residences) and 29 Category C receptors (businesses).

**TABLE 2-7: 2035 Noise Contours and Impact Summary for the Preferred Alternative**

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft) <sup>1</sup>		Approximate Number of Impacted Receptors By Activity Category <sup>2</sup>				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Road	80	77	72	245	375	0	1	16	0	0
Stallings Road to Indian Trail-Fairview Road	79	76	71	240	350	0	13	10	0	0
Indian Trail-Fairview Road to Unionville-Indian Trail Road	80	76	71	250	365	0	47	3	0	0
Unionville-Indian Trail Road to Rocky River Road	80	76	71	250	365	0	6	0	0	0
Rocky River Road to US 601	80	77	72	245	350	0	36	0	0	0
US 601 to NC 200 (Morgan Mill Road)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Road) to Austin Chaney Road	76	73	68	180	285	0	3	0	0	0
Austin Chaney Road to Forest Hills School Road	75	72	67	160	265	0	14	0	0	0
Forest Hills School Road to US 74 between Wingate and Marshville	75	71	66	150	250	0	0	0	0	0
<b>TOTALS</b>						0	124	29	0	0

Source: *Addendum Traffic Noise Technical Memorandum*, PBS&J, February 2010.

Notes: <sup>1</sup>Distances are from the roadway centerline. <sup>2</sup>Activity categories are defined in the FHWA Noise Abatement Criteria (23 CFR 772). A - lands on which serenity and quiet are of extraordinary significance. B - Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, church, libraries, and hospitals. C - Developed lands and properties not included in Categories A and B, including businesses. D - Undeveloped lands. E - Interiors of residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Compared to the numbers of impacts presented in Table 4-5 of the Draft EIS, two additional residences and one additional business are predicted to be impacted by future traffic noise from

the Preferred Alternative. The slight increase is due to the design changes that reduced the right of way required at the Preferred Alternative's interchanges with Unionville-Indian Trail Road and Austin Chaney Road and left in place additional noise sensitive receptors near the proposed right of way.

**Barrier Evaluation Areas.** As described in Section 4.1.6 of the Draft EIS, the noise sensitive sites predicted to be impacted by traffic noise (i.e., experience noise levels that approach or exceed the FHWA Noise Abatement Criteria or show a substantial increase over existing levels) that were not considered isolated sites were further reevaluated in terms of the feasibility and reasonableness of providing noise barriers.

The *Addendum Traffic Noise Technical Memorandum* (PBS&J, February 2010) focused on reevaluating areas where design changes occurred that could affect the noise analysis, and also at the western end of the project where traffic volumes were redistributed. There were four barrier evaluation areas (BEAs) reevaluated in detail. BEA N1 is located along existing US 74 from I-485 to Stallings Road. BEA N2 is located along the Preferred Alternative from Stallings Road to where the project crosses Stinson-Hartis Road (includes the Forest Park subdivision). BEA N4 is located near Beverly Drive, and BEA N5 is located adjacent to Bonterra Village.

The detailed TNM models for BEA N1 and BEA N5 concluded that barrier evaluations were not warranted due to the fact that the impacted receptors in these areas are isolated from each other, and barriers would not be cost effective.

Detailed barrier evaluations were performed for BEA N2 and BEA N4 to determine if noise barriers would be feasible and reasonable in these locations. Results of the BEA N2 analysis did not differ from the March 2009 *Final Traffic Noise Technical Memorandum*; and barriers in this area are not reasonable (cost-effective).

BEA N4 is located along DSA Segment 2 and DSA Segment 21, east of Indian Trail-Fairview Road in the Beverly Drive area. The barrier proposed for this area in the updated analysis differs in length and number of benefited receptors compared to Barrier N4-1 in the March 2009 *Final Traffic Noise Technical Memorandum*. The original barrier was proposed to be 1,522 feet in length and 16 feet high, benefitting 16 receptors. The revised N4-1 barrier would be 4,699 feet long and 16 feet high, benefitting 26 receptors as shown in **Figure 2-6**.

There are no changes to the other two barriers recommended in the March 2009 *Final Traffic Noise Technical Memorandum*. Preliminary feasible and reasonable noise barriers for the Preferred Alternative are described in **Table 2-8** and shown in **Figure 2-7a-c**. A Design Noise Study will be prepared to update the noise analysis based upon the most recent traffic forecasts and the final design of the Preferred Alternative.

**TABLE 2-8: Preliminary Feasible and Reasonable Noise Barriers for the Preferred Alternative**

Description	Preliminary Barriers <sup>1</sup>		
	N4-1	N7-2	N9-1
DSA Segment	2	31	40
Description	Eastbound side of mainline. East of Indian Trail-Fairview Rd, west of Faith Church Rd, near Acorn Woods neighborhood.	Eastbound side of mainline. East of Roanoke Church Rd, west of Fowler Rd, near Avondale Park neighborhood.	Westbound side of mainline. East of Ansonville Rd, near Glencroft neighborhood.
Average dBA Reduction for Benefited Receptors	8	9	6
Number of Benefited Receptors	26	18	17
Barrier Length (Ft)	4,699	2,593	2,343

TABLE 2-8: Preliminary Feasible and Reasonable Noise Barriers for the Preferred Alternative

Description	Preliminary Barriers <sup>1</sup>		
	N4-1	N7-2	N9-1
Barrier Height (Ft)	16	16	16/14 <sup>2</sup>
Approximate Barrier Cost <sup>3</sup>	\$1,127,760	\$622,320	\$543,930
Cost Per Benefited Receptor	\$43,375	\$34,573	\$31,996
Allowable Cost Per Benefited Receptor	\$44,500	\$46,000	\$38,294

Source: *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009); *Addendum Traffic Noise Technical Memorandum* (PBS&J, February 2010).

Notes: <sup>1</sup>The determination of feasibility and reasonableness is preliminary and subject to change based on final design; building permits issued as of the Date of Public Knowledge, and the completion of the public involvement process. <sup>2</sup>Barrier height varies. <sup>3</sup>Based on \$15/sf.

### 2.5.2.2 Air Quality

The information in this section is summarized from Section 4.2 of the Draft EIS. Air quality issues addressed in Section 4.2 of the Draft EIS and **Section 1.3.2.2** include transportation conformity, MSATs, and potential air quality impacts from construction activities. As noted in **Section 1.3.2.2** and discussed below, there have been updates to transportation conformity and MSATs since the Draft EIS was published. A discussion of climate change and green house gas emissions also has been added.

**Transportation Conformity Update.** On November 17, 2008, the USEPA informed the North Carolina Department of Environment and Natural Resources (NCDENR) it could not approve the ozone air quality plan or SIP for the Metrolina region, since the area was unlikely to attain the 1997 ozone standard by June 15, 2010 or meet the requirements for a one-year extension of the attainment date. NCDENR committed to develop a SIP that would address the air quality issues for the Metrolina region. In January 2010, USEPA notified the NCDENR that the modified SIP was adequate for the purposes of transportation conformity.

The Draft *Conformity Analysis and Determination Report for the Cabarrus-Rowan MPO, Mecklenburg-Union MPO, and the Gaston Urban Area MPO 2035 Long Range Transportation Plans and the FY 2009-2015 Transportation Improvement Programs for Non-MPO Areas of Lincoln County, Iredell County, Gaston County, and Union County areas (8-Hour Ozone, and CO (Mecklenburg County Only))* was made available for public review on February 5, 2010. Public meetings to solicit comments on these documents as well as the Draft 2035 LRTP and the 2009 – 2015 STIP Amendment were held on February 24, 2010 in the Charlotte Mecklenburg Government Center, and on February 25, 2010 in the Indian Trail Town Hall. All of the above referenced documents were made available for review until the close of the public review and comment period on March 8, 2010. As of that date, no substantive comments were received and all were endorsed by the MUMPO TCC on March 11, 2010 and by MUMPO on March 24, 2010. USDOT issued a conformity determination on the LRTPs and TIPs on May 3, 2010. A copy of this letter can be found in **Appendix D** of this Final EIS.

**Mobile Source Air Toxics Impact Analysis Update.** An updated MSAT guidance document was published by FHWA in September 2009, *Interim Guidance Update on MSAT Analysis in NEPA Documents*. This update does not change any project analysis thresholds, recommendations, or guidelines. Therefore, the qualitative impact evaluation conclusions described in Section 4.2.5.2 and Appendix E of the Draft EIS do not change. However, the interim guidance update did recommend revised language for incomplete and unavailable information and provided information on new research.

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision making within the context of the NEPA process.

Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, FHWA is duly expected by the public and other agencies to address MSAT impacts in environmental documents. The FHWA, USEPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this emerging field.

While this research is ongoing, FHWA requires each NEPA document to qualitatively address MSATs and their relationship to the specific highway project through a tiered approach (*Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents*, September 30, 2009). An updated qualitative analysis of MSATs for this project appears in its entirety in **Appendix E** of this Final EIS.

**Climate Change / Greenhouse Gas Emissions.** The issue of greenhouse gas emissions and their effects on global climate is an important national and global issue in which FHWA is actively engaged. FHWA has been working with other Federal agencies, including the USEPA and the Department of Energy, to evaluate effective approaches consistent with our national goals. However, no national approach has yet been set in law or regulations, nor has the USEPA established criteria or thresholds for greenhouse gas emissions. Because a national strategy to address greenhouse gas emissions from transportation and all other sectors is still being developed, FHWA believes that it is premature to implement policies that attempt to incorporate consideration of greenhouse gas emissions into transportation planning.

From a NEPA perspective, it is analytically problematic to conduct a project-level cumulative effects analysis of greenhouse gas emissions on a problem that is global in nature. It is technically infeasible to accurately model the negligible increases or decreases of carbon dioxide emissions at a project level and to determine how these changes would contribute to the global issue. Given the level of uncertainty involved, the results of such an analysis would not be likely to inform decision-making at the project level, while adding considerable administrative burdens to the NEPA process. The scope of any such analysis, with any results being purely speculative, goes far beyond the disclosure of impacts needed to make sound transportation decisions. FHWA believes this approach meets the stated purpose of NEPA. In accordance with CEQ regulations, agencies should concentrate on the analyses of issues that can be truly meaningful to the project decision, rather than simply amassing data (40 CFR 1502.2 and 1502.15).

### 2.5.2.3 Farmland

#### **Prime and Important Farmland Soils and the Farmland Protection Policy Act.**

USDA NRCS has updated the lists of prime and other important farmland soils for Mecklenburg and Union Counties since the Draft EIS, as described in **Section 1.3.2.3**. Soils within the right of way for the Preferred Alternative considered by the NRCS to be prime or of statewide importance are listed in **Table 1-3**. There are no farmland soils classified as unique or locally important within the right of way for the Preferred Alternative.

Construction of the Preferred Alternative would involve the use of prime and statewide important farmland soils. **Table 2-9** presents the acreages of prime and statewide important farmland soils within the refined engineering design right of way for the Preferred Alternative. The acreages were calculated using GIS by overlaying the functional design right of way on the soils GIS layer and subtracting disturbed land (land already in urban development).

**TABLE 2-9: Impacts to Prime and Important Farmland Soils for the Preferred Alternative**

Total Acreage in Right of Way	Prime Farmland Soils	Statewide Important Farmland Soils	Prime and Important Farmland Soils in DSA	
	Acres in Right of Way*		Total Acres	%
1,312	184	751	935	71

\*Acreages are calculated for the refined functional engineering design right of way (November 2009). Areas of prime and statewide important soils already in urban development were not included in the totals.

In accordance with the Farmland Protection Policy Act (FPPA) and FHWA *Guidelines for Implementing the Final Rule of the Farmland Protection Policy Act for Highway Projects*, a “Farmland Conversion Impact Rating for Corridor Type Projects” form published by the NRCS was prepared for each DSA and included in Appendix F of the Draft EIS. **Section 1.3.2.3** contains updated information on the prime and important farmland soils in the project corridor.

The ratings on the NRCS forms are comprised of two parts. The Land Evaluation Criterion Value represents the relative value of the farmland to be converted on a scale from 0 to 100 points. The Corridor Assessment, which is rated on a scale of 0 to 150 points, evaluated farmland soils based upon its use in relation to the other land uses and resources in the immediate area. The two ratings are added together for a possible total rating of 260 points. Sites receiving a total score of 160 points or more are given increasingly higher levels of consideration for protection (7 CFR Part 658.4).

The NRCS forms for DSA D included in Appendix F of the Draft EIS still apply to the Preferred Alternative. As listed in the forms, total acres of prime and unique farmland were assumed to be 241 acres and total acres of statewide and local important farmland was assumed to be 897 acres. These values are both greater than the values listed in **Table 2-9**. Therefore, the Land Evaluation Criterion Value reported on the form for DSA D would be the same or higher than what the value would be if the updated acreages were used.

The total points for DSA D are 146 points for the portion of the project in Union County and 148 points for the portion of the project in Mecklenburg County. Since the soils impacted by the Preferred Alternative do not meet the threshold of protection based on the evaluation under the FPPA, the impacts to prime and statewide important farmland are not considered under the FPPA.

**Farm Relocations.** The Preferred Alternative would displace three farms, as reported in Section 4.3.4.3 of the Draft EIS. Because much of eastern Union County is still rural, it is anticipated that there would be suitable replacement property available for farm relocation.

#### 2.5.2.4 Utilities and Infrastructure

Impacts to utilities and infrastructure reported in Section 4.4 of the Draft EIS and **Section 1.3.2.4** have not changed for the Preferred Alternative. Utilities addressed include electric power, water and sewer facilities, natural gas, telecommunications, and railroads. The Preferred Alternative has the potential to impact utilities, as summarized below.

The Preferred Alternative would cross the high-voltage Duke Energy Corporation power line easement that runs between Faith Church Road (SR 1518) and Sardis Church Road (SR 1516). There are no electrical substations or towers located within the Preferred Alternative, but there may be vertical clearance issues associated with power lines in areas where the elevation of the proposed roadway is higher than the existing ground.

The Preferred Alternative would cross water and sewer lines, but no negative impacts to water or sewer service are anticipated. The Preferred Alternative would not impact water or wastewater treatment facilities.

The Preferred Alternative would cross the two-inch gas lines running parallel to US 601, NC 200, and Olive Branch Road (SR 1006), but would not directly impact the aboveground Piedmont Natural gas switching station located within DSA Segment 31. At its closest point, the estimated construction limits would be approximately 60 feet from the fenced-in area. The functional design in this area would be in a fill section and impacts to the natural gas switching station are not anticipated.

Telephone and cable lines are located throughout the project study area and the Preferred Alternative would cross telecommunications lines, but no cellular telephone towers would be impacted.

On the eastern end of the project, the Preferred Alternative would cross the CSX Railroad line that parallels existing US 74. NCTA will coordinate with the NCDOT Rail Division and CSX Railroad during final design for the project's eastern terminus at US-74, which would affect the east-west rail mainline through Union County.

Utility coordination would be conducted during final design. All utility providers would be contacted and coordinated with to ensure that the proposed design and construction of the project would not substantially disrupt service.

#### 2.5.2.5 Visual Resources

DSA D was selected as the Preferred Alternative and therefore unique visual impacts could occur due to the section of elevated roadway along existing US 74 from just east of I-485 to just east of Stallings Road (SR 1365). Appendix G of the Draft EIS contains a photo simulation of the elevated roadway.

NCTA is committed to incorporating community input into the aesthetic design process. Two stakeholder meetings were held during the aesthetic design process. The meetings were attended by NCTA staff, consultants, elected officials, and other invited guests. At the first stakeholder meeting on July 28, 2009, design consultants presented four alternative aesthetic design concepts. Meeting attendees were given time to review and comment on the design concepts. The regional architecture theme was selected as the preferred concept for further development.

At the second stakeholder meeting on August 25, 2009, two concepts were presented depicting the selected regional architecture theme. Meeting attendees were given time to review and discuss the concepts. The stakeholders selected Concept A, which included a combination of brick and arches, as the preferred concept to be carried forward into the creation of the aesthetic design standards document. The *Monroe Parkway Aesthetic Design Guide* (PBS&J, March 2010) developed as result of this work will be incorporated into the design-build contract for the project.

### 2.5.2.6 Hazardous Materials

An updated hazardous materials evaluation was prepared by the NCDOT Geotechnical Engineering Unit for the Preferred Alternative. The evaluation investigated five potentially contaminated parcels in the project corridor identified in the *GeoEnvironmental Impact Evaluation* (April 2008). The Draft EIS identified 11 sites for investigation, but six of these were outside of the Preferred Alternative corridor. The results for four of the five parcels are presented in a memo to the NCDOT Right of Way Branch from the Geotechnical Engineering Unit dated December 11, 2009. The results for the fifth site are presented in a supplemental memo dated February 16, 2010.

When the final proposed alignment is established and right of way limits are determined, a hazardous materials site assessment will be performed to determine levels of contamination at any potential hazardous materials sites. The assessment will be made prior to right-of-way acquisition. Regarding specific sites, the Geotechnical Engineering Unit offered the following recommendations:

- Independence Real Estate Investors Property (12518 East Independence Boulevard)  
This is Site Number 6 as shown in Figure 4-3 of the Draft EIS. A geophysical investigation found no evidence of underground storage tanks (UST) located within the proposed right of way at this active gas station. Three USTs are located just outside the proposed controlled access right of way. Laboratory results indicated minor soil contamination.
- McGee Corporation Property (12701 East Independence Boulevard)  
This is Site Number 7 shown in Figure 4-3 of the Draft EIS. A geophysical investigation found no evidence of USTs located within the proposed right of way at this manufacturing facility. Laboratory results indicated petroleum contamination, and silver, cadmium, and mercury were identified at levels just above the North Carolina Hazardous Waste Section Screening Levels.
- Circle K Stores Inc. Property (13024 East Independence Boulevard)  
This is Site Number 10 shown in Figure 4-3 of the Draft EIS. A geophysical investigation found no evidence of USTs located within the proposed right of way at this active gas station. Five registered USTs are located outside the proposed right of way. Laboratory results indicated an estimated 70 cubic yards of petroleum contaminated soil within the proposed right of way.
- Jerry & Mary Oliver Property (13145 East Independence Boulevard)  
This is Site Number 11 shown in Figure 4-3 of the Draft EIS. This site is currently a junkyard and body shop. A geophysical investigation could not be performed on this property due to junked cars. A full geophysical investigation should be performed once the property has been acquired and the vehicles have been removed. Preliminary results indicate minor petroleum contamination.
- NewCarr II LLC Property (13025 E Independence Boulevard)  
Four USTs are located within the proposed right of way and easement at this property. Laboratory results indicated approximately 85 to 175 cubic yards of petroleum contaminated soil is within the proposed cut section.

### 2.5.2.7 Floodplains and Floodways

Floodplains and floodways in the project study area are described in **Section 1.3.2.7**.

As discussed in Section 4.7.3 of the Draft EIS, a preliminary hydraulics analysis (*Preliminary Hydraulic Technical Memorandum*, PBS&J, December 2008) was performed to identify the preliminary sizes and locations of major drainage structures along the DSAs that would be needed to adequately carry floodwaters. Major drainage structures are bridges, box culverts, or pipe culverts greater than 72 inches in diameter.

The locations of major drainage structures for the Preferred Alternative are shown on **Figure 2-3a-t**. Appendix H of the Draft EIS includes details about the crossing locations such as preliminary drainage structure size and length, floodplain width, and floodway width.

The Preferred Alternative would include six bridge crossings and 35 major culverts or pipes. There would be five crossings of floodways and 11 crossings of floodplains. During final design, a detailed hydrologic and hydraulic analysis will be performed for each crossing location to determine the actual size and configuration of each structure. Also, for all new location crossings on FEMA-regulated streams (streams where a floodway and/or floodplain has been identified), a Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) will be prepared and submitted to the NC Floodplain Mapping Program or Mecklenburg County, as applicable, for approval.

Based on information provided in the *Preliminary Hydraulic Technical Memorandum* (PBS&J, December 2008), and updated information from the November 2008 Union County Flood Insurance Rate Maps (FIRM), the bridge structures for the Preferred Alternative are as follows:

- Twin 150-foot long bridges over South Fork Crooked Creek (Stream S047).
- One 75-foot long bridge over South Fork Crooked Creek (Stream S047).
- Twin 240-foot long bridges over Stewarts Creek (Stream S082).
- Twin 320-foot long bridges over Richardson Creek (Stream S111).
- Twin 280-foot long bridges over Ray's Fork (Stream S112).
- Twin 575-foot long bridges over Meadow Branch (Stream S152).

In National Flood Insurance Program flood hazard areas, the final hydraulic designs for the Preferred Alternative would be such that the floodway would carry the 100-year flood without a substantial increase in flood elevation. The effect of the project on floodwaters can be mitigated effectively through proper sizing and design of hydraulic structures.

A LOMR is FEMA's modification to an effective FIRM, or Flood Boundary and Floodway Map (FBFM), or both. LOMRs generally are based upon the implementation of physical measures affecting the hydrologic or hydraulic characteristics of a flooding source, and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations, or the Special Flood Hazard Area. The LOMR officially revises the FIRM or Flood Boundary and FBFM, and sometimes the Flood Insurance Study report, and when appropriate, includes a description of the modifications (FEMA Web site: [www.fema.gov/plan/prevent/floodplain/nfipkeywords/lomr.shtm](http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/lomr.shtm)).

**Floodplain Finding.** Executive Order 11988 directs federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only practicable alternative. The FHWA requirements for compliance with this Executive Order are included in 23 CFR 650 Subpart A.

In accordance with 23 CFR 650.113, "A proposed action which includes a significant encroachment shall not be approved unless the FHWA finds that the proposed significant encroachment is the only practicable alternative. This finding shall be included in the final environmental document (final environmental impact statement or finding of no significant impact) and shall be supported by the following information:

- (1) The reasons why the proposed action must be located in the floodplain,
- (2) The alternatives considered and why they were not practicable, and
- (3) A statement indicating whether the action conforms to applicable State or local floodplain protection standards.

A "significant encroachment" shall mean a highway encroachment and any direct support of likely base floodplain development that would involve one or more of the following construction- or flood-related impacts (23 CFR 650.105):

- A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route,
- A significant risk, or
- A significant adverse impact on natural and beneficial floodplain values.

The Preferred Alternative will impact 100-year floodplains associated with major drainages within the study area, including North Fork Crooked Creek, South Fork Crooked Creek, East Fork Stewarts Creek, Stewarts Creek, Richardson Creek, Rays Fork Creek, Stumplick Branch, Meadow Branch, and Negro Head Creek. All of the stream crossings would be perpendicular or near to perpendicular, which would minimize impacts to the associated floodplains. All bridges or culverts designed for the project will be sized to ensure that no increases to the extent and level of flood hazard risk will result from such encroachments.

The Preferred Alternative was selected based on a consideration of impacts to natural resources, and the human and physical environments, and on the ability to minimize impacts. As such, there is no other practicable alternative to reduce impacts to floodplains.

### **2.5.3 CULTURAL RESOURCES AND SECTION 4(f) AND SECTION 6(f) RESOURCES**

#### **2.5.3.1 Historic Architectural Resources**

Section 5.2 of the Draft EIS includes descriptions of the historic architectural resources in the project's Area of Potential Effects. There have been no updates to this information since the Draft EIS was published.

Four historic architectural resources on or eligible for listing on the NRHP were identified in the project's Area of Potential Effects. These are the Secrest Farm (Site Number UN 835), Hiram Secrest House (Site Number UN 351), William Bivens House (Site Number UN 830), and Perry-McIntyre House (Site Number UN 306). The locations of these resources are shown on Figure 5-1 of the Draft EIS.

The Preferred Alternative would not result in an Adverse Effect to a historic property on or eligible for listing on the NRHP. No property would be acquired from any of the historic resources. The effects determinations are No Adverse Effect for Secrest Farm, Hiram Secrest House, and Perry-McIntyre House. The effects determination for William Bivens House is No Effect. These determinations were reconfirmed with the HPO on September 29, 2009.

### 2.5.3.2 Archaeological Resources

An additional archaeological assessment was prepared for the Preferred Alternative to identify archaeological resources that may be impacted. Previous studies on the Monroe Bypass portion of the project include the *Archaeological Background Report – US 74 Monroe Bypass (R-2559) Study Area* (NCDOT, 1995) and an intensive field survey of the Monroe Bypass preferred alignment (Ashley et al., 1997). No sites eligible for listing on the NRHP were discovered in these previous studies. The Office of State Archaeology (OSA) confirmed in an email dated January 20, 2010 (**Appendix D**) that an updated archaeological evaluation for the Monroe Bypass portion of the project was not required, as archaeological resources have not changed since the completion of the prior studies.

The *Final Archaeological Inventory and Evaluation for the US 74 Monroe Connector* (New South Associates, March 2009) examined archaeological resources within the 11.4-mile Monroe Connector portion of the project, between I-485 and US 601. In total, the Area of Potential Effects (APE) encompassed approximately 696 acres. Prior to the archaeological survey, all background information on previously recorded resources was compiled and included in the spatial data.

Archaeological inventory and evaluation was conducted throughout the entire APE using a spatial model of the probability of the presence of significant archaeological sites. The APE was divided into two classes based on the potential for significant archaeological sites. Areas considered to have low probability for significant archaeological sites included all areas mapped with gravelly or channery soils, areas of standing water, areas of prior modern disturbance, and areas with greater than 15 percent slope. Approximately 429 acres of the APE were designated as having low probability. The remainder of the APE, approximately 267 acres, was considered to have medium to high probability for significant archaeological sites.

All low probability areas were inventoried by pedestrian walkover along transects at intervals no greater than 30 meters (98.4 feet). Shovel testing was used in any areas that had the potential for archaeological sites. Field inventory methods in medium to high probability areas included systematic shovel testing and pedestrian walkover. Shovel testing was conducted at 30-meter (98.4-foot) intervals throughout all medium to high probability areas. Shovel testing was conducted at 15-meter (49-foot) intervals around all positive discovery shovel tests. These radial shovel tests were used to more accurately delineate site boundaries.

Field work was conducted from August 17-28, 2009. A total of 1,034 shovel tests and eight test units were excavated for the evaluation. Twenty archaeological resources were identified within the APE for the Monroe Connector portion of the project, all of which are determined not eligible for the NRHP. However, further work is recommended at the Fowler/Hasty/Secrest Cemetery (Site 31UN351\*\*) where human remains are suspected to be present within the APE. A probe delineation identified several features consistent with historic graves, but machine-assisted removal of the topsoil is recommended to complete the delineation. Details of the delineation will be discussed with and approved by the North Carolina Cemetery Program at the Office of State Archaeology before implementation.

In a memorandum dated February 23, 2010, the HPO concurred with the findings of the *Final Archaeological Inventory and Evaluation for the US 74 Monroe Connector* (New South Associates, March 2010) and the recommendation for additional work at the Fowler/Hasty/Secrest Cemetery site. The HPO requested the opportunity to review and comment on the draft cemetery delineation plan as well as any plan detailing removal of the burials, if necessary. These plans must be submitted and approved prior to any ground-

disturbing activities in areas suspected to contain marked or unmarked graves. The memorandum from the HPO is included in **Appendix D**.

In conclusion, a previous archaeological evaluation for the Monroe Bypass portion of the project and the recently completed archaeological inventory and evaluation for the Monroe Connector portion of the project found no resources eligible for listing on the NRHP; therefore, the proposed action would have no effects on any archaeological resource on or eligible for listing on the NRHP.

### 2.5.3.3 Section 4(f) and Section 6(f) Resources

As discussed in the Draft EIS Section 5.4, Section 4(f) and Section 6(f) resources are afforded special considerations from federal actions. The names “Section 4(f) resources” and “Section 6(f) resources” are derived from the laws which established these protections. Section 4(f) resources include publicly-owned parks, recreation areas, and wildlife and waterfowl refuges, as well as significant historic sites under public or private ownership. Section 6(f) resources include public recreation sites and facilities that have utilized funding through the Land and Water Conservation Fund Act.

The Preferred Alternative would not impact any Section 4(f) or Section 6(f) resources.

## 2.5.4 NATURAL ENVIRONMENT

### 2.5.4.1 Soils and Mineral Resources

**Soils.** As shown in **Table 1-6**, the entire area underlain by the DSAs, including the Preferred Alternative, is rated “somewhat limited” or “very limited” for road construction. This means that the soil properties indicate that special planning, design, or maintenance is needed to overcome soil limitations. The concern cited in the soil surveys was low strength (i.e., the soil is unable to support loads). Some soils also had shrink-swell potential, which is the potential for a soil volume to change with a loss or gain of moisture. Shrinking and swelling can cause damage to structures and roads, if either lacks special design (USDA, January 1996).

The expected soil limitations can be overcome through proper engineering design, including the incorporation of techniques such as soil modification, appropriate choice of fill material, use of non-corrosive subgrade materials, and design of drainage structures capable of conveying estimated peak flows. Decisions regarding soil limitations and methods to overcome them would be determined during the final design phase.

**Mineral Resources.** None of the active or inactive mines permitted by the NCDENR Division of Land Resources described in Section 6.1.2 of the Draft EIS would be impacted by the Preferred Alternative. Geotechnical surveys conducted during the final design phase would identify abandoned mine shafts in the area that could affect construction activities. It is expected that abandoned mine shafts can be accommodated in the design and construction of the Preferred Alternative.

### 2.5.4.2 Water Resources

Existing water resources and water quality are discussed in **Section 1.3.4.2**. The impacts discussion in Section 6.2.3 of the Draft EIS related to DSA D applies to the Preferred Alternative.

Short-term impacts on water quality within the project study area may result from soil erosion and sedimentation. Construction impacts to water quality may not be restricted to the communities in which the construction activity occurs, but may also affect downstream communities. Long-term impacts on water quality also are possible due to particulates, heavy metals, organic matter, pesticides, herbicides, nutrients, and bacteria that are often found in highway runoff.

For the benefit of the sensitive watersheds, the NCTA will ensure that all construction activities would be located outside of Goose Creek watershed. If any construction staging, storage, refueling, borrow pit or spoil areas are chosen within the Goose Creek or Sixmile Creek watersheds, the NCDOT Division Environmental Officer will coordinate with the NCTA and USFWS and the contractor to develop BMPs for each site to avoid/minimize the potential for adverse effects. In addition, NCTA will follow NCDOT’s *Design Standards in Sensitive Watersheds* for implementing erosion and sediment control BMPs along the entire project.

Final designs will incorporate hazardous spill basins along the project corridor within the designated hazardous spill basin area associated with Lake Twitty. These basins will be designed in accordance with NCDOT’s *Best Management Practices for Protection of Surface Waters, Guidelines for the Location and Design of Hazardous Spill Basins, and Guidelines for Drainage Studies and Hydraulic Design*. A turbidity water quality testing program for the main stem of Stewarts Creek will also be implemented to evaluate the performance of BMPs. Testing will be completed upstream and downstream of the construction area, as well as before, during, and after storm events.

The *Standard Specifications for Roads and Structures* requires proper handling and use of construction materials (NCDOT, January 2002) (NCDOT Web site: [www.ncdot.org/doh/preconstruct/ps/specficiations/dual/](http://www.ncdot.org/doh/preconstruct/ps/specficiations/dual/)). The contractor would be responsible for taking every reasonable precaution throughout the construction of the project to prevent the pollution of any body of water. Seeding will be required within 14 calendar days of completing construction activities in an area and the contractor shall be responsible for preventing soil erosion and stream siltation.

**2.5.4.3 Natural Communities and Wildlife**

**Terrestrial Communities and Wildlife.** Terrestrial communities would be impacted permanently by project construction from clearing and paving. **Table 2-10** provides the acreage of terrestrial communities by habitat type that would be impacted by the Preferred Alternative refined functional design. The acreages represent the area within the proposed right-of-way limits.

**TABLE 2-10: Potential Impacts from the Preferred Alternative to Terrestrial Communities**

Agriculturally Maintained	Basic Mesic Forest (Piedmont Subtype)	Mesic Mixed Hardwood Forest (Piedmont Subtype)	Piedmont/ Low Mountain Alluvial Forest	Pine Forest	Suc-Cessional	Urban/ Disturbed	Open Water	Impervious Surface	Total Acres
489	22	394	21	13	97	212	6	58	1,312

Source: Data in table was calculated using GIS with data from the *Jurisdictional and Community Impacts Technical Memorandum for the Monroe Connector/Bypass* (ESI, January 2009 and updates) and refined functional design (November 2009).

As discussed in **Section 1.3.4.3**, direct impacts from the DSAs, including the Preferred Alternative, would occur to the terrestrial communities and to the animals that inhabit them. Destruction of natural communities along the Preferred Alternative right of way would result in the loss of foraging and breeding habitats for the various animal species that utilize the area.

The Preferred Alternative also has the potential to indirectly affect terrestrial communities through fragmentation, which would result from road construction and induced land use change. Habitat fragmentation also is expected to occur under the No Build Alternative due to continued growth in population and development within Union County. The *Monroe Connector/Bypass (R-3329/R-2559 Indirect and Cumulative Effects Quantitative Analysis* (Michael Baker Engineering Inc., April 2010), summarized in **Section 2.5.5**, addresses indirect and cumulative effects to natural communities in more detail.

**Aquatic Communities and Wildlife.** As discussed in **Section 1.3.4.3**, direct impacts from the DSAs, including the Preferred Alternative, to aquatic communities include both intermittent and perennial piedmont streams, as well as still-water ponds. Impacts to aquatic communities include fluctuations in water temperature as a result of the loss of riparian (forest) vegetation. Construction impacts may not be restricted to the communities in which the construction activity occurs, but may also affect downstream communities. Temporary and permanent impacts to aquatic organisms may result from increased sedimentation. Impacts to aquatic communities and wildlife from erosion and sedimentation would be minimized through implementation of a stringent erosion-control schedule and the use of BMPs, as discussed in **Section 2.5.4.2**.

**Invasive Plant Species.** Several known invasive species are present within the DSA corridors, including the Preferred Alternative, as described in Section 6.3.4 of the Draft EIS. Construction of the Preferred Alternative has the potential to provide opportunities for the introduction or spread of invasive plant species. Known invasive plant species will not be used in construction, revegetation, or landscaping. NCTA will follow the BMPs recommended by NCDOT for management of invasive plant species.

#### 2.5.4.4 Water Resources in Federal Jurisdiction

**Impacts to Jurisdictional Resources.** Table 2-11 presents the impacts to water resources for the Preferred Alternative. Impacts were calculated using the refined functional design estimated construction limits, plus 40 feet, in accordance with NCDOT procedures for functional level designs. It is expected that the stream and wetland impact estimates likely will decrease as the level of design detail increases, since smaller buffers are used in estimating impacts from preliminary design (construction limits plus 25 feet) and from final design (construction limits plus 5-10 feet).

**TABLE 2-11: Potential Impacts from the Preferred Alternative to Waters of the US**

Intermittent Stream Impacts (linear ft) <sup>1</sup>	Perennial Stream Impacts (linear ft) <sup>1</sup>	Total Stream Impacts (linear ft) <sup>1</sup>	Total Number of Stream Crossings	Wetland Impact Area (acres) <sup>1</sup>	Total Number of Wetlands Impacted	Pond Impact Area (acres) <sup>1</sup>
12,729	10,353	23,083	107	8.1	46	3.1

Source: Data in table was calculated using GIS with data from the *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008) and updated fieldwork; and the refined functional design (November 2009).

Notes: <sup>1</sup> Impacts were calculated using the functional design's construction limits, with an additional 40-foot buffer, in accordance with NCDOT procedures.

**Avoidance and Minimization.** The USEPA and USACE regulations governing wetlands mitigation embrace a policy of “no net loss of wetlands” and sequential consideration of

avoidance, minimization, and mitigation. As discussed in Section 6.4.5.2 of the Draft EIS, all DSAs incorporated measures to avoid and minimize impacts to Waters of the US. The horizontal alignment of the functional design was adjusted where possible to minimize or avoid impacts to streams, wetlands, and ponds. The presence of wetlands and streams, and the minimization or avoidance of impacts to these resources, were factors in considering interchange configurations.

Impacts to wetlands and streams were further reduced through the design refinements made to the Preferred Alternative. Specific areas where design refinements for the Preferred Alternative resulted in net reductions to stream impacts included the area around Beverly Drive where a bridge was removed, the area around Bobwhite Circle where a service road was removed and a bridge was modified, the area surrounding the Austin Chaney Road interchange, and the area east of the Forest Hills School Road interchange where a previously shown NCDOT service road was shortened. These design refinements resulted in a decrease of 709 linear feet of jurisdictional stream impacts.

The service roads added an additional 1,489 linear feet of total stream impacts, of which 1,260 linear feet are anticipated to require mitigation.<sup>1</sup> With the inclusion of service roads, the total stream impacts for the Preferred Alternative increased by 1,020 linear feet from the impacts for DSA D reported in the Draft EIS. The length of stream impacts anticipated to require mitigation for the Preferred Alternative, including the service roads, is 13,235 linear feet, which is 685 linear feet more than the impacts for DSA D in the Draft EIS. Wetland impact acreage stayed approximately the same between DSA D in the Draft EIS and the Preferred Alternative, but the number of wetlands impacted decreased by one for the Preferred Alternative. Pond impacts increased by approximately one-half acre for the Preferred Alternative compared to DSA D in the Draft EIS.

**Mitigation.** As discussed in Section 6.4.5.1 of the Draft EIS and **Section 1.3.4.4**, an Individual Permit would be required from the USACE for the Preferred Alternative's impacts to Waters of the US.

Mitigation would be required for the anticipated impacts to Waters of the US. Mitigation is anticipated to be a combination of off-site mitigation through the in-lieu fee program of the NCDENR Ecosystem Enhancement Program (EEP) and potential on-site mitigation.

Throughout the development of this project, EEP has regularly been apprised of anticipated mitigation requirements to ensure that sufficient mitigation credits are available. This coordination will continue through construction of the project.

A conceptual mitigation plan has been prepared for the Preferred Alternative. This plan, *Review for Potential On-Site Mitigation* technical memorandum (ESI, January 2010), is incorporated by reference into this Final EIS and is summarized below.

The conceptual mitigation plan documents potential on-site mitigation opportunities within the project study area that may assist in meeting the compensatory mitigation requirements of the project. "On-site" is defined as an area in the immediate vicinity of the Preferred Alternative. Potential mitigation sites were identified using aerial photography and further evaluated in the field. Based on this review, 25 sites were identified totaling approximately 2,000 acres that potentially contain mitigation opportunities. Of these 25 sites, 21 were not recommended for mitigation opportunities because they did not meet site selection criteria developed with guidance from the USACE and the EEP. Four sites were considered viable potential mitigation

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<sup>1</sup> It should be noted that additional impacts for the service roads were calculated with a 40-foot buffer; excluding this buffer, the total stream impacts for the service roads would be reduced to 942 feet.

opportunities for stream restoration and are described in detail in the conceptual mitigation plan. All of the recommended sites would require additional analysis to determine the full mitigation potential. This analysis will be conducted during the permitting phase of the project.

**Wetland Finding.** Executive Order 11990, Protection of Wetlands, and DOT Order 5660.1A, Preservation of the Nation's Wetlands, emphasize the important functions and values inherent in the Nation's wetlands. Federal agencies are directed to avoid new construction in wetlands unless there is no practicable alternative to such construction, and the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use.

As discussed in **Section 2.2**, DSA D was selected as the Preferred Alternative because it represents a balanced minimization of all impacts analyzed. From a natural environment standpoint, DSA D was in the lower range of impacts to ponds and intermittent streams, had the least impacts to perennial streams, and had the least linear feet of streams requiring mitigation.

Based on available data, the Preferred Alternative includes all practicable measures to minimize harm to wetlands. As discussed in **Table 2-10**, the refined design for the Preferred Alternative results in no net gain in wetland impacts compared to the functional design for DSA D documented in the Draft EIS, even though service roads have been added to the design.

#### 2.5.4.5 Protected Species

Protected Species information was presented in Section 6.5 of the Draft EIS, and summarized in **Section 1.3.4.5**. Since the publication of the Draft EIS, a Biological Assessment was prepared to evaluate protected species that may be impacted by the Preferred Alternative. The Biological Assessment addresses endangered plant species and freshwater mussels.

The *Biological Assessment for the Monroe Connector-Bypass Project (R-3329/R-2559)* (The Catena Group, May 2010), examined impacts to Michaux's sumac (*Rhus michauxii*), Schweinitz's sunflower (*Helianthus schweinitzii*), and Smooth coneflower (*Echinacea laevigata*).

The Biological Assessment also addressed freshwater mussels, in particular the federally endangered Carolina heelsplitter (*Lasmigona decorate*). The results of the *Freshwater Mussel Survey Report* (The Catena Group, June 2009), which identify existing populations of freshwater mussels within the project corridor, was incorporated into the Biological Assessment.

The Biological Assessment was submitted to the US Fish and Wildlife Service on April 19, 2010 for their review and concurrence. Concurrence on the biological conclusions for all the species addressed in the Biological Assessment will be achieved prior to the ROD. This is a project commitment listed in **Section PC** of the Final EIS.

**Freshwater Mussels.** Project construction would impact streams within the Rocky River sub-basin of the greater Pee Dee River basin, and potentially the headwaters of Four Mile Creek within the Sugar Creek sub-basin of the greater Catawba River basin. Construction within these watersheds could potentially impact freshwater mussels, in particular the federally endangered Carolina heelsplitter (*Lasmigona decorate*), and the state endangered / federal species of concern (FSC) Atlantic pigtoe (*Fusconaia masoni*) and Savannah liliput (*Toxolasma pullus*), all of which are known to occur in the Rocky River sub-basin.

Surveys were conducted for the Carolina heelsplitter in the project area in April and May 2009 by The Catena Group. The non-regulated Atlantic pigtoe and Savannah liliput were also targeted in the surveys because the USFWS is in the process of preparing "Elevation to

Candidate Species Status” packages for these species and they may be federally listed in the near future (*Freshwater Mussel Survey Report*, The Catena Group, June 2009).

The *Freshwater Mussel Survey Report* (The Catena Group, June 2009) presents the detailed methodology and results of the mussel survey. South Fork Crooked Creek was the only surveyed area that contained a viable and relatively diverse mussel assemblage, including state listed and FSC species. The only federally protected species targeted by the survey, the Carolina heelsplitter, was not found and, given the degraded conditions of most of the streams surveyed, is unlikely to occur within the project corridor. Therefore, direct or indirect impacts to this species are not anticipated as a result of this project. Restrictions on locating new borrow sites and waste disposal areas in the Goose Creek and Sixmile Creek watersheds (included in Special Project Commitments) further reduce the chances for adverse effects to the species.

The biological conclusion in the Draft EIS for the Carolina heelsplitter is 'Unresolved'. Based on the Biological Assessment, the biological conclusion for the Carolina heelsplitter is May Affect/Not Likely to Adversely Affect. The FHWA and NCTA are coordinating with the USFWS in accordance with Section 7 of the ESA. Coordination will be completed prior to issuance of the ROD. This is a project commitment listed in **Section PC** of the Final EIS.

**Plant Species.** A Biological Assessment was prepared to determine whether the proposed action may affect federally listed endangered plant species that occur in the project area. The species evaluated included Michaux’s sumac (*Rhus michauxii*), Schweinitz’s sunflower (*Helianthus schweinitzii*), and smooth coneflower (*Echinacea laevigata*). Details of the evaluation are provided in the *Biological Assessment for the Monroe Connector-Bypass Project (R-3329/R-2559)* (The Catena Group, May 2010).

Three types of potential effects were evaluated. Direct effects are impacts that can be directly attributed to the project and include land clearing, loss of habitat, grading, stream re-channelization, hydrologic modification, and erosion. Indirect effects are impacts that are caused by the project and are later in time, but are reasonably foreseeable. Cumulative effects are effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area.

**Michaux’s sumac.** Based on the results of the Biological Assessment, there would be no direct, indirect, or cumulative effects to Michaux’s sumac associated with the project due to the absence of the species within the Future Land Use Study Area (FLUSA). A biological conclusion of No Effect was reached for Michaux’s sumac.

**Schweinitz’s sunflower.** The Draft EIS included a conclusion of “May Affect/Not Likely to Adversely Affect” for Schweinitz’s sunflower. USFWS comments on the Draft EIS (dated June 12, 2009) indicated that “*it is premature to determine that there will be no impacts to the Schweinitz’s sunflower (Helianthus schweinitzii) from this project. Until more specifics about design and any changes that may result from public comment or other information are available we believe the appropriate conclusion for this species is ‘unresolved.’*”

On July 22, 2009, representatives of NCTA, FHWA, and USFWS met to discuss design revisions incorporated into the Preferred Alternative as a result of public comments on the Draft EIS. This included revising the proposed interchange configuration at Unionville-Indian Trail Road to reduce the footprint of the design. Two populations of Schweinitz’s sunflower were identified along Secrest Shortcut Road in the vicinity of this proposed interchange.

USFWS indicated that based on the design change, which would increase the potential for future development adjacent to the interchange, it would be highly likely that the populations would be

lost due to indirect impacts of this project – either related to future road improvements along Secrest Shortcut Road or to future development. As a result, USFWS recommended formal consultation under the ESA for these impacts to Schweinitz’s sunflower. Appropriate coordination will be completed prior to issuing the ROD.

No occurrences of Schweinitz’s sunflower were identified within the proposed right of way, but there are two populations that occur in proximity to the proposed right of way for the Preferred Alternative. The first is located on Secrest Shortcut Road (SR 1501) between the intersection of Unionville-Indian Trail Road and South Fork Crooked Creek. The second is a small population (approximately 12 stems) located along the south side of Secrest Shortcut Road several hundred feet west of the Unionville-Indian Trail Road interchange.

There are three additional known occurrences of Schweinitz’s sunflower within the Future Land Use Study Area (FLUSA) for the project. The first occurrence (EO#18) is located along Indian Trail-Fairview Road (SR 1520) approximately halfway between Rocky River Road and Cunningham Lane. The second (EO#77) is located just west of US 601 between Sikes Mill Road (SR 1001) and Stumplick Branch. This population is considered extirpated by the North Carolina Natural Heritage Program (NCNHP) because recent surveys failed to locate it. The third population (EO#78) is located on the south side of Gold Mine Road (SR 1162) at Bearskin Creek.

There would be no direct effects to Schweinitz’s sunflower associated with the project since there are no populations located within the proposed right of way. There is the potential for indirect effects to the two populations of Schweinitz’s sunflower identified in proximity to the proposed right of way for the project. These populations have an increased risk of significant degradation or destruction because of projected increases in the density of residential development, as reported in the *Indirect and Cumulative Effects Quantitative Analysis* (Michael Baker Engineering, Inc., April 2010). Since these populations are at an increased risk of degradation due to nearby project-induced future development, FHWA and NCTA propose on-site preservation to reduce the potential for adverse effects to the Schweinitz’s sunflower. Relocation of these populations was considered; however, preservation in place was deemed a more suitable option as reasonably foreseeable unavoidable impacts to these populations are not anticipated with on-site preservation and management.

NCTA has committed to exercising additional precautions near these populations during construction (**Table PC-1**). Additionally, since these two populations are located partly within utility right of way, Union Power was contacted regarding potential utility relocation needs as a result of project construction. Union Power stated their intention to keep the power lines in their existing location in this area and elevate them above the proposed roadway (*Biological Assessment for the Monroe Connector-Bypass Project (R-3329/R-2559)*, The Catena Group, May 2010). The populations will remain in the Union Power easement under the jurisdiction of Union Power’s Schweinitz’s sunflower management plan (Union Power, 2010).

There is also the potential for cumulative effects to two of the populations of Schweinitz’s sunflower in the FLUSA when comparing the current level of development to what is anticipated through the year 2030. This anticipated growth would have potential cumulative effects through the expansion of residential and industrial development to areas where little or no development currently exists. It should be noted that this anticipated growth is predicted to occur within the FLUSA regardless of whether the Monroe Connector/Bypass is built. The potentially affected populations are located along Indian Trail-Fairview Road (SR 1520) and Gold Mine Road (SR 1162). Both of these populations occur within either NCDOT or some other utility right of

way and could be protected through the use of NCDOT *Roadside Vegetation Management in Marked Areas*

([http://environment.transportation.org/environmental\\_issues/construct\\_maint\\_prac/compendium/manual/1\\_1\\_33.aspx](http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/1_1_33.aspx)).

A biological conclusion of May Affect/Not Likely to Adversely Affect was reached for the Schweinitz's sunflower. Potential indirect adverse effects from projected development will be avoided through on-site preservation and management. NCDOT signed a Memorandum of Understanding (MOU) with NCDENR in 1990 that committed NCDOT to protecting populations of threatened and endangered species that occur within NCDOT right of way throughout the State. On-site preservation will be the responsibility of NCDOT and project funds will be designated to mark the extent of the populations with "Do Not Mow" signs. Additionally, NCDOT personnel and field maintenance crews will conduct vegetation management and maintenance activities per NCDOT's *Roadside Vegetation Management Guidelines in Marked Areas*

([http://environment.transportation.org/environmental\\_issues/construct\\_maint\\_prac/compendium/manual/1\\_1\\_33.aspx](http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/1_1_33.aspx)). Conservation measures for the Schweinitz's sunflower are detailed in the *Biological Assessment for the Monroe Connector-Bypass Project (R-3329/R-2559)*, The Catena Group, May 2010).

*Smooth coneflower.* There would be no direct, indirect, or cumulative effects to smooth coneflower associated with the project due to the absence of the species within the FLUSA. A biological conclusion of No Effect was reached for smooth coneflower.

## 2.5.5 INDIRECT AND CUMULATIVE EFFECTS

### 2.5.5.1 Quantitative Indirect and Cumulative Effects Assessment

**Introduction.** As stated in **Section 2.4**, a quantitative indirect and cumulative effects (ICE) study was prepared for the Preferred Alternative to expand on the qualitative analysis previously prepared for the project. The *Indirect and Cumulative Effects Assessment* (HNTB, January 2009), hereinafter referred to as the *Qualitative Indirect and Cumulative Effects Assessment* is summarized in Section 7 of the Draft EIS and is available in its entirety in **Appendix G**, and on the NCTA Web site ([www.ncturnpike.org/projects/monroe](http://www.ncturnpike.org/projects/monroe)). Agency comments on the Draft EIS raised the following issues related to indirect and cumulative effects: water quality, threatened and endangered species, the extent of land use changes, and air quality.

The *Monroe Connector/Bypass (R-3329/R-2559 Indirect and Cumulative Effects Quantitative Analysis* (Michael Baker Engineering, Inc., April 2010), is included in its entirety as **Appendix H**, and is also available on the NCTA Web site. The report is hereinafter referred to as the Quantitative Indirect and Cumulative Effects Analysis. It addresses changes in land use and associated impacts to watershed percent impervious surfaces, threatened and endangered species, and wildlife habitat.

The scope of the analysis in the report was developed with agency review and input. MUMPO is in the process of addressing air quality through the regional air quality conformity analysis and a separate water quality modeling analysis was prepared as discussed below in **Section 2.5.5.2**.

The Quantitative Indirect and Cumulative Effects Analysis considered the three scenarios defined in **Table 2-12**. An additional scenario also was studied, the 2030 Preferred Alternative without the US 601 Interchange; however, the results for this scenario are not included because the project will not be constructed without the US 601 interchange.

**TABLE 2-12: Scenarios Considered in the Quantitative ICE Analysis**

Alternative	Definition
Baseline Condition*	Conditions existing in 2007
2030 No Build Alternative**	Conditions anticipated for year 2030 without construction of the Preferred Alternative
2030 Preferred Alternative	Conditions anticipated for year 2030 with construction of the Preferred Alternative

\*The year 2007 was selected for the Baseline condition because it is the closest year to the two main elements incorporated to the land use: parcel data from 2008 and aerial photography from 2007. North Carolina Gap Analysis Project data is also a large component of the data and is from 1992; however, it was only used to describe natural land use categories, which are less likely to change dramatically (e.g., from forest to grassland or vice versa). \*\*The year 2030 was selected for the Future condition for consistency with the Draft EIS qualitative ICE assessment and for compatibility with the forecasts.

**Study Area.** In establishing the study area for the Quantitative Indirect and Cumulative Effects Analysis, the FLUSA used for the Qualitative Indirect and Cumulative Effects Analysis presented in the Draft EIS (Figure 7-1) was expanded to include all of the Goose Creek watershed, which contains designated critical habitat for the federally endangered Carolina heelsplitter (*Lasmigona decorata*). The FLUSA for the Quantitative Indirect and Cumulative Effects Analysis, as depicted in **Figure 2-8**, is the area within which the Preferred Alternative has the potential to affect the resources that were analyzed (water quality, threatened and endangered species, and land use). Watersheds within the FLUSA are shown in **Figure 2-9**.

The FLUSA includes several municipalities: Charlotte, Monroe, Matthews, Stallings, Indian Trail, Weddington, Wesley Chapel, Hemby Bridge, Fairview, Unionville, Wingate, Mint Hill and Marshville. As shown in **Table 2-13**, these municipalities and Mecklenburg and Union Counties have experienced extensive growth since 1990.

**TABLE 2-13: Growth in the Study Area, 1990 to 2008**

Municipality	1990 Population	2000 Population	2008 Population	% Increase from 2000 to 2008
Charlotte	395,934	540,828	683,541	26
Monroe	16,567	26,228	37,280	42
Matthews	13,651	22,127	28,634	29
Mint Hill	11,567	14,922	20,748	39
Weddington	3,803	6,696	14,420	115
Hemby Bridge	2,876	897	1,921	114
Wingate	2,821	2,406	4,255	77
Stallings	2,132	3,189	12,345	287
Marshville	2,020	2,360	3,090	31
Indian Trail	1,942	11,905	26,954	126
Fairview	1,830	2,495	5,105	105
Wesley Chapel	NA	2,549	6,299	147
Unionville	NA	4,797	7,754	62
<b>County Population</b>				
Mecklenburg	511,433	695,454	877,007	26
Union	84,211	123,677	191,108	55

Source: Population data for 1990 and 2000 are from the US Census and the 2008 population estimate was obtained from the North Carolina State Demographics Unit (NCSDU).

**Project Approach.** The Quantitative Indirect and Cumulative Effects Analysis closely followed the 2001 guidance developed by NCDOT and NCDENR entitled *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, Volume II: Practitioner's Handbook* (November 2001), hereinafter referred to as *ICE Guidance*. The *ICE Guidance* provides the following eight steps that should be taken to thoroughly assess indirect and cumulative effects:

- Step 1: Definition of the FLUSA
- Step 2: Identification of the FLUSA's Direction and Goals
- Step 3: Inventory of Notable Features
- Step 4: Identification of Important Impact-Causing Activities
- Step 5: Identification and Analysis of Potential Indirect/Cumulative Effects
- Step 6: Analyze Indirect/Cumulative Effects
- Step 7: Evaluate Analysis Results
- Step 8: Assess the Consequences and Develop Appropriate Mitigation and Enhancement Strategies

For the Draft EIS, NCTA completed Steps 1 through 5, culminating in a qualitative assessment of indirect and cumulative effects. The analysis in the Quantitative Indirect and Cumulative Effects Analysis builds on the data, research and findings of the qualitative analysis to complete Steps 6 and 7 of the analysis process. The Quantitative Indirect and Cumulative Effects Analysis does not include assessment of mitigation and enhancement strategies (Step 8). This final, more qualitative step is anticipated to be completed within the context of all impacts assessed in this Final EIS and after further agency coordination.

The Quantitative Indirect and Cumulative Effects Analysis began with background research, proceeded with interviews of municipal and county planners whose jurisdiction overlapped the FLUSA, and continued with follow-up interviews as necessary. Local governments provided GIS data, when available, and documents that included information on land use, zoning, new developments, updated plans, and water and sewer service. All of this information was used to develop the existing and future land use data.

Interviews. For the Qualitative Indirect and Cumulative Effects Assessment, interviews were conducted in 2008 with planners whose jurisdiction overlapped the FLUSA (e.g., the Council of Government (COG) and city planning department representatives). For the Quantitative Indirect and Cumulative Effects Analysis, members of the project team conducted interviews with the same organizations in August 2009, with follow-up questions if necessary. For each interview, **Table 2-14** lists the organization that was the focus of the interview, the individual respondents, and the dates of contact.

**TABLE 2-14: List of Interviews Completed in August 2009**

Organization	Respondents	Date of Interview
Town of Wingate	Dryw Blanchard - Planning Director	August 12 and 25, 2009, via email exchange
Centralina COG	Bill Duston - Director Centralina COG Jana Finn - Marshville and Fairview Land Use Administrator Nadine Bennett - Former Unionville Land Use Administrator	August 17, 2009
Town of Matthews	Kathi Ingrish - Planning Director	August 18, 2009
Union County Planning	Dick Black - Director Lee Jenson - Land Use Administrator Cynthia Mabry - GIS Specialist	August 18, 2009
Town of Marshville	John Munn - Interim Planning Director	August 19, 2009
Town of Indian Trail	Shelly DeHart - Planning Director	August 19, 2009
Town of Mint Hill	Lee Bailey - Planning Director	August 21, 2009
Charlotte – Mecklenburg Planning	Garet Johnson - Assistant Director, Land Range Planning Services & Strategic Planning Services	August 24, 2009

TABLE 2-14: List of Interviews Completed in August 2009

Organization	Respondents	Date of Interview
City of Monroe	Lisa Stiwinter - Interim Director of Planning Doug Britt - Senior Planner	August 24, 2009
Union County Public Works	Ed Goscicki - Director Amy Helms - Asst. Director, Infrastructure and Development Mike Garbarak - Asst. Director, Engineering Scott Huneycutt - Asst. Director, Water	August 24, 2009
Town of Stallings	Brian Matthews - Town Manager Lynne Hair - Planning Director	August 27, 2009

Each interview began with an introduction of the study and its goals. A map of the FLUSA was provided to facilitate communication. The purpose of the interviews was to identify changes to future land use scenarios since the 2008 interviews for the *Qualitative ICE*, gather additional information on the expanded FLUSA (i.e., Goose Creek watershed area), and gather any new or updated databases or GIS data that would be useful to the analysis. Requested data included:

- Approved developments
- Updated zoning
- Information on current stream buffer or other environmental protection areas
- Water and sewer utility information
- Water and sewer priority areas
- Future land use forecasts and/or GIS data
- Existing land use (GIS data preferred)
- Approved population and employment forecasts and anticipated variations from forecasts with each land use scenario.

Prior to the discussion, staff provided a list of the questions to the respondents. Appendix A of the Quantitative Indirect and Cumulative Effects Analysis contains complete minutes from all of the interviews. Several common outcomes occurred among the interviews:

- Often, zoning maps provided the best current land use, while land use plans provided the best future land use.
- A number of the land use plans were in the process of being updated and were not yet available for this study. Older land use plans tended not to include the Monroe Connector/Bypass, while the updated plans usually included the project.
- In every case, respondents said that their long-term population growth expectations (to 2030) had not changed since the 2008 interviews, but they expected slower growth in the near term due to the economic recession.
- Much of the growth depends on expanded water and sewer service, but respondents generally assumed these would be built within 10-15 years.
- The Traffic Analysis Zone (TAZ)-level forecasts of households and employment were generally considered to be reasonable for broader areas (i.e., municipalities), but less accurate for specific areas (i.e., section of town or major road intersection). A TAZ is the unit of geography most commonly used in conventional transportation planning models. The zones are developed using socio-economic information from the US Census.

- Respondents reported very few zoning violation enforcement issues; however, they noted that natural resource protection (e.g., stream buffer enforcement at Goose Creek) was considered to be a responsibility of the State.

Based on the interviews, the existing land use plans for Monroe (except for the Rocky River Corridor), Marshville, Matthews, Mint Hill, Stallings, Wingate, Centralina COG, and Charlotte-Mecklenburg do not include the Monroe Connector/Bypass. The land use plan for Indian Trail includes the project, and plans for Union County include the Monroe Connector/Bypass, but do not include surrounding land use changes associated with the project. The City of Monroe has developed a supplemental plan for the Rocky River Corridor that includes the Monroe Connector/Bypass. The land use plans and zoning for Monroe, Matthews, and Union County are currently being updated and will include the Monroe Connector/Bypass.

Assumptions Used in the Land Use Analysis. Specific analytical assumptions that shaped the quantitative land use analysis include the following:

1. Regional TAZ forecasts for 2030 households (i.e., number of dwelling units) and employment (i.e., number of jobs) served as the primary sources of data for developing the 2030 No Build land use estimate. (TAZs are smaller in size than watersheds or jurisdictions and thus provide a relatively small-scale geography for applying control totals.) These forecasts were developed mid-decade through a cooperative process with the MUMPO jurisdictions based on current land use plans and were adopted in 2008; they are the most recent regional, adopted forecasts, and they generally represent the No Build land use scenario for this analysis.
2. TAZ household forecasts were translated to residential acres based on low, medium and high density residential categories representing 2, 2-5, and 5 or greater dwelling units per acre, respectively. These densities were derived from the Soil Conservation Service (SCS) TR-55 Manual (SCS, 1986), which is the basis for impervious surface analysis.
3. TAZ employment forecasts were translated to acres of commercial or industrial land use based on densities from the FHWA Social Cost of Alternative Land Development Scenarios (SCALDS) model.
4. TAZ forecasts for the 2030 No Build scenario were allocated based on existing land use plans and zoning, except where higher density land use assumptions were required in order to accommodate the forecasted land use within the TAZ boundary.
5. Where forecasted land use was less than full build-out for any TAZ, the distribution of forecasted development within the TAZ was based on a proportional build-out of all undeveloped parcels within the TAZ, rather than full build-out of particular parcels.
6. 2030 land use changes associated with the Preferred Alternative include interchange-area development and residential development.
7. Interchange-area development was based on a combination of land use plans, planner interviews, and build-out analysis as informed by the “Hartgen” method of rural interchange analysis, which considers several factors that are associated with different levels and types of interchange area development.
8. Residential development was estimated to increase in amount and/or density in areas that:
  - a. Would have markedly increased accessibility with the Build Alternative
  - b. Would be served by water and/or sewer service

- c. Were identified through planning interviews and/or planning documents as being likely receptors for increased growth with the Build Alternative.
9. The redistribution of residential development in the 2030 Preferred Alternative scenario does account for the replacement of low density residential development in the 2030 No Build condition by the Preferred Alternative corridor and interchange area development, but does not account for broader, regional redistribution of residential growth that may offset the net increase in households that is projected in the Preferred Alternative residential development analysis. From a regional perspective, it appears likely that some reductions would occur, most likely in the areas that do not show much change in accessibility with the Build scenario.

Changes in the amount of impervious surface throughout the FLUSA and within each watershed were used to analyze potential effects to certain resources, including water quality, the Carolina heelsplitter, and aquatic habitat. In order to determine the amount of induced impervious surface, each land use category was assigned an assumed level of impervious surface. This step of the analysis followed guidance in the Soil Conservation Service (SCS) TR-55 Manual (SCS, 1986), as shown in **Table 2-15**. The SCS TR-55 Manual is widely used for drainage studies and runoff calculations.

**TABLE 2-15: Percent Impervious Surface**

Land Use Category	% Impervious
Commercial	85
Industrial/Office/Institutional	70
High Density Residential	38
Medium Density Residential	25
Low Density Residential	20
Transportation	100
Agricultural and Natural	0

Source: SCS TR-55 Manual, 1986

A complete description of the project approach used in the land use analysis can be found in Section 3 of the Quantitative Indirect and Cumulative Effects Analysis.

**Definitions.** The following definitions were applied for direct, indirect, and cumulative impacts. Direct effects are caused by the proposed action and generally occur at the same time and place as the project.

Indirect effects ...”are caused by the action and are later in time and farther removed in distance, but must be reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 CFR 1508).

For water quality, land use, and wildlife habitat, cumulative effect is “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

As stated in USFWS guidance for implementing Section 7 of the ESA, cumulative effects “are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR 402.02). Examination of federal projects included review of actions associated with funding from the US Department of Housing and Urban Development (HUD), specifically the Community Development Block Grant (CDBG); expenditures of federal highway funds; stimulus funds from the American Recovery and Reinvestment Act of 2009 (ARRA); and other actions that require federal permits.

**Limitations of Analysis.** As with any attempt to forecast future growth or development, there are limitations to the accuracy and certainty of the results of these analyses. Most of these analyses rely on the land use forecasts developed using recommended methods as described in the *ICE Guidance* (NCDOT & NCDENR, 2001a). Specifically, the land use forecasts rely on the socioeconomic forecasts developed by MUMPO, and therefore the results are only as accurate as those forecasts. The methods used to distribute land use effects are based on reasonable assumptions to produce a valid comparative analysis, but these methods also result in high, conservative estimates of effects.

**Summary of Direct and Indirect Effects.** The direct effect to land use from the Build scenarios is calculated to be the conversion of 1,306 acres for the right of way of the Preferred Alternative.

Indirect effects are those caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. To determine the effects caused by the action, conditions predicted for the 2030 Preferred Alternative scenario were compared to conditions predicted for the 2030 No Build scenario. Through the analysis described in the previous section, including use of the TAZ forecasts and information from interviews and local plans, land use forecasts were made for the 2030 Preferred Alternative and 2030 No Build scenario, and these land use forecasts were used to predict percent impervious surfaces within the FLUSA as whole and within individual watersheds.

As shown in **Table 2-16**, overall differences in land use between the 2030 Preferred Alternative and 2030 No Build scenarios are small relative to the overall level of development expected in the FLUSA. The projected land use under the 2030 No Build Scenario compared to the Baseline (2007) is shown in **Figure 2-10**, while **Figure 2-11** shows a comparison of the projected 2030 land use between the 2030 Preferred Alternative and the 2030 No Build scenarios.

**Table 2-16** shows total changes in land use with both the 2030 No Build and the 2030 Preferred Alternative and the difference between those results. These results include both the direct (for the 2030 Preferred Alternative) and indirect effects to provide a more complete calculation of the differences between the No Build and Build scenarios.

**TABLE 2-16: Changes in Land Use Comparison**

Land Use Category	2030 No Build		2030 Preferred Alternative		Difference from 2030 No Build (acres)	% Difference from 2030 No Build
	Total Area (acres)	% of Total Area	Total Area (acres)	% of Total Area		
Total Residential	97,900	49	97,500	48	-400	<1↓
<i>Low Density</i>	81,300	40	80,100	40	-1,200	<1↓
<i>Medium Density</i>	13,600	7	14,300	7	700	<1↑
<i>High Density</i>	3,100	2	3,000	2	<100*	<1↓

TABLE 2-16: Changes in Land Use Comparison

Land Use Category	2030 No Build		2030 Preferred Alternative		Difference from 2030 No Build (acres)	% Difference from 2030 No Build
	Total Area (acres)	% of Total Area	Total Area (acres)	% of Total Area		
Commercial	4,800	2	5,100	3	200	<1↑
Industrial/Office/Institutional	8,500	4	8,700	4	100	<1↑
Transportation	12,900	6	13,900	7	1,000**	1↑
<b>Total Developed</b>	<b>124,200</b>	<b>61</b>	<b>125,200</b>	<b>62</b>	<b>1,000</b>	<b>1↑</b>
<b>Total Agricultural</b>	<b>37,800</b>	<b>19</b>	<b>37,200</b>	<b>18</b>	<b>-600</b>	<b>1↓</b>
<b>Total Forested</b>	<b>38,200</b>	<b>19</b>	<b>37,700</b>	<b>19</b>	<b>-400</b>	<b>&lt;1↓</b>
<b>Total Other</b>	<b>1,800</b>	<b>1</b>	<b>1,800</b>	<b>1</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>	<b>202,000</b>	<b>100</b>	<b>202,000</b>	<b>100</b>		

Notes: The numbers in the far right column show the net differences in acres that are predicted for the Preferred Alternative scenario as compared to the No Build scenario in 2030 throughout the FLUSA. Results have been rounded to the nearest 100 acres. Differences were calculated prior to rounding. \* The difference in high density residential acres is less than 20 acres but does produce a change in rounding, so the change is represented as <100 acres to provide consistency in reporting results. \*\* The direct effect of the Preferred Alternative is approximately 1,300 acres, which accounts for the change in transportation land use.

Based on this analysis, differences in land use between the 2030 Preferred Alternative and 2030 No Build scenarios are small relative to the overall level of development in the Study Area. Total additional developed land is approximately 1,000 acres, less than one percent of all land in the FLUSA. Transportation (i.e., the Preferred Alternative itself) accounts for the primary difference in acres of land use from the No Build scenario to the 2030 Preferred Alternative scenario.

The 2030 Preferred Alternative scenario is expected to include approximately 200 additional commercial acres, approximately 100 additional acres of industrial/office/institutional development, approximately 700 additional acres of medium-density residential development, approximately 100 additional acres of high-density residential development, and approximately 1,200 fewer acres of low-density residential development in the FLUSA as compared to the 2030 No Build scenario. Agricultural and forested lands decrease by 600 and 400 acres, respectively, as a result of the additional developed land. These additional changes represent a one percent and less than one percent greater decrease, respectively, as compared to the 2030 No-Build condition.

Most of this induced development is expected within approximately one mile of the interchanges, as shown in **Figure 2-11**. This development pattern would result from accessibility improvements that are most marked around the interchanges and because local land use policy and the lack of access to sewer service, particularly north of the project in Unionville, are not conducive to additional land development or increases in density further away from the interchanges.

Associated with the increase in developed acreage is a decrease in vegetated land cover. With the 2030 Preferred Alternative scenario, agricultural and forested lands decrease more than with the 2030 No Build scenario by 600 acres and 400 acres, respectively. These additional changes represent a one percent decrease and less than one percent decrease, respectively, as compared to the No Build scenario.

Table 2-17 shows total changes in percent impervious cover for the 2030 No Build and the 2030 Preferred Alternative scenarios, as well as the differences between those results.

**TABLE 2-17: Comparison of Percent of Impervious Cover**

Watershed Name	2030 No-Build Impervious Cover (%)	2030 Preferred Alternative Impervious Cover (%)	Difference (%)
<b>STUDY AREA</b>	<b>22</b>	<b>22</b>	<b>&lt;1↑</b>
Beaverdam Creek	7	7	No Change
Richardson Creek (Upper)	18	18	No Change
Rays Fork	16	17	1↑
Bearskin Creek	31	31	No Change
Richardson Creek (Middle)	27	29	2↑
Gourdvine Creek	8	8	No Change
Salem Creek	13	14	1↑
Six Mile Creek	30	30	No Change
Twelve Mile Creek	25	22	No Change
Richardson Creek (Lower)	15	16	1↑
Stewarts Creek	20	22	2↑
Four Mile Creek	34	34	No Change
Crooked Creek	26	27	2↑
Goose Creek	17	17	No Change
Ivins Creek	37	37	No Change
McAlpine Creek	37	37	No Change
Bakers Branch	8	8	No Change
Wide Mouth Branch	12	12	No Change

Note: The numbers in the far right column show the net differences in percent impervious cover that are predicted for Preferred Alternative scenario compared to the No Build scenario in 2030. Results have been rounded to the nearest whole percent. Differences were calculated prior to rounding. Calculations are based on percentages of impervious surface per land use category provided in the SCS TR-55 Manual (SCS, 1986).

With respect to impervious surfaces (**Table 2-17**), results indicate that the 2030 Preferred Alternative scenario will increase the percentage of the FLUSA covered by impervious surfaces by less than one percent more than with the 2030 No Build scenario. For individual watersheds, increases are found in six of the 18 FLUSA watersheds (Rays Fork, Richardson Creek - Middle, Salem Creek, Richardson Creek - Lower, Stewarts Creek, and Crooked Creek). All six of these watersheds would experience an increase in impervious surface of one or two percent. The 2030 Preferred Alternative has no measurable difference in effects on the amount of impervious surface in the remaining 12 watersheds, including the Goose Creek watershed.

The summary of differences provided above highlights the incremental effect of the Preferred Alternative. These are the effects expected to occur by 2030 with construction of the Preferred Alternative that are greater than those expected to occur with the No Build scenario.

**Summary of Cumulative Effects.** For analysis of cumulative impact, the incremental effects were examined in light of additional reasonably foreseeable effects in the FLUSA. While total amounts of effects (e.g., acreages, percentages, or miles change in forest edge) are presented in the Quantitative Indirect and Cumulative Effects Analysis, actual cumulative effects attributable to the Monroe Connector/Bypass only equal the results from the “incremental impact” of this project. The totals are presented to provide context and to help determine whether or not the direct and indirect effects attributable to the project make the total of all reasonably foreseeable effects reach a threshold at which new or additional adverse effects may occur.

With respect to other reasonably foreseeable future projects, the incremental effects of the 2030 Preferred Alternative are generally one percent greater than the effects associated with the 2030 No Build. Greater differences can be found with examination of results for individual watersheds, but no measureable differences in development or impervious surface were found in the Goose Creek watershed. Very little change in the 2030 scenario can be attributed to federal projects (less than 100 acres of additional developed land cover). Therefore, the cumulative totals of change to land use, percent impervious surface, or changes in habitats are not likely to be pushed past a threshold with the added consideration of other reasonably foreseeable future federal projects.

The following sections summarize the incremental effects attributable to the Monroe Connector/Bypass for each of the issues addressed in the Quantitative Indirect and Cumulative Effects Analysis. For analysis of incremental effects to certain individual resources (e.g., endangered species and wildlife habitat), it was necessary to consider multiple land use categories. Grouping of categories was based on best professional judgment of areas that would most likely encompass the resources.

*Water Quality and Carolina Heelsplitter.* With regard to percent impervious cover as an indicator for water quality effects and effects to aquatic species, including the endangered Carolina heelsplitter, findings show no measurable difference in percent impervious cover between the 2030 Preferred Alternative and 2030 No Build for the FLUSA as a whole (**Table 2-17**). For individual watersheds with the 2030 Preferred Alternative, findings show no difference for 12 of the 18 watersheds, including Goose Creek. For the remaining six watersheds, a one to two percent difference between the 2030 Preferred Alternative and the 2030 No Build was found.

From a cumulative effects standpoint, the threshold of concern for impervious surfaces for this project is a total of more than six percent impervious surface within any given watershed (NCWRC, 2002). For all but Goose Creek, this is a conservative threshold, as six percent is the level recommended by the North Carolina Wildlife Resources Commission (NCWRC) for watersheds that contain threatened or endangered mussel species. For other watersheds, NCWRC recommends ten percent, but for the purposes of this report the six percent level was used.

The Preferred Alternative scenario does not cause an increase over this threshold. All watersheds except Beaverdam and Baker's Branch are estimated to be over the six percent threshold in the Baseline condition. These two watersheds are estimated to exceed the six percent threshold in the 2030 No Build scenario at seven percent and eight percent, respectively. The percent impervious surface estimated for these watersheds with the Preferred Alternative are the same as the 2030 No Build; thus, the incremental effects of the 2030 Preferred Alternative do not appear to produce a negative cumulative effect on water quality. The results of a more detailed water quality modeling analysis are presented below in **Section 2.5.5.2**.

*Other Endangered Species.* The Quantitative Indirect and Cumulative Effects Analysis considers the species listed as federally-endangered that occur in Mecklenburg and/or Union Counties: Carolina heelsplitter (addressed in the previous section with water quality), Michaux's sumac (*Rhus michauxii*), Schweinitz's sunflower (*Helianthus schwieinitzii*), and smooth coneflower (*Echinacea laevigata*). The *Biological Assessment for the Monroe Connector-Bypass Project (R-3329/R-2559)* (The Catena Group, May 2010) indicates a biological conclusion of No Effect for both Michaux's sumac and smooth coneflower (see **Section 2.5.4.5**) due to the absence of these species in the FLUSA. For Schweinitz's sunflower, the Biological Assessment found the

potential for indirect and cumulative effects to four populations in the FLUSA.

Cumulative effects to Schweinitz's sunflower were addressed through examining the conversion of land cover presumed to be suitable habitat for the species to developed land cover. The species is known to exist in recently disturbed habitats of various types, including several NCGAP habitat types in addition to utility and road rights of way. Investigation of suitable habitat within forest gaps was beyond the scope of this analysis. In addition, though the sunflower is an opportunistic species that can colonize disturbed areas and may eventually inhabit some of the lands converted to developed land use, such land use categories were not included in the analysis to present a more conservative estimate of the amount of suitable habitat loss.

Results of the analysis found an approximately one percent incremental decrease in potential suitable habitat for the Schweinitz's sunflower. With the 2030 No Build scenario, there is an estimated 30 percent decrease in land cover types presumed to provide suitable habitat for the sunflower, compared to an estimated 31 percent decrease with the 2030 Preferred Alternative scenario.

*Land Use and Farmland Conversion.* With the exception of approximately 100 acres of land cover converted to transportation land use as a result of federal projects, cumulative land use totals are presented in **Table 2-16**. As indicated in the summary of that data, the 2030 Preferred Alternative scenario is predicted to have less than one percent incremental increase in total developed land uses. However, the composition of the total additional development is different between the 2030 Preferred Alternative and No Build scenarios. With the 2030 Preferred Alternative scenario, there is more medium density residential, commercial, and industrial/office/institutional growth, such that the increase in low density residential development is six percent less than that with the 2030 No Build (79 percent of the total predicted cumulative development with the Preferred Alternative versus 85 percent with the No Build).

The 2030 Preferred Alternative scenario is also predicted to convert 600 acres of agricultural land to low-density residential or other developed uses, as shown in **Table 2-16**. This represents a less than one percent greater conversion than that predicted with the 2030 No Build scenario for farmlands in the FLUSA.

*Wildlife Habitat.* With respect to terrestrial habitat, the 2030 Preferred Alternative scenario is predicted to convert an approximately one percent greater amount of undeveloped vegetated land in the FLUSA as compared to the conversion predicted for the No Build scenario. Measurable differences are anticipated in Richardson Creek (Lower) and Crooked Creek, which each show a 200-acre greater decrease with the 2030 Preferred Alternative scenario. The 2030 Preferred Alternative scenario shows no measurable difference from the 2030 No Build scenario with respect to land cover types that are presumed to encompass jurisdictional and non-jurisdictional wetlands. These results are shown in Table 27 of the Quantitative Indirect and Cumulative Effects Analysis.

The effect to potential aquatic habitat is inferred from the effect to water quality (discussed above). With regard to percent impervious cover as an indicator for effects to water quality and thus aquatic habitat, findings show no measurable difference in percent impervious cover between the 2030 Preferred Alternative and 2030 No Build scenarios for the FLUSA as a whole. Findings also show only as much as a one percent incremental effect with either Build scenario within any individual watershed, except for Stewarts Creek, Richardson Creek (Middle) and Crooked Creek, which will each have a two percent incremental effect with the Build scenarios (**Table 2-17**).

With increased development in the midst of previously contiguous vegetated patches, fragmentation of habitat increases. This can affect some species that require large patches of habitat; and the increase in edge between different types of habitat, such as forested and residential areas, can cause an increase in encounters (such as vehicle crashes) that hurt wildlife populations. In order to address fragmentation of forested habitat, a patch analysis was conducted by measuring the amount of edge between forested patches and developed patches in the Baseline and future conditions. The results are shown in Table 28 of the Quantitative Indirect and Cumulative Effects Analysis. With respect to forest fragmentation, the 2030 Preferred Alternative scenario shows an estimated one percent decrease in miles of edge between forested and developed areas as compared to the No Build. This incremental effect is a result of greater contiguous build-out (resulting in less fragmentation) from infill development, particularly in proposed interchange areas, and therefore does not represent a notable effect.

With conditions predicted for the year 2030 the Preferred Alternative is predicted to have incremental effects relative to the No Build Alternative that generally fall within a range of one percent difference. Greater differences can be found with examination of results for individual watersheds, but no measureable differences in development or impervious surface were found in the Goose Creek watershed.

### 2.5.5.2 Water Quality Modeling

A water quality modeling analysis was conducted to determine if induced land use change resulting from the Preferred Alternative would affect water quality within the project study area. Specifically, the modeling effort attempted to quantify the differences between the stream flow and pollutant loadings (total sediment, nitrogen, and phosphorous) of the Build and No Build future land use scenarios. The results of the analysis generally suggest that the water quality effects of the project are relatively minor compared to those expected from natural growth. Details of these findings can be found in the *Monroe Connector/Bypass (R-3329/R-2559) Indirect and Cumulative Effects Water Quality Analysis* (PBS&J, April 2010) which is included in its entirety as **Appendix I** and is also available on the NCTA Web site ([www.ncturnpike.org](http://www.ncturnpike.org)). The results of this analysis will be used in the permitting process.

The water quality analysis was performed by constructing watershed models for portions of eighteen 14-digit hydrologic units (HUs) (also referred to as catchments) composing the FLUSA using the ArcView Generalized Watershed Loading Functions (AVGWLF) modeling suite. Model estimates of annual streamflow, runoff, and annual overland pollutant loadings of total nitrogen (TN), total phosphorus (TP), total suspended sediment (TSS), and fecal coliform (FC) loads produced from the three land use scenarios – Baseline Condition, 2030 No Build, and 2030 Build – were reviewed to assess the project effects. Specifically, model results of the 2030 No Build and Build scenarios were compared.

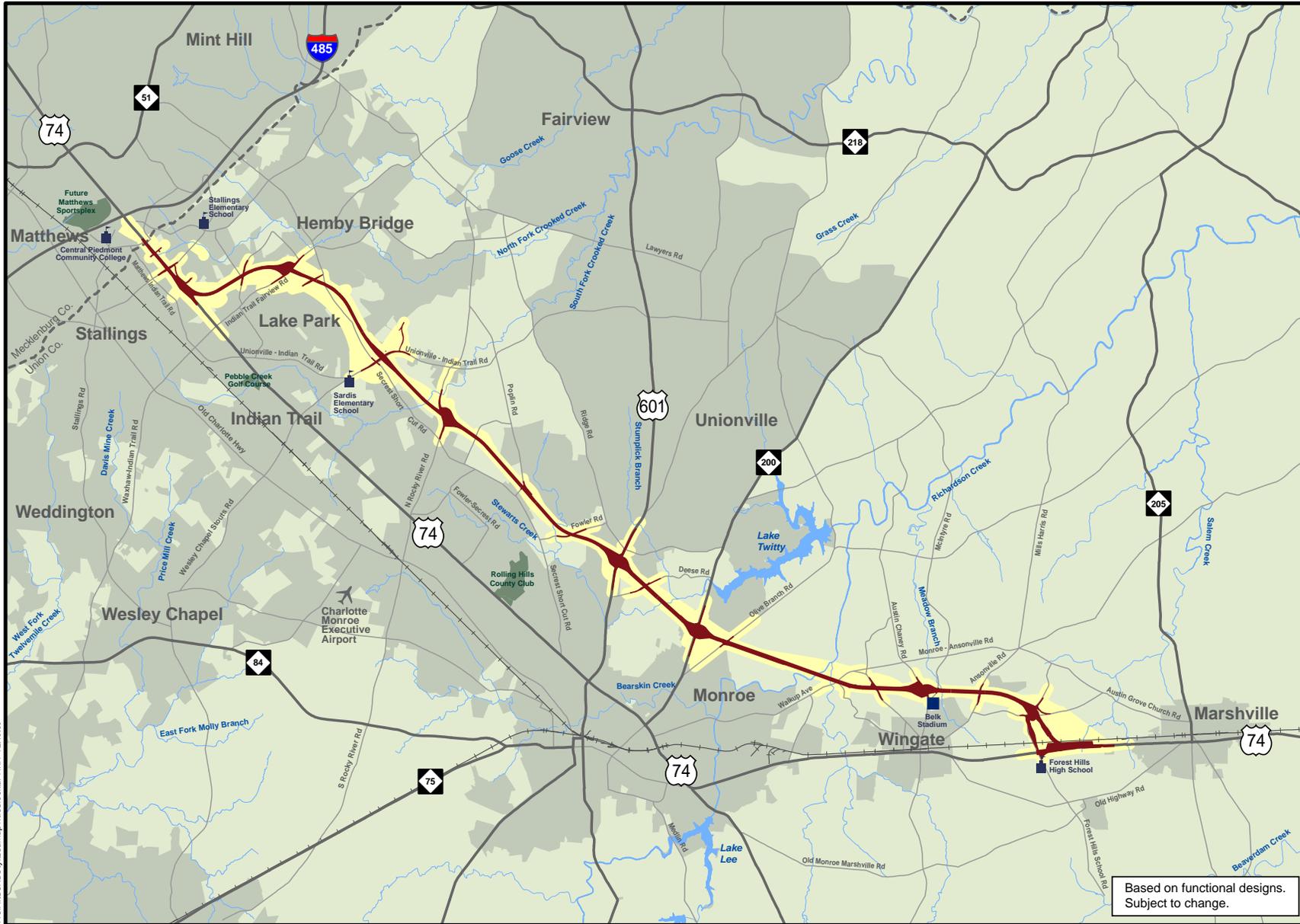
The water quality modeling was not conducted for the purpose of predicting the specific amount of pollutants delivered at the outlet of each modeled catchment. Rather, the aim of the analysis was to determine the magnitude of stream flow and pollutant change between the 2030 No Build and 2030 Build scenarios, which indicates the trend of water quality over time in each catchment and the FLUSA as a whole. Also, in terms of BMPs, the analysis only considered riparian buffers. No site-specific BMPs, such as – bioretention basins, stormwater ponds, grass swales, etc., are accounted for in the results. Consequently, the watershed model likely overestimates pollutant loadings from areas with treated stormwater. In reality, substantial reductions in pollutant loadings could be attained as future development takes place if existing BMP regulations are enforced and BMPs are constructed and maintained properly.

Results are discussed below in relation to all catchments in the FLUSA, catchments known to support populations of the endangered Carolina heelsplitter freshwater mussel, and catchments that contain 303(d)-listed streams.

For the FLUSA as a whole, minor increases in stream flow, runoff, and pollutant loadings are confined to the six catchments intersected by the Preferred Alternative: Crooked, Richardson (Middle), Rays Fork, Stewarts, Richardson (Lower), and Salem Creeks. Of these catchments, Stewarts had the largest change in development density between the No Build and Build scenarios. Stewarts also had the largest amount of new development between 2030 No Build and Build. However, Richardson Creek (Lower) would experience the largest percent increases in runoff (5.97 percent increase between 2030 No Build and Build scenarios), and pollutant loads because the development would largely take place in an urban portion of the catchment. Water quality in the remainder of the FLUSA (13 catchments) was found to be unaffected by the Preferred Alternative, as the estimated runoff, stream flow and pollutant loadings for the catchment remained unchanged between the 2030 No Build and Build scenarios.

Streams within the Goose Creek and Sixmile Creek watersheds are known to support populations of the endangered Carolina heelsplitter, a freshwater mussel, and as such, resource agencies are particularly concerned with potential impacts to these watersheds. In terms of this analysis, the effect of the project on these watersheds was determined by comparing the 2030 No Build and Build streamflow, runoff, and pollutant loadings. Neither watershed was found to be affected by the Preferred Alternative: in both cases, the 2030 No Build streamflows, runoff, and pollutant loads equal those of the 2030 Build scenario. This result was expected as the *Monroe Connector/Bypass (R-3329/R-2559 Indirect and Cumulative Effects Quantitative Analysis* (Michael Baker Engineering, Inc., April 2010) concluded no project induced growth would occur in the Goose Creek and Sixmile Creek watersheds.

Four of the catchments within the FLUSA contain streams on the North Carolina 303(d) list (NCDWQ 2006). The Preferred Alternative intersects three of these catchments: Crooked, Richardson (Middle), and Richardson (Lower) Creeks. In addition, interchanges are proposed in Crooked Creek (4 interchanges) and Richardson Creek (Lower) (1 interchange). The watershed model results for these three catchments indicate increased streamflow, runoff, and pollutant loads in the 2030 Build scenario compared to the 2030 No Build scenario. Richardson Creek (Lower) experiences the greatest increases for all modeled parameters; an observation explained by the fact that Richardson Creek (Lower) incurs the largest increase in high-density development per catchment area.

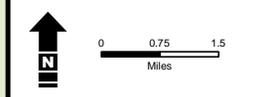


- Legend**
- Preferred Alternative Right of Way
  - Preferred Alternative Study Corridor
  - County Line
  - Lakes
  - Streams
  - Interstates & Highways
  - Local Roads
  - Railroad



Mecklenburg and Union Counties  
North Carolina Counties

Source: Mecklenburg County and Union County GIS  
Map printed: February 2010



STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR / BYPASS**

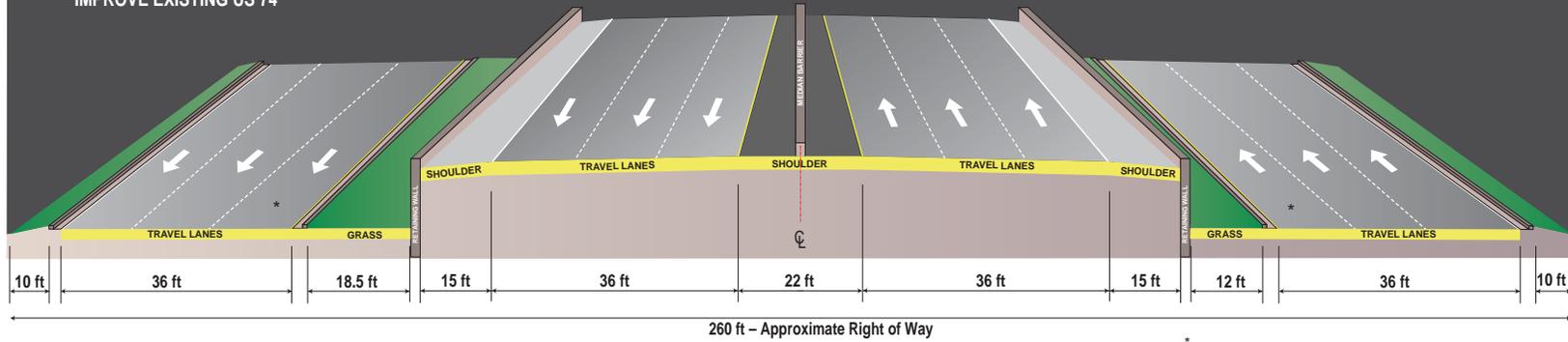
**PREFERRED ALTERNATIVE DSA D**

Based on functional designs.  
Subject to change.

Figure 2-1

Pre:ARSDSADStylizedMapTitleBlock\_AKH 12.19.09

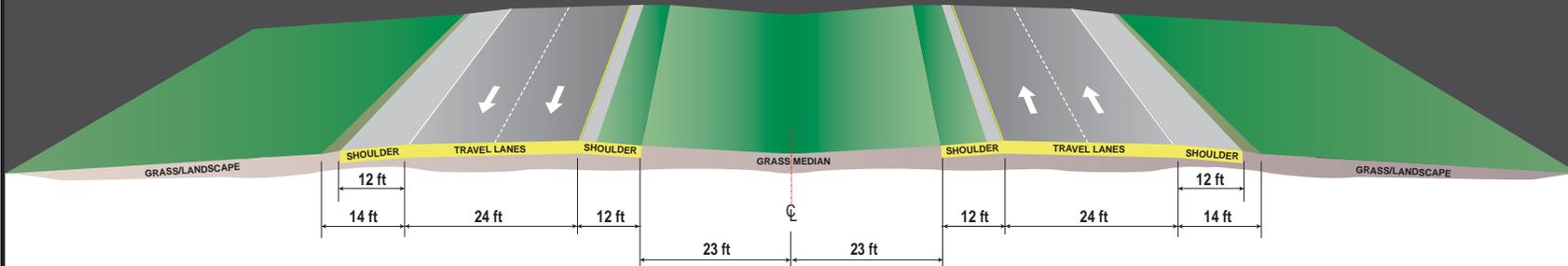
**TYPICAL SECTION No. 1  
IMPROVE EXISTING US 74**



260 ft – Approximate Right of Way

\* Areas with turn lanes or near access points will require three lanes on the service roads. Other areas will only have two lanes.

**TYPICAL SECTION No. 2  
NEW LOCATION**



300 ft – Approximate Right of Way

**↑**  
**N**  
**NOT TO SCALE**



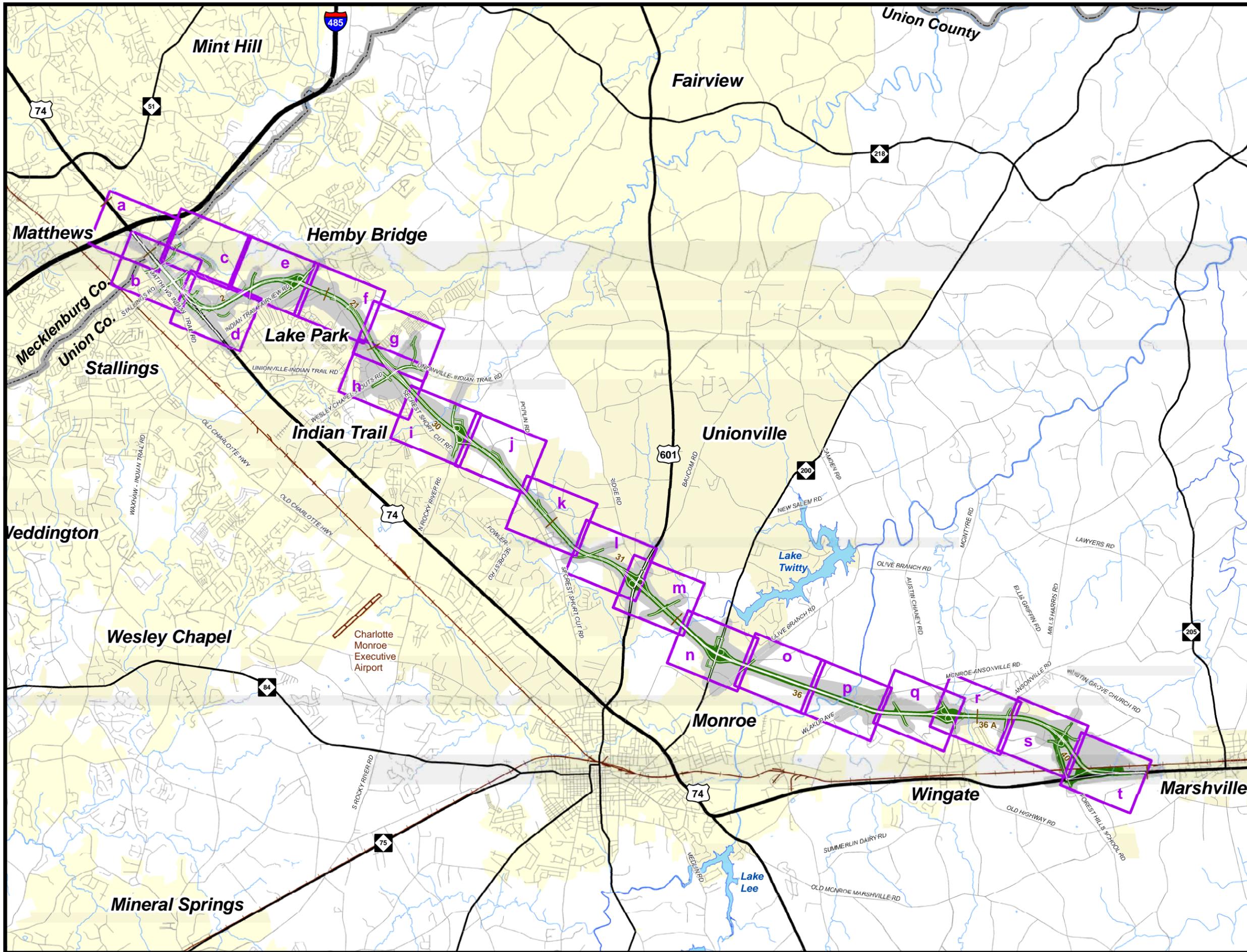
STIP PROJECT  
NO. R-3329/R-2559

Union County and  
Mecklenburg County

**MONROE CONNECTOR /  
BYPASS**

**NEW LOCATION  
ALTERNATIVE  
TYPICAL SECTION**

Figure 2-2

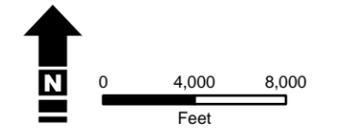


- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Map Grid
  - City Limits
  - Corridor Study Area
  - Interstate Highway
  - US Highway
  - NC State Highway
  - Major Road
  - Railroad
  - River / Stream
  - Lake
  - County Boundary



Mecklenburg and Union Counties  
North Carolina Counties

Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



STIP PROJECT  
NO. R-3329/R-2559

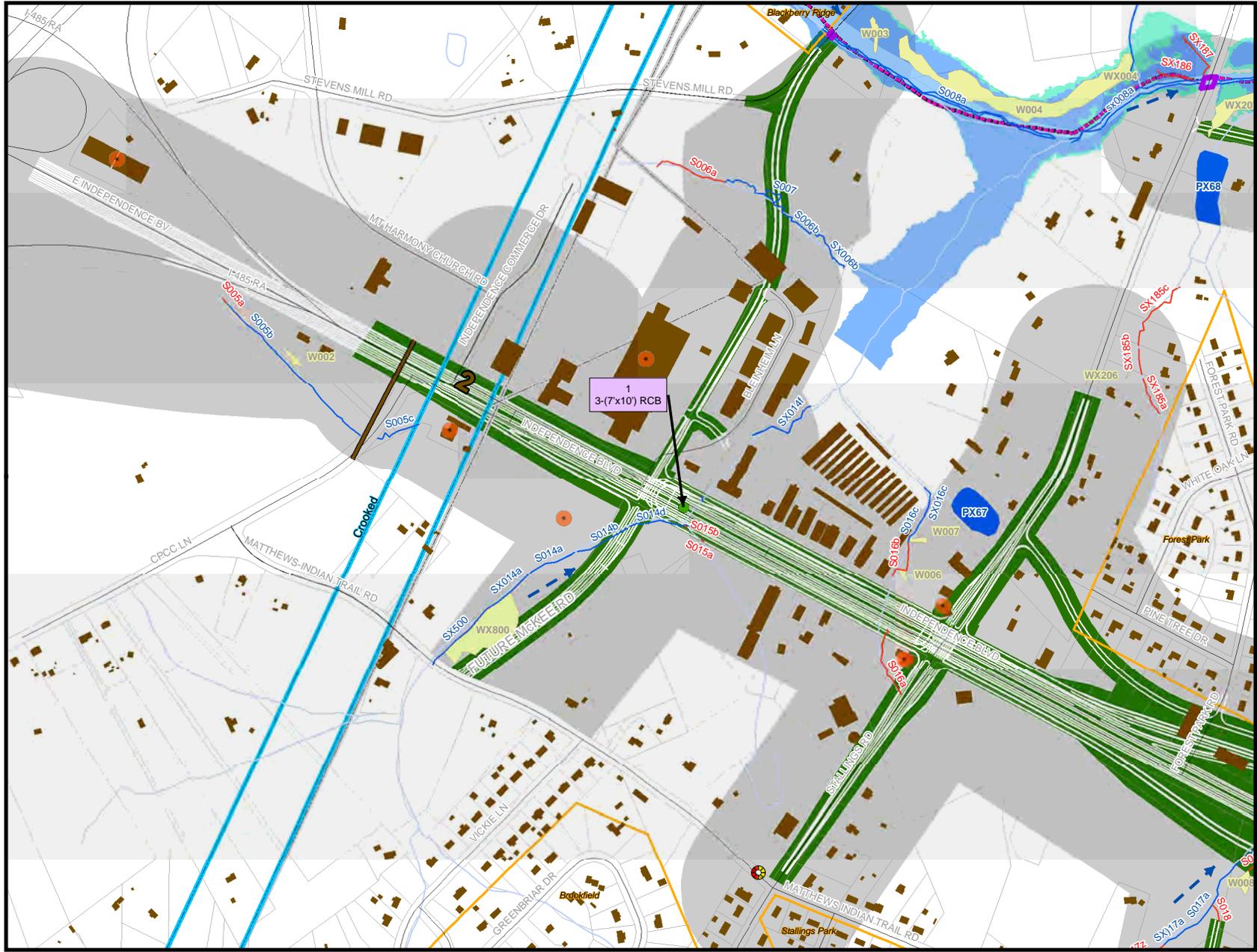
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

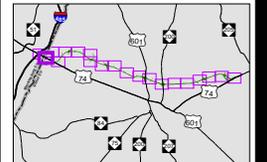
**PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

**Figure 2-3 INDEX**

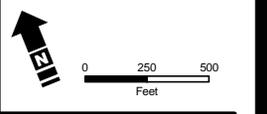




- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
  - Other Hydrology
  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



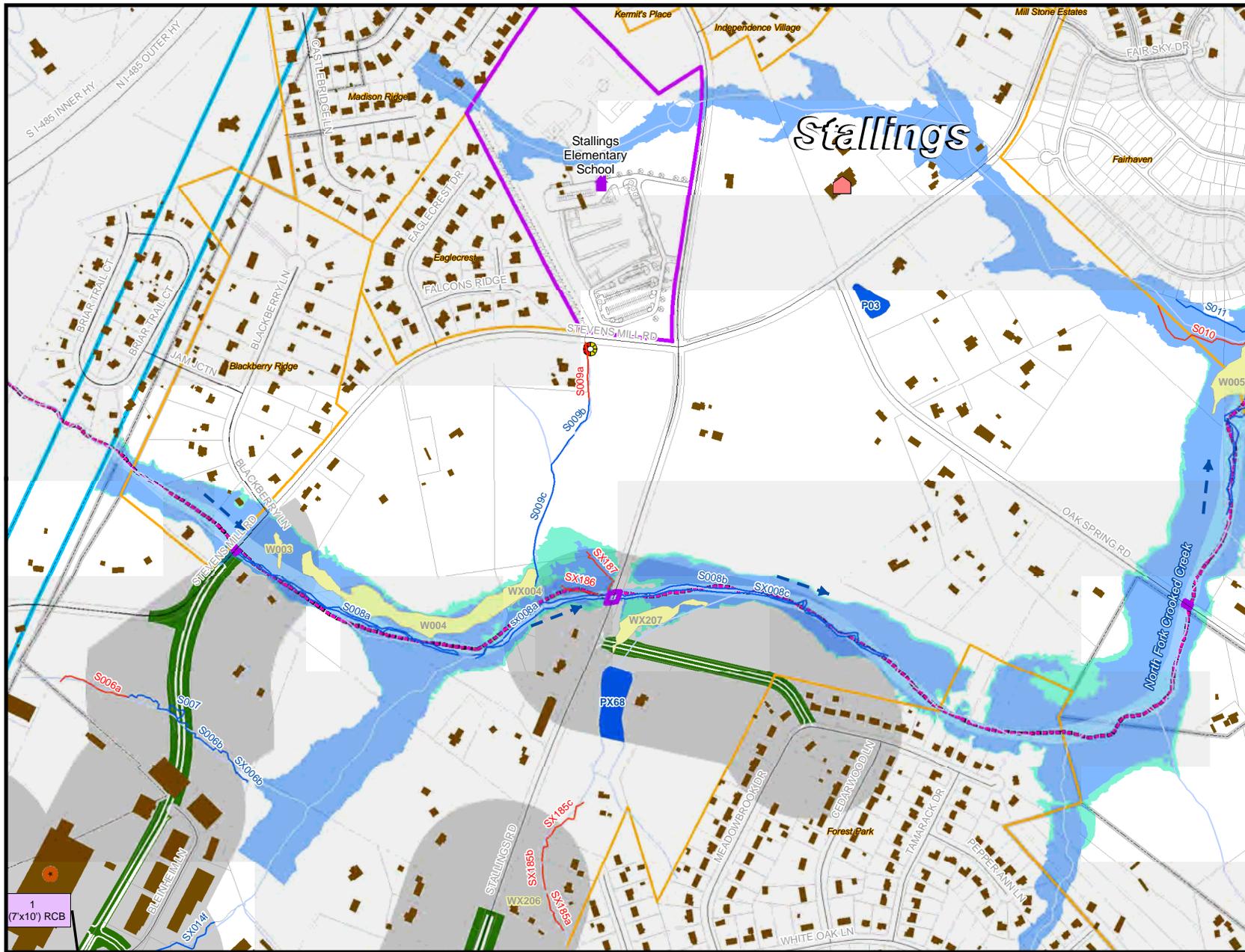
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

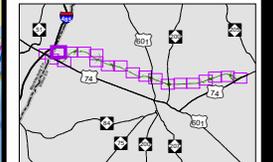
Mecklenburg County and Union County

**MONROE CONNECTOR/  
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PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

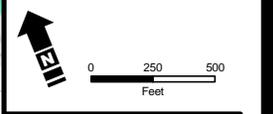
Figure 2-3b



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
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  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools
- Stream Crossings**
- Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

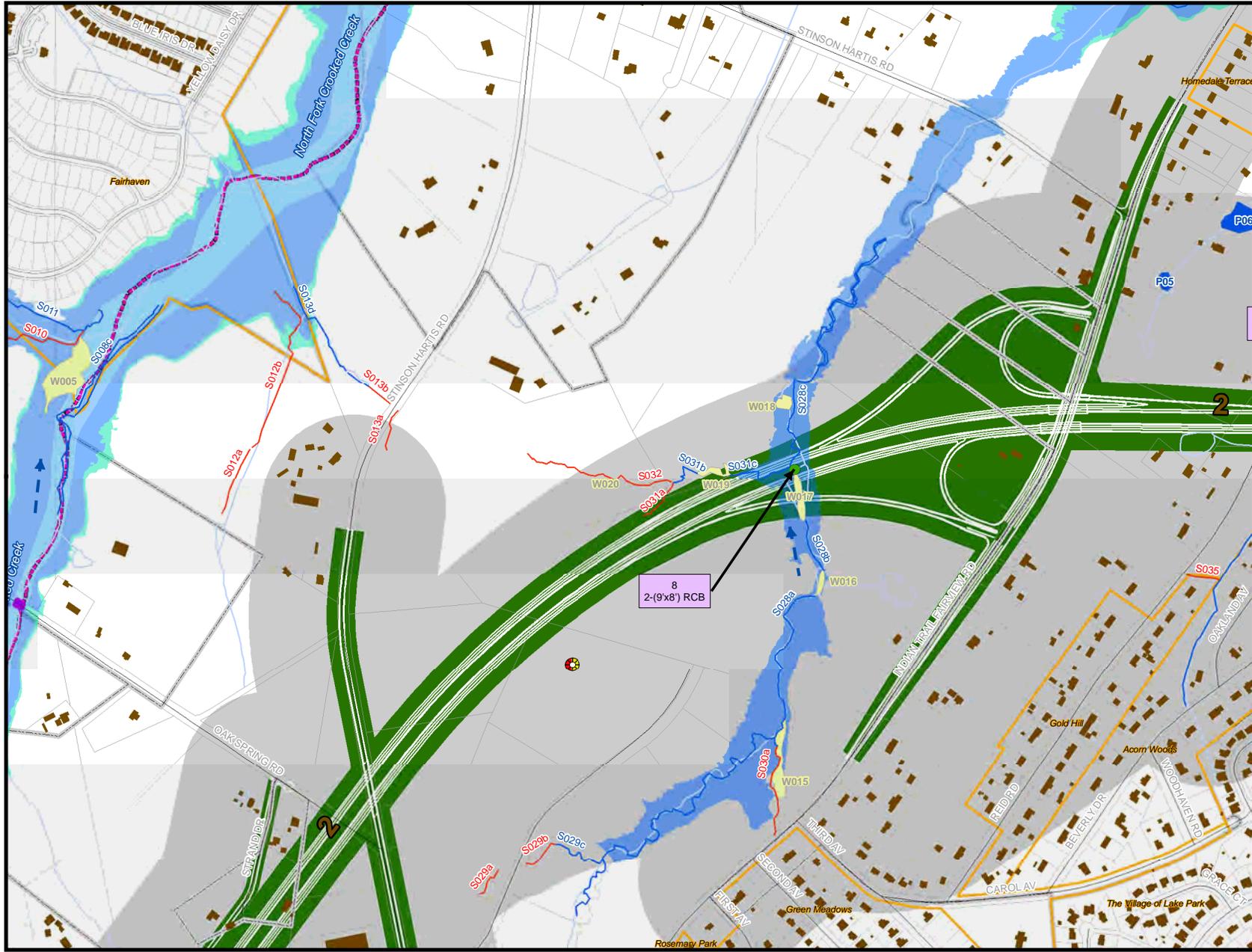
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

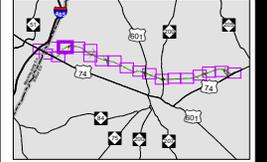
Figure 2-3c

1  
(7'x10') RCB

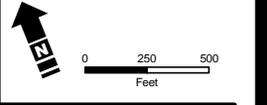




- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
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  - Stream Crossings
  - Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction
  - Cemetery
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  - College
  - Fire Department
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  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



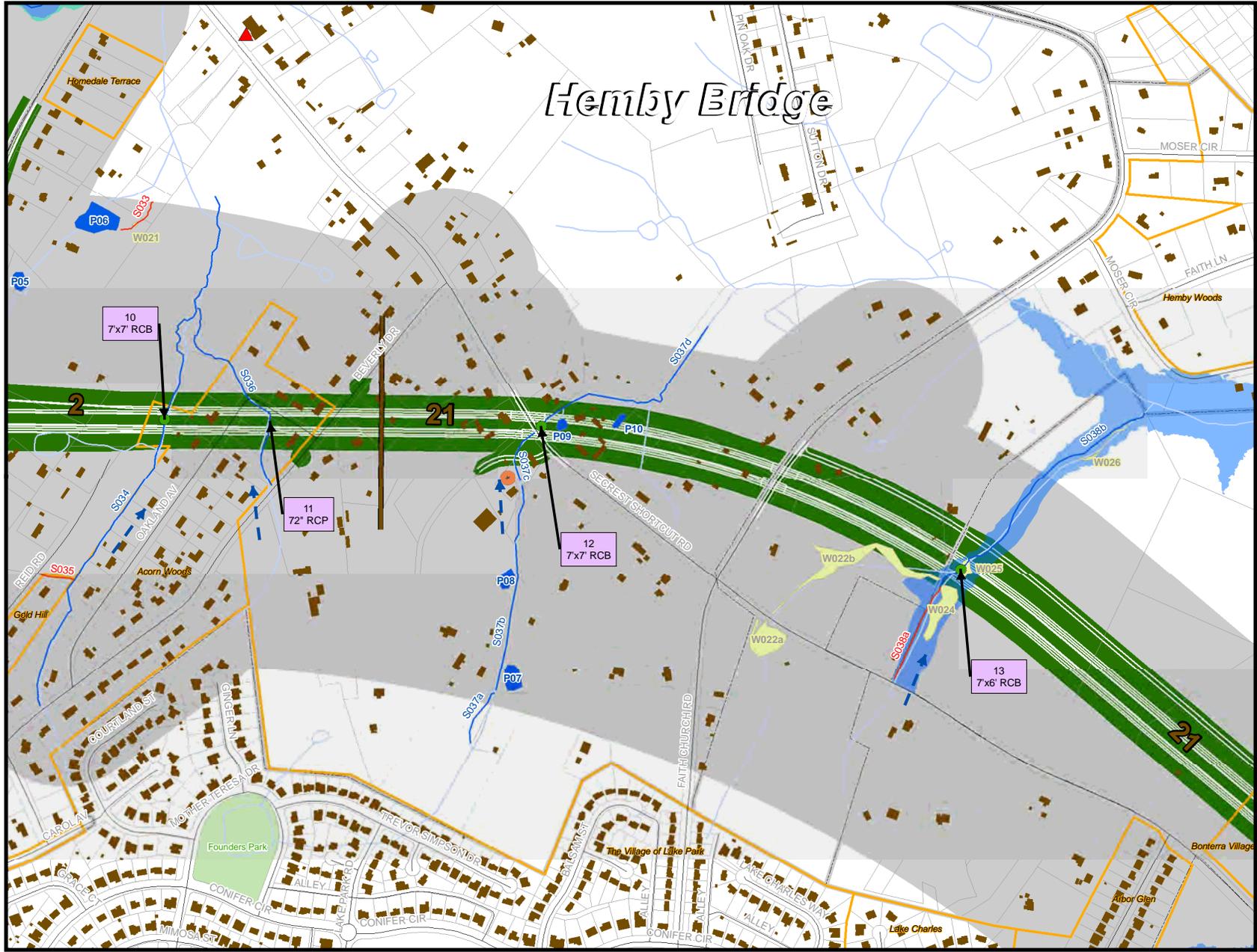
**NORTH CAROLINA Turnpike Authority**

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Mecklenburg County and Union County

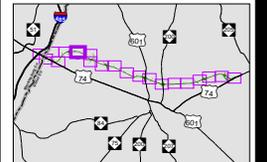
**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

Figure 2-3e

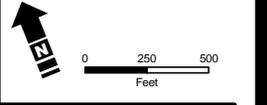


# Hemby Bridge

- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
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  - Surveyed Wetlands (W000)
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  - 500 Yr. Floodplain
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  - Stream Crossings
  - Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



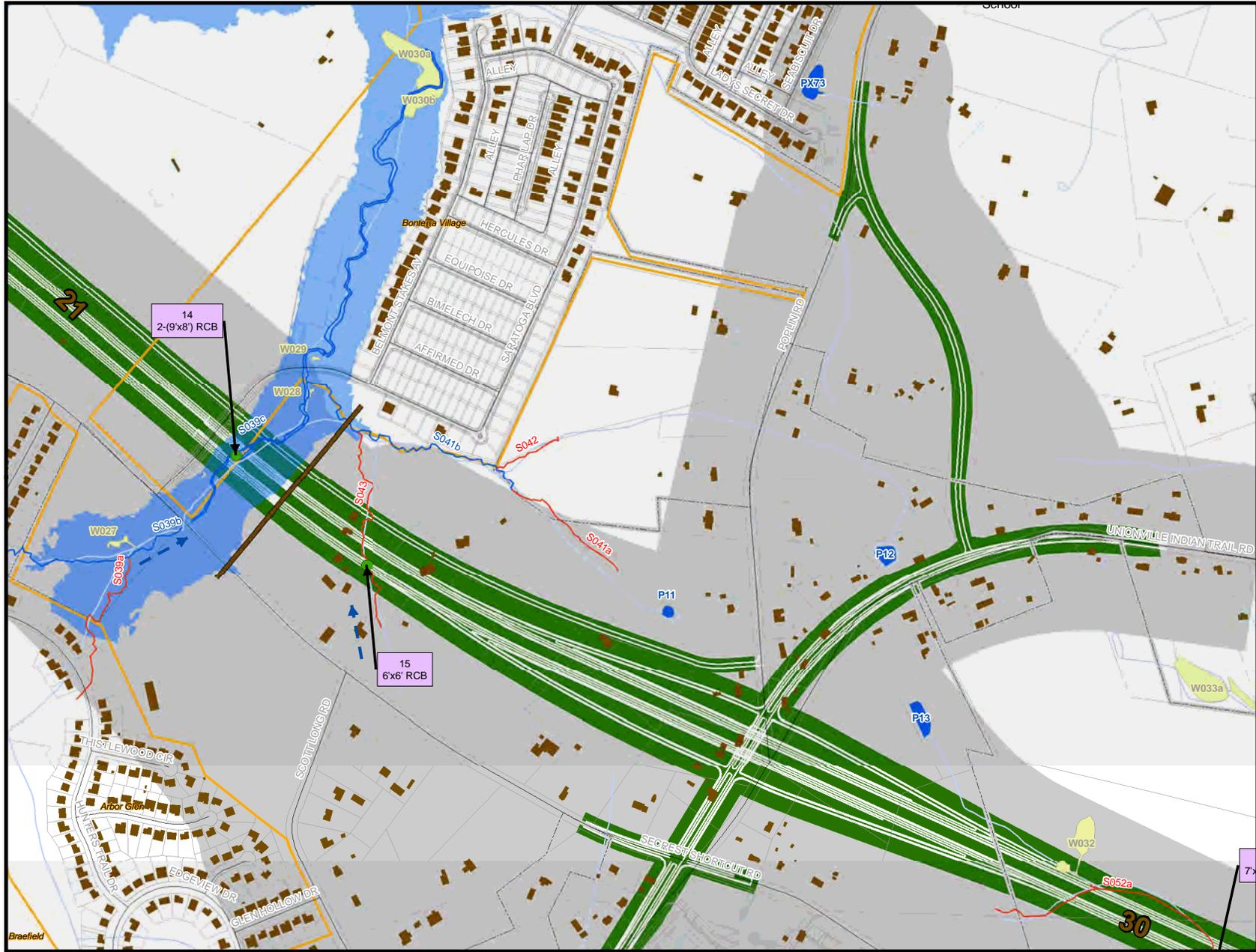
**NORTH CAROLINA Turnpike Authority**

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NO. R-3329/R-2559

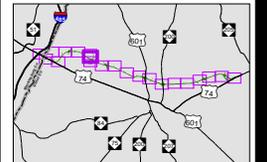
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

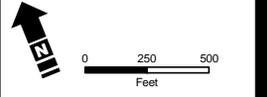
Figure 2-3f



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
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  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
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  - 500 Yr. Floodplain
  - Watersheds
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools
- Stream Crossings**
- Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



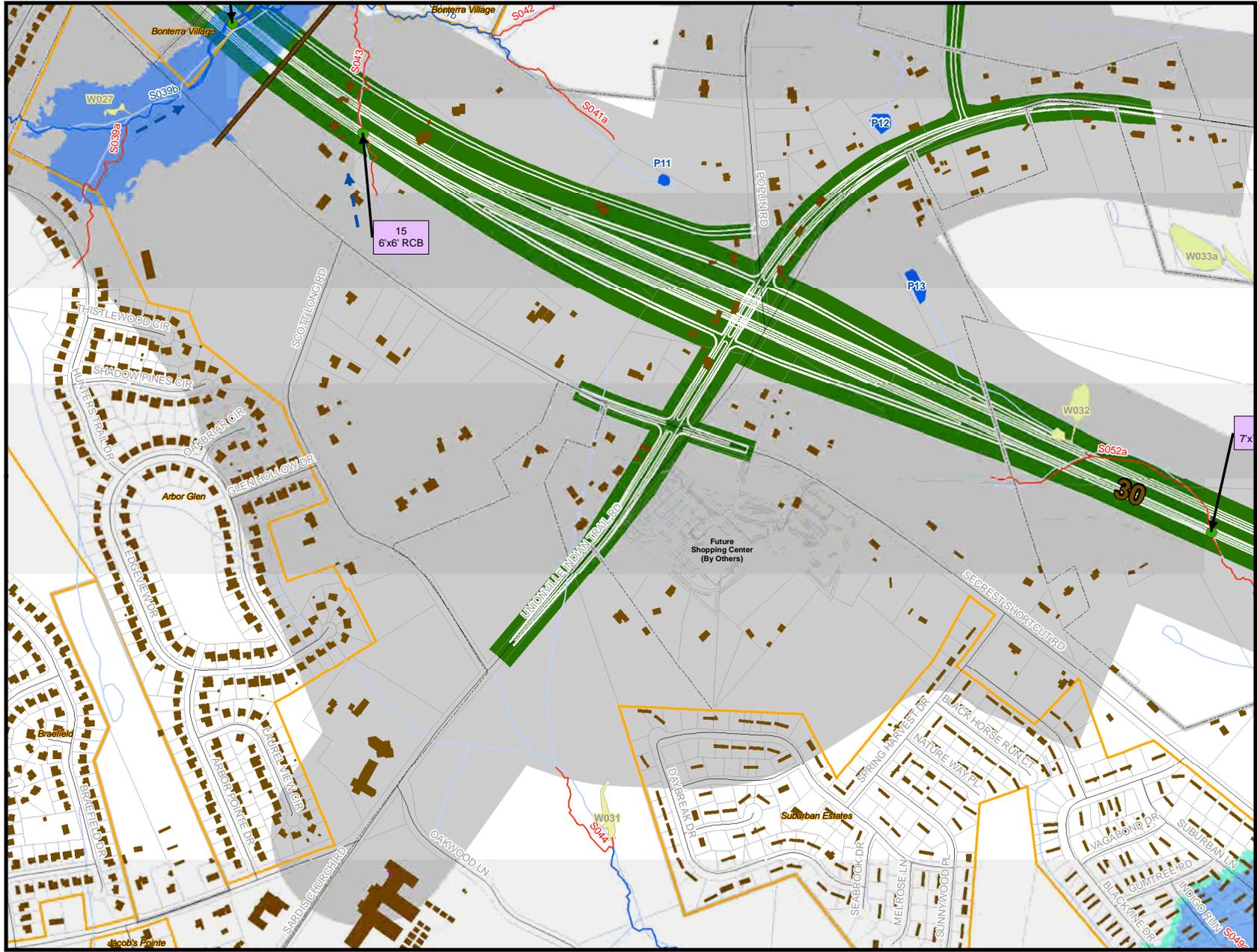
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
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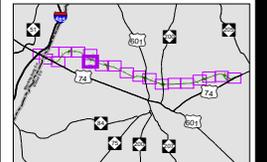
Mecklenburg County and Union County

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FUNCTIONAL  
DESIGNS**

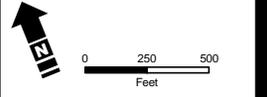
Figure 2-3g



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
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  - Surveyed Wetlands (W000)
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  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Stream Crossings
  - Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction
  - Cemetery
  - Church
  - College
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  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



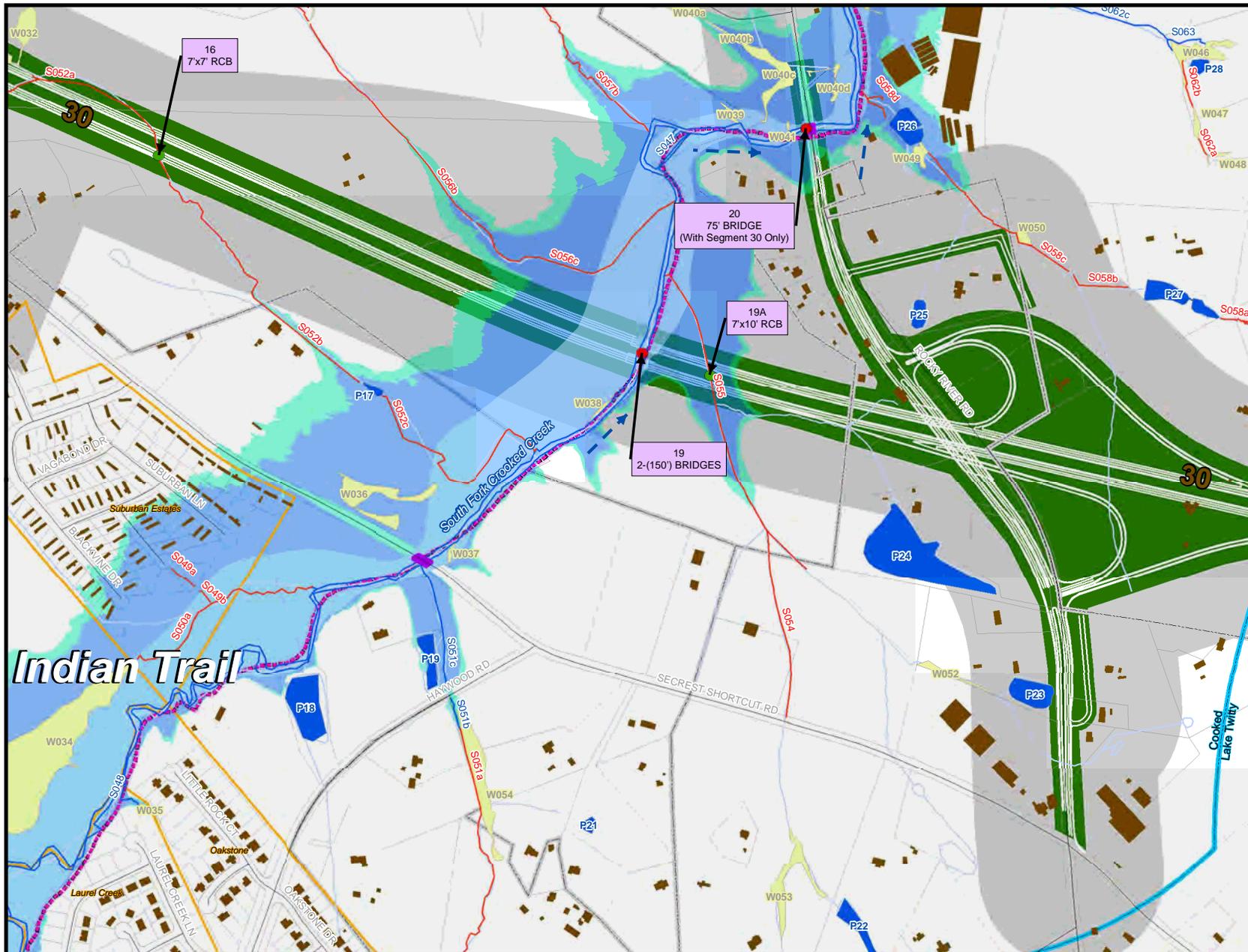
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
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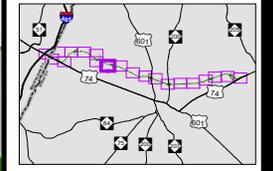
Mecklenburg County and Union County

**MONROE CONNECTOR/  
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ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

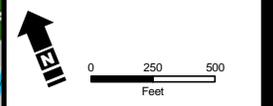
Figure 2-3h



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
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  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



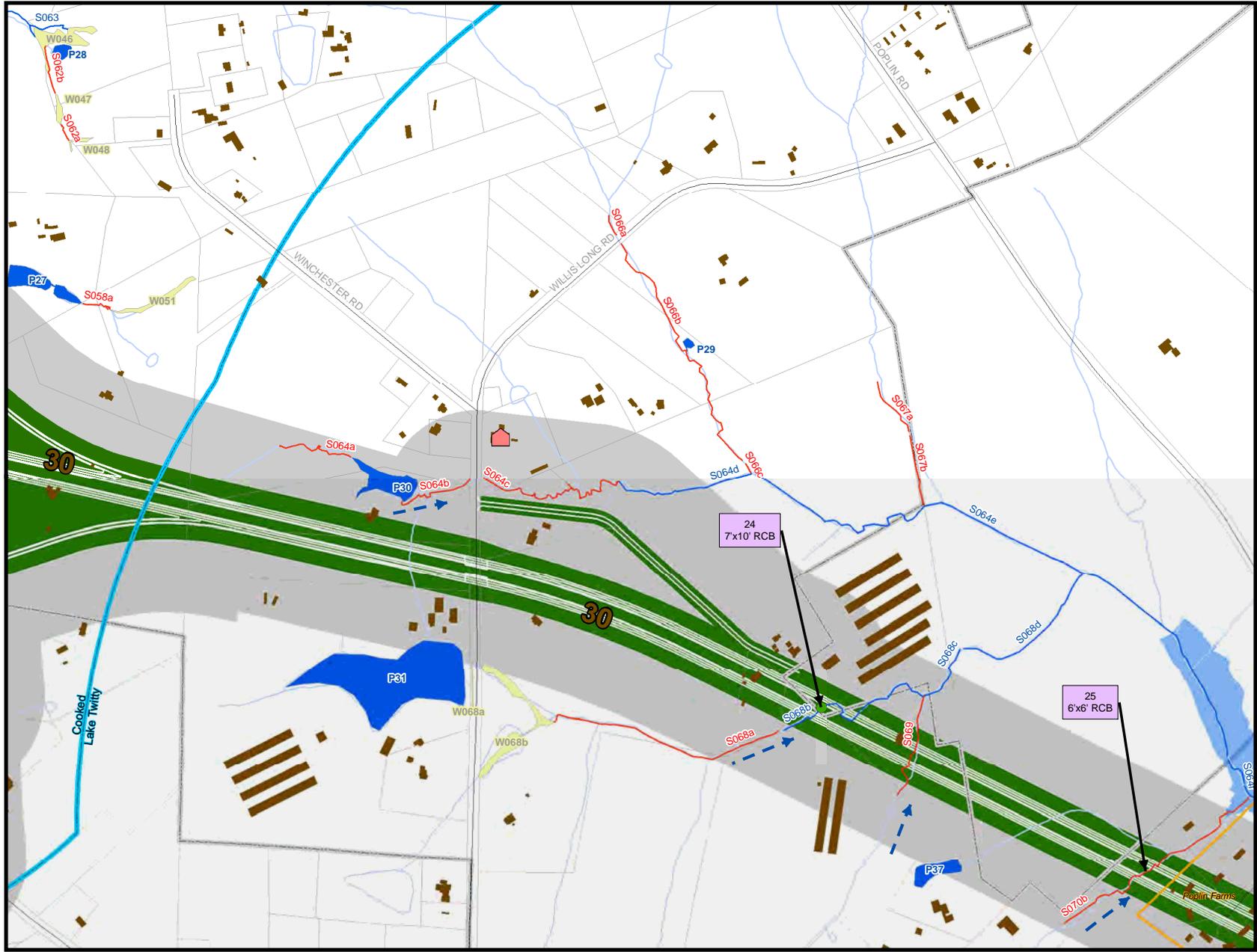
**NORTH CAROLINA Turnpike Authority**

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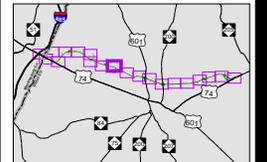
Mecklenburg County and Union County

**MONROE CONNECTOR/  
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ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

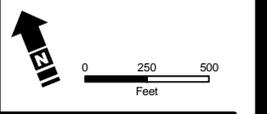
Figure 2-3i



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
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  - Library
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  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



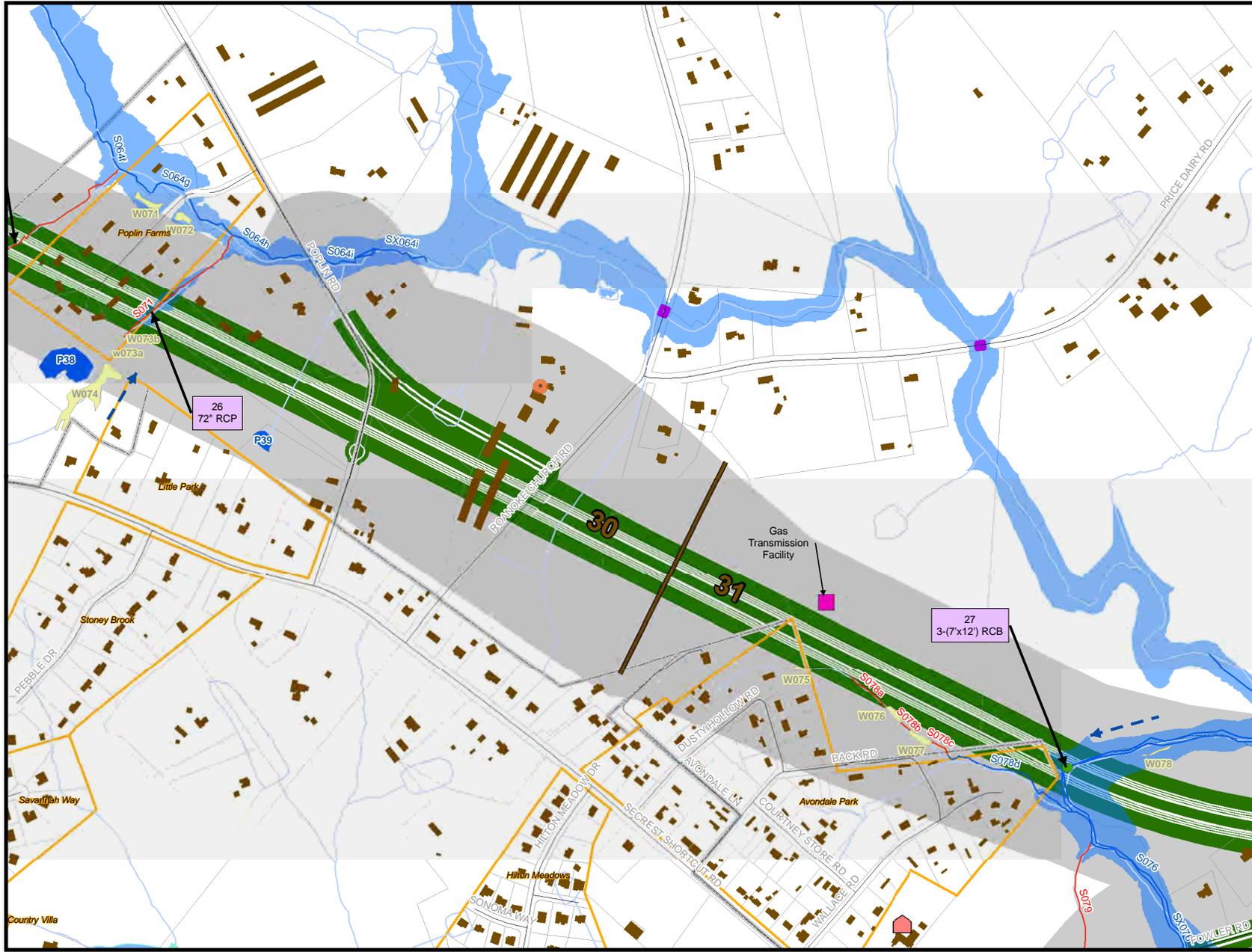
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STIP PROJECT  
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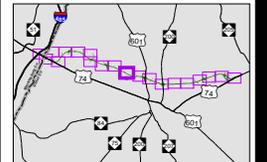
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

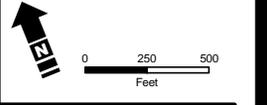
Figure 2-3j



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
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  - Potential Hazmat
  - Gold Mines
  - Hospital
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Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



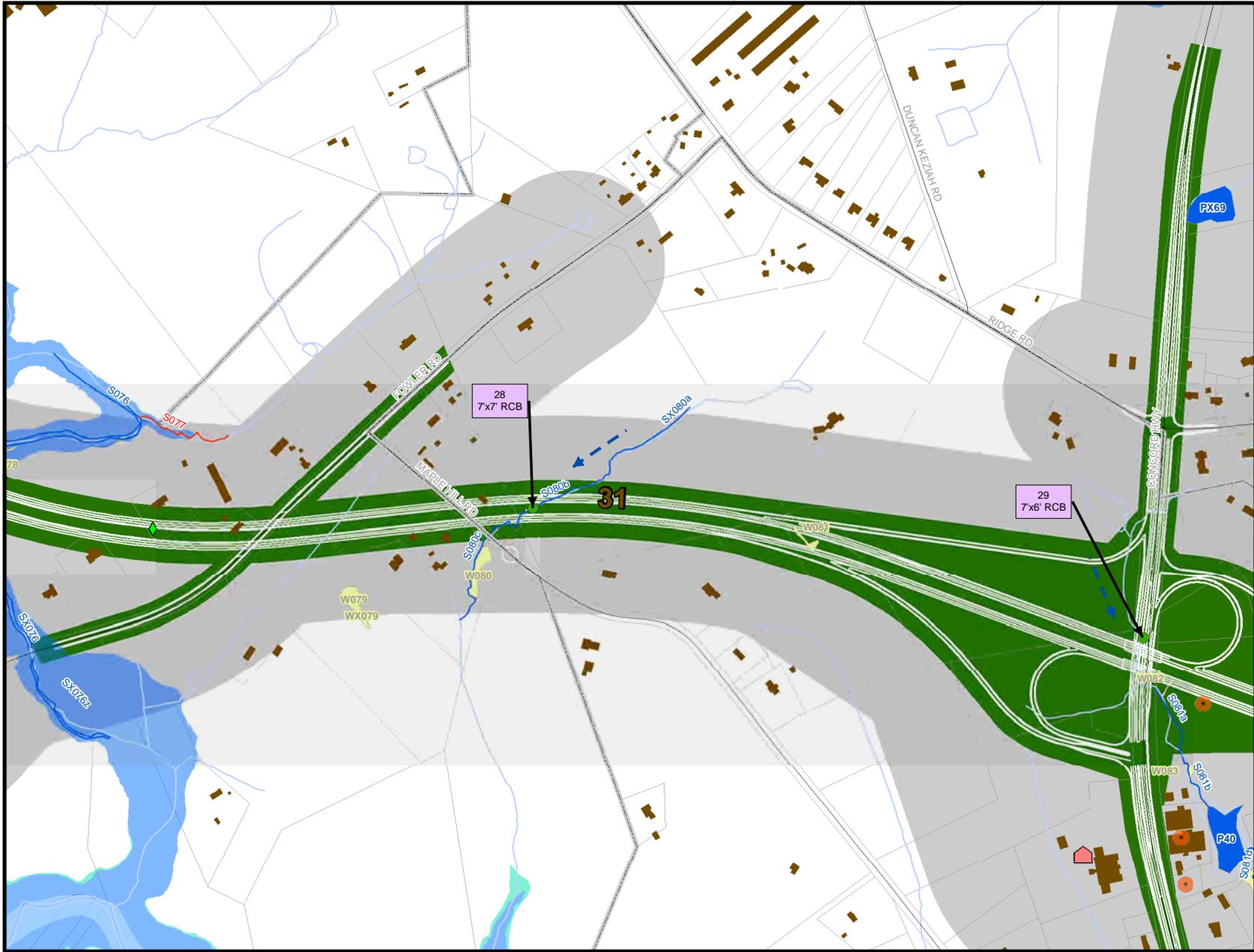
**NORTH CAROLINA Turnpike Authority**

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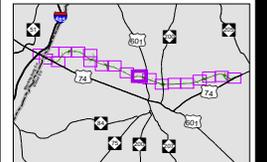
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
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DESIGNS**

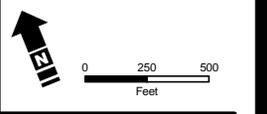
Figure 2-3k



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
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Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



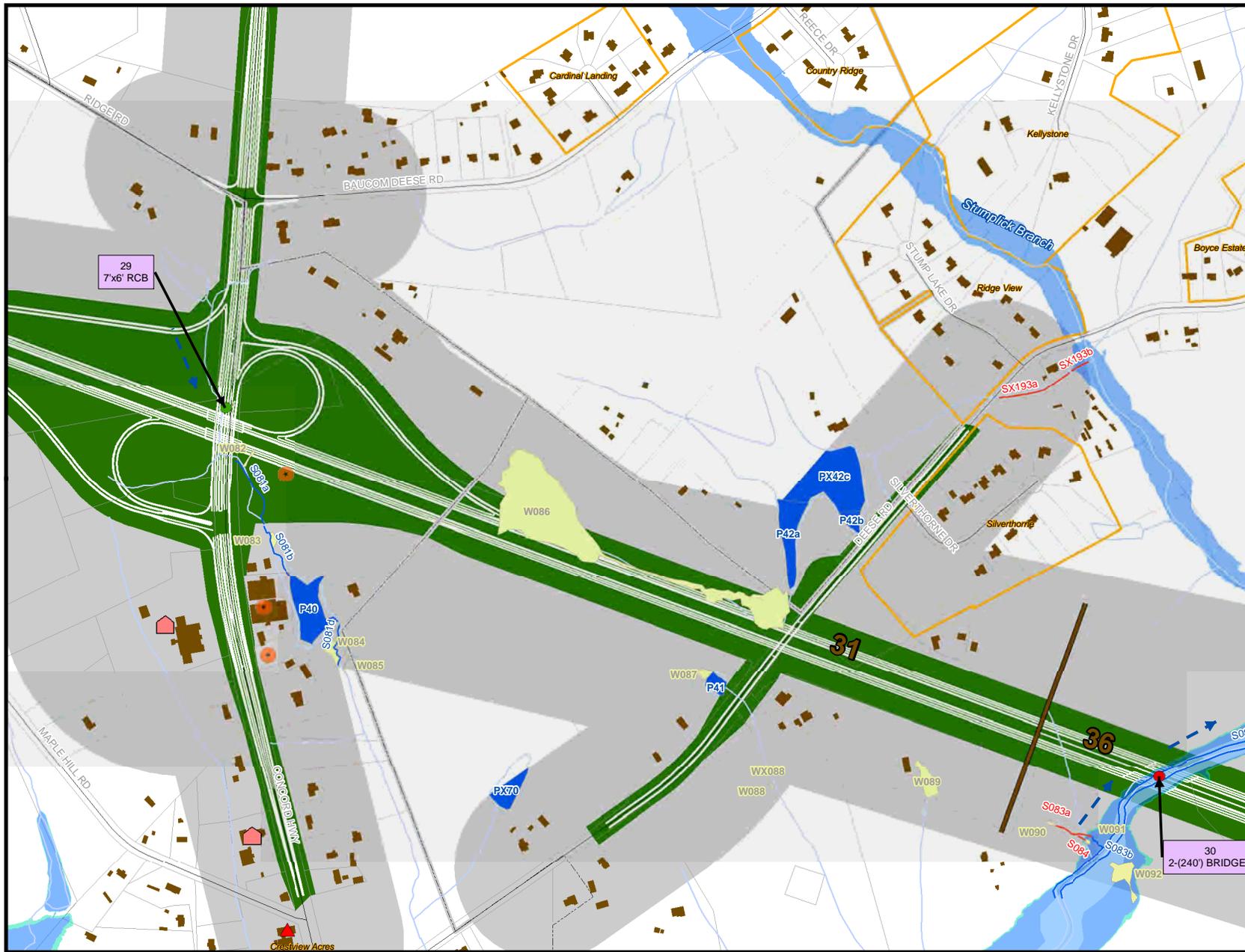
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
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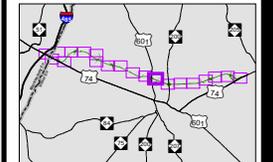
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
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ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

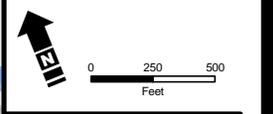
Figure 2-31



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
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Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



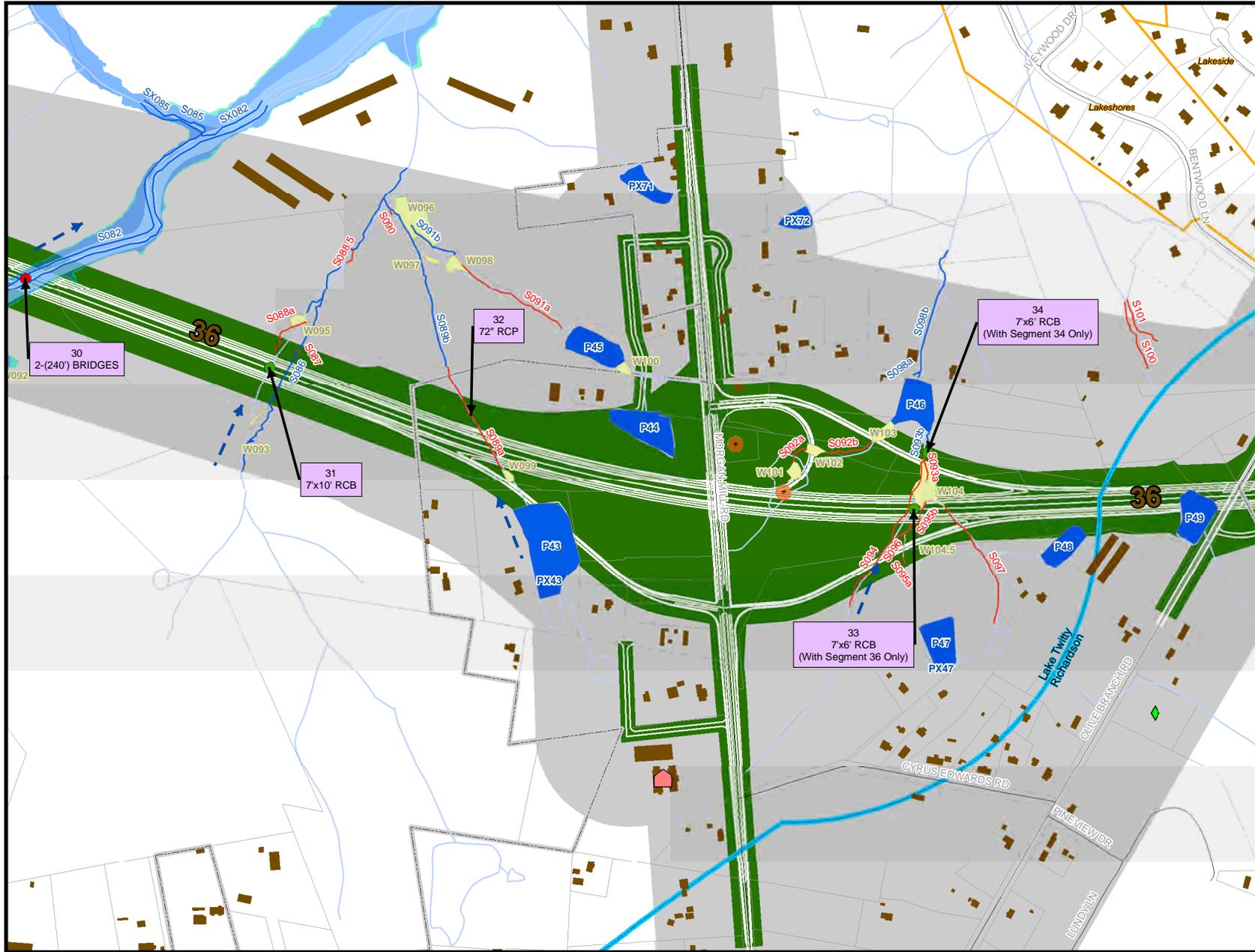
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
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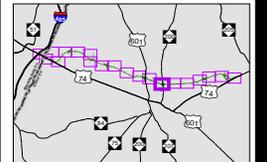
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

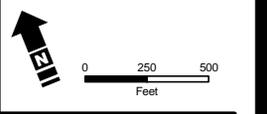
Figure 2-3m



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Existing Roads
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Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.

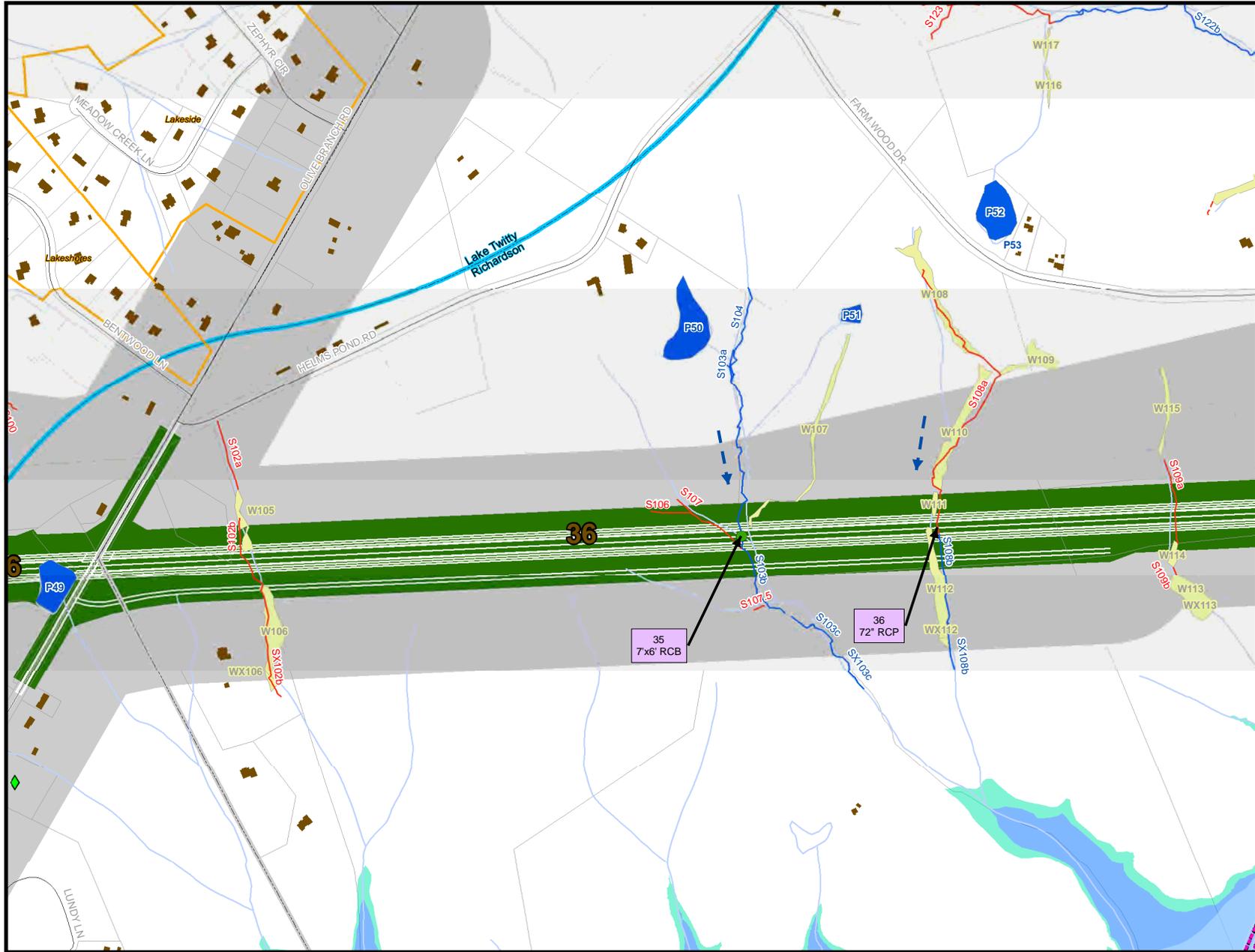


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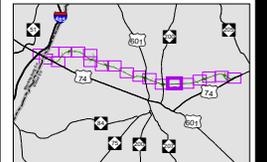
STIP PROJECT  
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Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
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ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

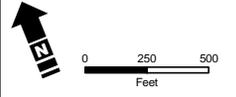
Figure 2-3n



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
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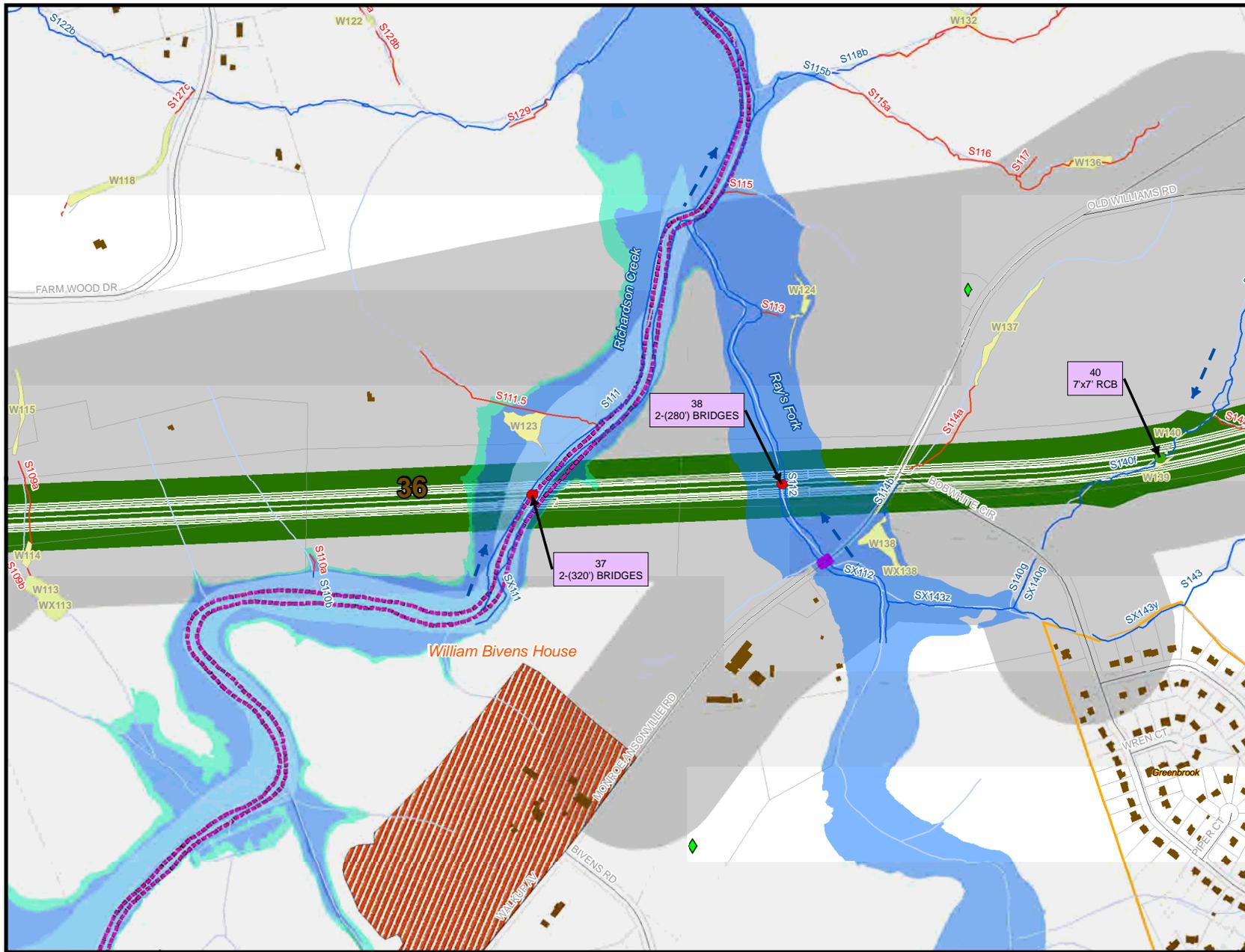
Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



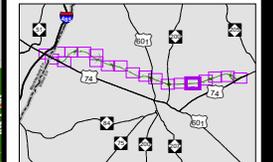
STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

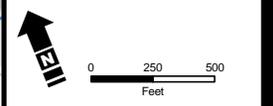
Figure 2-3o



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
  - Other Hydrology
  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Flow Direction
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



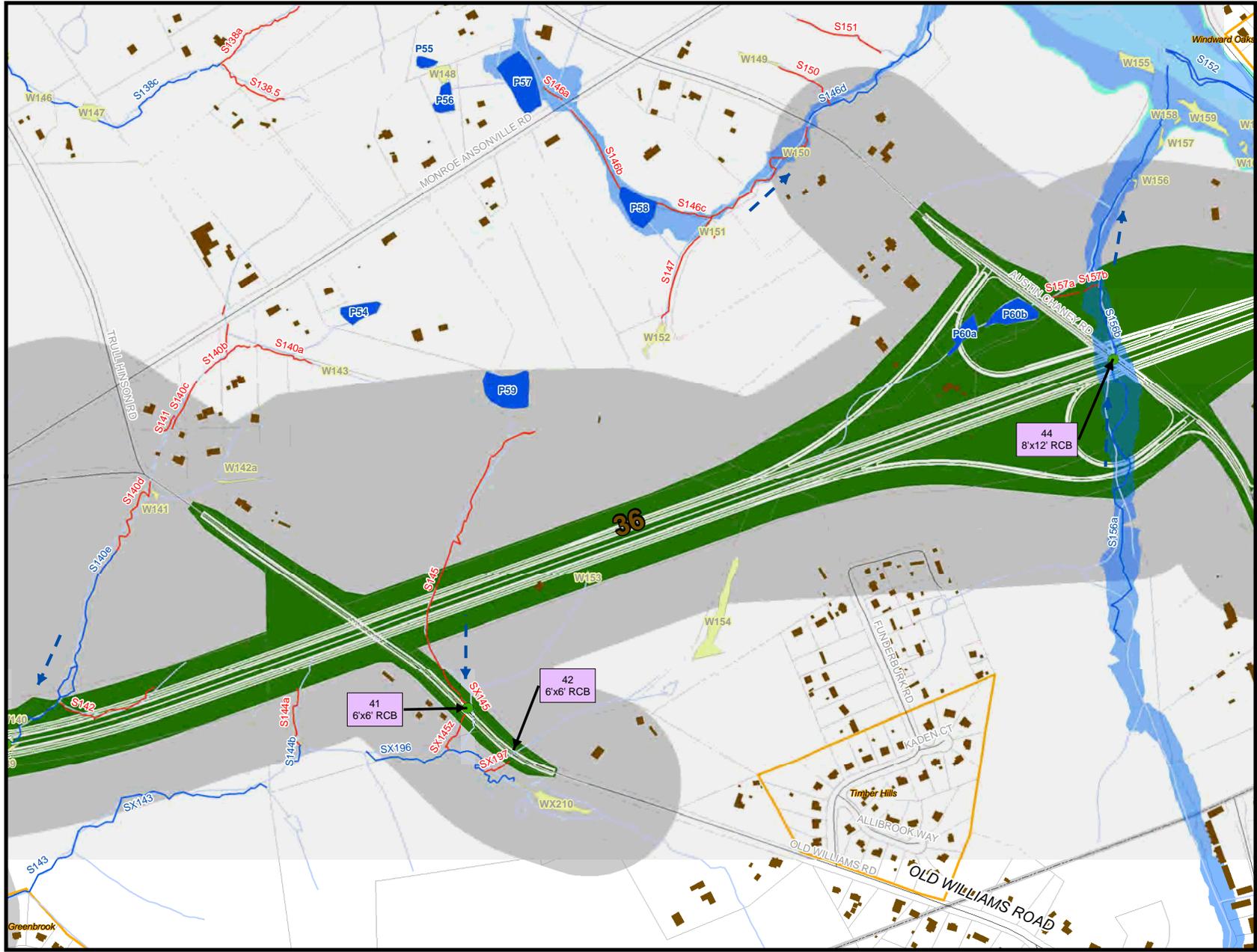
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

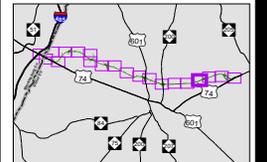
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

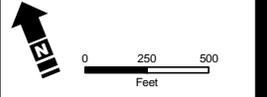
Figure 2-3p



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
  - Other Hydrology
  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Flow Direction
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



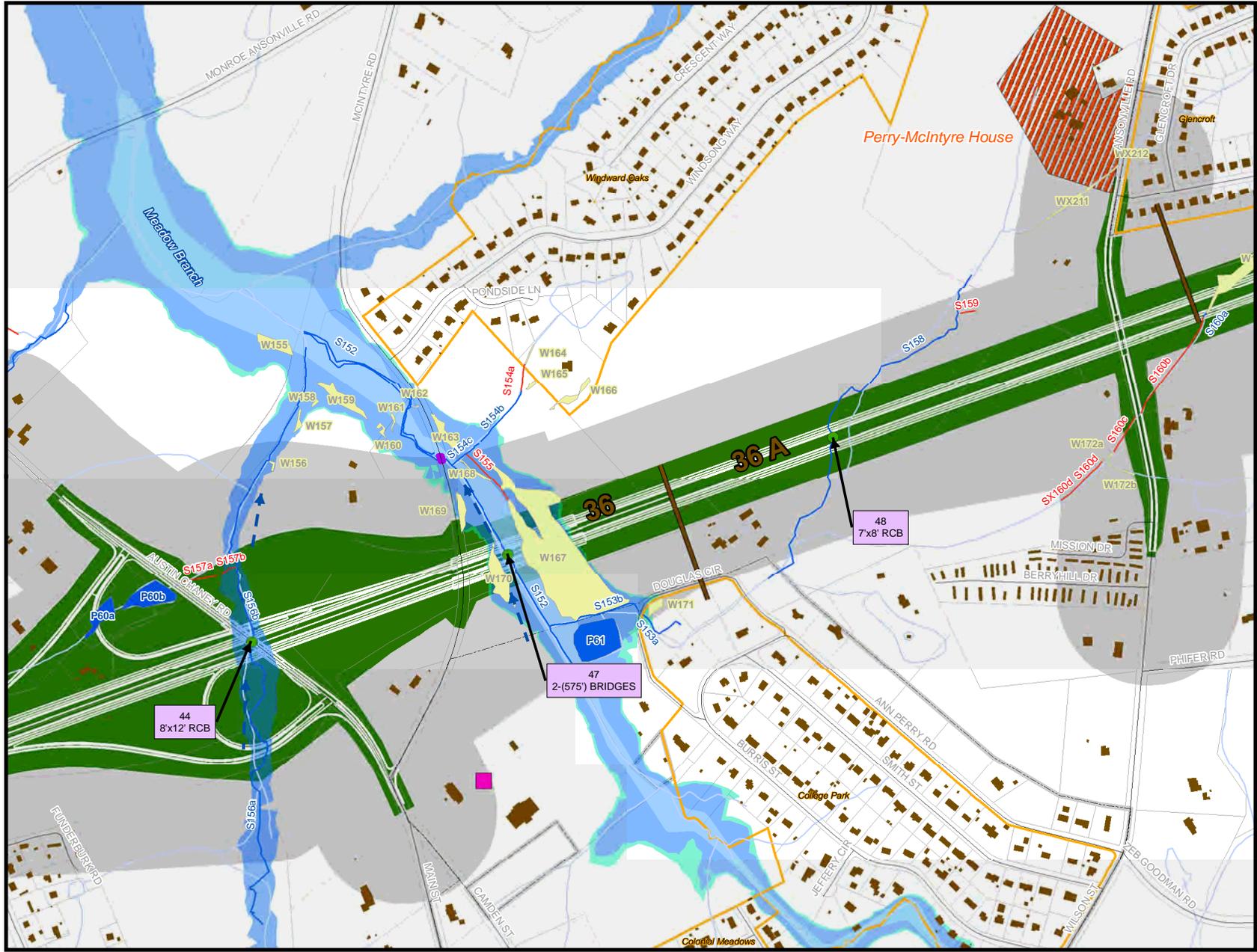
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

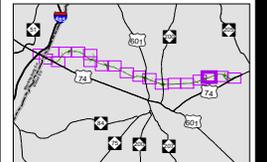
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

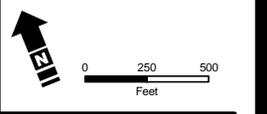
Figure 2-3q



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
  - Other Hydrology
  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Stream Crossings
  - Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



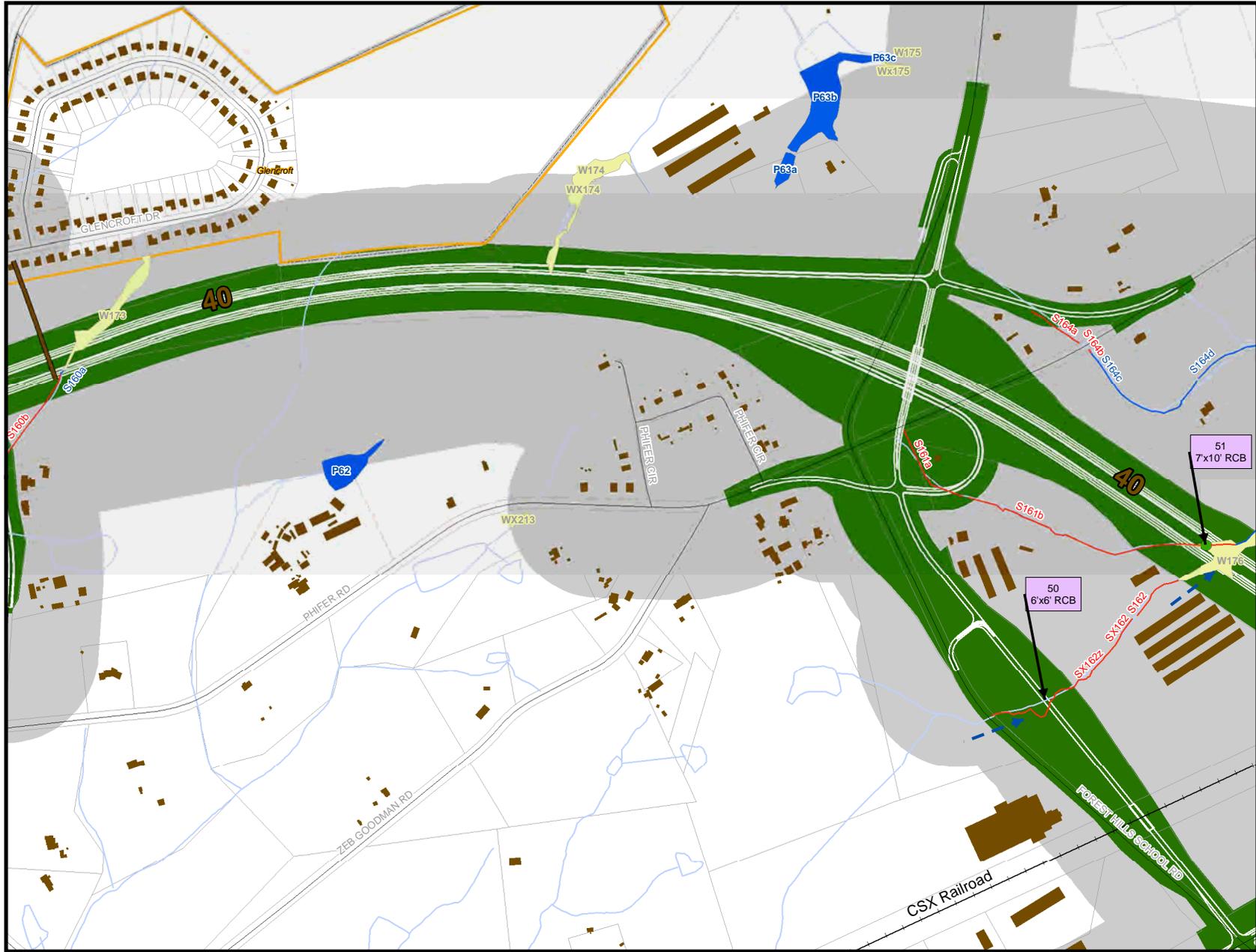
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

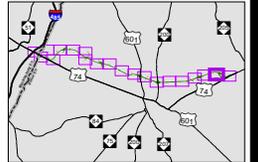
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

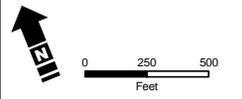
Figure 2-3r



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
  - Other Hydrology
  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools
- Stream Crossings**
- Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.

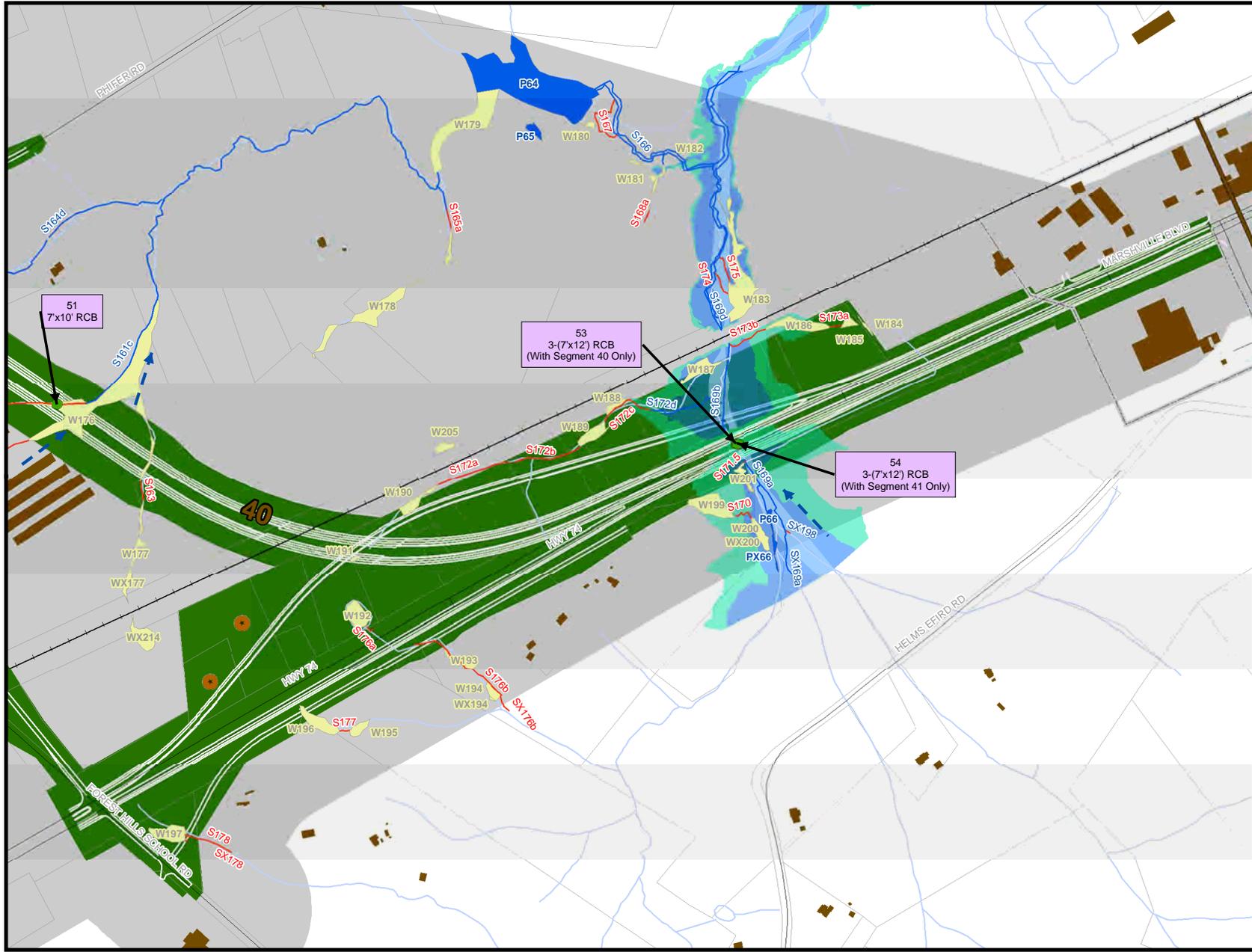


STIP PROJECT  
NO. R-3329/R-2559

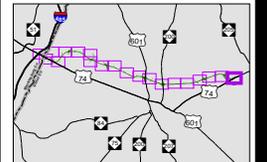
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

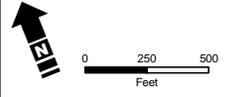
Figure 2-3s



- Legend**
- Functional Design
  - Right of Way
  - Segment Breakline
  - Segment Name
  - Corridor Study Area
  - Structures
  - Parcels
  - City Limits
  - Bridges
  - Existing Roads
  - Railroad
  - Subdivisions
  - Historic Sites
  - Parks
  - Significant Natural Heritage Area
  - 303(d) Streams
  - Other Hydrology
  - Surveyed Intermittent Stream (S000)
  - Surveyed Perennial Stream (S000)
  - Surveyed Wetlands (W000)
  - Surveyed Ponds (P00)
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain
  - Watersheds
  - Cemetery
  - Church
  - College
  - Fire Department
  - Library
  - Police Station
  - Public Facility
  - Potential Hazmat
  - Gold Mines
  - Hospital
  - Schools
- Stream Crossings**
- Culvert (72" dia. or larger)
  - Bridge
  - Flow Direction



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS  
PREFERRED  
ALTERNATIVE  
FUNCTIONAL  
DESIGNS**

Figure 2-3t

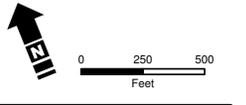


Forest Park Entrance

- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - B** Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA**  
**Turnpike Authority**

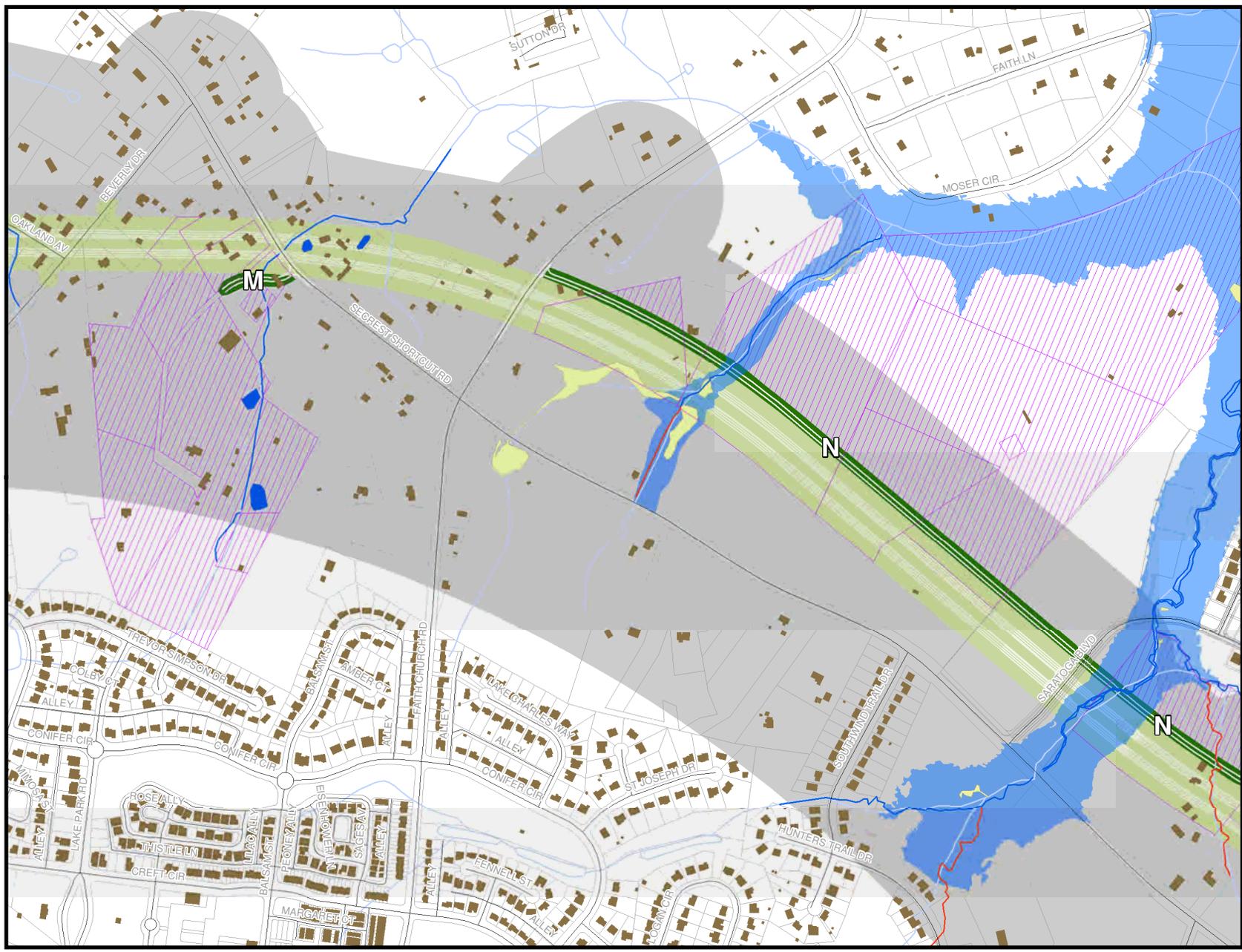
STIP PROJECT  
NO. R-3329/R-2559

Mecklenburg County and Union County

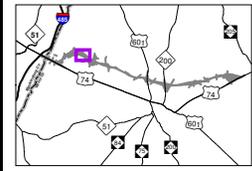
**MONROE CONNECTOR/  
BYPASS**

**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

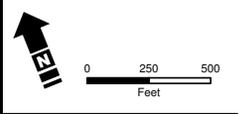
Figure 2-4a



- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA Turnpike Authority**

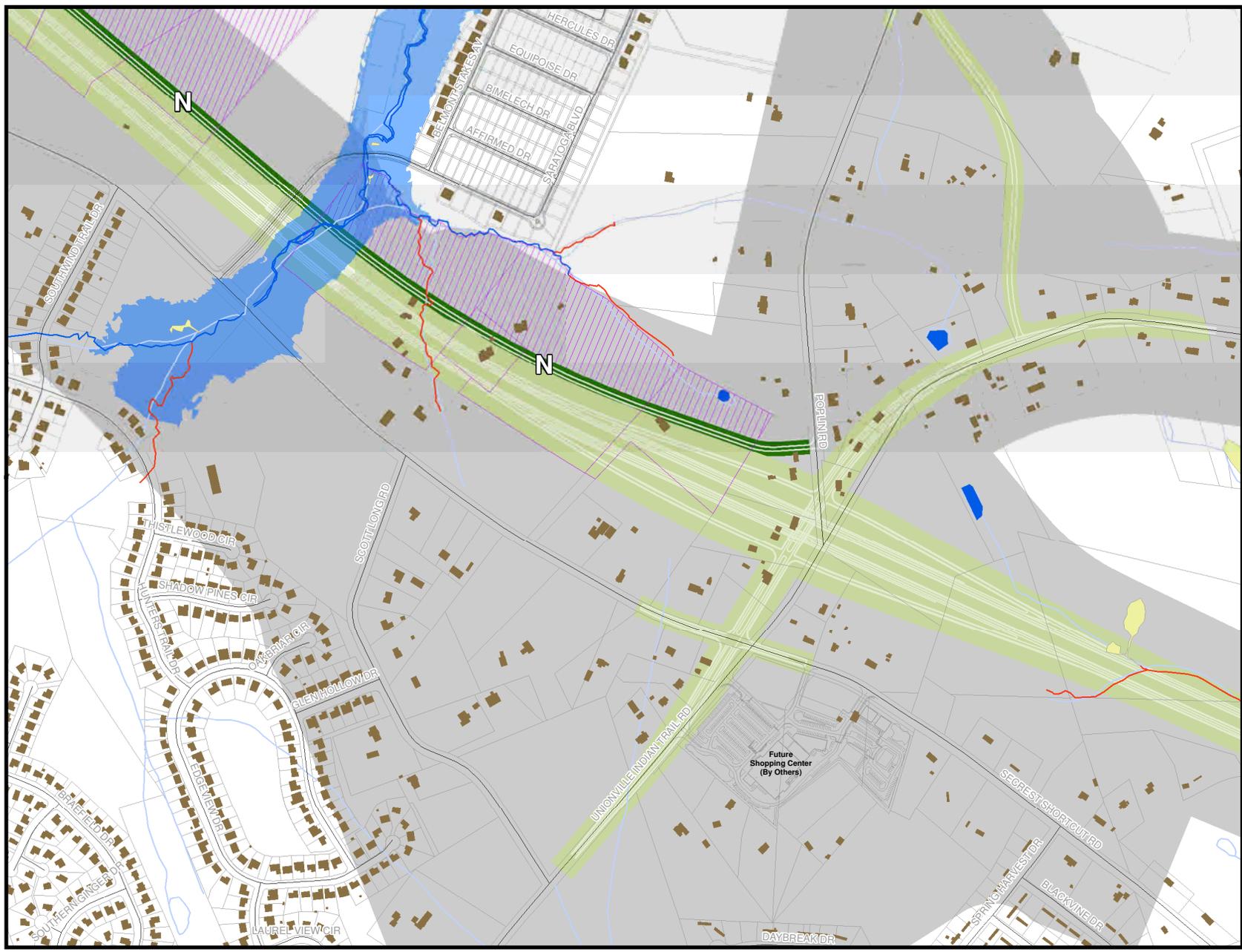
STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

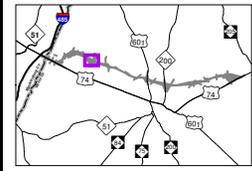
**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

Figure 2-4b

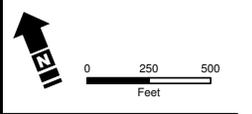
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- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA**  
**Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

Mecklenburg County and Union County

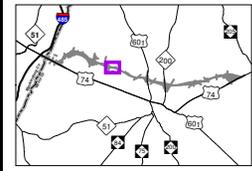
**MONROE CONNECTOR/  
BYPASS**

**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

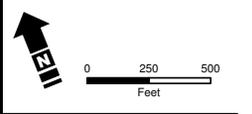
**Figure 2-4c**



- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA**  
**Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

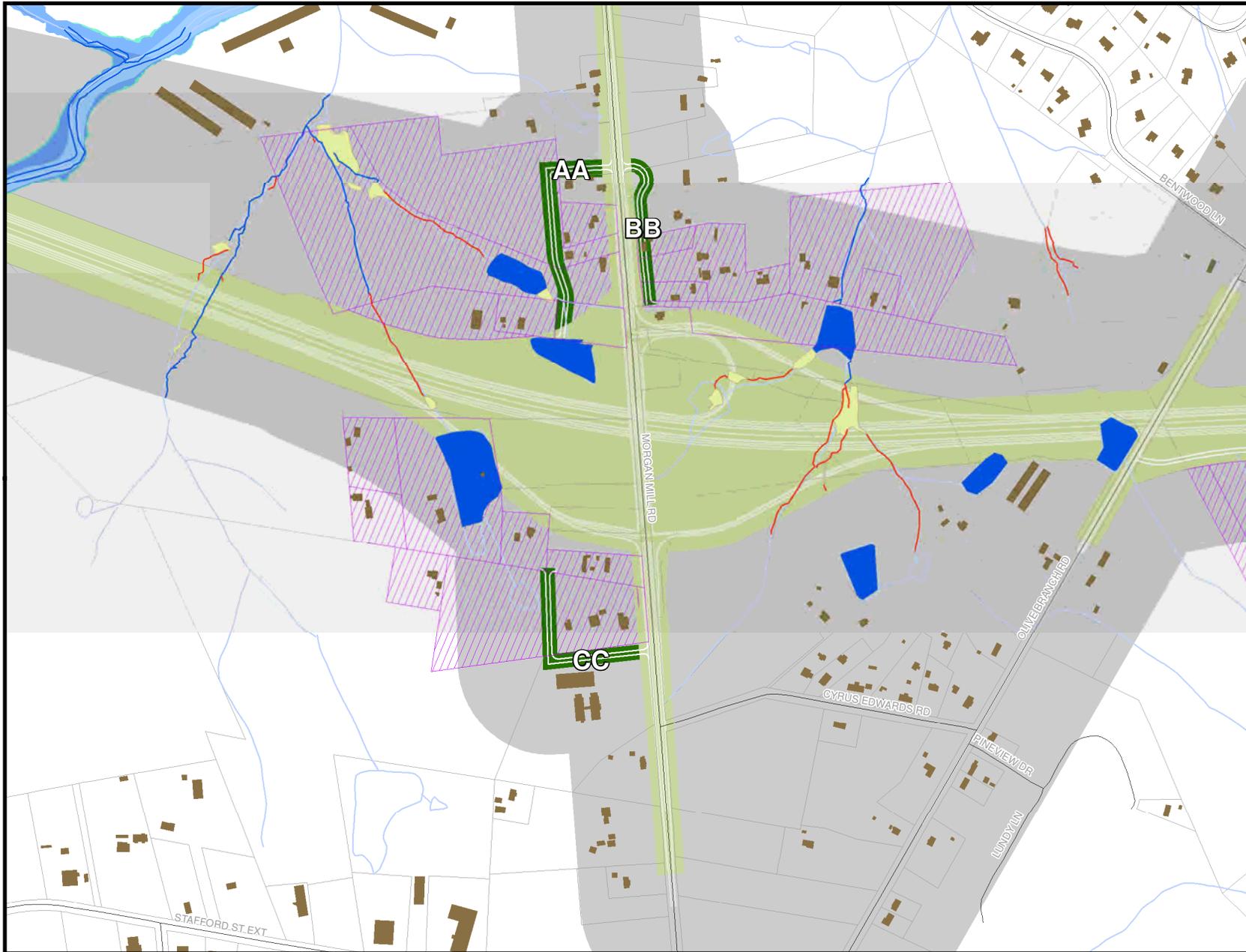
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

**Figure 2-4d**

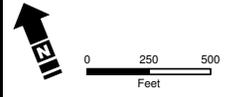
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- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



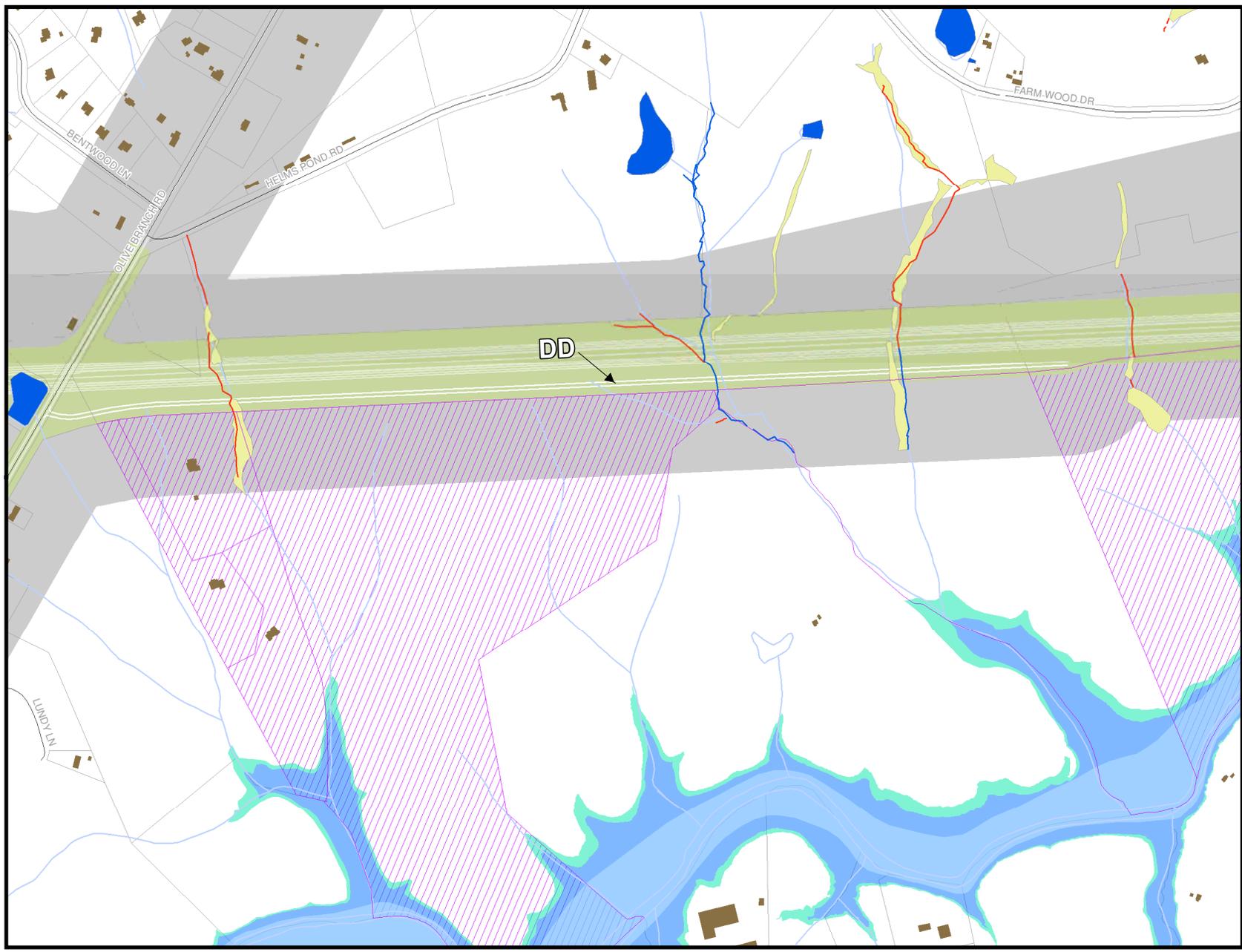
STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

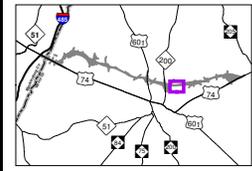
**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

**Figure 2-4e**

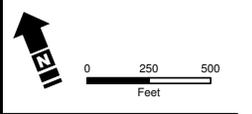
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- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - B Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

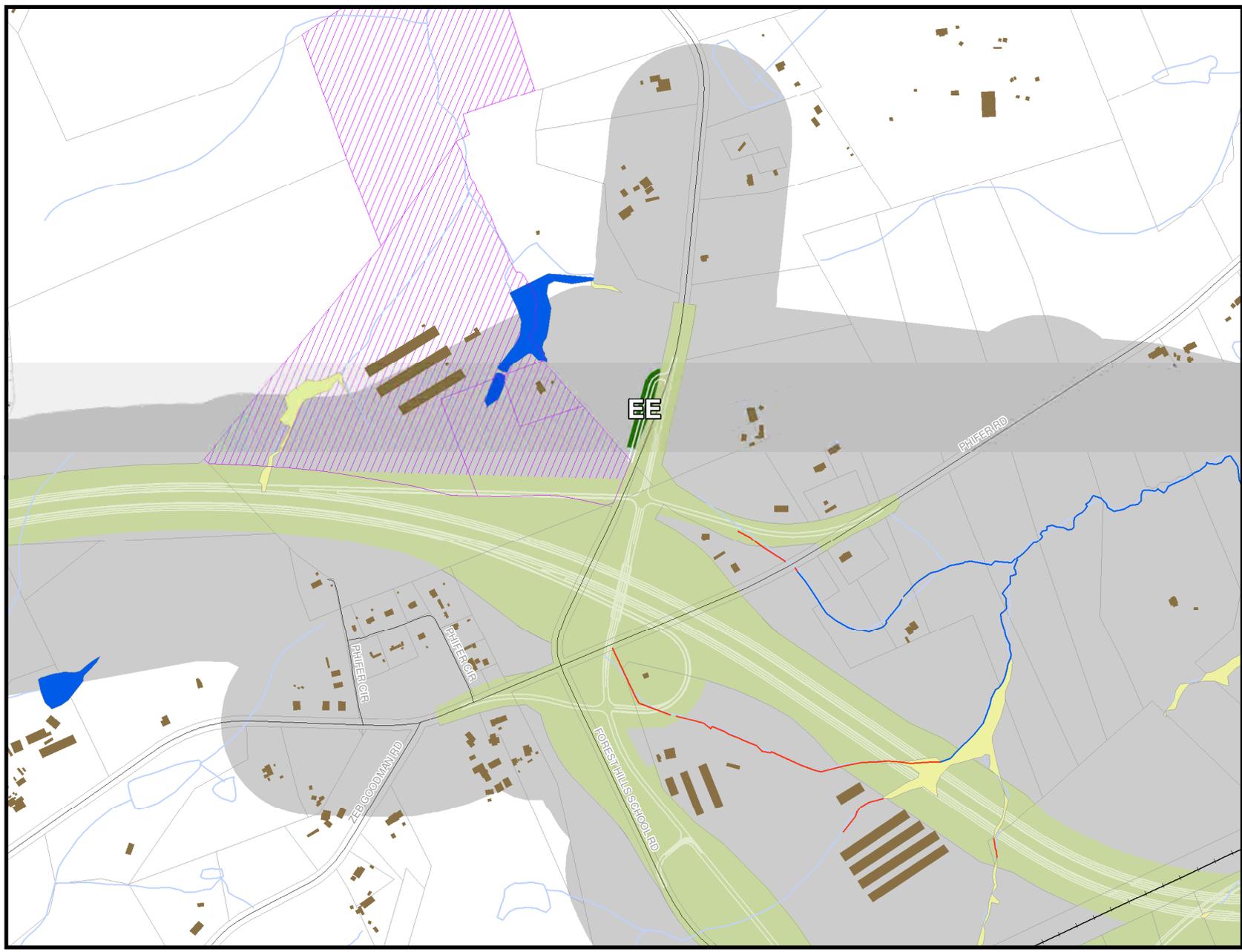
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

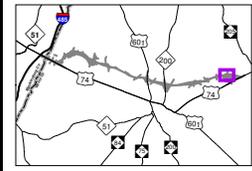
**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

Figure 2-4f

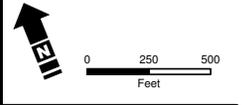
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- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA**  
**Turnpike Authority**

STIP PROJECT  
NO. R-3329/R-2559

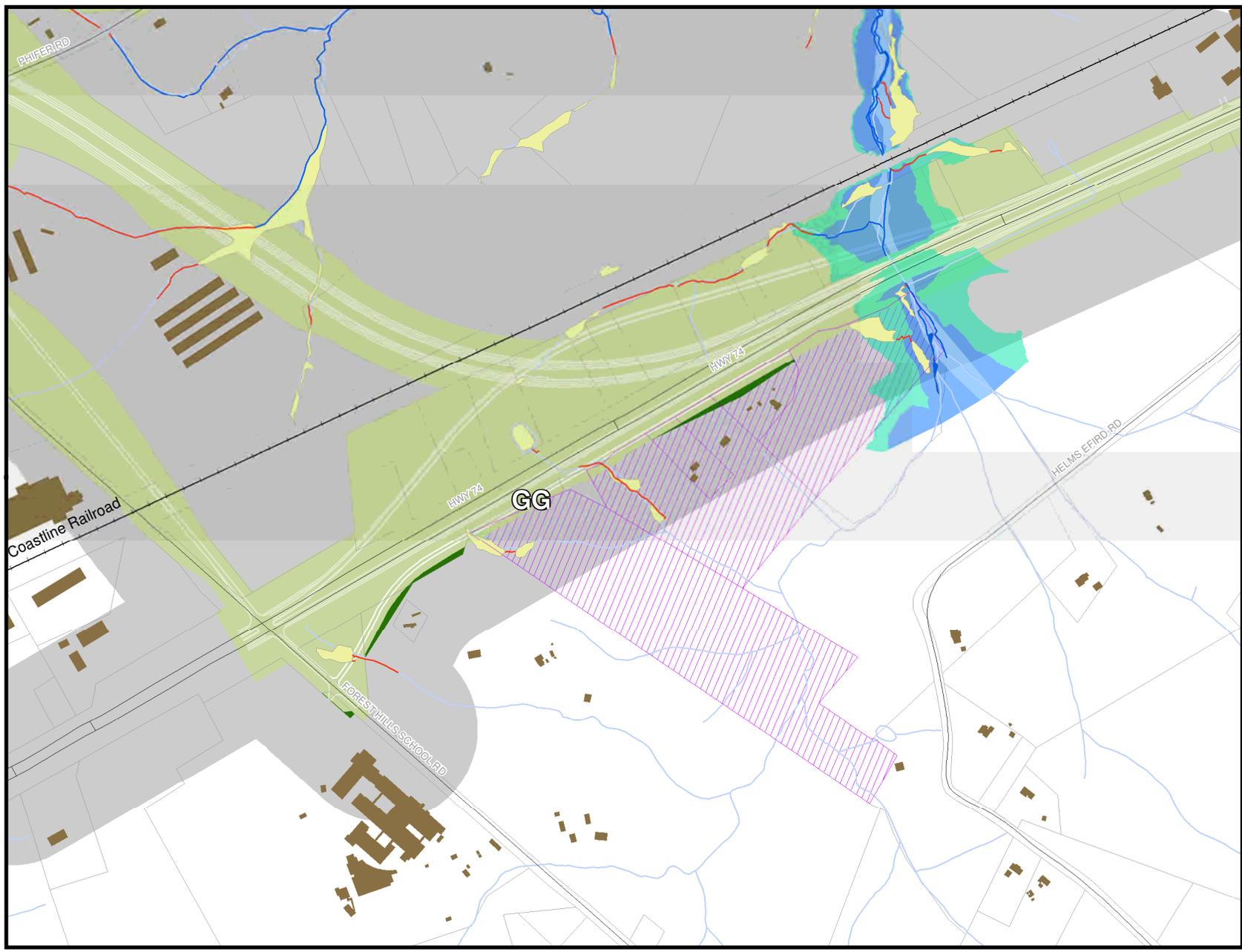
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

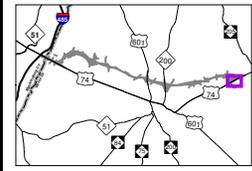
**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

Figure 2-4g

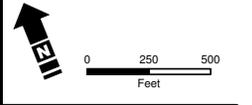
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- Legend**
- Service Road Design and Right-of-Way
  - Alternative 'D' Design and Right-of-Way
  - Service Road Identification Area
  - Corridor Study Area
  - Structures
  - Parcels
  - Potential Landlocked Parcels
  - Existing Roads
  - Railroad
  - Surveyed Intermittent Stream
  - Surveyed Perennial Stream
  - Other Hydrology
  - Surveyed Wetlands
  - Surveyed Ponds
  - Floodway
  - 100 Yr. Floodplain
  - 500 Yr. Floodplain



Source: Mecklenburg County and Union County GIS.  
Map Printed April 2010.



**NORTH CAROLINA Turnpike Authority**

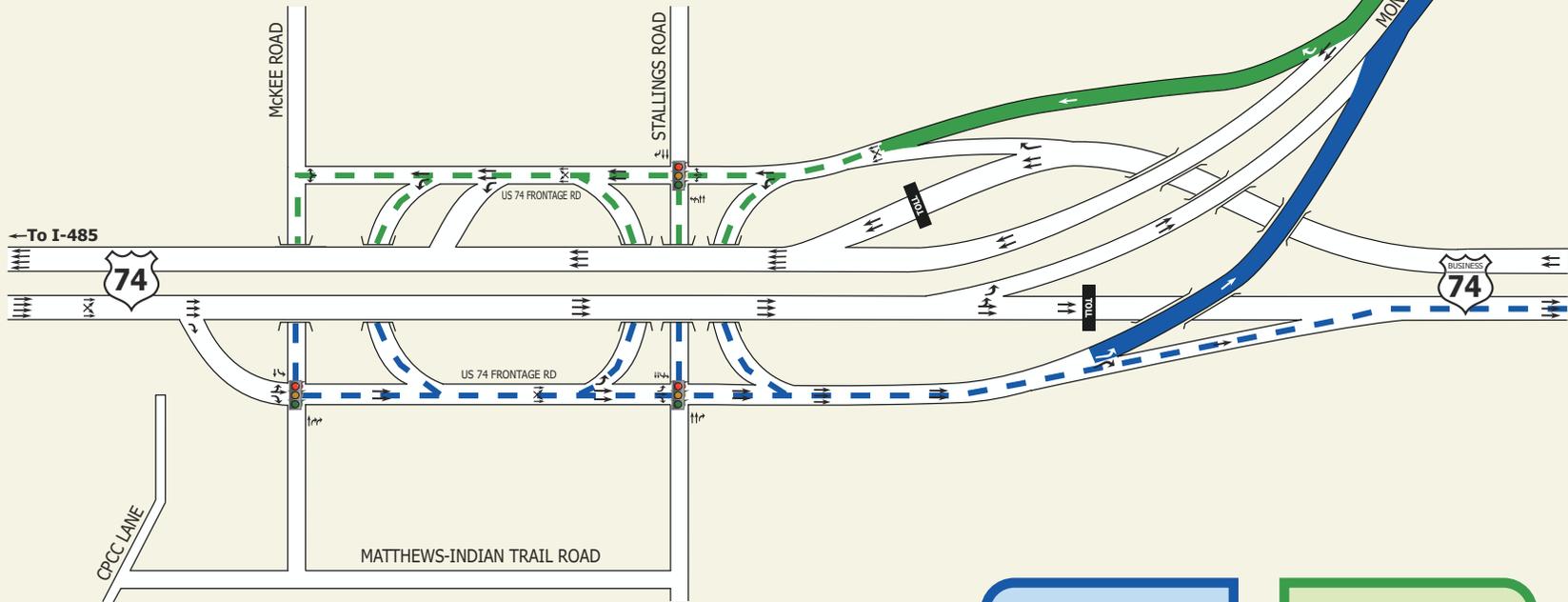
STIP PROJECT  
NO. R-3329/R-2559

Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

**SERVICE ROAD  
FUNCTIONAL  
DESIGNS**

Figure 2-4h



**Traveling East**  
 From: Local Businesses  
 To: Monroe  
 Via: Toll & Non-Toll

**Traveling West**  
 From: Monroe  
 To: Local Businesses  
 Via: Toll & Non-Toll

Non-Toll = Dashed Line

Non-Toll = Dashed Line

- Legend**
- Tolled Area Eastbound
  - Non-Tolled Area Eastbound
  - Tolled Area Westbound
  - Non-Tolled Area Westbound
  - Toll Plaza

**DRAFT**  
 PRELIMINARY  
 SUBJECT TO CHANGE

NOT TO SCALE



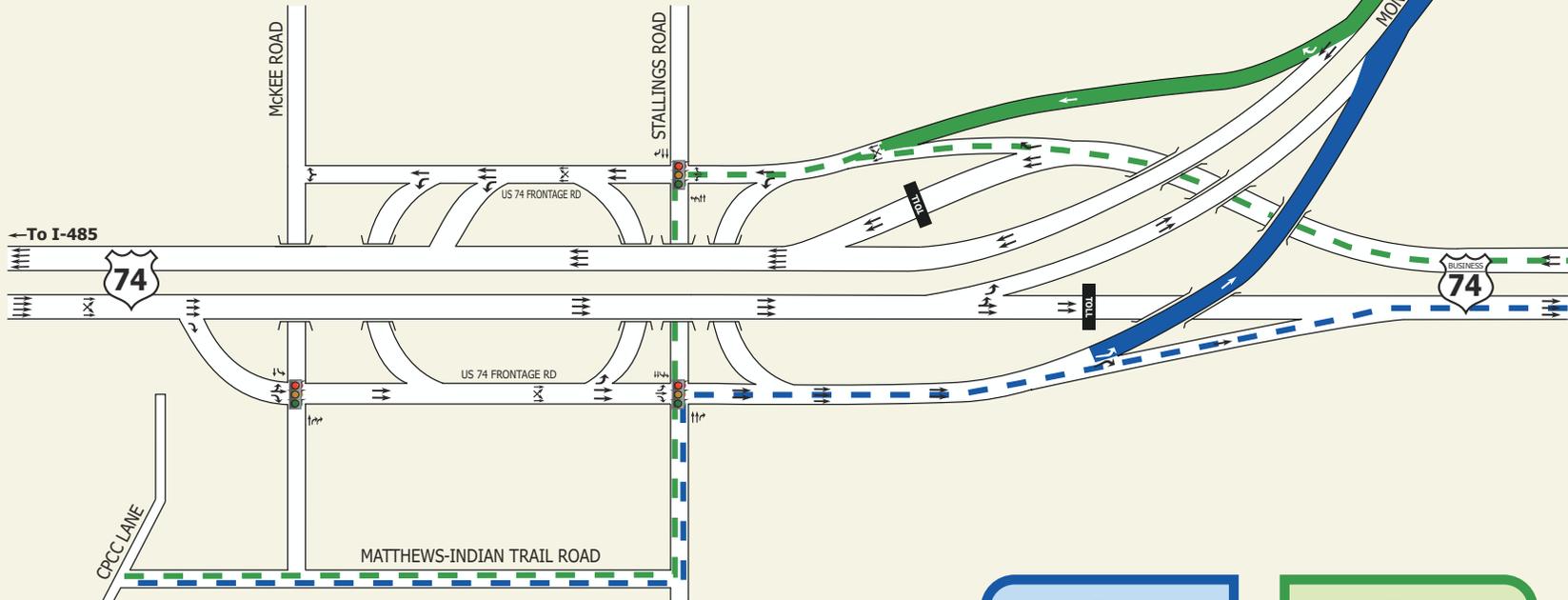
STIP PROJECT  
 NO. R-3329/R-2559  
 Mecklenburg County and  
 Union County

**MONROE CONNECTOR/  
 BYPASS**

**TOLL COLLECTION  
 PLAN**

FEIS: Monroe\_A\_Seg2\_Lodius\_MonroeTollNonToll\_AKVI\_02.24.2010

Figure 2-5a



**Traveling East**  
 From: CPCA Lane  
 To: Monroe  
 Via: Toll & Non-Toll

Non-Toll = Dashed Line

**Traveling West**  
 From: Monroe  
 To: CPCA Lane  
 Via: Toll & Non-Toll

Non-Toll = Dashed Line

- Legend**
- Tolled Area Eastbound
  - Non-Tolled Area Eastbound
  - Tolled Area Westbound
  - Non-Tolled Area Westbound
  - Toll Plaza

**DRAFT**  
 PRELIMINARY  
 SUBJECT TO CHANGE

NOT TO SCALE



STIP PROJECT  
 NO. R-3329/R-2559  
 Mecklenburg County and  
 Union County

**MONROE CONNECTOR/  
 BYPASS**

**TOLL COLLECTION  
 PLAN**

Figure 2-5b



**Traveling East**  
 From: Business US 74  
 To: Connector/Bypass  
 Via: Toll

**Traveling West**  
 From: Connector/Bypass  
 To: Business US 74  
 Via: Toll

- Legend**
- Tolled Area Eastbound
  - Non-Tolled Area Eastbound
  - Tolled Area Westbound
  - Non-Tolled Area Westbound
  - Toll Plaza

**DRAFT**  
 PRELIMINARY  
 SUBJECT TO CHANGE

NOT TO SCALE



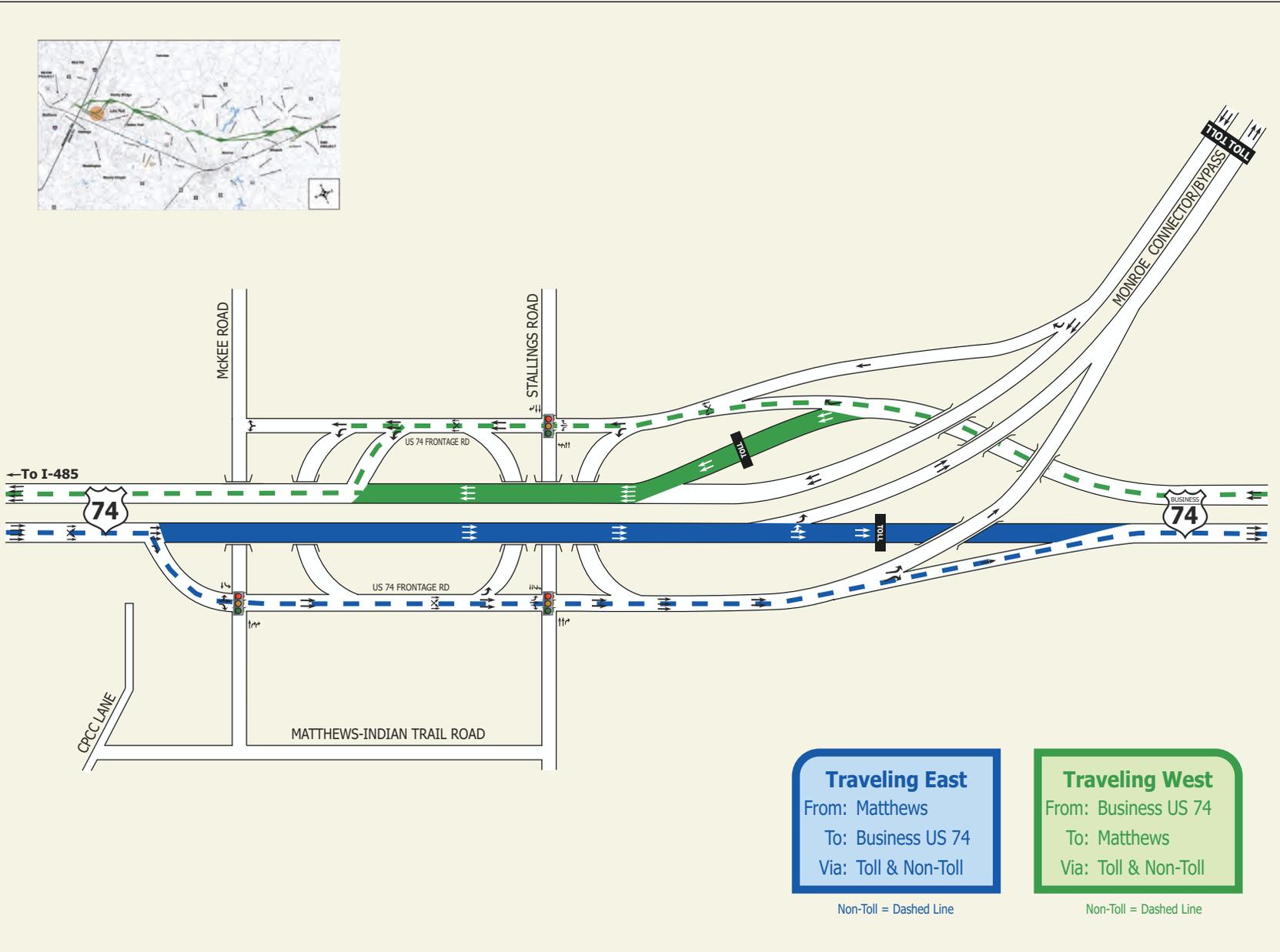
STIP PROJECT  
 NO. R-3329/R-2559  
 Mecklenburg County and  
 Union County

**MONROE CONNECTOR/  
 BYPASS**

**TOLL COLLECTION  
 PLAN**

FEIS: 004922\_C\_S002\_US74-MCSTP-A1-A01\_02.24.2010

Figure 2-5c



- Legend**
- Tolled Area Eastbound
  - Non-Tolled Area Eastbound
  - Tolled Area Westbound
  - Non-Tolled Area Westbound
  - TOLL
  - Toll Plaza

**DRAFT**  
PRELIMINARY  
SUBJECT TO CHANGE

NOT TO SCALE



STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and  
Union County

**MONROE CONNECTOR/  
BYPASS**

**TOLL COLLECTION  
PLAN**

**Traveling East**  
From: Matthews  
To: Business US 74  
Via: Toll & Non-Toll

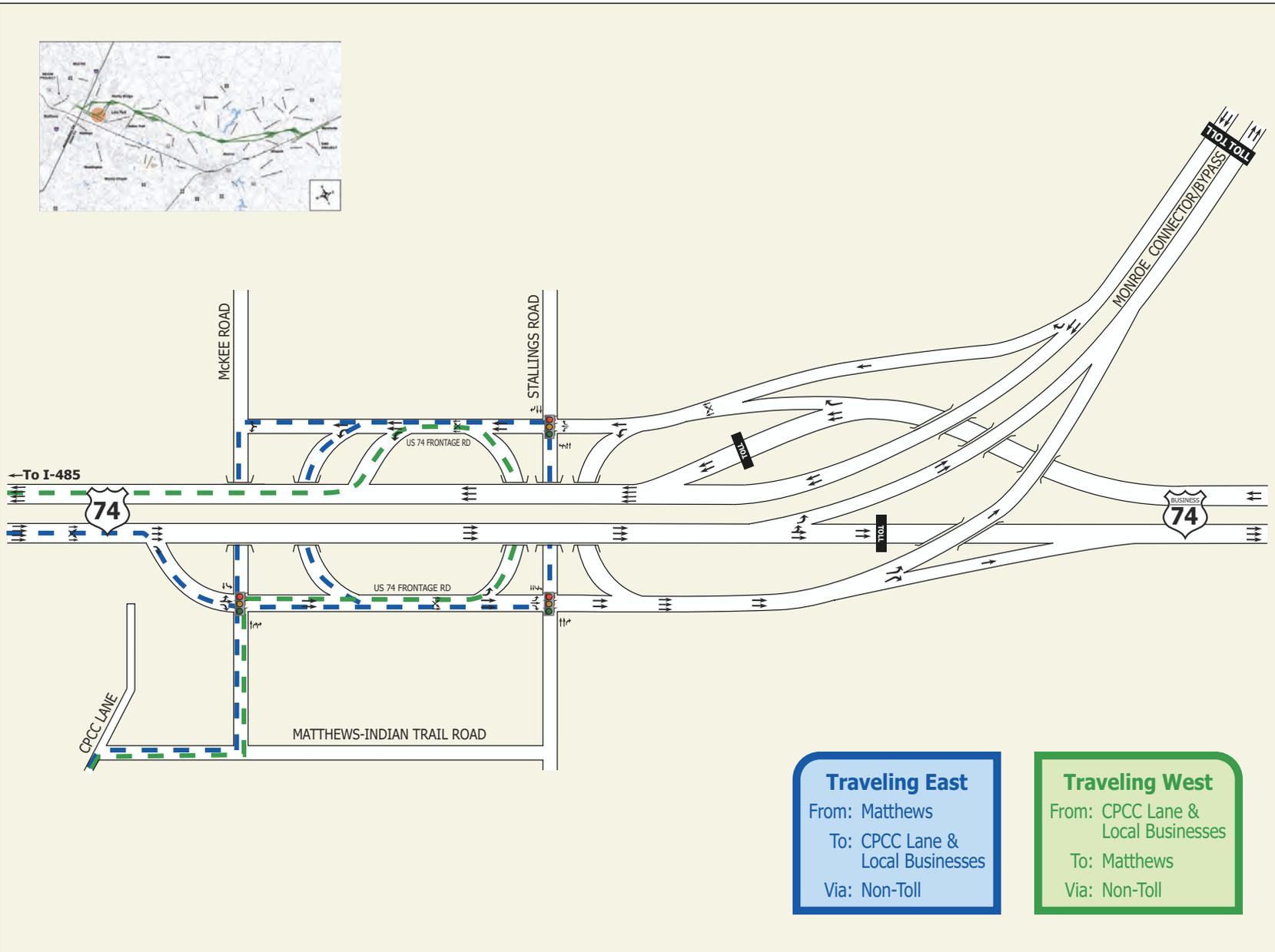
**Traveling West**  
From: Business US 74  
To: Matthews  
Via: Toll & Non-Toll

Non-Toll = Dashed Line

Non-Toll = Dashed Line

FEIS\_B0402\_C\_S002\_Matthews-US74TollMonrConByp\_A01\_02.24.2010

Figure 2-5d



- Legend**
- Tolled Area Eastbound
  - Non-Tolled Area Eastbound
  - Tolled Area Westbound
  - Non-Tolled Area Westbound
  - TOLL Toll Plaza

**DRAFT**  
PRELIMINARY  
SUBJECT TO CHANGE

NOT TO SCALE



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Union County

**MONROE CONNECTOR/  
BYPASS**

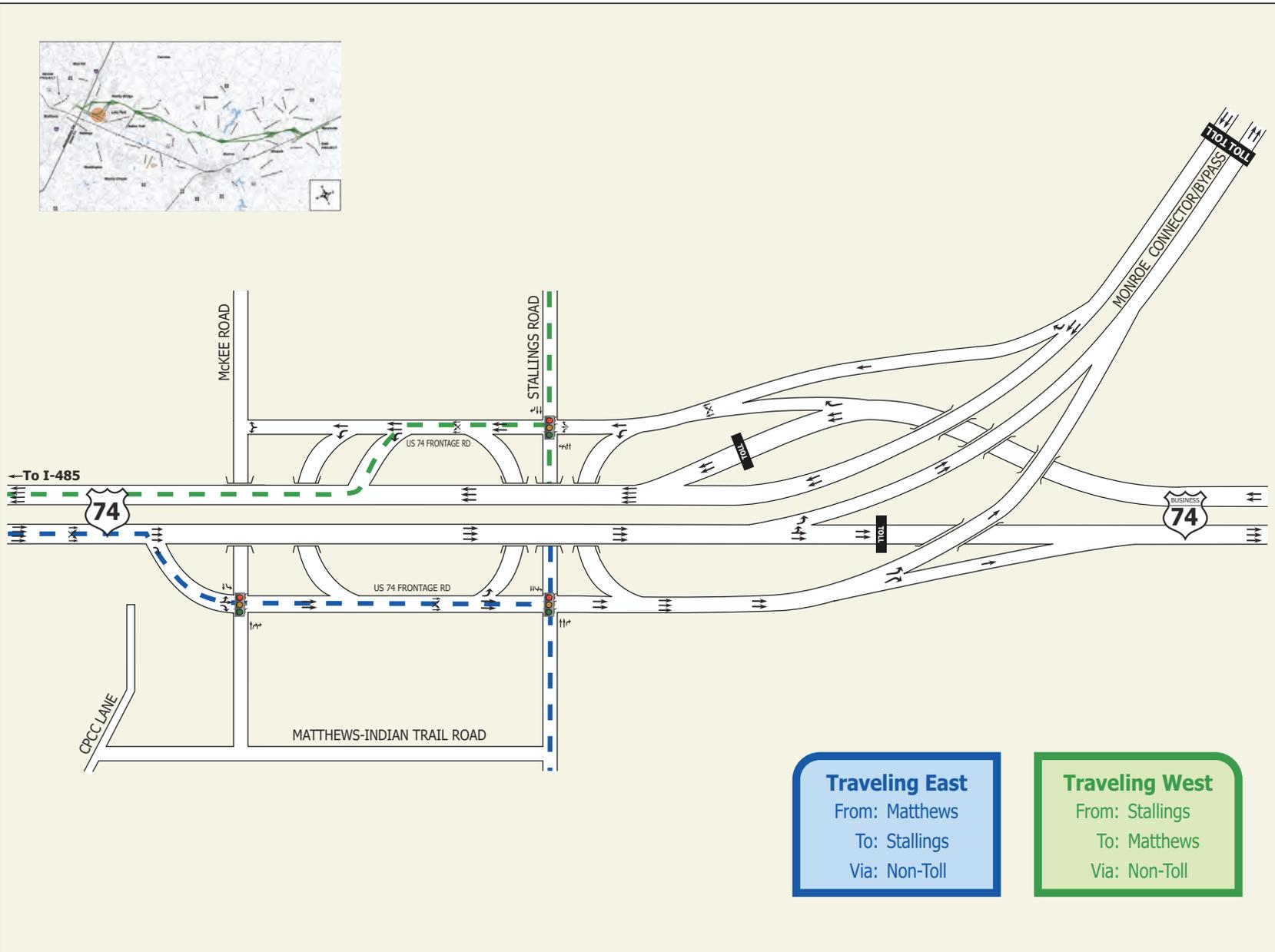
**TOLL COLLECTION  
PLAN**

**Traveling East**  
From: Matthews  
To: CPMC Lane &  
Local Businesses  
Via: Non-Toll

**Traveling West**  
From: CPMC Lane &  
Local Businesses  
To: Matthews  
Via: Non-Toll

PEIS\_Baird2\_E\_Seg2\_Matthews-CPMCLineNorthToll.dwg 02.24.2010

Figure 2-5e



- Legend**
- Tolled Area Eastbound
  - Non-Tolled Area Eastbound
  - Tolled Area Westbound
  - Non-Tolled Area Westbound
  - TOLL Toll Plaza

**DRAFT**  
PRELIMINARY  
SUBJECT TO CHANGE

NOT TO SCALE



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Union County

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BYPASS**

**TOLL COLLECTION  
PLAN**

**Traveling East**  
From: Matthews  
To: Stallings  
Via: Non-Toll

**Traveling West**  
From: Stallings  
To: Matthews  
Via: Non-Toll

Figure 2-5f



**Legend**

- Noise Receptors**
- Benefited Receptor Point
- Receptor Point
- Noise Barriers
- └ Stationing
- Preliminary Road Design
- Segment Breaklines
- ▭ Right of Way

NOTE: This barrier (N4-1) has been revised in height and length since the March 2009 Noise Study.



Source: Mecklenburg County and Union County GIS.  
Map Printed On 12.12.09.



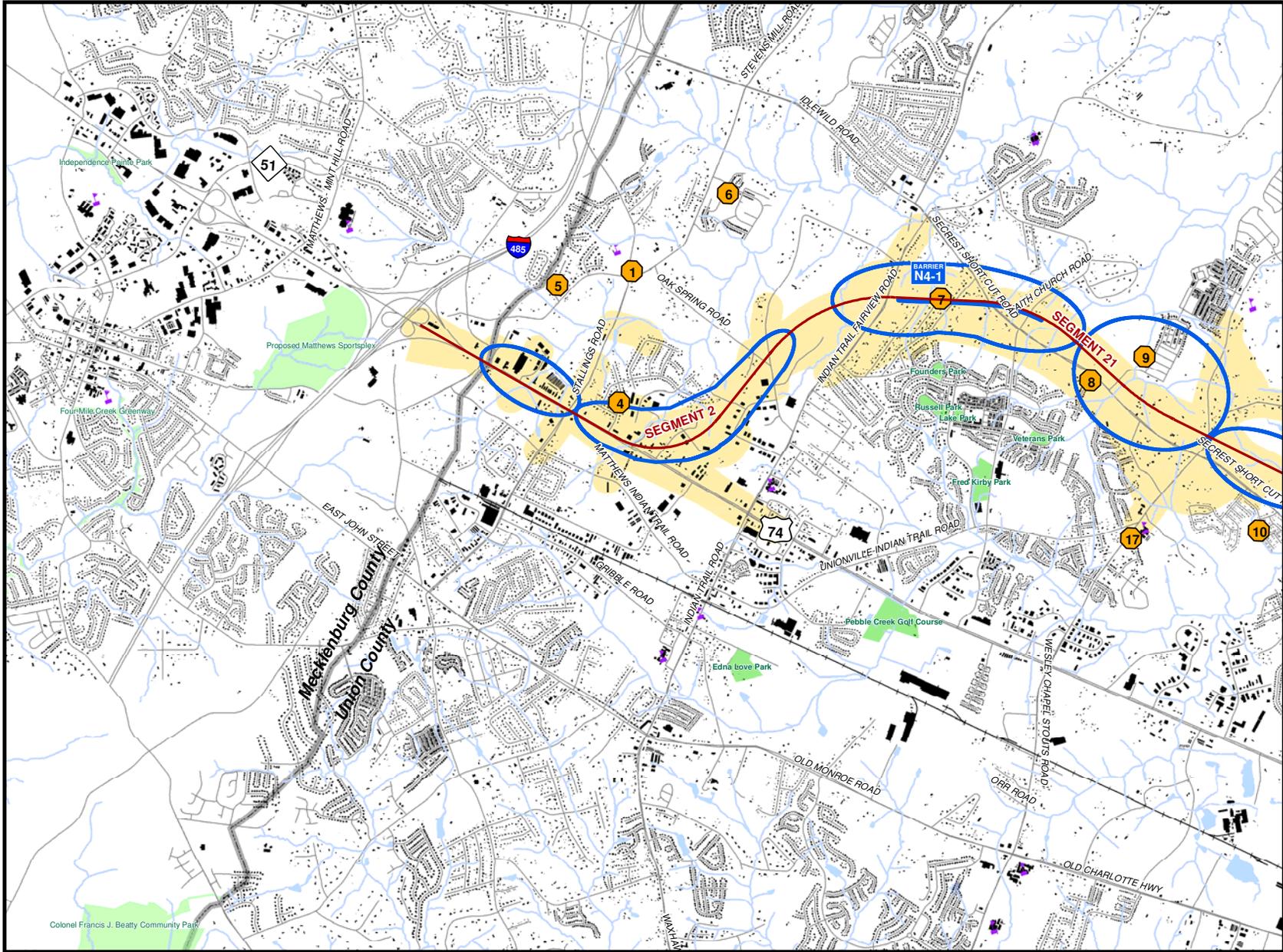
STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and  
Union County

**MONROE CONNECTOR/  
BYPASS**

**BARRIER  
EVALUATION AREA**

**BARRIER N-4-1**

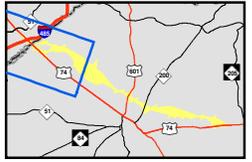
**Figure 2-6**



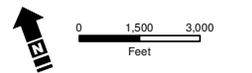
Legend

- Noise Measurement Site
- Noise Barrier
- Barrier Evaluation Area
- Alt D Centerline
- Hydrology
- School
- Structure
- Park
- Railroad
- Thoroughfare
- Street
- Lake
- County Boundary
- Alt D Study Corridor

\*Noise barriers shown on this map are preliminary. The feasibility and reasonableness of potential noise barriers will be reassessed for the Preferred Alternative during final design.



Source: Mecklenburg County and Union County GIS.  
Map Printed December 2009.

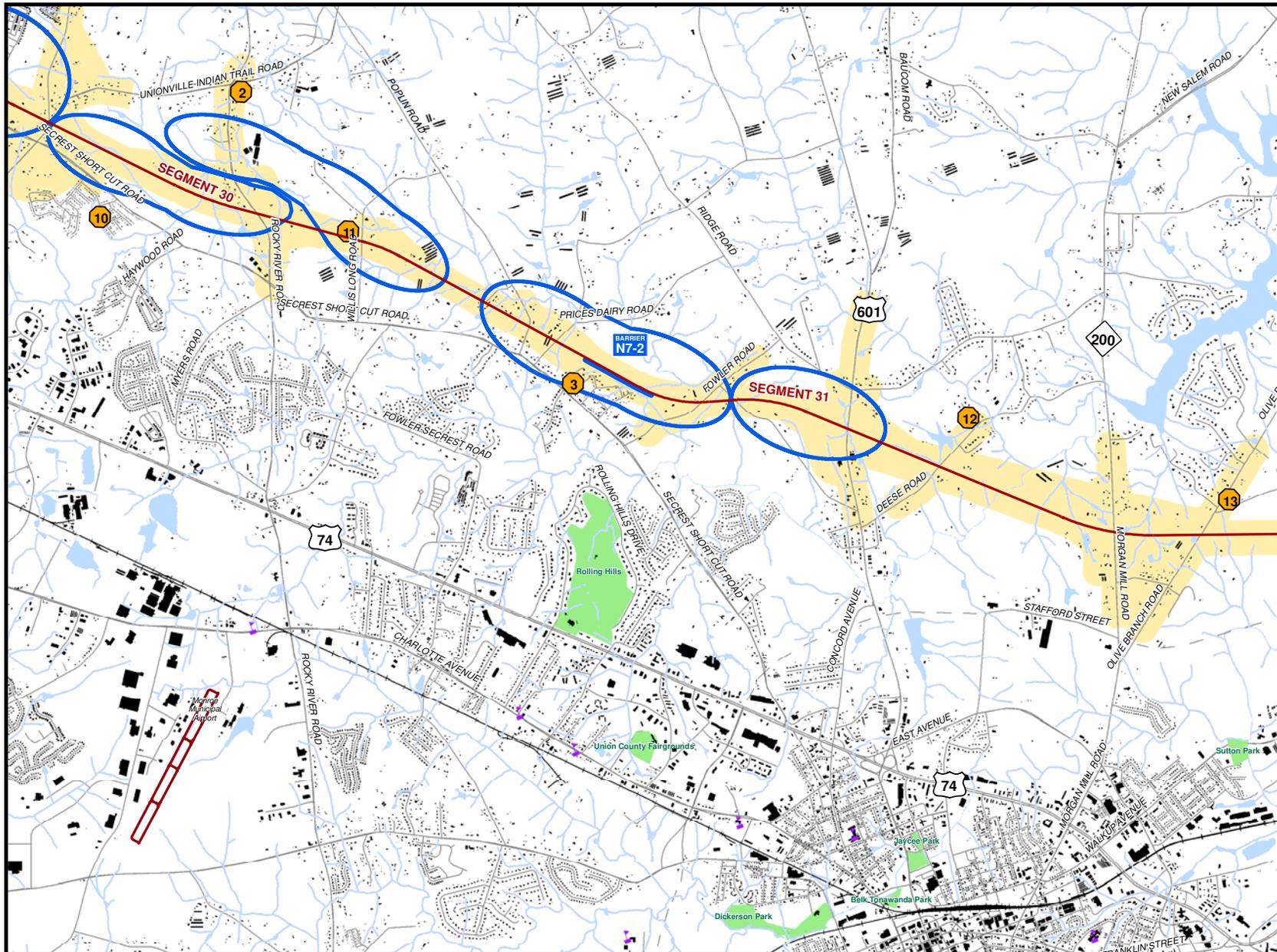


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Union County

**MONROE CONNECTOR/  
BYPASS**

**NOISE IMPACT  
ASSESSMENT  
INFORMATION**

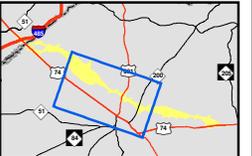
Figure 2-7a



Legend

- Noise Measurement Site
- Noise Barrier
- Barrier Evaluation Area
- Alt D Centerline
- Hydrology
- School
- Structure
- Park
- Railroad
- Thoroughfare
- Street
- Lake
- County Boundary
- Alt D Study Corridor

\*Noise barriers shown on this map are preliminary. The feasibility and reasonableness of potential noise barriers will be reassessed for the Preferred Alternative during final design.



Source: Mecklenburg County and Union County GIS.  
Map Printed December 2009.

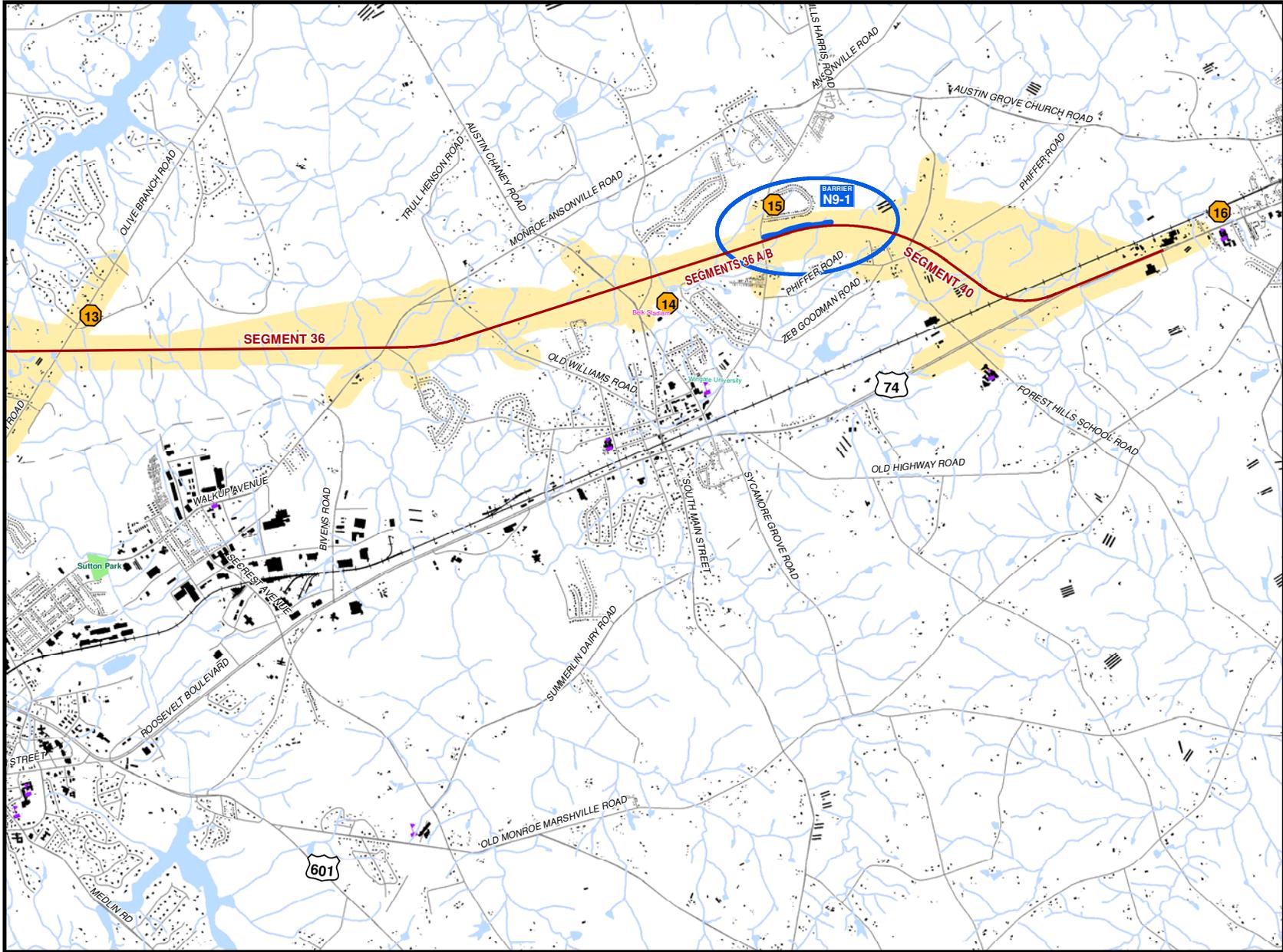


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**MONROE CONNECTOR/  
BYPASS**

**NOISE IMPACT  
ASSESSMENT  
INFORMATION**

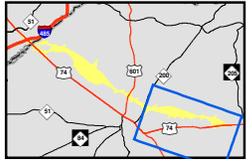
Figure 2-7b



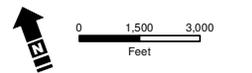
Legend

- Noise Measurement Site
- Noise Barrier
- Barrier Evaluation Area
- Alt D Centerline
- Hydrology
- School
- Structure
- Park
- Railroad
- Thoroughfare
- Street
- Lake
- County Boundary
- Alt D Study Corridor

\*Noise barriers shown on this map are preliminary. The feasibility and reasonableness of potential noise barriers will be reassessed for the Preferred Alternative during final design.



Source: Mecklenburg County and Union County GIS.  
Map Printed December 2009.

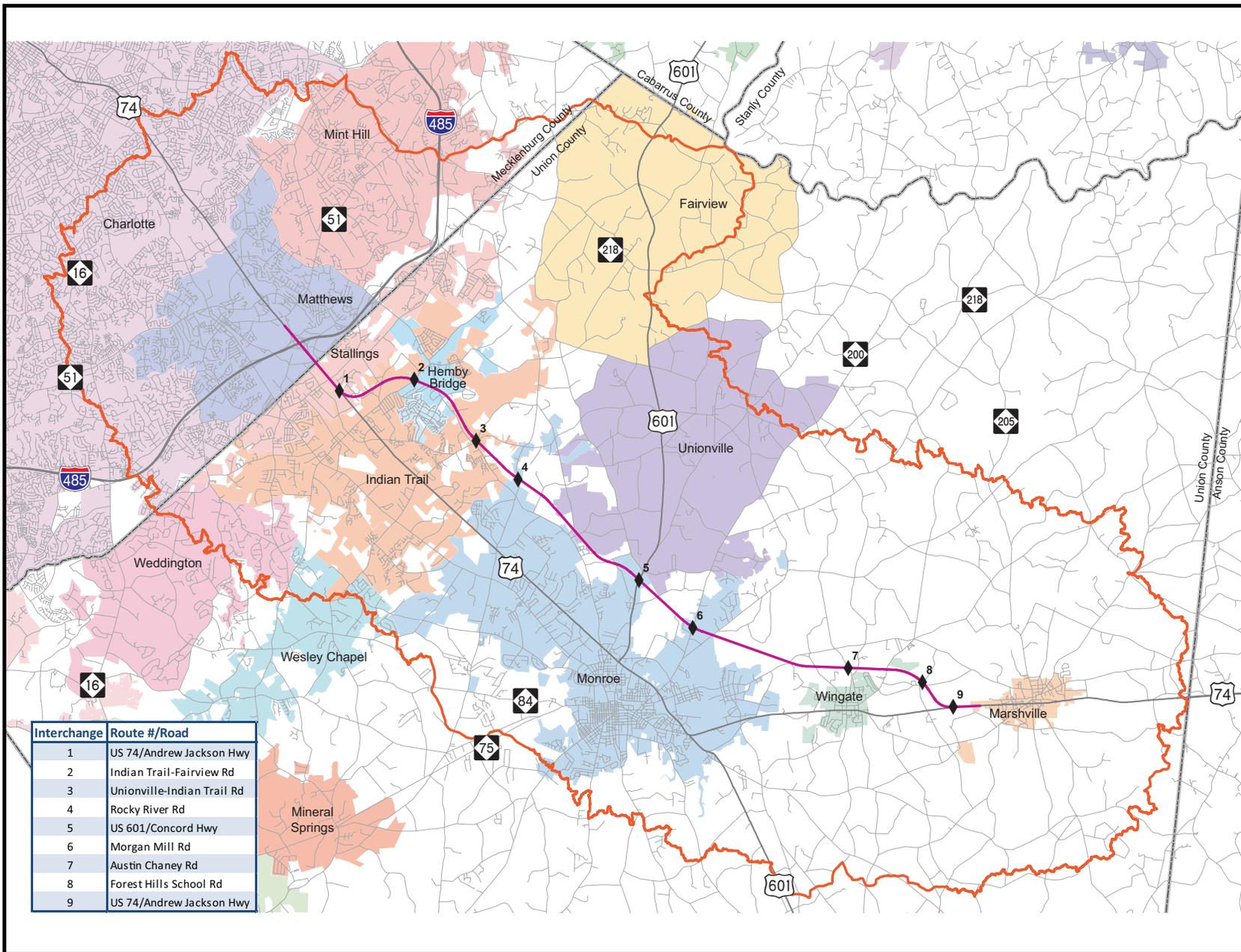


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Union County

**MONROE CONNECTOR/  
BYPASS**

**NOISE IMPACT  
ASSESSMENT  
INFORMATION**

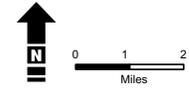
Figure 2-7c



- Legend**
- ◆ Interchanges
  - Recommended Preferred Alternative Centerline
  - Major Roads
  - Other Roads
  - ▭ Expanded Future Land Use Study Area



Source: Indirect and Cumulative Effects Quantitative Analysis Report from Michael Baker Engineering, Inc., January 2010. Map Printed January 2010.



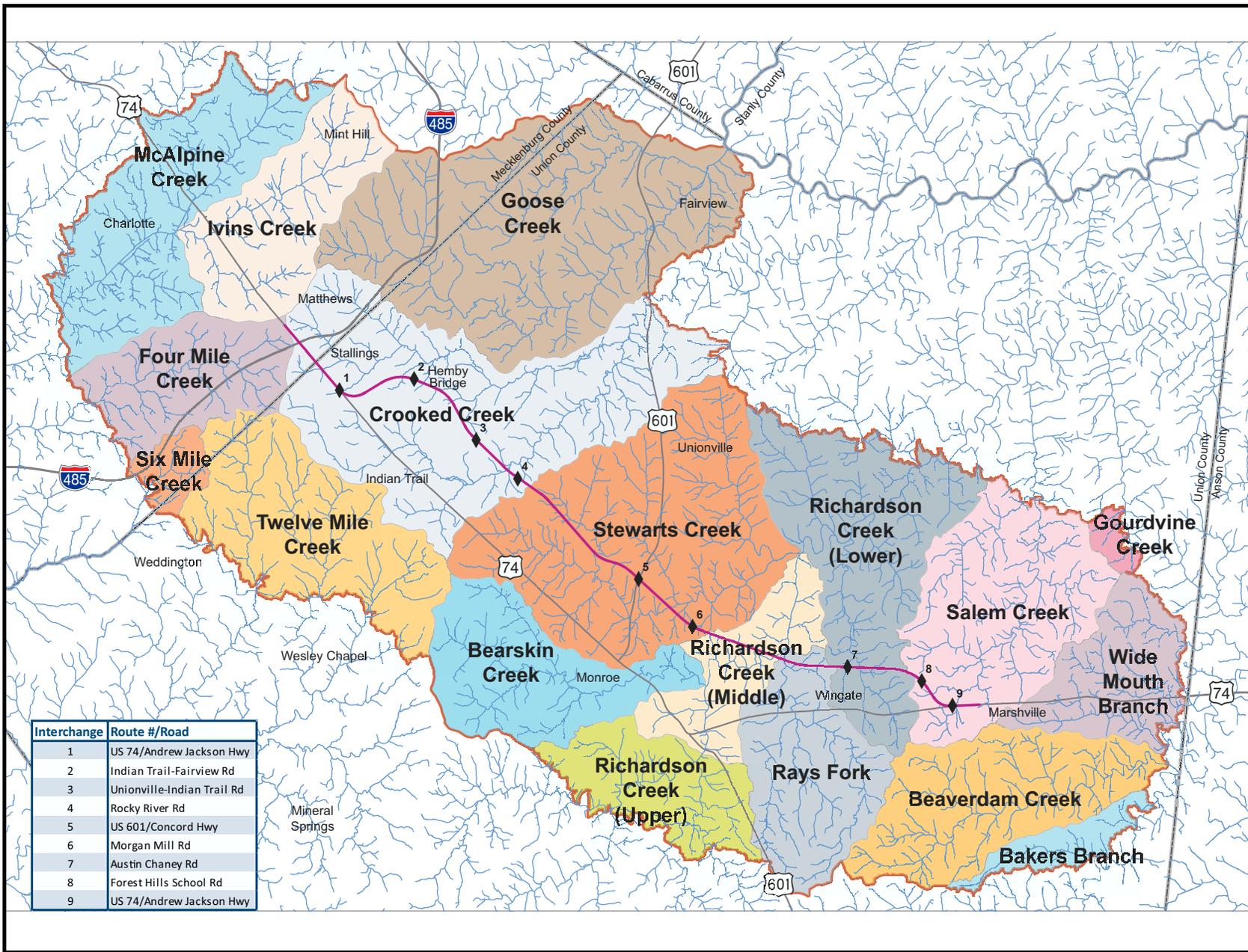
**TURNPIKE AUTHORITY**

STIP PROJECT  
NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

**STUDY AREA FOR  
QUANTITATIVE ICE**

Figure 2-8



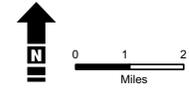
Interchange	Route #/Road
1	US 74/Andrew Jackson Hwy
2	Indian Trail-Fairview Rd
3	Unionville-Indian Trail Rd
4	Rocky River Rd
5	US 601/Concord Hwy
6	Morgan Mill Rd
7	Austin Chaney Rd
8	Forest Hills School Rd
9	US 74/Andrew Jackson Hwy

**Legend**

- ◆ Interchanges
- Recommended Alternative Centerline
- Major Roads
- Other Roads
- River or Stream
- ▭ Expanded Future Land Use Study Area



Source: Indirect and Cumulative Effects Quantitative Analysis Report from Michael Baker Engineering, Inc., January 2010. Map Printed January 2010.



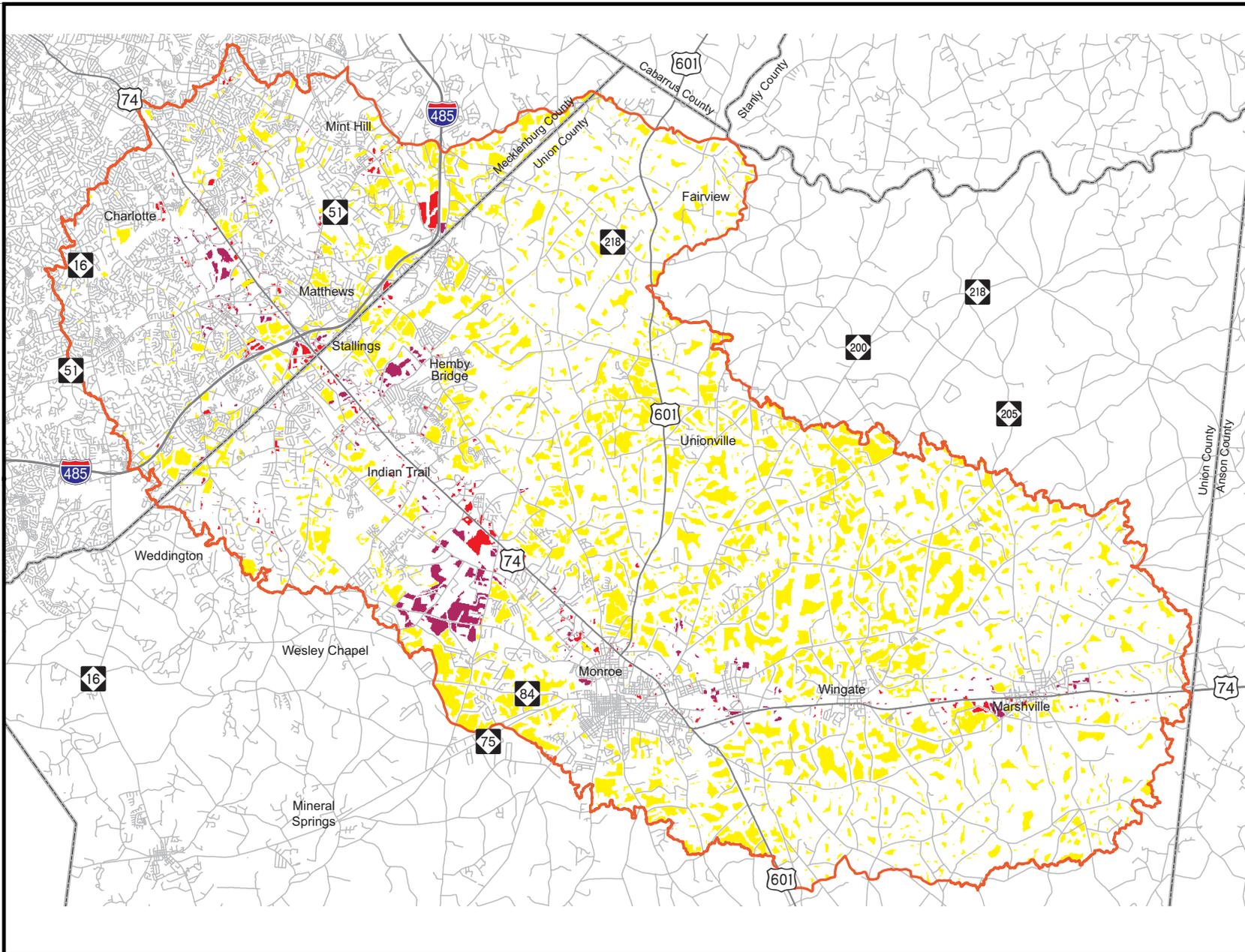
**NORTH CAROLINA Turnpike Authority**

STIP PROJECT NO. R-3329/R-2559  
Mecklenburg County and Union County

**MONROE CONNECTOR/ BYPASS**

**STUDY AREA WATERSHEDS**

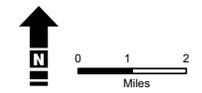
Figure 2-9



- Legend**
- Baseline to No Build Comparison
  - Undeveloped to Residential
  - Undeveloped to Industrial/Office
  - Undeveloped to Commercial
  - Residential to Industrial/Office
  - Residential to Commercial
  - Lower to Higher Density Residential
  - Industrial/Office to Residential
  - Industrial/Office to Commercial
  - Commercial to Industrial/Office
  - Commercial to Residential
  - Future Land Use
  - Study Area Boundary
- Note: Limitations of comparisons between Baseline and No Build are detailed in Section 3.6.



Source: Indirect and Cumulative Effects Quantitative Analysis Report from Michael Baker Engineering, Inc., January 2010. Map Printed January 2010.



**TURNPIKE AUTHORITY**

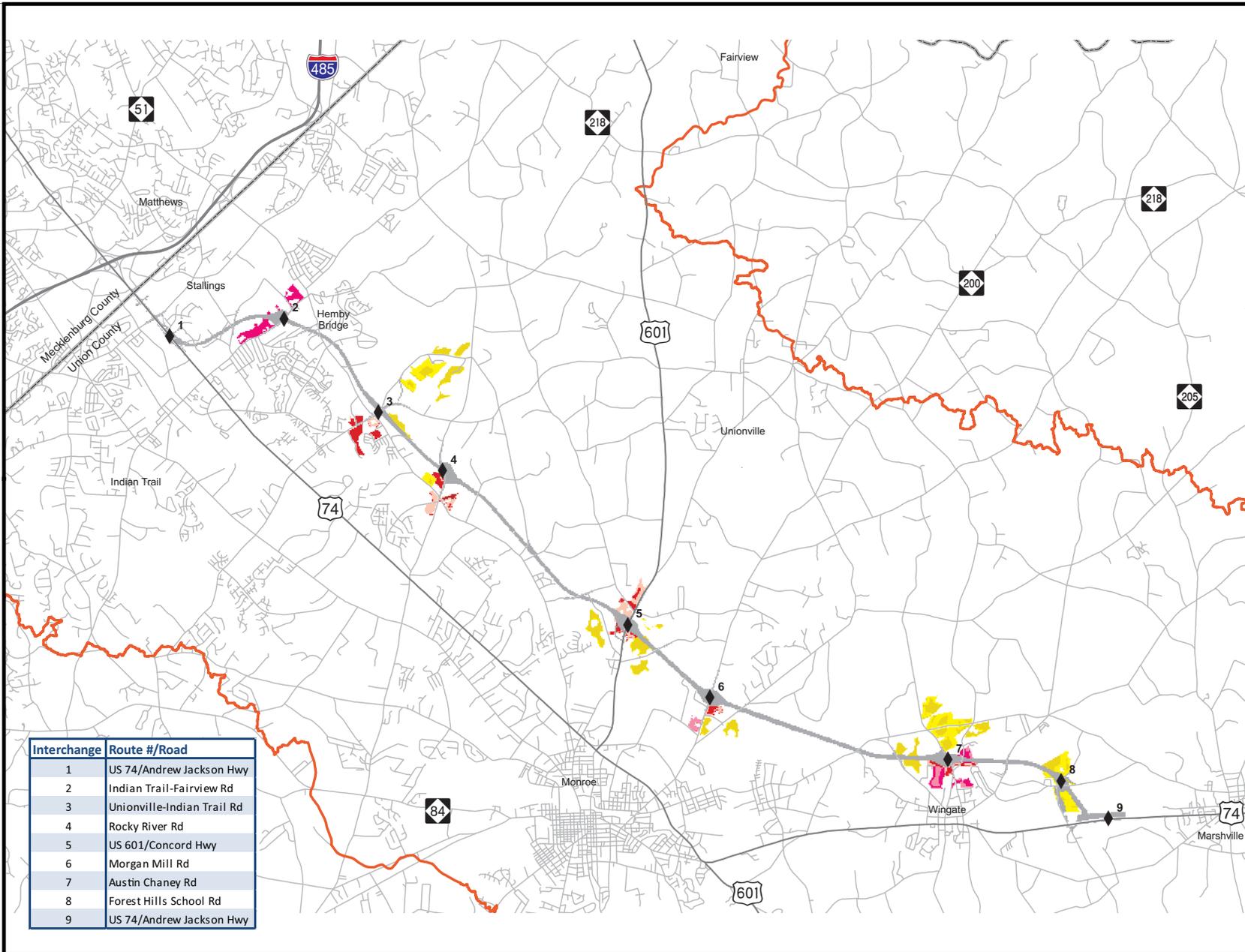
STIP PROJECT  
NO. R-3329/R-2559

Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

**BASELINE (2007) TO  
2030 NO BUILD  
LANDUSE**

Figure 2-10



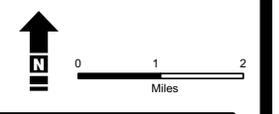
Interchange	Route #/Road
1	US 74/Andrew Jackson Hwy
2	Indian Trail-Fairview Rd
3	Unionville-Indian Trail Rd
4	Rocky River Rd
5	US 601/Concord Hwy
6	Morgan Mill Rd
7	Austin Chaney Rd
8	Forest Hills School Rd
9	US 74/Andrew Jackson Hwy

**Legend**

- ◆ Interchanges
- No Build to Build Comparison
- Low to Medium Density Residential
- Undeveloped to Residential
- Residential to Commercial
- Undeveloped to Commercial
- Residential to Industrial
- Undeveloped to Industrial/Office
- Industrial/Office to Commercial
- Roadway Footprint

Mecklenburg and Union Counties  
North Carolina Counties

Source: Indirect and Cumulative Effects Quantitative Analysis Report from Michael Baker Engineering, Inc., January 2010. Map Printed January 2010.



**TURNPIKE AUTHORITY**

STIP PROJECT  
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Mecklenburg County and Union County

**MONROE CONNECTOR/  
BYPASS**

**COMPARISON OF  
LANDUSE: 2030  
PREFERRED  
ALTERNATIVE  
TO 2030 NO BUILD**

**Figure 2-11**