FINAL
TRAFFIC NOISE TECHNICAL MEMORANDUM

For

ADMINISTRATIVE ACTION
ENVIRONMENTAL IMPACT STATEMENT

Monroe Connector/Bypass
Union and Mecklenburg Counties

STIP Project Nos. R-3329 and R-2559

Prepared for:

NORTH CAROLINA Turnpike Authority

Prepared by:

PBS&J

1616 East Millbrook Road
Raleigh, NC 27609

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1 PROJECT DESCRIPTION AND BACKGROUND

1.1 PROPOSED ACTION AND PROJECT PURPOSE

The purpose of the project is to improve mobility and capacity within the project study area by providing a facility in the US 74 corridor that allows for high-speed, regional travel consistent with the designations of the North Carolina Strategic Highway Corridor Program and the North Carolina Intrastate System, while maintaining access to properties along existing US 74. The proposed project would be a new location controlled-access toll facility in the US 74 corridor from I-485 in Mecklenburg County to just west of the Town of Marshville in Union County. **Figure 1** shows the general project location.

The Monroe Connector/Bypass is designated as Projects R-3329 (Monroe Connector) and R-2559 (Monroe Bypass) in the North Carolina Department of Transportation (NCDOT)'s *2009-2015 State Transportation Improvement Program* (STIP).

1.2 PURPOSE OF THIS TECHNICAL MEMORANDUM

The purpose of this memorandum is to present an analysis of the traffic noise impacts predicted to occur in 2035 along the proposed Detailed Study Alternatives for the Monroe Connector/Bypass. The analysis is based on the Functional Roadway Design Plans (August 2008). Completion and approval of the Final Roadway Design Plans may require modifications to the roadway alignments or locations of cut and fill slopes which may, in turn, require changes to the noise walls presented in this memorandum. Updates to traffic projections may also change the results described in this memorandum.

1.3 DETAILED STUDY ALTERNATIVES

The purpose of the project is to improve mobility and capacity within the project study area by providing a facility in the US 74 corridor that allows for high-speed, regional travel consistent with the designations of the North Carolina Strategic Highway Corridor Program and the North Carolina Intrastate System, while maintaining access to properties along existing US 74. The proposed project would be a new location controlled-access toll facility in the US 74 corridor from I-485 in Mecklenburg County to just west of the Town of Marshville in Union County. **Figure 1** shows the general project location.

The Monroe Connector/Bypass is designated as Projects R-3329 (Monroe Connector) and R-2559 (Monroe Bypass) in the North Carolina Department of Transportation (NCDOT)'s *2009-2015 State Transportation Improvement Program* (STIP).

In addition to the No-Build Alternative, there are sixteen new location Detailed Study Alternatives (DSAs) under consideration. Each one is proposed to be a four-lane, new-location toll facility with a 70-foot grassed median. The corridor segments comprising these sixteen DSAs are shown in **Table 1** and **Figures 2a-c**. Generally, there are up to two corridor options in any one area. Combinations of these options comprise the sixteen DSAs.

TABLE 1: Corridor Segments Comprising Each Detailed Study Alternative

Detailed Study Alternative*	Corridor Segments*
No-Build	N/A
A	18A, 21, 22A, 31, 36, 36A, 40
B	18A, 21, 30, 31, 36, 36A, 40
C	2, 21, 22A, 31, 36, 36A, 40
D	2, 21, 30, 31, 36, 36A, 40
A1	18A, 21, 22A, 31, 34, 34B, 40
B1	18A, 21, 30, 31, 34, 34B, 40
C1	2, 21, 22A, 31, 34, 34B, 40
D1	2, 21, 30, 31, 34, 34B, 40
A2	18A, 21, 22A, 31, 36, 36B, 41
B2	18A, 21, 30, 31, 36, 36B, 41
C2	2, 21, 22A, 31, 36, 36B, 41
D2	2, 21, 30, 31, 36, 36B, 41
A3	18A, 21, 22A, 31, 34, 34A, 41
B3	18A, 21, 30, 31, 34, 34A, 41
C3	2, 21, 22A, 31, 34, 34A, 41
D3	2, 21, 30, 31, 34, 34A, 41

* See **Figures 2a-c** for a map of the Detailed Study Alternatives.

Interchanges currently are proposed at nine to ten locations (depending on the DSA), as listed below from west to east. Unless otherwise noted, each interchange is included in all the DSAs.

- I-485 –partial interchange for Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, and B3)
- Stallings Road (SR 1365) – partial interchange for Segment 18A for movements not provided at I-485 interchange (DSAs A, B, A1, B1, A2, B2, A3, and B3)
- US 74 between Stallings Road and Indian Trail-Fairview Road (DSAs C, D, C1, D1, C2, D2, C3, and D3)
- Indian Trail-Fairview Road (SR 1520)
- Unionville-Indian Trail Road (SR 1367)
- North Rocky River Road (SR 1514)
- US 601
- NC 200 (Morgan Mill Road)
- Austin Chaney Road (SR 1758)

- Forest Hills School Road – partial interchange for movements not provided at the interchange with existing US 74 near Marshville
- Existing US 74 near Marshville – partial interchange

At the western terminus of Corridor Segment 18A (DSAs A, A1, A2, A3, B, B1, B2 and B3), the existing I-485/US 74 interchange would be modified to include the Monroe Connector/Bypass as a fifth leg. These DSAs also would include a partial interchange at Stallings Road to provide for movements not provided at the modified I-485/US 74/Monroe Connector/Bypass interchange. These movements are as follows: access to eastbound Monroe Connector/Bypass from westbound US 74, and access from westbound Monroe Connector/Bypass to eastbound US 74.

The western terminus of Corridor Segment 2 (DSAs C, C1, C2, C3, D, D1, D2, and D3) starts on US 74 in Mecklenburg County just east of the I-485 interchange. This segment would use existing US 74 for a distance of approximately 4,800 feet (0.9 mile). In this area, a six-lane elevated roadway would be constructed to serve as the Monroe Connector/Bypass, with three-lane, one-way frontage roads adjacent to either side of the Monroe Connector/Bypass to serve as Business 74 and provide access to adjacent properties. The DSAs would then transition to new location as a four-lane, median-divided facility.

At the eastern termini of all the DSAs near Marshville, the Forest Hills School Road partial interchange would provide for the following movements not provided at the interchange with existing US 74: access to westbound Monroe Connector/Bypass from eastbound US 74, and access from eastbound Monroe Connector/Bypass to westbound US 74.

Tolls would be paid through an electronic toll collection (ETC) system. There would be no cash toll booths so no vehicle stopping or idling would occur to collect tolls. The primary means of ETC would involve pre-registration with NCTA and use of a transponder/receiver system. The transponder may be mounted on the windshield of a vehicle. This allows the vehicle to move through the toll-collection locations at highway speeds. The user's account is then debited for the cost of the toll. The North Carolina Turnpike Authority (NCTA) would work with other toll authorities to enable, where possible, other systems' transponders to work on the Monroe Connector/Bypass. For travelers who do not have a transponder, a video system would capture license plate information and NCTA would bill the vehicle's registrant.

2 CHARACTERISTICS OF NOISE

Noise is basically defined as unwanted sound. It can be emitted from numerous sources, including airplanes, factories, railroads, power generation plants, trucks, and automobiles. Automobile noise is usually comprised of noises from engine exhaust, drive train, and tire/roadway interaction.

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly from object to object, a logarithmic scale is used to relate sound pressures to a common reference level, usually the decibel (dB). Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency weighted scales (A, B, C, or D).

The A-weighted decibel scale is used almost exclusively when measuring vehicle noise because it places a stronger emphasis on the frequency range to which the human ear is most sensitive (1,000 to 6,000 Hertz). Sound levels that are measured using the A-weighted decibel scale are

often expressed as dBA. Throughout this noise memorandum, all noise levels will be expressed in dBAs. Several examples of noise pressure levels in dBA are listed in **Table 2**.

The hourly Leq(h), or equivalent sound level, is the level of constant sound that over an hour time interval would contain the same acoustic energy as the time-varying sound. In other words, the fluctuating sound levels of traffic noise are represented in terms of a steady noise level with the same energy content.

A review of **Table 2** indicates that most individuals in urbanized areas are exposed to fairly high noise levels from different sources as they go about their daily activities. The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

1.) The amount and nature of the intruding noise.

2.) The relationship between background noise and the intruding noise.

3.) The type of activity occurring when the noise is heard.

TABLE 2: Typical Noise Sources

Noise Level (dBA)	Description	Transportation Sources	Other Sources
130	Painfully loud		
120		Jet takeoff (200 feet)	
110	Maximum vocal effort	Car horn (3 feet)	
100			Shout (.5 feet)
90	Very annoying; loss of hearing with prolonged exposure	Heavy truck (50 feet)	Jack hammer (50 feet) Home shop tools (3 feet)
85		Freight train on a structure (50 feet)	Backhoe (50 feet)
80	Annoying	City bus (50 feet)	Bulldozer (50 feet) Vacuum cleaner (3 feet)
75		Freight train (50 feet) City bus at stop (50 feet)	Blender (3 feet)
70		Freeway traffic (50 feet)	Lawn mower (50 feet) Large office
65	Intrusive	Freight train in station (50 feet)	Washing machine (3 feet)
60			TV (10 feet)
55		Light traffic (50 feet)	Talking (10 feet)
50	Quiet	Light traffic (100 feet)	
45			Refrigerator (3 feet)
40			Library
30	Very quiet		Soft whisper (15 feet)

Sources: FTA, 1995; U.S. EPA, 1971; U.S. EPA, 1974.

In considering the first of these three factors, it is important to note that individuals have different sensitivities to noise. Loud noises bother some more than others and some individuals become upset if an unwanted noise persists. The time patterns of noise also enter into an individual's judgment of whether or not a noise is offensive. For example, noises that occur during sleeping hours are usually considered to be more offensive than the same noises in the daytime.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). The honking of a car horn at night (when background noise levels are approximately 45 dBA Leq) would generally be more objectionable than the honking of a car horn during the daytime when background noises might be 55 dBA Leq.

The third factor is related to the interference of noise with activities of individuals. In a 60 dBA Leq environment, normal conversation would be possible, while sleep might be difficult. Work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Over time, individuals tend to accept the noises which intrude into their daily lives, particularly if the noises are steady or occur at regular known intervals. Many of these noises are subject to regulations, including airplane noise, factory noise, railroad noise, and highway traffic noise.

3 NOISE ABATEMENT CRITERIA

The FHWA has established Noise Abatement Criteria (NAC) and procedures to be used in the planning and design of highways. These NAC and procedures are found in 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*.

The FHWA NAC are presented in **Table 3**. As shown in the table, the NAC are divided into Activity Categories depending upon different sensitivities to noise. Most land uses in the project area are in Activity Categories B and C, and include residences, churches, schools, and businesses.

TABLE 3: FHWA Noise Abatement Criteria

Activity Category	Leq (hour)	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, schools, churches, libraries, and hospitals.
C	72 (exterior)	Developed lands, properties, or activities not included in Categories A and B above.
D	--	Undeveloped lands.
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*

Noise mitigation measures must be considered when future noise levels either approach or exceed the NAC levels, or if there are substantial increases over existing noise levels. The definitions of approach and substantial increase are left up to each state. NCDOT defines approach as within 1 decibel of the NAC. NCDOT's definitions for "substantial increases" are presented in **Table 4**. The NCTA follows NCDOT's policies, guidance, and procedures regarding noise.

TABLE 4: NCDOT Definition of Substantial Increase in Noise Levels

Existing Average Noise Level dBA Leq(hour)	Increase (in decibels) from Existing Noise Levels to Future Noise Levels Defined as a Substantial Increase
≥55	10 or more
54	11 or more
53	12 or more
52	13 or more
51	14 or more
≤50	15 or more

Source: NCDOT Traffic Noise Abatement Policy, 2004.

Title 23 CFR, Section 772.11(a) states, "In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit."

4 ANALYSIS METHODOLOGY

4.1 MEASUREMENTS OF EXISTING NOISE LEVELS

Noise level measurements were taken in the vicinity of the project to determine the typical existing background (ambient) noise levels and to provide a basis for assessing the impacts of future traffic noise levels. Ambient noise levels are defined as "the composite of airborne sound from many sources near and far associated within a given environment. No particular sound is singled out for interest" (American Society for Testing and Materials [ASTM] Standard C634-89).

Existing noise measurements were conducted following the guidance contained in FHWA's publication "Highway Traffic Noise Analysis and Abatement: Policy and Guidance" (June 1995) (available at FHWA's Web site, www.fhwa.dot.gov/environment/noise/polguide/polguid.pdf).

Existing noise measurements were performed in the project study area at seventeen representative locations in the vicinity of the Detailed Study Alternatives. Existing noise measurement locations are shown in **Figures 3a-c**. Seven measurement locations were adjacent to roadways and ten locations were in areas away from direct traffic noise sources.

Noise measurements were performed on average for 15-20 minute periods using a CEL 490 (Type I) sound level meter. Measurements taken adjacent to roadways were conducted during approximate peak travel periods (7:30- 9:30 am and 3:30- 6:30 pm). The sound level meter microphone was placed approximately 5 feet above the ground. The meter was calibrated before and after each day of the noise level survey. Where a roadway was adjacent to the field measurement site, traffic volumes and traffic mixes (numbers of cars, medium-sized trucks, and large trucks) were recorded.

The meter was set to fast response, although meters are typically set to slow response for measurements of existing noise. For purposes of this study, the results using the fast response were considered valid. A meter set to fast response may record noise levels that are slightly lower compared to a slow response setting when noise levels fluctuate between loud and quiet moments during the measurement period. However, since the noise environment tended to be relatively

constant at the measurement locations, any differences between fast response readings and slow response readings likely would be negligible (less than 1 decibel difference) for this study.

To further check the suitability of the measurements for use in the study, two sites adjacent to existing roadways were modeled using FHWA's Traffic Noise Model® (TNM), Version 2.5, released 2004 (See **Section 4.2**) for calibration purposes. Measurement Site 2 for traffic on Unionville-Indian Trail Road and Measurement Site 3 for traffic on Secrest Shortcut Road were modeled using the recorded existing conditions at the measurement site. Measurement Site 2 has a measured value of 59.1 dBA Leq, while the model results are 58.3 dBA Leq. The results for Measurement Site 3 are 61.0 dBA Leq measured and 63.1 dBA Leq modeled. Both sites have measured and modeled values within 2 decibels of each other, which indicates good calibration. **Appendix D** includes noise meter output.

4.2 PROCEDURE FOR PREDICTING FUTURE NOISE LEVELS

In general, the traffic situation is composed of a large number of variables, including vehicles driving at different speeds through a continually changing roadway configuration and surrounding terrain. Due to the complexity of the problem, certain assumptions and simplifications must be made to predict highway traffic noise. The model used to predict future noise levels was the FHWA's Traffic Noise Model® (TNM), Version 2.5, released 2004.

TNM calculates noise levels at selected receptor locations using input parameter estimates such as projected peak hour traffic volumes; vehicle mix (percentages of cars, medium trucks, and heavy trucks), speed; roadway lengths and gradients; distances between sources, barriers, and receptors; and shielding provided by intervening terrain, barriers, and structures. All data was input to the model in English units.

This analysis used a two-step approach to estimate noise levels and to minimize the number of receptors to be included in detailed three-dimensional TNM models in the second step. The first step used TNM to develop noise contours and to identify the sensitive receptors potentially impacted by the proposed Detailed Study Alternatives. The basic approach was to select receptor locations at various distances from the proposed alternatives to estimate future noise levels, then to determine the distances at which the predicted peak hour noise levels would be at 60 dBA Leq (representing a substantial increase for receptors with existing noise levels of 45 dBA Leq), or reaching 66 dBA and 71 dBA (representing sound levels approaching 67 dBA Leq and 72 dBA Leq, which are the NAC for Activity Categories B and C, respectively). Terrain features and shielding were not included in these model runs. The noise contours represent conservative estimates of noise levels valid only for preliminary identification of receptors potentially impacted by future traffic noise.

The noise contours were overlaid onto base mapping, and sensitive receptors within the contours were identified and numbered. There were 251 unique receptors identified. **Appendix A** is a master list of the receptors, receptor types, and location in State Planar Coordinates. Labels assigned to the receptors were based on their general location along the DSAs, as listed below. For example, Receptors A1 and A2 are located along US 74 west of Stallings Road, and Receptors H1 and H2 are located between NC 200 and Austin Chaney Road.

Receptor Label Letter	Location Along DSAs
A	Along US 74 west of Stallings Road
B	Along Segment 18A between US 74 and Stallings Road
C	Between Stallings Road and Indian Trail-Fairview Road
D	Between Indian Trail-Fairview Road and Unionville-Indian Trail Road
E	Between Unionville-Indian Trail Road and Rocky River Road
F	Between Rocky River Road and US 601
G	Between US 601 and NC 200
H	Between NC 200 and Austin Chaney Road
I	Between Austin Chaney Road and US 74 near Marshville

For all of these receptors described above, predicted noise levels were computed using a spreadsheet (designated by NCDOT as "Table N4") developed by NCDOT for this purpose based on the results of the noise contour TNM runs. The detailed summary sheets and TNM files are located in **Appendix E**.

In the second step, TNM was used to perform more detailed analyses in areas where approximately three or more receptors were identified as being potentially impacted. In these barrier evaluation areas (BEAs), a three-dimensional TNM model was developed. For receptors that would be impacted, noise barriers were developed. These barriers were then evaluated based on NCDOT's *Traffic Noise Abatement Policy* (2004) to determine if they would be feasible and reasonable. Feasibility and reasonableness determinations presented in this summary are preliminary. Feasibility and reasonableness of potential barriers will be reassessed during final design.

The following data and assumptions were used in TNM.

Roadways. The profiles and horizontal alignments of the functional engineering designs within the Detailed Study Alternatives were included in TNM. The typical roadway section used for analysis included a four-lane divided highway with 12-foot shoulders and a 70-foot wide median. Completion and approval of the Final Roadway Design Plans may include modifications to the roadway alignments and/or locations of cut and fill slopes.

Traffic. Future year 2035 traffic projections for the Detailed Study Alternatives were prepared by Wilbur Smith Associates for the NC Turnpike Authority (*Traffic Forecast for TIP Projects R-3329 and R-2559 Monroe Connector/Bypass*, September 2008). **Appendix B** includes the traffic projections, which assume the new roadway is a toll facility. Traffic forecasts were prepared for two representative corridors, labeled Scenario 1A (corresponding to DSAs A, B, A1, B1, A2, B2, A3, and B3) and Scenario 3A (corresponding to DSAs C, D, C1, D1, C2, D2, C3, and D3). Speeds were assumed to be 65 miles per hour (mph) for the DSA mainlines, and 45 mph for ramps and cross streets.

Peak hour traffic volumes are estimated to be 10 percent of the daily volumes for the DSA mainlines. In accordance with NCDOT Congestion Management Unit standard practice, peak hour traffic mixes are assumed to include one-half the truck percentages estimated for the daily traffic mixes. For example, if the traffic forecast estimated 25,000 ADT with a mix of 92 percent cars, 2 percent medium trucks and 6 percent heavy trucks, the peak hour volumes would be 2,500 vehicles per hour with 96 percent cars, 1 percent medium trucks, and 3 percent heavy trucks.

The NCTA is evaluating different options available for toll collection, but none include cash lanes. An open road (highway speed) transponder-based system will likely be used as the primary means of collection. This would allow drivers to open an account and drive through the toll collection points unobstructed at highway speeds. Therefore, no adjustments to traffic speeds or other traffic factors (other than projected volumes) were made due to the project being a toll facility.

Receptors. Receptors modeled in this study represent residences, businesses, schools, and churches. Receptors generally were located at building/house corners or areas of the lots that were closest to the proposed roadway. Receptor elevations were input as 5 feet above the ground elevation. Only existing noise-sensitive receptors were included (as opposed to platted subdivisions not yet built upon). Existing noise levels were individually assigned to each receptor using the results of the existing noise measurements in the locations most similar in land use type and nearby noise sources.

Barriers. Within the Barrier Evaluation Areas, terrain features such as hills, fill slopes, and cut slopes were input, where appropriate, to model actual conditions as closely as possible.

5 EXISTING NOISE ENVIRONMENT

Noise levels were measured at twelve locations on July 30, 2008, and five locations on July 31, 2008. The sampling period at each location was 15-20 minutes. Noise measurement data sheets were completed at each existing noise level measurement location. **Appendix C** contains the *Noise Measurement Data Sheets* with the collected field survey information.

Existing noise level measurements were downloaded from the noise level meter into the supporting dB23 software, then imported into an excel spreadsheet. **Appendix D** contains data downloaded from the noise level meter/dB23 software.

Table 5 shows the results of the noise measurements at each of the locations shown on **Figures 3a-c**.

At locations where traffic noise did not dominate the noise environment, the existing noise levels ranged from 39.8 dBA Leq to 54.6 dBA Leq. In the seven locations near roadways, noise levels ranged from 52.4 dBA Leq to 65.3 dBA Leq.

TABLE 5: Existing Noise Level Measurements

Site No.	Date and Time	Location	Description	Measured Avg. Noise Level (dBA Leq)
1	7/30/08 8:02 - 8:21 am	Stallings Elementary School (Stallings Rd).	50 ft. from road – measurement of traffic noise on Stallings Rd.	58.9
2	7/30/08 8:50 - 9:13 am	West of Rocky River Rd/Unionville Indian Trail Rd intersection.	50 ft. from road – measurement of traffic noise on Unionville-Indian Trail Rd.	59.1
3	7/30/08 9:34 - 9:55 am	Secrest Shortcut Rd near Dusty Hollow Rd. Avondale Park neighborhood.	50 ft. from road – measurement of traffic noise on Secrest Shortcut Rd.	61.0
4	7/30/08 10:28 - 10:44 am	Northeast side of Forest Park Rd/Pine Tree Dr intersection. Forest Park neighborhood.	Measured near US 74 side of neighborhood.	54.6

TABLE 5: Existing Noise Level Measurements

Site No.	Date and Time	Location	Description	Measured Avg. Noise Level (dBA Leq)
5	7/30/08 11:10 - 11:26 am	Blackberry Ln (off of Stevens Mill Rd) Eaglecrest/Blackberry Ridge neighborhood.	Measurement of background noise levels away from traffic.	48.8
6	7/30/08 11:42 - 12:03 pm	Shadowy Retreat Dr. Fairhaven neighborhood.	Measurement of background noise levels away from traffic.	52.9
7	7/30/08 12:23 - 12:38 pm	North end of Oakland Ave. Acorn Woods/Gold Hill neighborhoods.	Measurement of background noise levels away from traffic.	43.9
8	7/30/08 2:18 - 2:33 pm	Southwind Trail Dr, 5 lots in from Secrest Shortcut Rd. Arbor Glen neighborhood (northern end).	Measurement of background noise levels away from traffic.	53.2
9	10/17/07 2:40 - 2:56 pm	Parking area off Saratoga Blvd west of Belmont Stakes Ave. Bonterra neighborhood.	Measurement of background noise levels away from traffic.	39.8
10	7/30/08 3:14 - 3:31 pm	Suburban Dr. Suburban Estates neighborhood	Measurement of background noise levels away from traffic.	45.0
11	7/30/08 3:41 - 3:56 pm	Willis Long Rd/Winchester Rd intersection.	50 ft. from road – measurement of traffic noise on Willis Long Rd.	54.6
12	7/30/08 4:12 - 4:27 pm	Stump Lake Rd off Deese Rd. Ridge View neighborhood.	Measurement of background noise levels away from traffic.	45.7
13	7/31/08 8:53 - 9:10 am	East of Olive Branch Rd/Bentwood Ln intersection. Lakeside/Lakeshores neighborhood.	50 ft. from road – measurement of traffic noise on Olive Branch Rd.	59.9
14	7/31/08 8:10 - 8:31 am	McIntyre Rd near athletic stadium. College Park/Wingate University area.	Measurement of background noise levels away from traffic.	49.5
15	7/31/08 8:54 - 9:15 am	Ansonville Rd near Liles Way. Glencroft neighborhood.	50 ft. from road – measurement of traffic noise on Ansonville Rd.	52.4
16	7/31/08 9:31 - 9:52 am	US 74 near Marshville near the East Campus Church.	50 ft. from road – measurement of traffic noise on US 74.	65.3
17	7/31/08 10:11 – 10:26 am	Sardis Elementary School off Sardis Church Rd.	Measurement of background noise levels away from traffic.	49.5

6 PROJECTED TRAFFIC VOLUMES

As mentioned in **Section 4.2**, projected 2035 traffic volumes were prepared by Wilbur Smith Associates for the NC Turnpike Authority. These forecasts, which include ADTs, peak hour factors, traffic mixes, and peak hour directional distribution, are included in **Appendix B**. Peak directional volumes refers to the predominant direction of traffic volumes during the peak hour.

The forecasts were used to develop peak hour traffic volumes for the TNM input files. The peak hour traffic volumes between interchanges along the Monroe Connector/Bypass mainlines are shown in **Table 6a** for Forecast Scenario 1A (DSAs A, B, A1, B1, A2, B2, A3, and B3), and **Table 6b** for Forecast Scenario 3A (DSAs C, D, C1, D1, C2, D2, C3, and D3).

TABLE 6a: Projected 2035 Traffic Volumes Along Mainline – Scenario 1A - DSAs A, B, A1, B1, A2, B2, A3, and B3

Mainline Segment	Average Daily Traffic Volume	Peak Hour Traffic Mix[1]	Peak Hour Volumes[2]		
			Cars	Medium Trucks	Heavy Trucks
I-485 to Stallings Rd	41,400	88.5/4/7.5	2,198 1,466	99 66	186 124
Stallings Rd to Indian Trail-Fairview Rd	49,100	88.5/4/7.5	2,607 1,738	118 79	221 147
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	50,700	88.5/4/7.5	2,692 1,795	122 81	228 152
Unionville-Indian Trail Rd to Rocky River Rd	51,500	88.5/4/7.5	2,735 1,823	124 82	232 155
Rocky River Rd to US 601	46,200	88.5/4/7.5	2,453 1,635	111 74	208 139
US 601 to NC 200 (Morgan Mill Rd)	35,000	88.5/4/7.5	1,859 1,239	84 56	158 105
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	24,400	88/4/8	1,288 859	59 39	117 78
Austin Chaney Rd to Forest Hills School Rd	19,300	88/4/8	1,019 679	46 31	93 62
Forest Hills School Rd to US 74 near Marshville	15,400	88/4/8	813 542	37 25	74 49

1. Peak Hour Traffic Mix includes one-half the truck percentages for the Daily Traffic Mix. X/X/X = percent cars/ percent medium trucks/percent heavy trucks.
2. Peak Hour Volumes are provided for each direction of travel, with the heavier volume direction provided first. The directional split is 60%-40% during the peak hours. The heaviest volumes are eastbound in the morning and westbound in the evening (X/X = Eastbound/Westbound).

TABLE 6b: Projected 2035 Traffic Volumes Along Mainline – Scenario 3A - DSAs C, D, C1, D1, C2, D2, C3, and D3

Mainline Segment	Average Daily Traffic Volume	Peak Hour Traffic Mix[1]	Peak Hour Volumes[2]		
			Cars	Medium Trucks	Heavy Trucks
I-485 to Stallings Rd	95,600	88.5/4/7.5	3,828 3,132	147 120	231 189
Stallings Rd to Indian Trail-Fairview Rd	48,200	88.5/4/7.5	2,559 1,706	116 77	217 145
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	51,200	88.5/4/7.5	2,719 1,812	123 82	230 154
Unionville-Indian Trail Rd to Rocky River Rd	52,300	88.5/4/7.5	2,777 1,851	126 84	235 157
Rocky River Rd to US 601	46,600	88.5/4/7.5	2,474 1,650	112 75	210 140
US 601 to NC 200 (Morgan Mill Rd)	35,200	88.5/4/7.5	1,869 1,246	84 56	158 106
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	24,800	88/4/8	1,309 873	60 40	119 79
Austin Chaney Rd to Forest Hills School Rd	19,600	88/4/8	1,035 690	47 31	94 63
Forest Hills School Rd to US 74 near Marshville	16,400	88/4/8	866 577	39 26	79 52

1. Peak Hour Traffic Mix includes one-half the truck percentages for the Daily Traffic Mix. X/X/X = percent cars/ percent medium trucks/percent heavy trucks.
2. Peak Hour Volumes are provided for each direction of travel, with the heavier volume direction provided first. The directional split is 60%-40% during the peak hours. The heaviest volumes are eastbound in the morning and westbound in the evening (X/X = Eastbound/Westbound).

7 FUTURE TRAFFIC NOISE IMPACT ANALYSIS

7.1 NOISE CONTOUR MODEL

Traffic noise impacts occur when the predicted noise levels either: [a] approach or exceed the FHWA NAC ("approach" meaning within 1 dBA of the **Table 3** value), or [b] substantially exceed the existing noise levels (see **Table 4** for NCDOT definition of "substantial increase"). Consideration for noise abatement measures must be given to receptors that fall in either category.

According to policy, the Federal/State government is no longer responsible for providing noise abatement measures for new development when building permits are issued within the noise impact area of a proposed highway project after the "Date of Public Knowledge". The "Date of Public Knowledge" of the location of the proposed highway will be the approval date of the Record of Decision (ROD). For development occurring after this Date of Public Knowledge, local governing bodies are responsible to insure that noise compatible designs are utilized along the proposed route.

The maximum numbers of receptors in each activity category by roadway section predicted to be impacted by future 2035 traffic noise are shown for each DSA in **Tables 7a-p**. **Appendix E** includes the summary spreadsheets and TNM input/output files for each noise contour model. Summary sheets in **Appendix E** provide estimates of impacts based on the FHWA and NCDOT noise abatement criteria (See **Section 3** for a detailed discussion of the criteria).

Tables 7a-p also show the maximum extent of the 71 and 66 dBA Leq 2035 traffic noise level contours. Distances to these contour lines are measured from the Monroe Connector/Bypass centerline. This information should assist local authorities in exercising land use control over the remaining undeveloped lands adjacent to the roadway within the local jurisdiction. For example, with proper information on noise, the local authorities can prevent further development of incompatible activities and land uses with the predicted noise levels of an adjacent highway. The predicted 2035 noise contour distances along each Corridor Segment are shown in **Figures 4a-n**.

TABLE 7a: 2035 Noise Contours and Impact Summary – DSA A

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	14	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	120	10	0	0

* Distances are from the roadway centerline.

The total maximum numbers of receptors predicted to be impacted by DSAs associated with the Monroe Connector/Bypass range from 108 impacted Category B receptors for DSA B2, to 130 impacted Category B receptors for DSA C1. Category B receptors in the project area are mostly residential, with one church (Forest Hills Baptist) and one school (Stallings Elementary). The numbers of business impacts range from 9-11 for DSAs that use Corridor Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, and B3) to 28-31 for DSAs that use Corridor Segment 2 (DSAs C, D, C1, D1, C2, D2, C3, and D3). The higher numbers of business impacts for DSAs using Corridor Segment 2 occur along existing US 74. Impacted receptors are noted in terms of those receptors expected to experience traffic noise impacts either by approaching or exceeding the FHWA NAC, or by a substantial increase in exterior noise levels.

TABLE 7b: 2035 Noise Contours and Impact Summary – DSA B

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	35	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	14	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	118	9	0	0

* Distances are from the roadway centerline.

TABLE 7c: 2035 Noise Contours and Impact Summary – DSA C

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	14	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	123	29	0	0

* Distances are from the roadway centerline.

TABLE 7d: 2035 Noise Contours and Impact Summary – DSA D

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	36	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	14	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	122	28	0	0

* Distances are from the roadway centerline.

TABLE 7e: 2035 Noise Contours and Impact Summary – DSA A1

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	13	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	127	11	0	0

* Distances are from the roadway centerline.

TABLE 7f: 2035 Noise Contours and Impact Summary – DSA B1

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	35	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	13	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	125	10	0	0

* Distances are from the roadway centerline.

TABLE 7g: 2035 Noise Contours and Impact Summary – DSA C1

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	13	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	130	30	0	0

* Distances are from the roadway centerline.

TABLE 7h: 2035 Noise Contours and Impact Summary – DSA D1

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	36	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	13	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	129	29	0	0

* Distances are from the roadway centerline.

TABLE 7i: 2035 Noise Contours and Impact Summary – DSA A2

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	4	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	110	10	0	0

* Distances are from the roadway centerline.

TABLE 7j: 2035 Noise Contours and Impact Summary – DSA B2

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	35	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	4	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	108	9	0	0

* Distances are from the roadway centerline.

TABLE 7k: 2035 Noise Contours and Impact Summary – DSA C2

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	4	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	113	29	0	0

* Distances are from the roadway centerline.

TABLE 7I: 2035 Noise Contours and Impact Summary – DSA D2

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	36	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	0	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	2	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	4	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	112	28	0	0

* Distances are from the roadway centerline.

TABLE 7m: 2035 Noise Contours and Impact Summary – DSA A3

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	1	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	3	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	117	11	0	0

* Distances are from the roadway centerline.

TABLE 7n: 2035 Noise Contours and Impact Summary – DSA B3

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	79	75	70	225	340	0	3	6	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	360	0	9	1	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	360	0	45	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	35	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	260	0	3	0	0	0
Forest Hills School Rd to US 74 near Marshville	74	71	66	150	250	0	0	0	0	0
					TOTALS	0	115	10	0	0

* Distances are from the roadway centerline.

TABLE 7o: 2035 Noise Contours and Impact Summary – DSA C3

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	2	2	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	41	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	3	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	120	31	0	0

* Distances are from the roadway centerline.

TABLE 7p: 2035 Noise Contours and Impact Summary – DSA D3

Mainline Segment	Leq Noise Levels (dBA) (distance from center of nearest travel lanes)			Maximum Contour Distances (ft)*		Approximate Number of Impacted Receptors By Category				
	50ft	100ft	200ft	71 dBA Leq	66 dBA Leq	A	B	C	D	E
I-485 to Stallings Rd	81	77	72	265	395	0	1	16	0	0
Stallings Rd to Indian Trail-Fairview Rd	79	76	71	250	355	0	13	10	0	0
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	80	76	71	250	365	0	46	2	0	0
Unionville-Indian Trail Rd to Rocky River Rd	80	76	71	250	365	0	6	0	0	0
Rocky River Rd to US 601	79	76	71	245	350	0	36	0	0	0
US 601 to NC 200 (Morgan Mill Rd)	80	75	70	190	320	0	4	1	0	0
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	76	73	68	180	285	0	10	0	0	0
Austin Chaney Rd to Forest Hills School Rd	75	72	67	160	265	0	3	0	0	0
Forest Hills School Rd to US 74 near Marshville	75	71	66	150	250	0	0	0	0	0
					TOTALS	0	119	29	0	0

* Distances are from the roadway centerline.

7.2 POTENTIAL NOISE IMPACTS TO CHURCHES, SCHOOLS AND OTHER SPECIAL USES

There is one church (Forest Hills Baptist Church), one public school (Stallings Elementary School), and one planned future park (Matthews Sportsplex) within the noise contours shown in **Figures 4a-n**. These are discussed below.

Forest Hills Baptist Church. This church (Union County parcel number 08303015B) is located adjacent to Corridor Segment 22A (DSAs A, C, A1, C1, A2, C2, A3, and C3) at the intersection of Willis Long Road (SR 1509) and Winchester Road, and is represented by Receptor F04 (**Figure 4f**). This church was included in the detailed model for BEA N6 (**Section 8.4.1**). A barrier for this church and adjacent residences was found to be not reasonable. Year 2035 noise levels are projected to be 67 dBA Leq at the side of the church facing the proposed project. There is a church parking lot between the building and the proposed right of way for Corridor Segment 22A, which is not an area of frequent outdoor use sensitive to noise.

The interior NAC of 52 dBA Leq (**Table 3**) would not be exceeded in the church structure. Light frame buildings can achieve at least 20 dBA of exterior to interior noise reduction, and masonry buildings can achieve 25-35 dBA of exterior to interior noise reduction (FHWA, *Highway Traffic Noise Analysis and Abatement: Policy and Guidance*, June 1995). With an exterior noise level of 67 dBA Leq, interior noise levels due to traffic noise would be expected to be no more than 47 dBA Leq (67 dBA Leq minus 20 dBA of reduction).

Stallings Elementary School. This school (Union County parcel number 07099018D) is located adjacent to Corridor Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, and B3) at the intersection of Stallings Road (SR 1365) and Stevens Mill Road (SR 1524), and is represented by Receptor B08 (**Figure 4b**). This school was included in the detailed model for BEA N3 (**Section 8.4.1)**. A barrier for nearby impacted residences was found to be not reasonable. Year 2035 noise levels are projected to be 58 dBA Leq at the side of the school facing the proposed project, which would not be considered an impact.

There is a school parking lot, which is not an area of frequent outdoor use sensitive to noise, located between the building and the proposed right of way for Corridor Segment 18A. Playgrounds and recreational fields associated with the school are located behind the school, away from the proposed project, and would be shielded from project-generated traffic noise by the school building.

Future Matthews Sportsplex. The proposed Matthews Sportsplex would be located on a 160-acre property owned by Mecklenburg County in the southwest quadrant of the existing I-485/US 74 interchange (**Figure 4a**). The sportsplex is proposed as an active use facility with several soccer/multi-use fields. The first phase of the project is expected to start construction in the winter of 2009 (Charlotte-Mecklenburg Web site: www.charmeck.org/Departments/Park+and+Rec/Inside+The+Department/Divisions/Park+Planning/SportsComplex.htm).

DSA Segment 18A (included in DSAs A, A1, A2, A3, B, B1, B2, and B3) would involve improvements to the I-485/US 74 interchange, including reconstruction of the ramp in the southwest quadrant of the interchange. These improvements would result in a minor right-of-

way acquisition from the property (approximately 2.25 acres). No capacity improvements to US 74 west of I-485 or to I-485 south of US 74 would be needed with the proposed project DSAs.

With DSAs that include Segment 18A, traffic volumes along US 74 west of the interchange and along I-485 south of the interchange, would be slightly less with these DSAs in place than under the No-Build Alternative (*Traffic Forecast for TIP Projects R-3329 and R-2559 Monroe Connector/Bypass*, Wilbur Smith and Associates, September 2008).

The 66 dBA Leq noise contours would extend onto the-property with or without the proposed project due to traffic on US 74 and I-485. Traffic noise on the property would be dominated by traffic on I-485 south of US 74 and traffic on US 74 west of I-485. As mentioned above, the proposed project would not contribute to increased traffic volumes on these segments, and the proposed project would not cause an increase in traffic noise levels along these roadways. Therefore, no detailed noise analysis was conducted in this area.

The NCTA coordinated with Mecklenburg County Park and Recreation Department regarding the minor encroachment. In a meeting on September 4, 2008, the Mecklenburg County Park and Recreation Department stated the proposed encroachment would not affect the function and use of the property. However, if one of the DSAs that includes Segment 18A is chosen as the Preferred Alternative, the NCTA will coordinate with the Mecklenburg County Park and Recreation Department on efforts to minimize impacts to the property. These efforts could include evaluating potential noise abatement measures such as noise walls or vegetative buffers.

7.3 DETAILED NOISE MODELING

The results of the noise contour modeling were mapped with the functional engineering designs and the GIS database information to identify those areas where there were groups of sensitive receptors requiring a three-dimensional TNM model (Step 2 from **Section 4.2**). Ten areas, called Barrier Evaluation Areas (BEAs) were identified, as shown in **Figures 3a-c**. The results of this detailed modeling are discussed in **Chapter 8.**

Detailed models were prepared for a No Barrier case, and when warranted, for a With Barrier case. Some of the BEAs were modeled more than once. Modeling was done more than once if there was more than one functional engineering design passing near the BEA or different DSAs had different traffic volumes near the BEA.

8 NOISE ABATEMENT MEASURES

According to NCDOT's *Traffic Noise Abatement Policy* (2004), if traffic noise impacts are predicted, examination and evaluation of alternative noise abatement measures for reducing or eliminating the noise impacts must be considered. Consideration for noise abatement measures must be given to all impacted receptors. Types of abatement measures include highway alignment selection, traffic system management measures, vegetative screening, property acquisition, or noise barriers. As described below, the only appropriate measure to analyze in detail is the construction of noise barriers.

8.1 HIGHWAY ALIGNMENT SELECTION

Highway alignment selection involves the horizontal or vertical orientation of the proposed improvements in such a way as to minimize impacts and costs. The selection of alternative alignments for noise abatement purposes must consider the balance between noise impacts and other engineering and environmental parameters. For noise abatement, horizontal alignment selection is primarily a matter of siting the roadway at a sufficient distance from noise sensitive areas.

Changes in vertical alignment can be effective in limiting noise impacts of certain roadway facilities. Depressing or raising the highway elevations can create cut and fill slopes which may block the line of sight from a receptor to a road and provide shielding from traffic noise. No major alterations in the proposed horizontal or vertical alignment of this project for noise purposes are feasible. The proposed functional design alignments fall within the design criteria for the roadway classification and take into account the existing topography of the area, interchanges, existing roads, residences, businesses, and cultural and natural resources.

8.2 TRAFFIC SYSTEM MANAGEMENT MEASURES

Traffic management measures that limit vehicle type, speed, volume and time of operations are often effective noise abatement measures. For this project, traffic management measures are not considered appropriate for noise abatement due to their effect on the capacity and level of service on the proposed roadway.

Modeling has shown a reduction in the speed limit of 10 mph would result in a noise level reduction of approximately 1 to 2 decibels (Bolt, Beranek, and Newman, Inc., 1972:1-20). Because most people cannot detect a noise reduction of 3 decibels (Bolt, Beranek, and Newman, INC., 1972:1-20), and because reducing the speed limit would reduce roadway capacity, it is not considered a viable noise abatement measure. This and other traffic system management measures, including the prohibition of truck operations, are not considered to be consistent with the project's purpose and need.

8.3 VEGETATIVE SCREENING AND PROPERTY ACQUISITION

The use of vegetation for noise mitigation is not considered reasonable for this project, due to the substantial amount of right of way necessary to make vegetative barriers effective. FHWA research has shown that a vegetative barrier should be approximately 100 feet wide to provide a 3 dBA reduction in noise levels. In order to provide a 5 dBA reduction, substantial amounts of additional right of way would be required. The cost of the additional right of way and vegetation would most likely exceed the minimum abatement threshold of $35,000 per benefited receptor plus the adjustment factor. This cost threshold is adjusted upwards by $500 increments for each average decibel increase in noise from existing levels.

The acquisition of property in order to provide buffer zones to minimize noise impacts is not considered to be a reasonable noise mitigation measure for this project. The cost to acquire impacted receptors for buffer zones would exceed the minimum abatement threshold of $35,000 per benefited receptor (plus the adjustment for average decibel increase). The use of buffer zones to minimize impacts to future sensitive areas is not recommended because this could be accomplished by local officials through land use control.

8.4 NOISE BARRIERS

Solid barriers reduce noise levels by blocking the sound path between the noise source and noise sensitive areas. This measure is most often used on high-speed, limited access facilities where noise levels are high and there is adequate space for continuous barriers. Noise barriers may be constructed of a variety of materials either individually or combined, including concrete, wood, metal, earth, and vegetation.

For a noise barrier to provide sufficient noise reduction it must be high enough and long enough to shield the receptor from significant sections of the roadway. The barrier must also be feasible to construct as well as economically reasonable. NCDOT's *Traffic Noise Abatement Policy* (2004) provides guidance on determining the feasibility and reasonableness of providing noise barriers.

Several factors must be examined to determine if construction of sound barriers is feasible and reasonable. These factors include benefits to those impacted by noise, the cost of abatement, and overall social, economical and environmental effects of sound barrier construction. Also, Title 23 CFR, Section 772.11(a) states, "In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent outdoor human use occurs and a lowered noise level would be of benefit."

Feasibility considers source/receptor relationships and the engineering aspects of constructing a barrier at impacted sites, including potential safety and/or drainage problems. Determination of feasibility includes consideration of whether a barrier can be built on the site topography, and whether other noise sources are present in the area. Noise reductions of 10 decibels or less are usually attainable, and the barrier should achieve at least 5 decibels of noise reduction for front row receptors. Access openings in barriers severely reduce the noise reduction provided by barriers, making barriers along roadways that lack access control generally infeasible to construct.

An evaluation of reasonableness should include the following criteria: barrier cost, public support, the degree of noise impact, and required sound barrier height. A reasonable barrier must be cost effective. The NCDOT considers a cost-effective barrier as one that is no more than $35,000 per benefited receptor (a site having 5 dBA or more noise reduction), plus an incremental increase of $500 per dBA average increase in the predicted exterior noise levels of the impacted receptors in the area. The cost of the barrier used in these calculations is $15.00 per square foot. Also, in general, barriers are not considered reasonable for businesses or isolated residences (NCDOT, 2004). Barriers were optimized during barrier design to achieve the maximum noise reduction benefit for the least cost.

8.4.1 Barrier Evaluation Areas

The noise sensitive sites predicted to be impacted directly (i.e., experience noise levels that approach or exceed FHWA NAC or show a substantial increase over existing levels) that were not considered isolated sites were further evaluated in terms of the feasibility and reasonableness of providing noise barriers.

Ten barrier evaluation areas (BEAs) were modeled in TNM with three-dimensional models to determine if barriers would be feasible and reasonable in these locations. **Figures 3a-c** show the general locations of the BEAs. The detailed analysis of potential noise barriers incorporated existing natural terrain and design features such as fill/cut sections. Barrier heights of up to a maximum of 25 feet were evaluated for the receptors impacted under each DSA at each location.

Appendix F includes the TNM input/output files for each detailed model.

As the result of the analyses performed for the ten BEAs mentioned above, three locations were identified where noise barriers were determined to be feasible and reasonable (BEAs N4, N7, and N9). The barriers are located adjacent to the following subdivisions: Acorn Woods/Gold Hill, Avondale Park, and Glencroft. Barrier lengths range between 1,522 feet and 2,593 feet, while barrier heights range between 14 feet and 16 feet. Barrier costs for the barriers identified in **Table 8** are between $365,280 and $622,320; and costs per benefited receptors are between $22,830 and $34,573.

The feasible and reasonable barriers along the DSAs are shown in **Figures 5a-c** and **are** described in **Table 8**. The results of the detailed noise model for each BEA are described below. Receptor locations are shown in **Figures 4a-n**. **Figures 6 through 8** show the individual feasible and reasonable barriers.

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 public involvement process.

Barrier Evaluation Area N1

This area is located along DSA Segment 2 along US 74 between I-485 and Stallings Road. Modeled receptors in this BEA include commercial businesses along US 74 (Receptors B02, A05-A20, and A22) and one residence on the south side of US 74 (A21). A barrier evaluation was not warranted in this BEA due to the fact that the four impacted sites (Receptors A05, A16, A18 and A21) are each in isolated locations.

Table 8: Preliminary Feasible and Reasonable Noise Barriers

Proposed Barriers	Segment & DSAs	Description	Modeled Receptor #'s	Average dBA Reduction for Benefited Receptors	Benefited Receptors	Number of Impacted Receptors in BEA		Barrier Length (ft)	Barrier Height (ft)	Approximate Cost	Cost Per Receptor / Allowable Cost per Receptor
						Without Barrier	With Barrier*				
BEA N4, Barrier N4-1	Segment 18A and Segment 2 All DSAs	Eastbound side of mainline. East of Indian Trail-Fairview Rd, west of Secrest Shortcut Rd, near the Acorn Woods subdivision.	D01, D03-D09, D11, D12, D41-D46	7	16	16	0	1,522	16	$ 365,280	$22,830 $45,500
BEA N7, Barrier N7-2	Segment 31 All DSAs	Eastbound side of mainline. East of Roanoke Church Rd, west of Fowler Rd, near the Avondale Park subdivision.	F17-F24, F38-F47	9	18	18	0	2,593	16	$ 622,320	$34,573 $46,000
BEA N9, Barrier N9-1	Segment 40 DSAs A, B C, D, A1, B1, C1, D1	Westbound side of mainline. East of Ansonville Rd, near the Glencroft subdivision.	I05-I26	6	17	7	0	2,343	16/ 14	$ 543,930	$31,996 $38,294

* In some instances, 5 dBA of reduction was achieved at a receptor, but the receptor would still experience a substantial increase in noise levels.

Barrier Evaluation Area N2

This area is located along DSA Segment 2 between the existing US 74/Stallings Road intersection and Stinson Hartis Road, and covers the length of DSA Segment 2. Modeled receptors in this BEA are scattered along both sides of the mainline. On the northwest side of the mainline, receptors include:

- Ten residences in Forest Park near US 74 (Receptors C09, C10, C29-C36).
- Three commercial buildings (Receptors C11, C13, C40) and one residence (Receptor C12) on Union West Boulevard.
- A cluster of eight residences. Three residences on Sherin Lane (Receptors C16, C41, C42), four residences on White Oak Lane in Forest Park (Receptors C43-C46), and one residence on Oscar Robinson Road (Receptor C21).
- A cluster of four residences on Strand Drive off of Oak Spring Road (Receptors C23-C26).

On the southeast side of the mainline, receptors include:

- Four commercials buildings on US 74 (Receptors C14, C37-C39).
- A commercial building on Union West Boulevard (Receptor C15)
- A cluster of six commercial buildings on Van Buren Avenue (Receptors C17-C20, C22, C47).

Five barrier locations were modeled for the receptors on both sides of the mainline: a barrier 12 feet high for the ten residences on the west side of Forest Park near US 74; a barrier 16 feet high, for the southeast side of Forest Park; a barrier, 10 to 12 feet high, for the northeast side of Forest Park; a barrier 22 feet high, for the businesses on US 74 east of the proposed Bypass; and a barrier, 10 to 14 feet high also on the east side of the proposed Bypass for the businesses on Van Buren Avenue.

None of these barriers were found to be cost effective.

Barrier Evaluation Area N3

This area is located along DSA Segment 18A between I-485 and Stinson Hartis Road. Modeled receptors in this BEA include two clusters of residences and Stallings Elementary School (Receptor B08). Stallings Elementary School would not be impacted by noise (**Section 7.2**).

The first cluster of residences includes two homes in the Blackberry Ridge subdivision (Receptors B11 and B14) and nearby residences on Stevens Mill Road (Receptors B05-B07, B10, B12, B13, and B15). A barrier 12-14 feet high was modeled for this area and found to be not cost effective.

The second cluster of residences includes seven homes on Oak Spring Road. These include Receptors C02-C05 north of the mainline and Receptors C01, C27, and C27 south of the mainline. A barrier 10-16 feet high was modeled for this area and found to be not cost effective.

Barrier Evaluation Area N4

This area is located along DSA Segments 18A/2, and DSA Segment 21 east of Indian Trail-Fairview Road. Modeled receptors include four clusters of residences, located on either side of the mainline, east and west of Beverly Drive.

The first cluster of residences includes 16 homes south of the project mainline (eastbound side) in the Acorn Woods and Gold Hill subdivisions between Indian Trail-Fairview Road and Beverly Drive (Receptors D01, D03-D09, D11, D12, D41-D46). A barrier 16 feet high was modeled for this area and found to be feasible and reasonable. Barrier N4-1 is shown on **Figure 6**.

The second cluster of residences includes seven homes (Receptors D24, D27-D31) and one business (Receptor D23) south of the project mainline (eastbound side) in the Acorn Woods subdivision and along Secrest Shortcut Road between Beverly Drive and Faith Church Road. A barrier 14 feet high was modeled for this area and found to be not cost effective.

The third cluster of residences includes fifteen homes (Receptors D02, D10, D13-D15, D19, D20, D22, D25, D26, and D47-D50) and one business (Receptor D21) north of the project mainline (westbound side) in the Acorn Woods subdivision and along Secrest Shortcut Road between Beverly Drive and Faith Church Road.

The fourth cluster of residences includes five homes (Receptors) north of the project mainline (westbound side) in the Acorn Woods subdivision between Indian Trail-Fairview Road and the east side of Beverly Drive. The fourth cluster includes D32, D33, D35, and D51.

Two barriers designed to work together, ranging in height from 14- to 22-feet high, were modeled for both the third and fourth clusters of receptors and were found to be not cost effective.

Barrier Evaluation Area N5

This area is located along DSA Segment 22A/30, west of Unionville-Indian Trail Road. Modeled receptors in this area include two clusters of residences. Two barriers, designed to act independently, were modeled in this area.

The first cluster includes five homes in the Arbor Glen subdivision on Southwind Trail (Receptors D53-D56). A barrier 22 feet high was modeled for this area and found to be not feasible. This barrier did not achieve 5 dBA of noise reduction. Traffic noise from Secrest Shortcut Road, outside the DSA right of way, contributes to the noise environment in this location.

The second cluster includes three homes on Secrest Shortcut Road near Scott Long Road (Receptors D37-D39). A barrier 10-14 feet high was modeled for this area and found to be not cost effective.

Barrier Evaluation Area N5A

This area is located along DSA Segment 22A/30, between Unionville-Indian Trail Road and Rocky River Road. Modeled receptors in this area include two clusters of residences.

The first cluster includes five homes on Secrest Shortcut Road (Receptors E5 and E7-E10). A barrier 14 feet high was modeled for this area and found to be not cost effective.

The second cluster includes six homes on existing Rocky River Road (Receptors E11-E16). A barrier 16 feet high was modeled for this area and found to be not cost effective.

Barrier Evaluation Area N6

This area is located along DSA Segment 22A, on either side of Rocky River Road.

The modeled receptors are located northeast, northwest, and southwest of the Monroe Connector/Bypass interchange with Rocky River Road. Northeast of the interchange are

residences along Winchester Road (Receptors F01, F02, F03, F35, and F36) and the Forest Hills Baptist Church (Receptor F04) at the intersection of Winchester Road and Willis Long Road. Northwest of the interchange are residences along existing Rocky River Road (Receptors E01, E02, and E03) and a commercial plant nursery (Receptor E04). Southwest of the interchange are residences along existing Rocky River Road (Receptors E11, E12, and E13).

Barriers were modeled in each of the three quadrants, and none were determined cost effective. The barriers are described below.

- Northwest of the interchange, a barrier 12-16 feet high was modeled along the cut/fill of the mainline, and was determined not to be cost effective.
- Southwest of the interchange, a barrier 8-14 feet high was modeled along the cut/fill of the mainline, and was determined not to be cost effective.
- Northeast of the interchange, a barrier 8-20 feet high was modeled along the cut/fill of the mainline, and was determined not to be cost effective.

Barrier Evaluation Area N7

This area is located along the eastern end of DSA Segment 22A/30 (where they are common) and the western end of DSA Segment 31. These segments are located west of US 601.

The 28 modeled receptors are spread out in three clusters, located north and south of the mainline. From west to east, the first cluster includes Receptors F07-F12 north of the mainline. Receptors F07-F10 are in the Poplin Farms subdivision off Poplin Road, while F11 and F12 are on Poplin Road. Also included in this area are two homes (Receptors F15 and F16) off Roanoke Church Road.

The second cluster consists of three homes south of the mainline (Receptors F13, F14, and F37). Receptors F13 and F14 are off Poplin Road and Receptor F37 is in the Little Park subdivision off Secrest Shortcut Road. Only two of these residences (F14 and F37) were predicted to be impacted by noise, and since these two residences were isolated from one another, a noise barrier was not modeled for these receptors.

The third cluster consists of sixteen homes in Avondale Park, south of the mainline (Receptors F17-F24 and F38-F45). An isolated receptor, Receptor F25, located off Fowler Road, was included in this area's model, but not considered for a barrier.

Barriers were modeled for the first and third clusters of residences. A barrier 14 feet high (Barrier N7-1) was modeled for Receptors F07-F12 and found to be not cost effective.

A barrier 16 feet high (Barrier N7-2) was found to be feasible and reasonable for Receptors F17-F24 and F38-F47 in the Avondale Park subdivision. This barrier is shown in **Figure 7**.

Barrier Evaluation Area N8

This area is located along DSA Segment 31 east of Fowler Road. There were five residences on Maple Hill Road modeled (F27-F31). Receptors F27, F29, F30 and F31 are south of the mainline and F28 is located north of the mainline.

A barrier 8-14 feet high was modeled for the four receptors south of the mainline and found to be not cost effective.

Barrier Evaluation Area N9

This area is located along DSA Segment 41, east of Ansonville Road, in the Glencroft subdivision. The 60 dBA Leq contour line from the DSA Segment 41 functional engineering designs did not encroach on the subdivision properties, so only DSA Segment 40 was modeled.

The modeled receptors are north of the mainline along Glencroft Drive, facing the proposed mainline. There are 22 receptors in this area (Receptors I05 – I26).

A barrier 14-16 feet high (Barrier N9-1b) that benefits most of this row of receivers (except Receptor I05 at the western end of the subdivision) was found to be feasible and reasonable. This barrier is shown on **Figure 8**.

8.4.2 Noise Barriers By Alternative

Table 9 is a summary of the preliminary feasible and reasonable barriers for each DSA. Noise barriers were developed to be consistent with FHWA and NCDOT NAC for noise abatement. The table identifies the noise barriers for each alternative as well as the total barrier lengths and costs and total numbers of benefited receptors. The numbers of impacted receptors with and without a barrier and numbers of benefited receptors also are listed in **Table 8**.

As shown in **Table 9**, the DSAs with the shortest total length of noise barrier and least cost would be DSAs A2, B2, C2, D2, A3, B3, C3, and D3.

TABLE 9: Noise Barriers for Each Detailed Study Alternative

DSA	Barrier N4-1* Acorn Woods/ Gold Hill	Barrier N7-2* Avondale Park	Barrier N9-1* Glencroft	Total Number of Benefited Receptors	Total Length of Barriers (ft)	Total Cost for Barriers
A	X	X	X	51	6,458	$1,531,530
B	X	X	X	51	6,458	$1,531,530
C	X	X	X	51	6,458	$1,531,530
D	X	X	X	51	6,458	$1,531,530
A1	X	X	X	51	6,458	$1,531,530
B1	X	X	X	51	6,458	$1,531,530
C1	X	X	X	51	6,458	$1,531,530
D1	X	X	X	51	6,458	$1,531,530
A2	X	X	--	34	4,115	$987,600
B2	X	X	--	34	4,115	$987,600
C2	X	X	--	34	4,115	$987,600
D2	X	X	--	34	4,115	$987,600
A3	X	X	--	34	4,115	$987,600
B3	X	X	--	34	4,115	$987,600
C3	X	X	--	34	4,115	$987,600
D3	X	X	--	34	4,115	$987,600

* X means barrier is included in DSA -- means barrier not included in DSA

9 CONSTRUCTION NOISE

The major construction elements of this project are expected to be earth removal, hauling, grading, and paving. General construction noise impacts, such as temporary speech interference for passersby and those individuals living or working near the project, can be expected particularly from paving operations and from the earth moving equipment during grading operations. Overall, construction noise impacts are expected to be minimal, since the construction noise is relatively short in duration and is generally restricted to daytime hours. Furthermore, the transmission loss characteristics of surrounding wooded areas and other natural and man-made features are considered sufficient to moderate the effects of intrusive construction noise.

10 SUMMARY

This section summarizes the work performed to analyze the potential traffic noise impacts associated with the Monroe Connector/Bypass Detailed Study Alternatives (DSAs). There are sixteen new location DSAs under consideration for the proposed project, with up to two corridor options at any one location.

Noise Abatement Procedures - According to FHWA policy, noise mitigation measures must be considered when future noise levels either approach or exceed NAC levels, or if there are substantial increases over existing noise levels. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit. For this project, identified receptors were commercial uses, residences, schools and churches.

Noise Measurements - A total of seventeen noise level measurements were taken in the vicinity of the project to determine typical existing background (ambient) noise levels and to provide a basis for assessing the impacts of future traffic noise levels. Seven measurement locations were adjacent to roadways and ten locations were in areas away from direct traffic noise sources.

Noise Modeling - Noise modeling was conducted with FHWA's Traffic Noise Model® (TNM). The analysis procedure consisted of a two-step approach to estimate noise levels and to minimize the numbers of receptors to be modeled during the second step of detailed modeling. The first step used the TNM model to develop noise contours and to identify the sensitive receptors potentially impacted by the proposed DSAs. The noise contours were overlaid onto base mapping, and sensitive receptors within the contours were identified and numbered. There were 251 unique receptors identified.

In the second step, the TNM model was used to perform more detailed analyses in areas where approximately three or more receptors were identified as being potentially impacted. For receptors that would be impacted, noise barriers were developed. These barriers were then evaluated based on NCDOT's *Traffic Noise Abatement Policy* (2004) to determine if they would be feasible and reasonable.

The total maximum numbers of receptors predicted to be impacted by DSAs range from 108 impacted Category B receptors for DSA B2, to 130 impacted Category B receptors for DSA C1. Category B receptors in the project area are mostly residential, with one church and one school. The numbers of business impacts range from 9-11 for DSAs that use Corridor Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, and B3) to 28-31 for DSAs that use Corridor Segment 2 (DSAs C, D, C1, D1, C2,

D2, C3, and D3). The higher numbers of business impacts for DSAs using Corridor Segment 2 occur along existing US 74.

Noise Abatement Measures - According to NCDOT's Traffic Noise Abatement Policy (2004), if traffic noise impacts are predicted, examination and evaluation of alternative noise abatement measures for reducing or eliminating the noise impacts must be considered. Consideration for noise abatement measures must be given to all impacted receptors. Types of abatement measures include highway alignment selection, traffic system management measures, vegetative screening, property acquisition, or noise barriers.

Highway Alignment Selection - Changes in vertical alignment can be effective in limiting noise impacts of certain roadway facilities. Depressing or raising the highway elevations can create cut and fill slopes which may block the line of sight from a receptor to a road and provide shielding from traffic noise. Changes in the horizontal alignment of roadways can limit noise impacts by locating the roadway facilities farther away from sensitive receptors. No major alterations in the proposed horizontal or vertical alignment of this project for noise purposes are feasible.

Traffic System Management - Traffic management measures that limit vehicle type, speed, volume and time of operations are often effective noise abatement measures. For this project, traffic management measures are not considered appropriate for noise abatement due to their effect on the capacity and level of service on the proposed roadway.

Vegetative Screening and Property Acquisition – Neither the use of vegetative screening nor property acquisition were considered reasonable for this project, due to the substantial cost of acquiring additional right of way or property necessary for effectiveness.

Noise Barriers - Ten barrier evaluation areas (BEAs) were modeled in TNM with three-dimensional models to determine if barriers would be feasible and reasonable in these locations. The detailed analysis of potential noise barriers incorporated existing natural terrain and design features such as fill/cut sections.

As the result of the analyses performed for the ten BEAs mentioned above, three locations were identified along all the DSAs combined where noise barriers were determined to be potentially feasible and reasonable. Individual barrier lengths range between 1,522 feet and 2,593 feet, while barrier heights range between 14 feet and 16 feet. Barrier costs are between $365,280 and $622,320; and costs per benefited receptor are between $22,830 and $34,573.

For each DSA, the total numbers of feasible and reasonable barriers are one (DSAs C, D, C1 and D1), two (DSAs A, B, A1, B1, C2, D2, C3, and D3) or three (DSAs A2, B2, A3, and B3).

The DSAs with the shortest total length of noise barriers and least cost would be DSAs C, D, C1, and D1, followed by DSAs A, B, A1, and B1, then DSAs C2, D2, C3, and D3, and finally DSAs A2, B2, A3, and B3.

The feasible and reasonable barriers identified are preliminary and subject to change based on completion of final design, building permits issued as of the Date of Public Knowledge, and completion of the public involvement process.

Construction Noise - The major construction elements of this project are expected to be earth removal, hauling, grading, and paving. Overall, construction noise impacts are expected to be minimal, since the construction noise is relatively short in duration and is generally restricted to daytime hours. Furthermore, the transmission loss characteristics of surrounding wooded areas and other natural and man-made features are considered sufficient to moderate the effects of intrusive construction noise.

11 REFERENCES AND SUPPORTING DOCUMENTATION

REFERENCES

Bolt, Beranek, and Newman

Fundamentals and Abatement of Highway Traffic Noise. June 1973. Prepared for FHWA. Report No. PB-222 703.

Federal Highway Administration

23 CFR 772 - Procedures for Abatement of Highway Traffic Noise and Construction Noise.

Traffic Noise Model® (TNM) Version 2.5 and User's Guide.

Highway Traffic Noise Analysis and Abatement: Policy and Guidance. June 1995 available at http://www.fhwa.dot.gov/environment/noise/polguide/polguid.pdf.

North Carolina Department of Transportation

NCDOT Traffic Noise Abatement Policy, 2004.

SUPPORTING DOCUMENTATION

Functional Engineering Designs for the Monroe Connector/Bypass Detailed Study Alternatives. Design Plans prepared by PBS&J. August 2008.

Traffic Forecast for TIP Projects R-3329 and R-2559 Monroe Connector/Bypass. Prepared by Wilbur Smith Associates. September 2008.

APPENDICES

APPENDIX A
MASTER LIST OF MODELED RECEPTORS

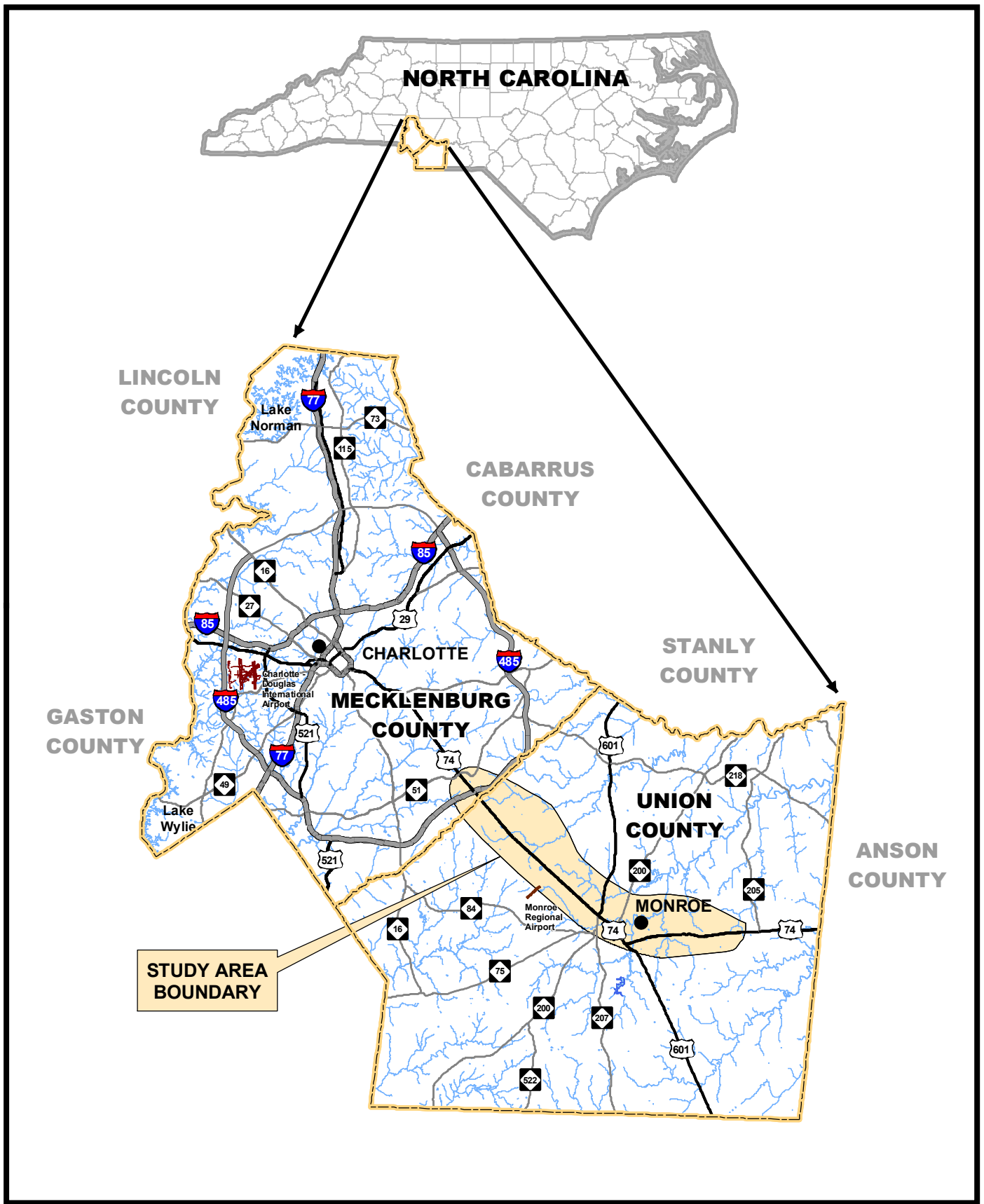
APPENDIX B
TRAFFIC FORECASTS AND PEAK HOUR TRAFFIC VOLUMES

APPENDIX C
EXISTING NOISE MEASUREMENT DATA FORMS

APPENDIX D
EXISTING NOISE MEASUREMENTS – NOISE METER OUTPUT

APPENDIX E
NOISE MODEL RESULTS

APPENDIX F
BARRIER EVALUATION AREA RUNS



NORTH CAROLINA Turnpike Authority

MONROE CONNECTOR / BYPASS

STIP PROJECT NO. R-3329 / R-2559

Mecklenburg County and Union County

0 4.25 8.5

Miles

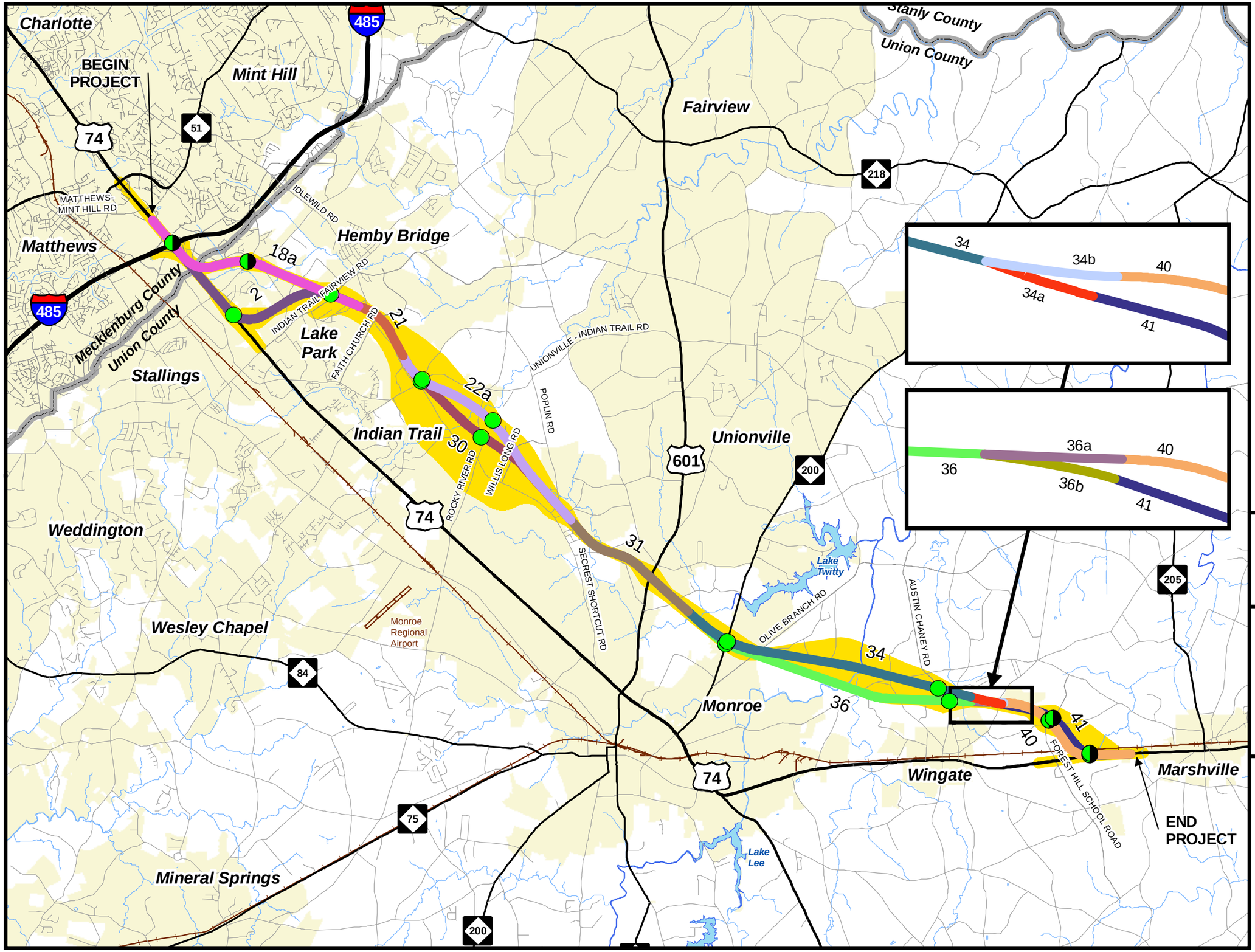
N

Source: Mecklenburg County and Union Counties GIS.
Map Printed On 10-09-08.

PROJECT LOCATION

Figure 1

CIA_Proj_Local_Regional.mxd 10-09-08

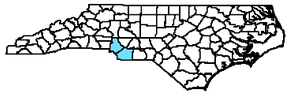


Legend

- Potential Partial Interchange
- Potential Interchange
- Interstate Highway
- US Highway
- NC State Highway
- State Road
- Railroad
- Parcels
- Corridor Study Area
- River / Stream
- Lake
- County Boundary

Detailed Study Alternative

- Segment 18A
- Segment 2
- Segment 21
- Segment 22A
- Segment 30
- Segment 31
- Segment 34
- Segment 34A
- Segment 34B
- Segment 36
- Segment 36A
- Segment 36B
- Segment 40
- Segment 41



Mecklenburg and Union Counties
North Carolina Counties

Source: Mecklenburg County and Union County GIS.
Map Printed On 11-14-08.

N

0 4,250 8,500
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

Mecklenburg County and Union County

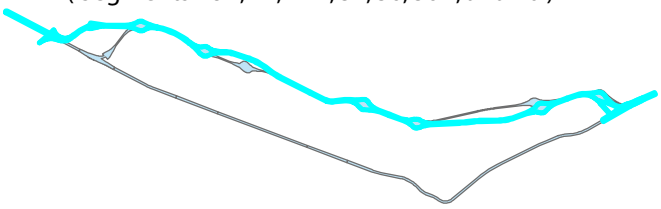
MONROE CONNECTOR/ BYPASS

DETAILED STUDY ALTERNATIVES

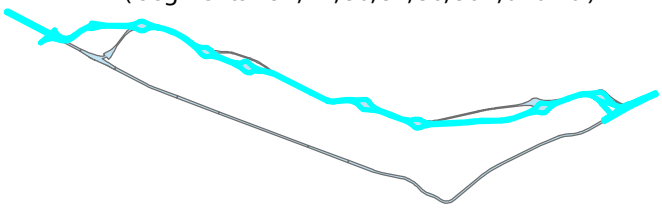
Figure 2a

CIA_02a-dsa_rev.ai 03.16.09

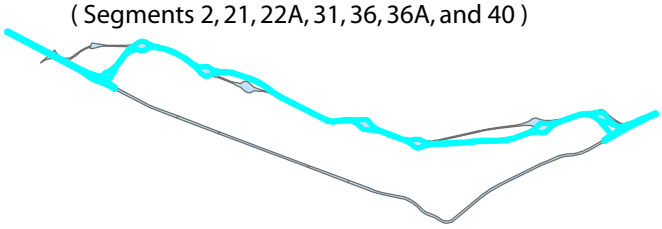
Alternative A
(Segments 18A, 21, 22A, 31, 36, 36A, and 40)



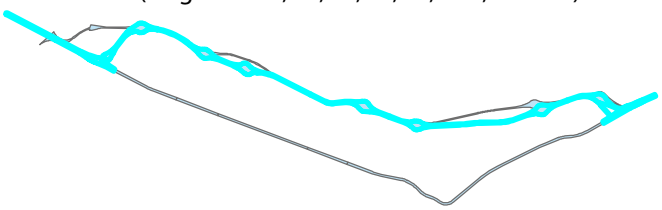
Alternative B
(Segments 18A, 21, 30, 31, 36, 36A, and 40)



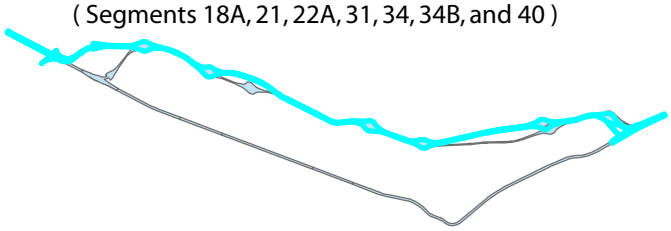
Alternative C
(Segments 2, 21, 22A, 31, 36, 36A, and 40)



Alternative D
(Segments 2, 21, 30, 31, 36, 36A, and 40)



Alternative A1
(Segments 18A, 21, 22A, 31, 34, 34B, and 40)



Alternative B1
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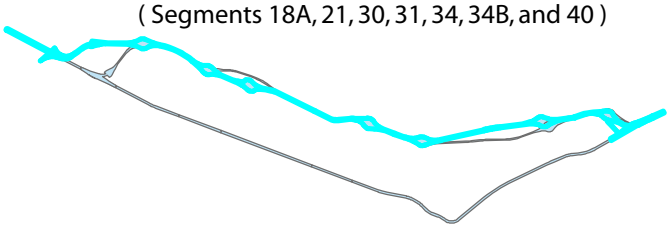

Alternative C1
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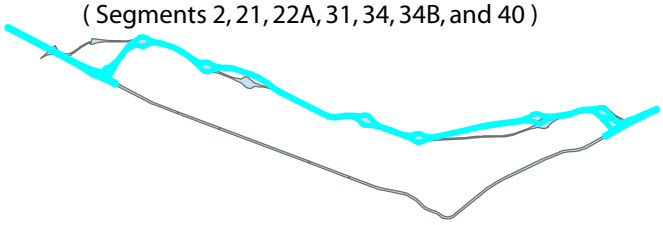

Alternative D1
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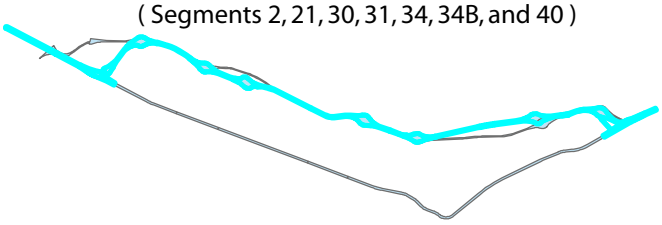


NORTH CAROLINA Turnpike Authority

MONROE CONNECTOR / BYPASS

STIP PROJECT NO. R-3329 / R-2559

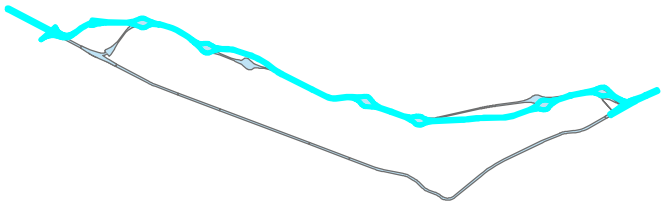
Mecklenburg County and Union County

DETAILED STUDY ALTERNATIVES

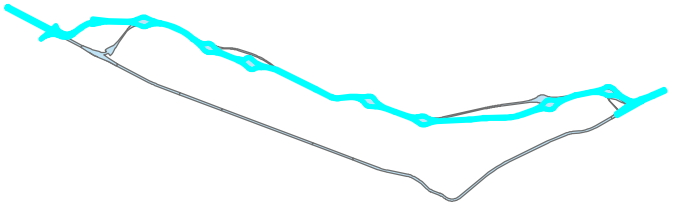
FIGURE 2b

DEIS_Prelim_Corr_Seg.pdf.ai 11-06-08

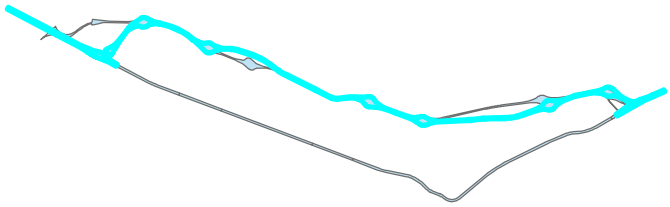
Alternative A2
(Segments 18A, 21, 22A, 31, 36, 36B and 41)



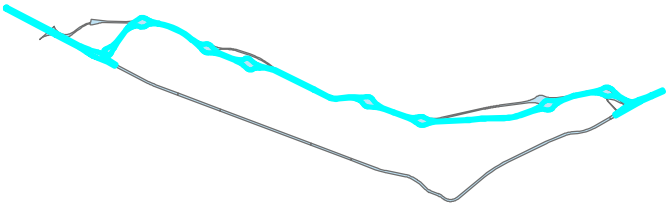
Alternative B2
(Segments 18A, 21, 30, 31, 36, 36B and 41)



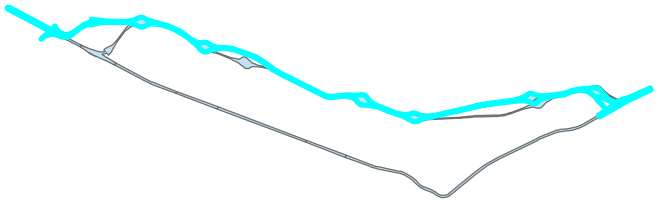
Alternative C2
(Segments 2, 21, 22A, 31, 36, 36B, and 41)



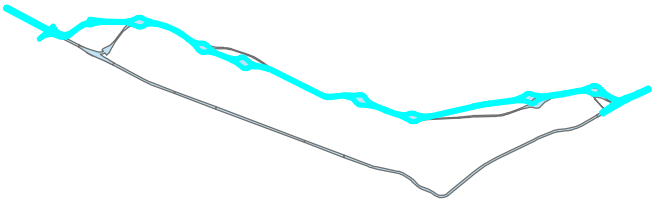
Alternative D2
(Segments 2, 21, 30, 31, 36, 36B, and 41)



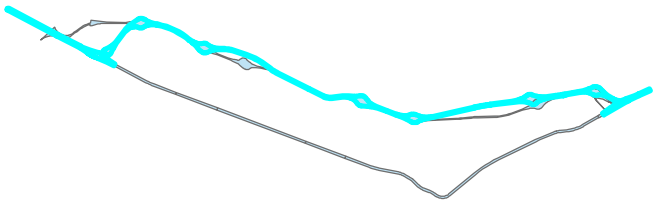
Alternative A3
(Segments 18A, 21, 22A, 31, 34, 34A, and 41)



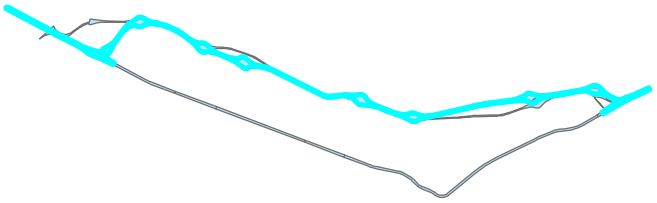
Alternative B3
(Segments 18A, 21, 30, 31, 34, 34A, and 41)



Alternative C3
(Segments 2, 21, 22A, 31, 34, 34A, and 41)



Alternative D3
(Segments 2, 21, 30, 31, 34, 34A, and 41)



NORTH CAROLINA Turnpike Authority

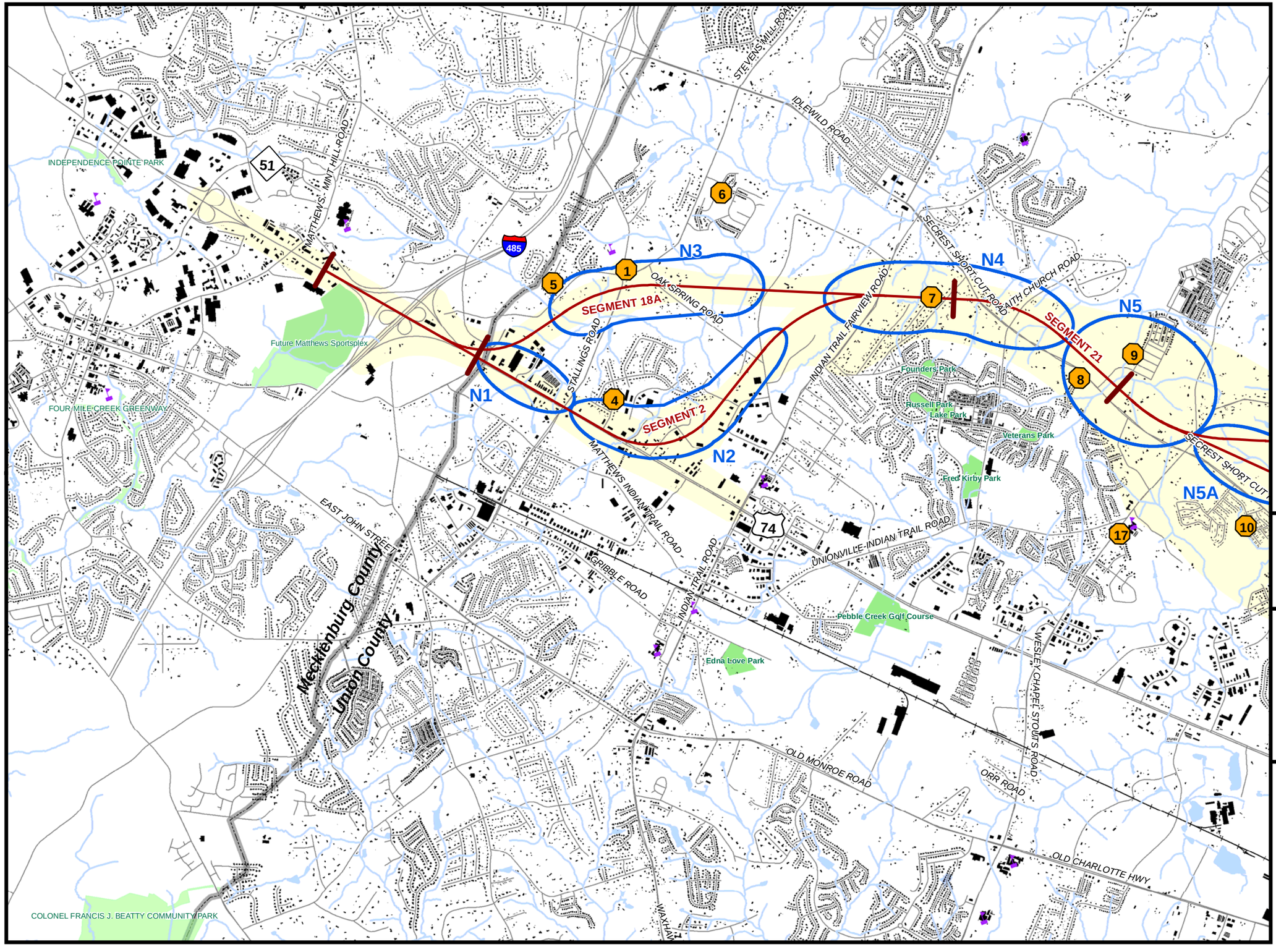
MONROE CONNECTOR / BYPASS

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

DETAILED STUDY ALTERNATIVES

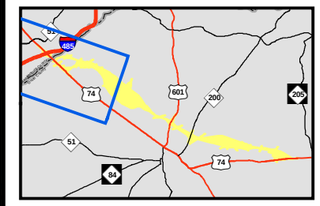
FIGURE 2c

DEIS_Prelim_Corr_Seg.pdf.ai 11-06-08



Legend

- Noise Measurement Site
- Barrier Evaluation Area*
- Segment Breaklines
- Design Centerline
- Schools
- Structures
- Parks
- Rail
- Thoroughfares
- Streets
- Hydrology
- Lakes
- County Boundaries
- Corridor Study Area



Source: Mecklenburg County and Union County GIS.
Map Printed On 10-30-08.

0 1,500 3,000
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

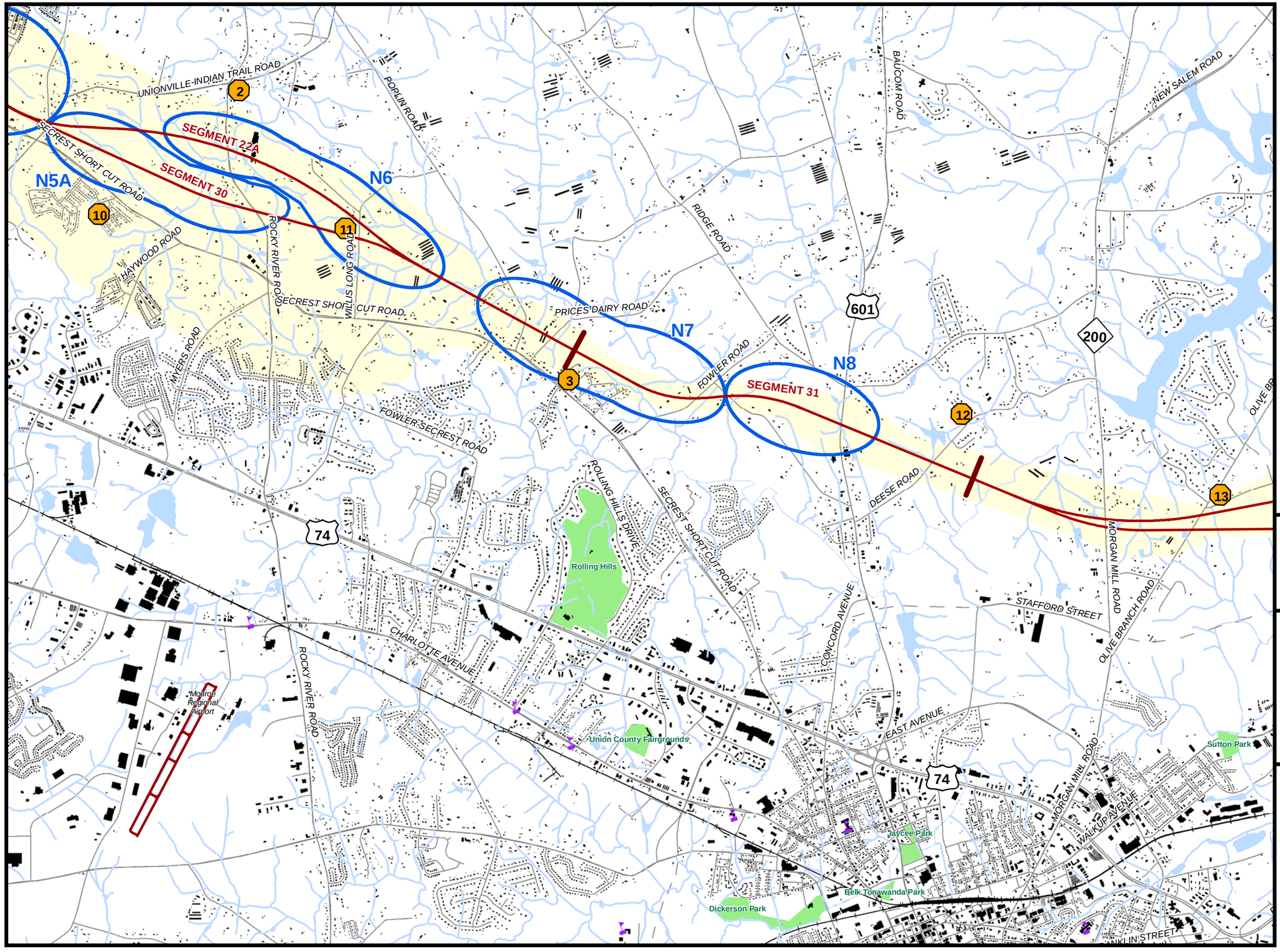
Mecklenburg County and Union County

MONROE CONNECTOR/ BYPASS

NOISE MEASUREMENT LOCATIONS and BARRIER EVALUATION AREAS

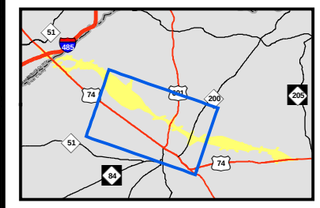
Figure 3a

NoisyStudyBarrierEvalAreas.mxd 11.18.08 AKH



Legend

- Noise Measurement Site
- Barrier Evaluation Area*
- Segment Breaklines
- Design Centerline
- Schools
- Structures
- Parks
- Rail
- Thoroughfares
- Streets
- Hydrology
- Lakes
- County Boundaries
- Corridor Study Area



Source: Mecklenburg County and Union County GIS.
Map Printed On 10-30-08.

0 1,500 3,000
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

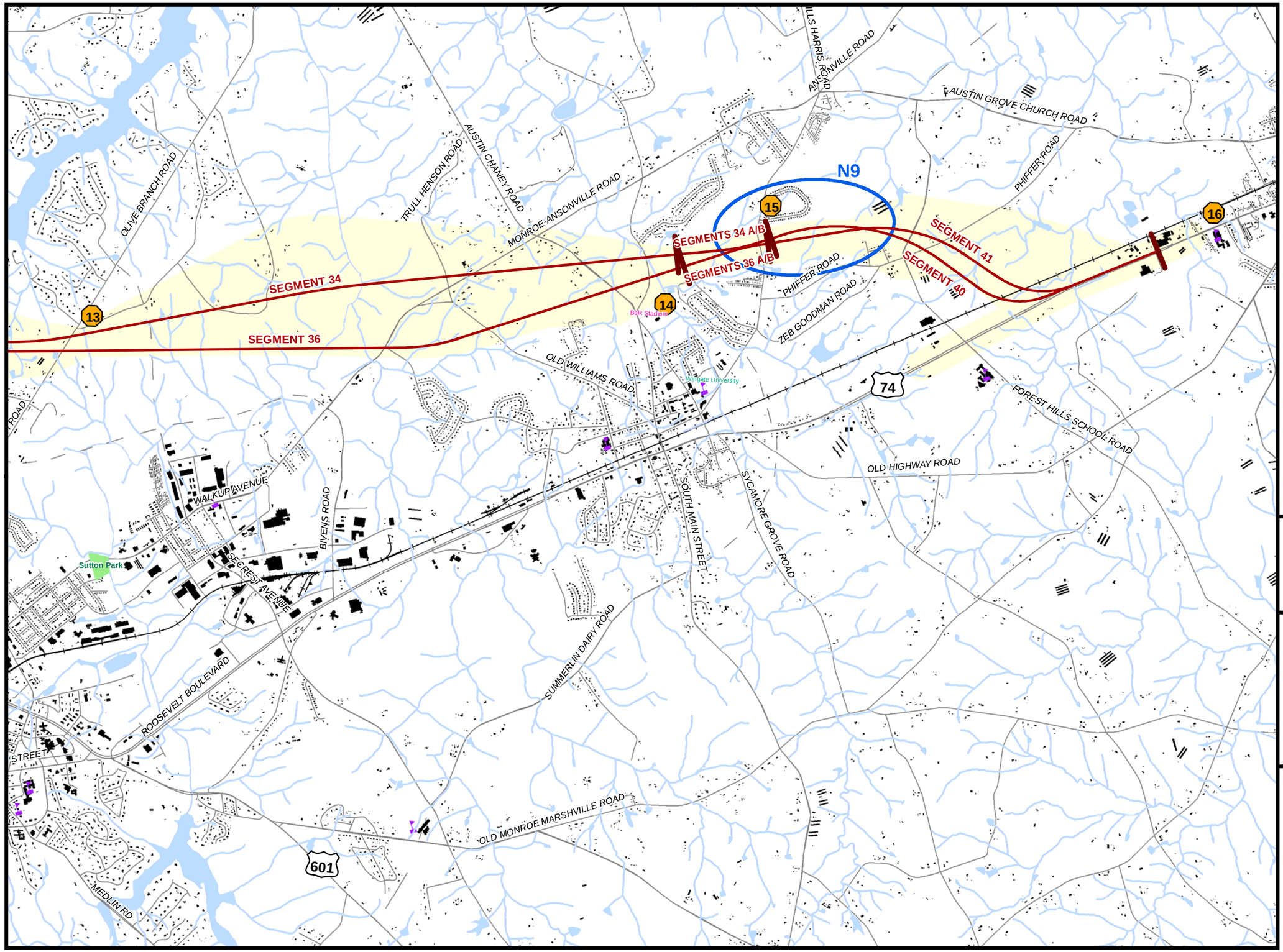
Mecklenburg County and Union County

MONROE CONNECTOR/ BYPASS

NOISE MEASUREMENT LOCATIONS and BARRIER EVALUATION AREAS

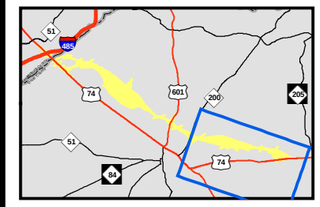
Figure 3b

NoisyStudyBarrierEvalAreas.mxd 11.18.08 AKH



Legend

- Noise Measurement Site
- Barrier Evaluation Area*
- Segment Breaklines
- Design Centerline
- Schools
- Structures
- Parks
- Rail
- Thoroughfares
- Streets
- Hydrology
- Lakes
- County Boundaries
- Corridor Study Area



Source: Mecklenburg County and Union County GIS.
Map Printed On 10-30-08.

N

0 1,500 3,000
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

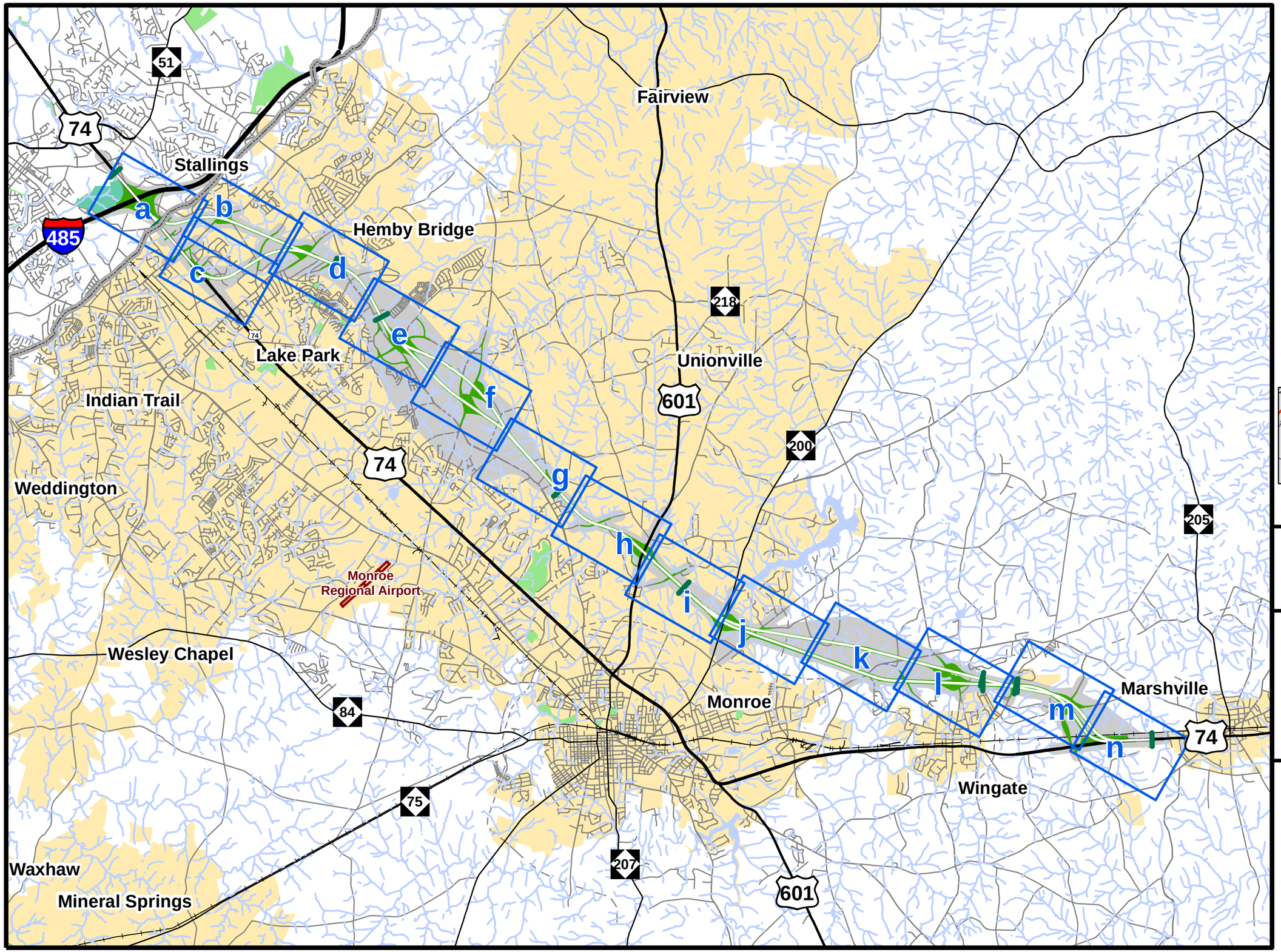
Mecklenburg County and Union County

MONROE CONNECTOR/ BYPASS

NOISE MEASUREMENT LOCATIONS and BARRIER EVALUATION AREAS

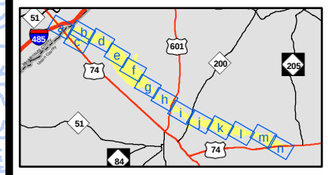
Figure 3c

NoisyStudyBarrierEvalAreas.mxd 11.18.08 AKH



Legend

- Design Centerline
- Segment Breaklines
- Proposed Right of Way
- Detailed Study Area
- Parks
- Interstate Highway
- US Highway
- NC State Highway
- Rail
- Streets
- Hydrology
- Municipalities
- County Boundaries



Source: Mecklenburg and Union Counties GIS Map Printed 10/28/08

N

0 1.5 Miles

NORTH CAROLINA Turnpike Authority

STIP PROJECT NO. R-3329 & R-2559

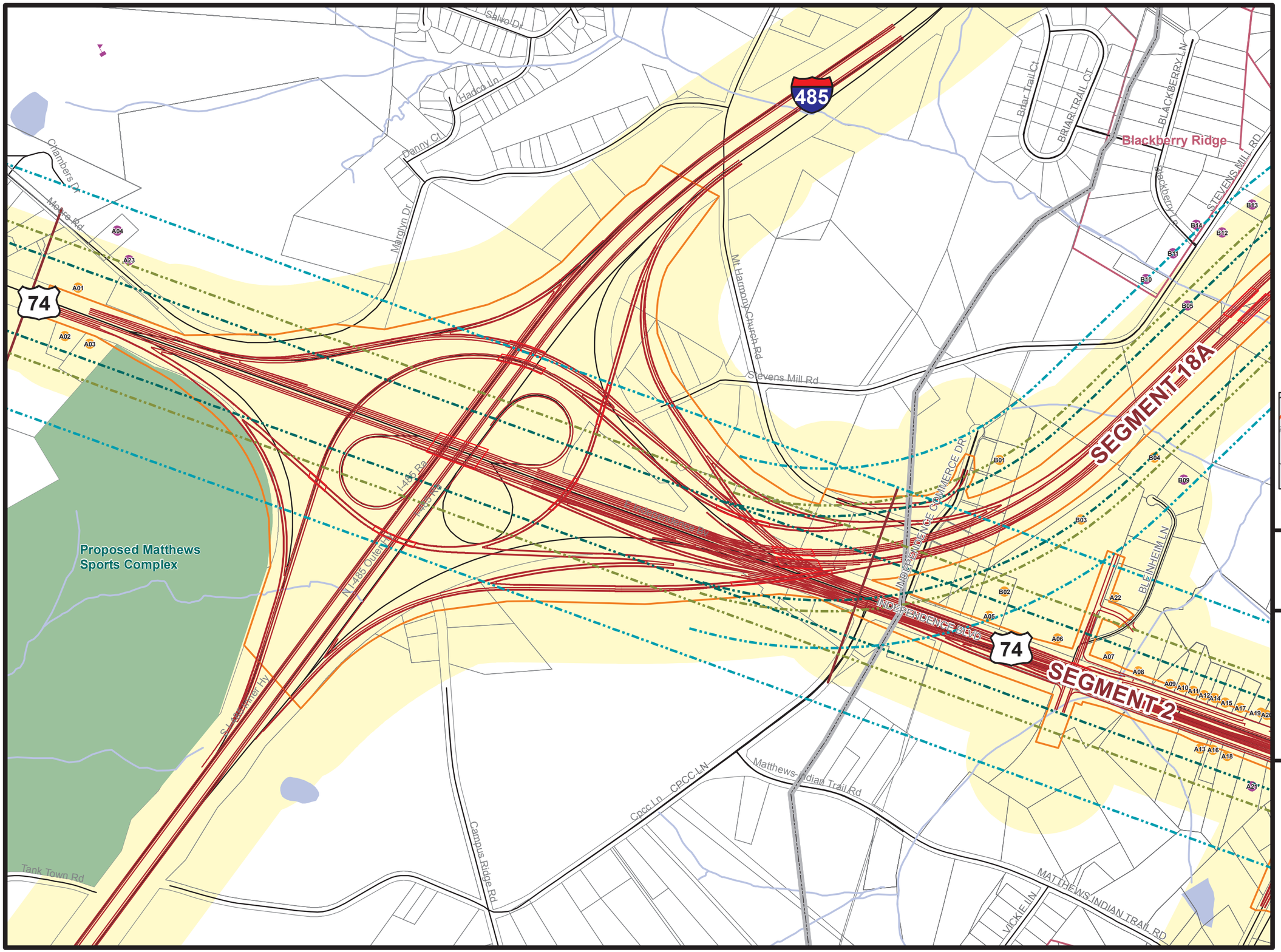
Mecklenburg County and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 Index

NoiseStudyMapbookIndex.mxd AKH 3.16.09



Legend

Noise Receptors

- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

0 600

Feet

NORTH CAROLINA
Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 a

NoiseStudyMapbook.mxd AKH 11.18.08

Woodbridge
Mill Stone Estates
Madison Ridge
Fairhaven
Eaglecrest
Forest Park
SEGMENT 18A
SEGMENT 2
MIDDLESBOROUGH DR
STALLINGS RD
STALLINGSWOOD DR
SCARLET ST
STEVENS MILL RD
FAIR SKY DR
TRANQUIL FALLS LN
BLUE IRIS DR
YELLOW DAISY DR
EAGLECREST DR
FALCONS RIDGE
OAK SPRING RD
STRAND DR
ATKINSON HARRIS RD
MEADOWBROOK DR
CEDARWOOD LN
TAMARACK DR
PEPPER ANN LN
WHITE OAK LN
CUPPED OAK DR
PESCA LN
VAN BUREN AV
B08
B15
B07
B06
B13
C01
C02
C03
C04
C05
C06
C07
C08
C23
C24
C25
C26
C27
C28
C47

Legend

Noise Receptors
- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

0 600
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

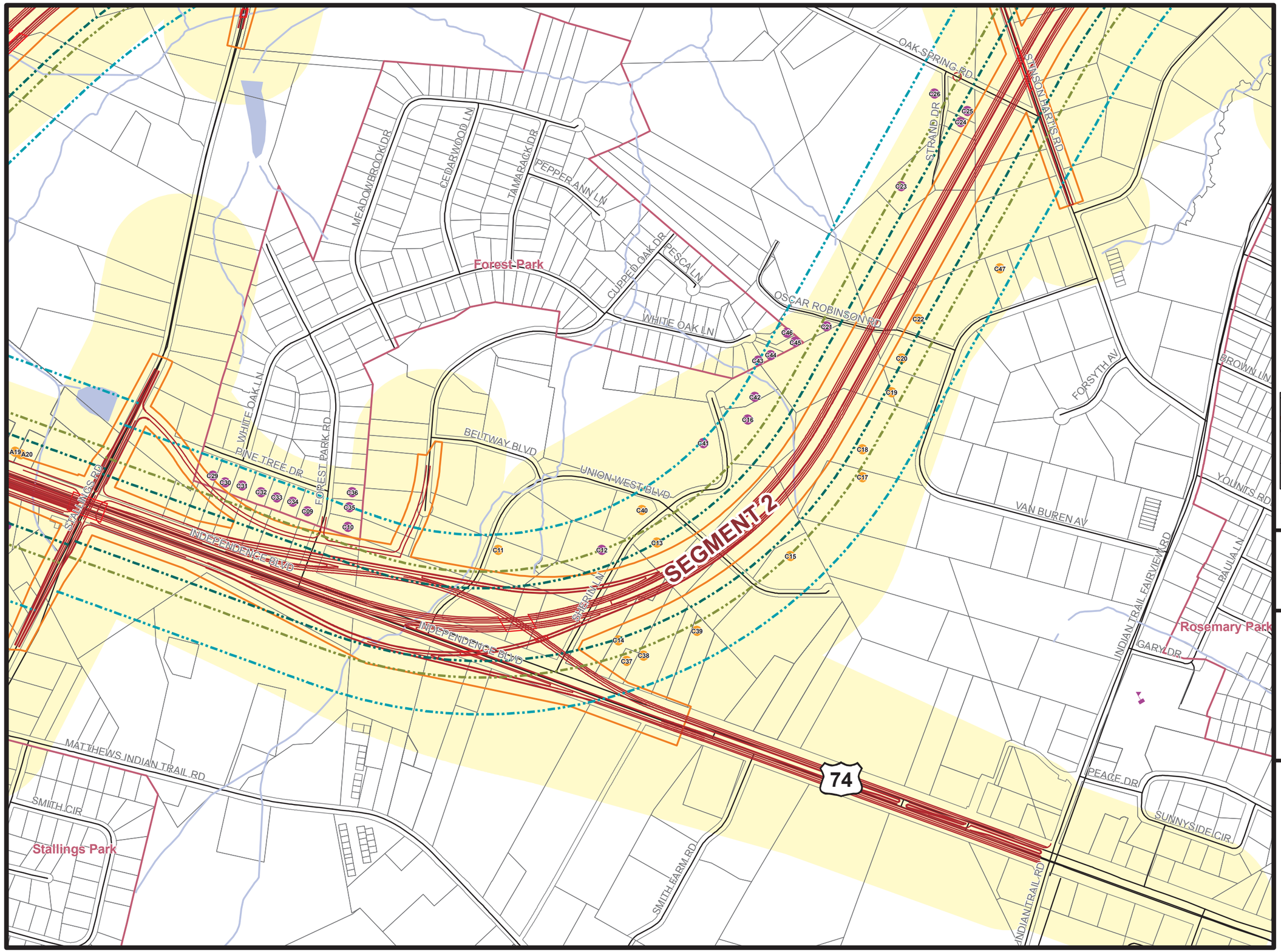
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 b

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors
- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

0 600
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

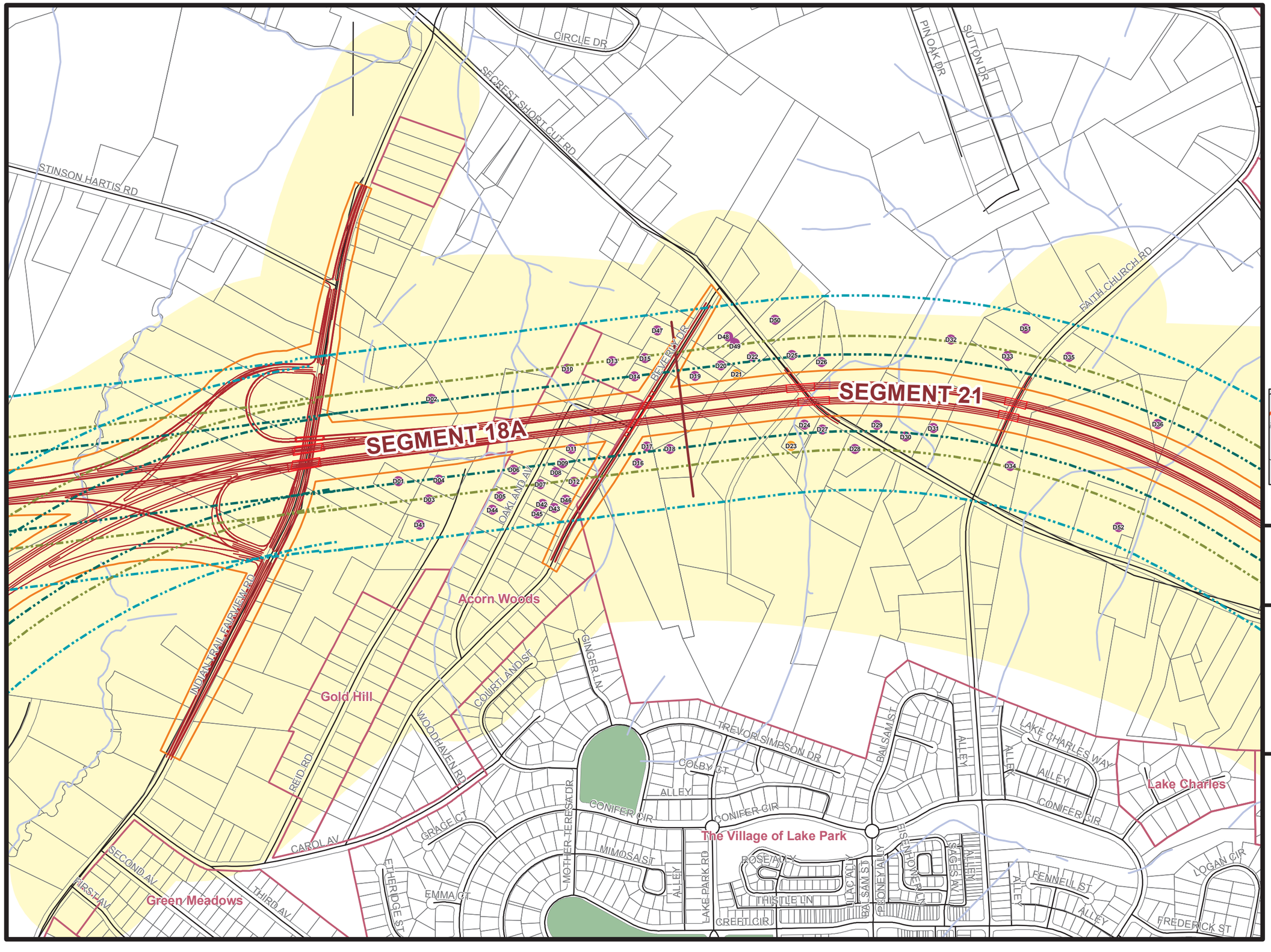
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 c

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors

- Church/School
- Commercial
- Residential
- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

0 600

Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

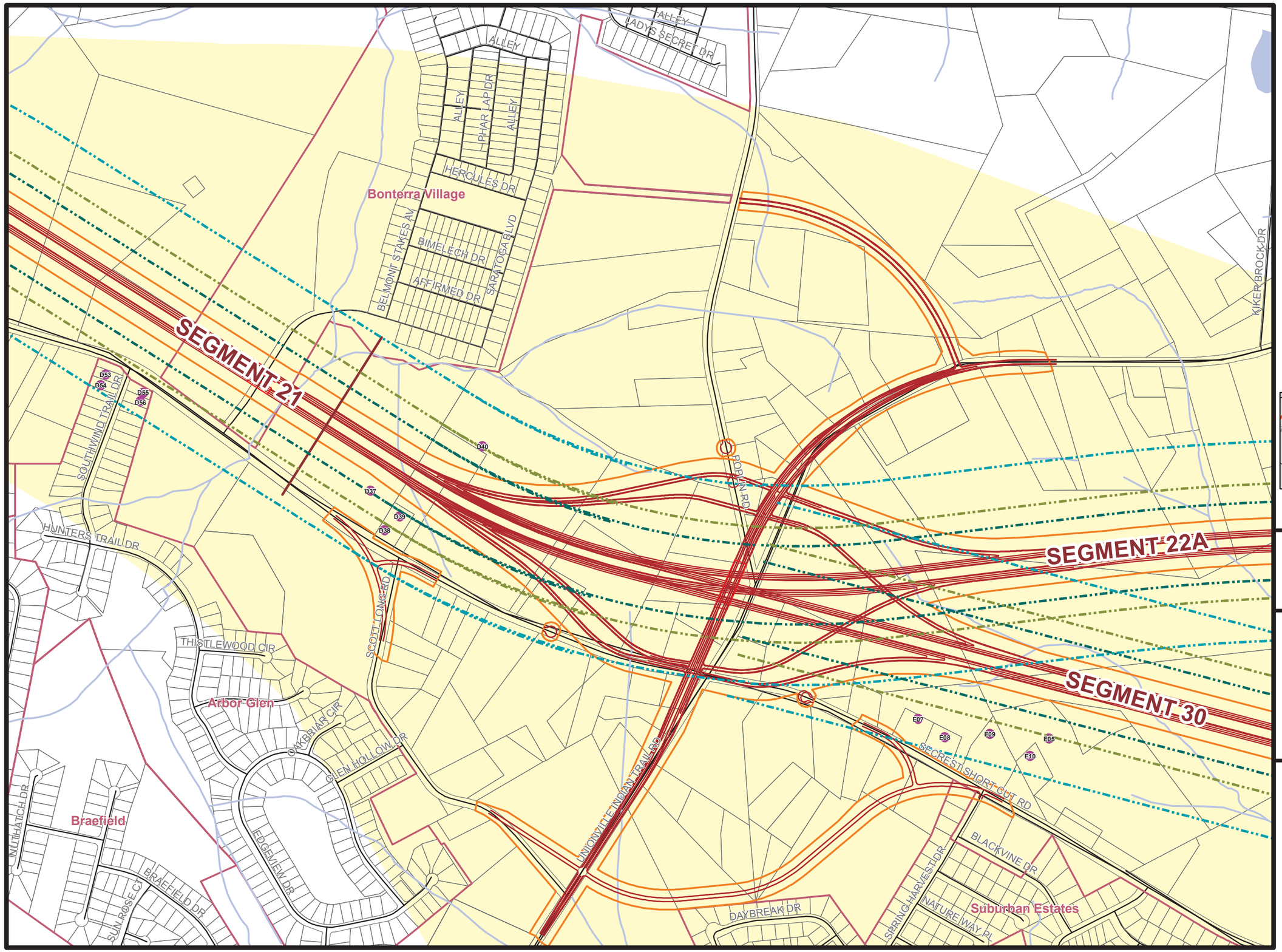
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 d

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors
- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

N

0 600

Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

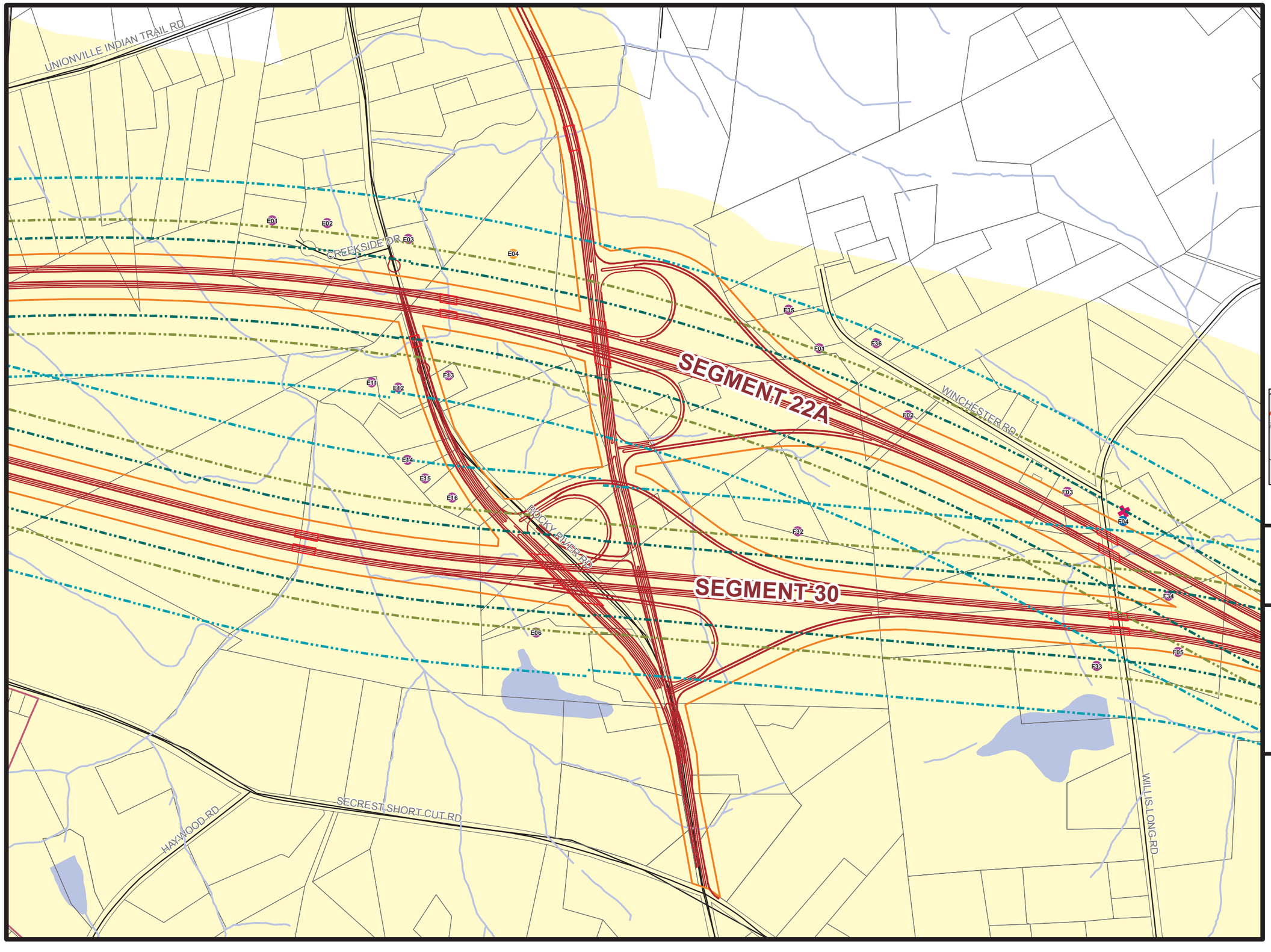
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 e

NoiseStudyMapbook.mxd AKH 11.18.08

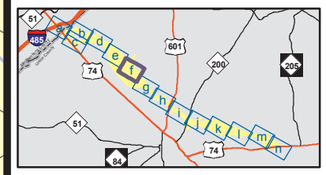


Legend

Noise Receptors

- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology



Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

0 600

Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 f

NoiseStudyMapbook.mxd AKH 11.18.08

SEGMENT 30 and SEGMENT 22A

SEGMENT 31

Poplin Farms

Little Park

Stoney Brook

Savannah Way

Avondale Park

Hilton Meadows

CLEAR CREEK CT

POPLIN RD

PRICE DAIRY RD

ROANOKE CHURCH RD

PEBBLE DR

SAVANNAH WAY

TELEFAIR LN

PULASKI DR

AVONDALE LN

BACK RD

HILTONMEADOW DR

MILLINGTON CT

RICHMOND LN

SECREST SHORT CUT RD

WALLACE RD

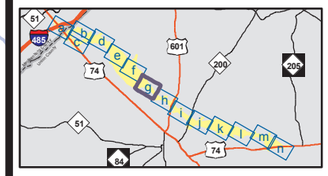
F06 F07 F08 F09 F10 F11 F12 F13 F14 F15 F16 F17 F18 F19 F20 F21 F22 F37 F38 F39 F40 F41 F42 F43

Legend

Noise Receptors

- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology



Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

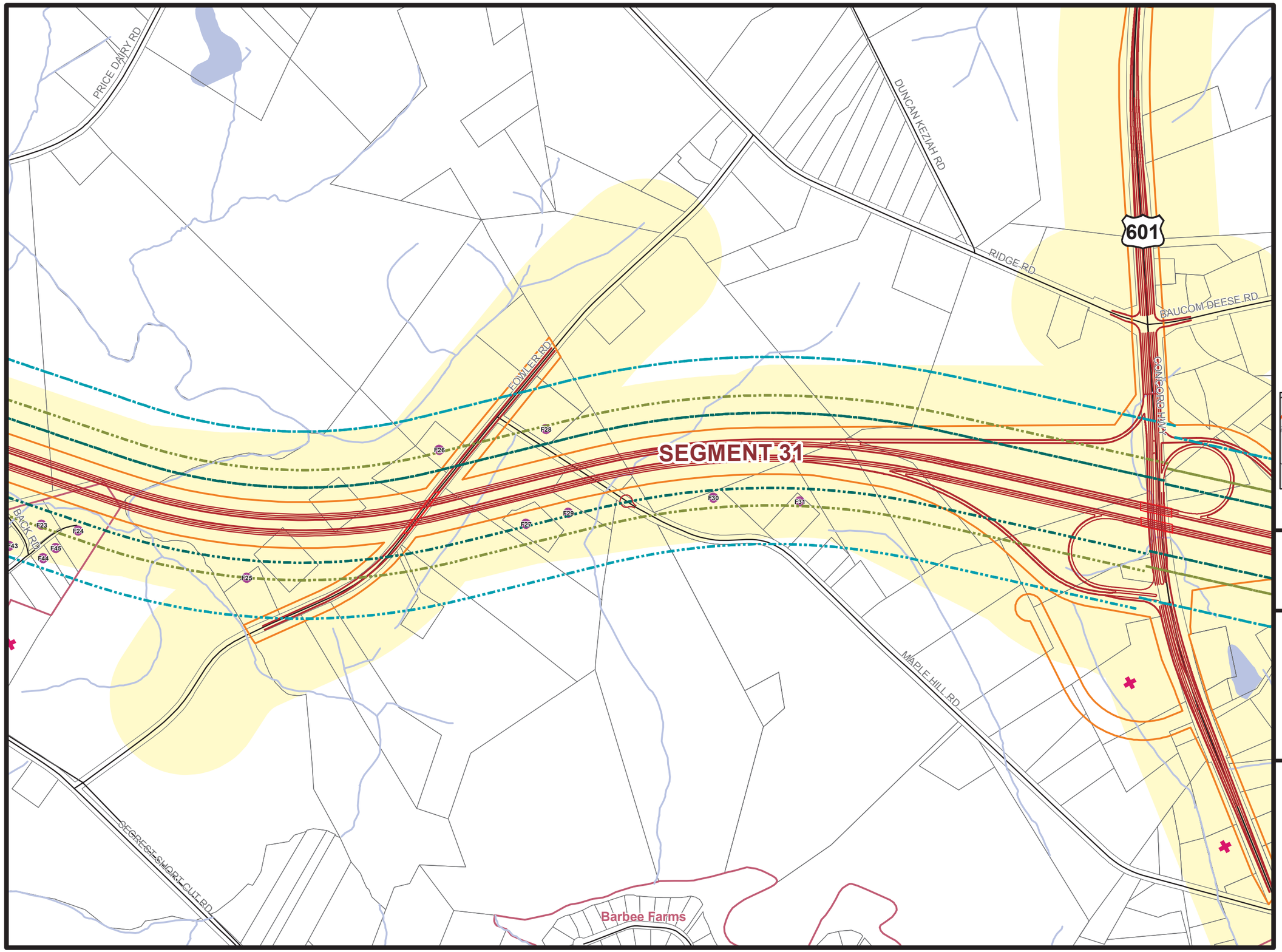
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 g

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors

- Church/School
- Commercial
- Residential

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- 66dBA Leq.
- 71dBA Leq.
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- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
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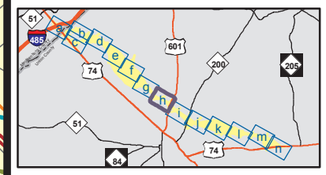
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology



Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

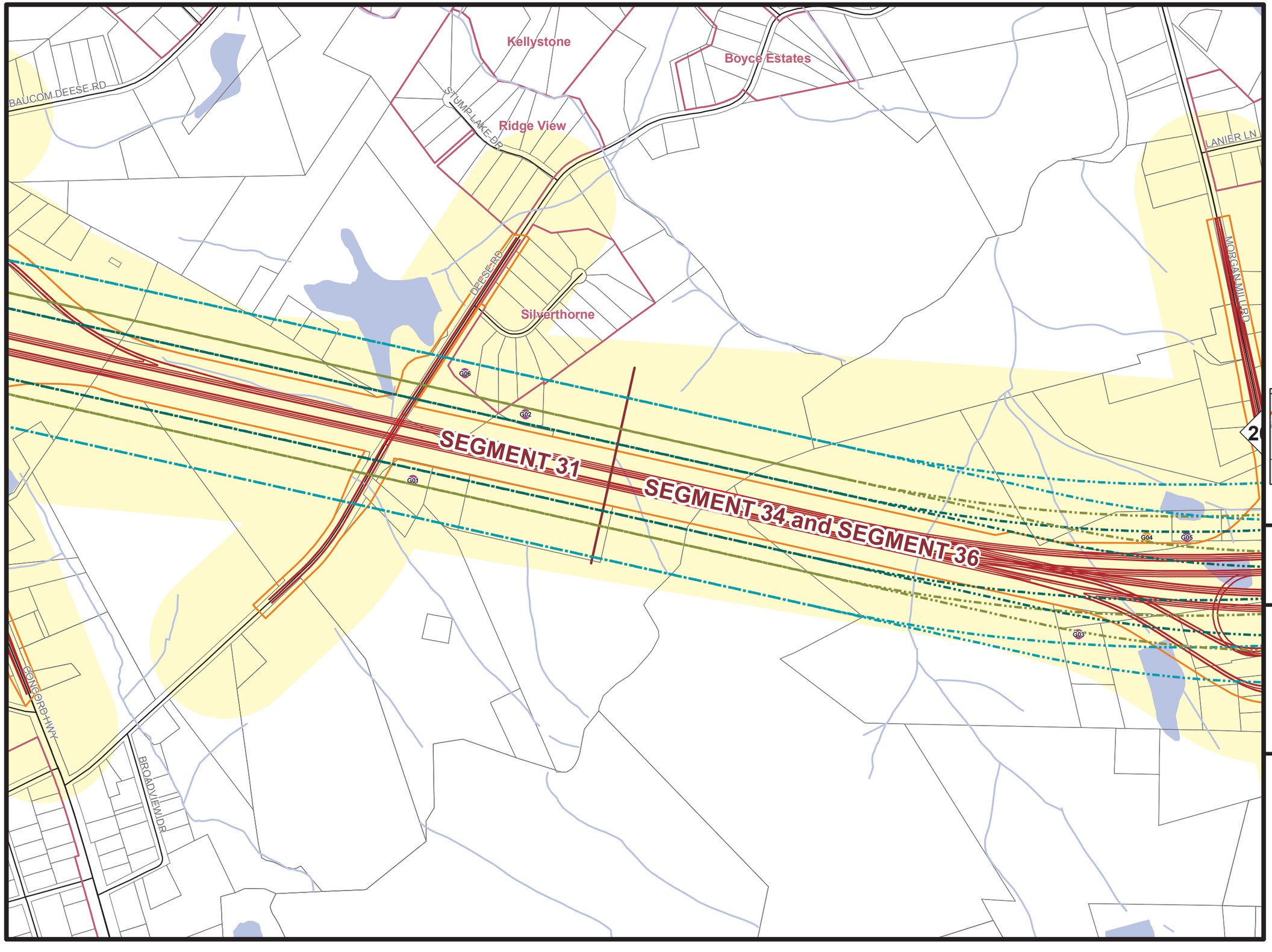
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 h

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors
- Church/School
- Commercial
- Residential

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- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
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- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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Feet

NORTH CAROLINA
Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 i

NoiseStudyMapbook.mxd AKH 11.18.08

Mallard Landing
Lake Haven
Lakeside
Lakeshores
MALLARD LANDING DR
ZEPHYR CIR
IVEYWOOD DR
BENTWOOD LN
MEADOW CREEK LN
FARM WOOD DR
HELMS POND RD
SEGMENT 34
SEGMENT 36
200
MORGAN MILL RD
OLIVE BRANCH RD
CYRUS EDWARDS RD
PINEVIEW DR
LUNDY LN
H01
H02
H03
H08
H09
H10
H11

Legend

Noise Receptors
- Church/School
- Commercial
- Residential

- 60dBA Leq.
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- Church
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- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

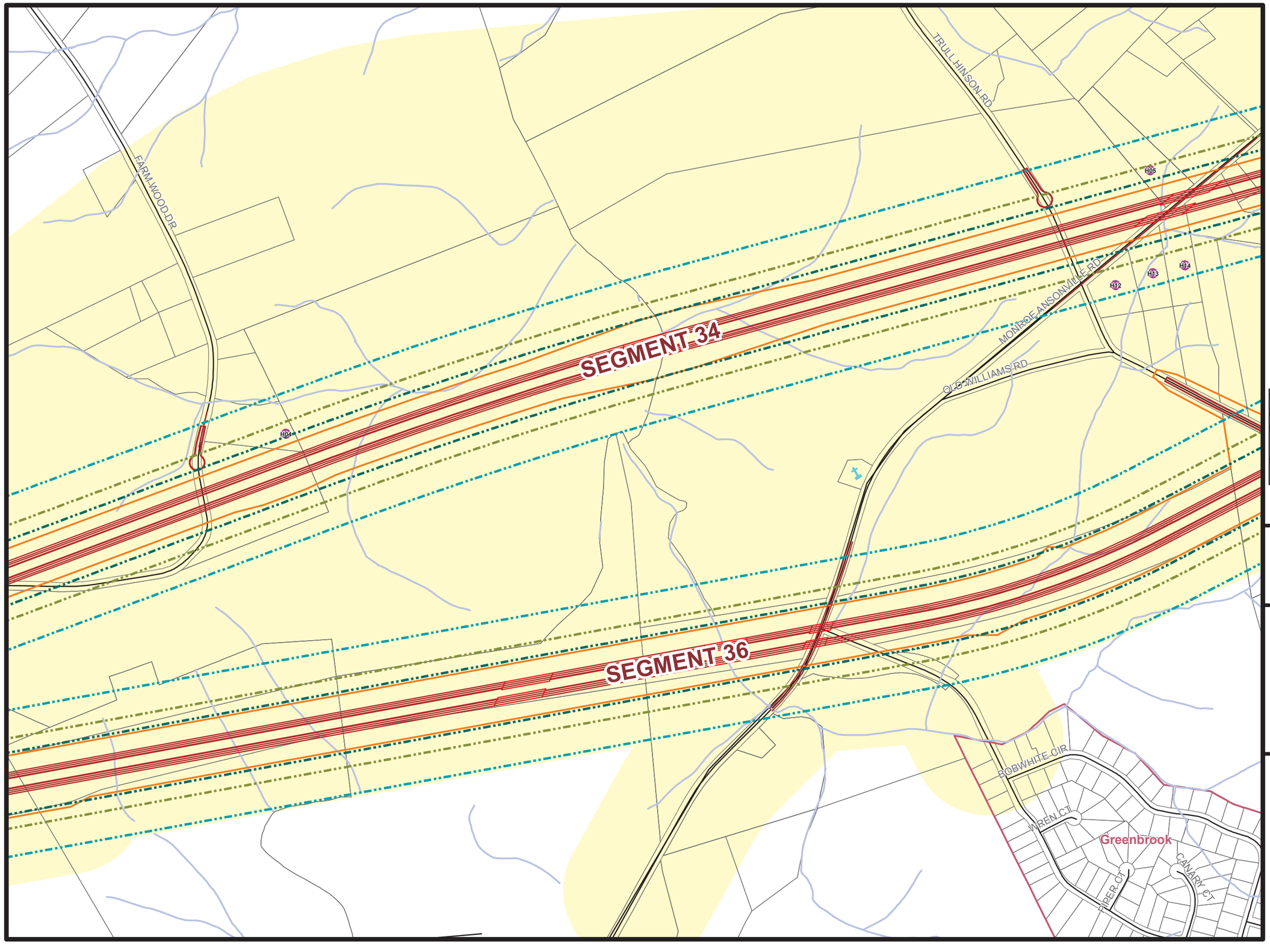
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 j

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors
- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

N

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

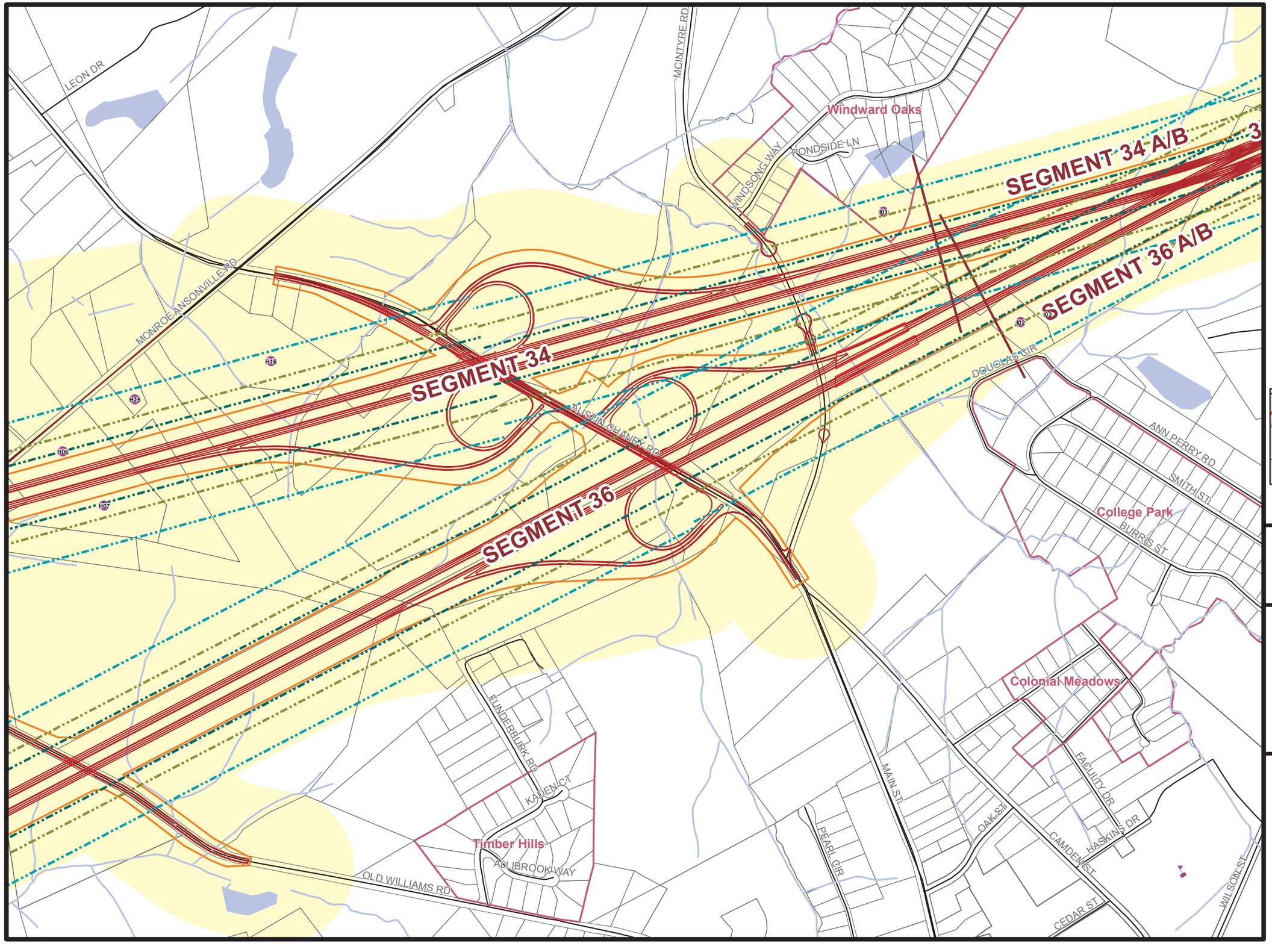
Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 k

NoiseStudyMapbook.mxd AKH 11.18.08



Legend

Noise Receptors
- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
- Parks
- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 I

NoiseStudyMapbook.mxd AKH 11.18.08

College Grove

Eastwood

Glencroft

RENNY LN

CLARK ST

TAYLOR ST

ANSONVILLE RD

GLENCROFT DR

SEGMENT 40

SEGMENT 41

36 A/B

34 A/B

PHIFER RD

PHIFER CIR

FOREST HILLS SCHOOL RD

MISSION DR

BERRYHILL DR

ZEB GOODMAN RD

HWY 74

Legend

Noise Receptors

- Church/School
- Commercial
- Residential

- 60dBA Leq.
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- 71dBA Leq.
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- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329 & R-2559

Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

Figure 4 m

NoiseStudyMapbook.mxd AKH 11.18.08

PHIFER RD

AUSTIN RD

MARSHVILLE BLVD

LONG ST

HAMBRICK ST

AUSTIN RD

74

CUDDY DR

PHILLIPS SANDERS RD

SEGMENT 41

SEGMENT 40

HWY 74

HWY 74

HELMS EFIRD RD

74

OLD 74 HWY

NoiseStudyMapbook.mxd AKH 11.18.08

Legend

Noise Receptors

- Church/School
- Commercial
- Residential

- 60dBA Leq.
- 66dBA Leq.
- 71dBA Leq.
- Functional Road Design
- Roadway Bridge
- Segment Breaklines
- Detailed Study Area
- Cemetery
- Church
- Library
- Schools
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- Parcels
- Subdivisions
- Streets
- County Boundaries
- Hydrology

Source: Mecklenburg and Union Counties GIS Map Printed 10/30/08

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NORTH CAROLINA Turnpike Authority

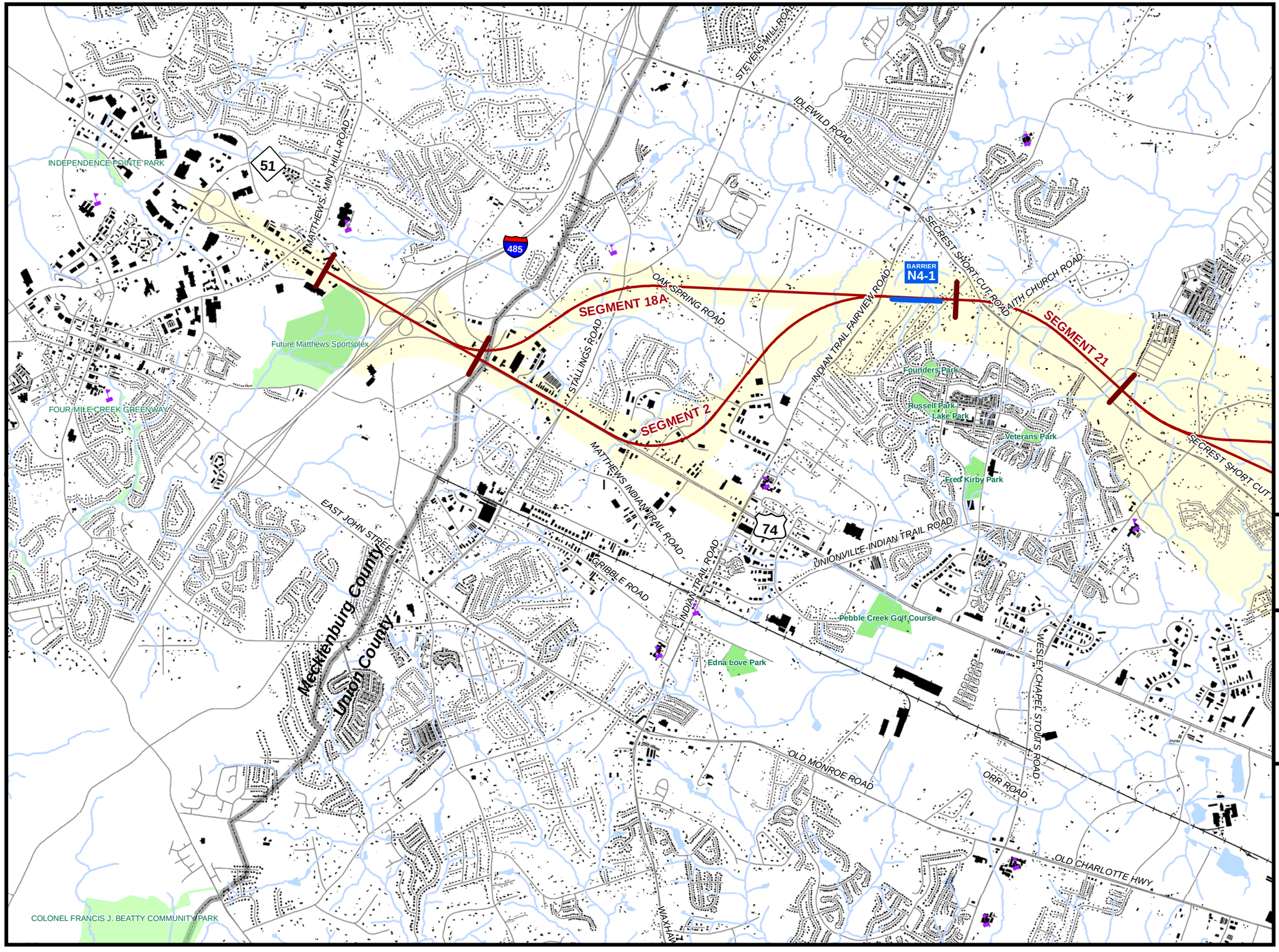
STIP PROJECT
NO. R-3329 & R-2559

Mecklenburg County
and Union County

MONROE CONNECTOR/BYPASS

2035 NOISE CONTOURS and SENSITIVE RECEPTOR LOCATIONS

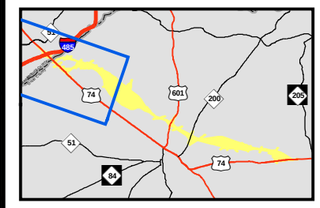
Figure 4 n



Legend

- Noise Barriers*
- Design Centerline
- Segment Breaklines
- Corridor Study Area
- Schools
- Structures
- Parks
- Rail
- Thoroughfares
- Streets
- Hydrology
- Lakes
- County Boundaries

*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 On 10-30-08.

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

Mecklenburg County and Union County

MONROE CONNECTOR/ BYPASS

FEASIBLE and REASONABLE NOISE BARRIERS

Figure 5a

Feas&ReasNoiseBarriers.mxd 11.18.08 AKH

SEGMENT 22A
SEGMENT 30
SEGMENT 31
BARRIER N7-2
UNIONVILLE-INDIAN TRAIL ROAD
SECREST SHORT CUT ROAD
POPLIN ROAD
BAUCOM ROAD
NEW SALEM ROAD
RIDGE ROAD
HAYWOOD ROAD
ROCKY RIVER ROAD
WILLIS LONG ROAD
SECREST SHORT CUT ROAD
PRICES DAIRY ROAD
MYERS ROAD
FOWLER ROAD
FOWLER-SECREST ROAD
ROLLING HILLS DRIVE
SECREST SHORT CUT ROAD
DEESE ROAD
601
200
74
Rolling Hills
CHARLOTTE AVENUE
ROCKY RIVER ROAD
Monroe Regional Airport
CONCORD AVENUE
STAFFORD STREET
MORGAN MILL ROAD
OLIVE BRANCH ROAD
Union County Fairgrounds
EAST AVENUE
Sutton Park
Jaycee Park
Belk Tonawanda Park
Dickerson Park
WALKUP AVENUE
FRANKLIN STREET

Legend
- Noise Barriers*
- Design Centerline
- Segment Breaklines
- Corridor Study Area
- Schools
- Structures
- Parks
- Rail
- Thoroughfares
- Streets
- Hydrology
- Lakes
- County Boundaries

*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 On 10-30-08.

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0 1,500 3,000
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT NO. R-3329/R-2559

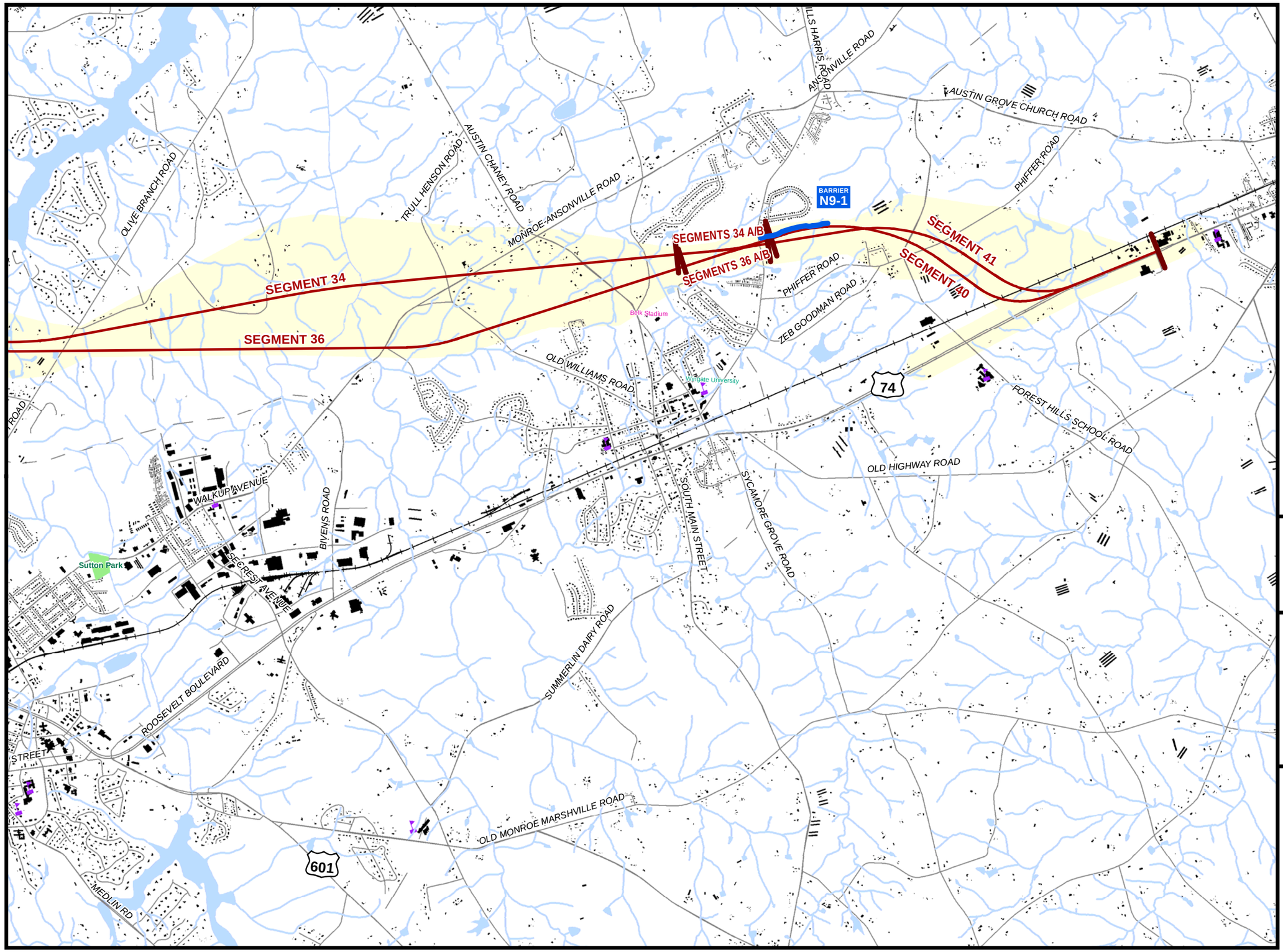
Mecklenburg County and Union County

MONROE CONNECTOR/ BYPASS

FEASIBLE and REASONABLE NOISE BARRIERS

Figure 5b

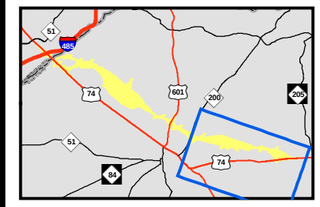
Feas&ReasNoiseBarriers.mxd 3.16.09 AKH



Legend

- Noise Barriers*
- Design Centerline
- Segment Breaklines
- Corridor Study Area
- Schools
- Structures
- Parks
- Rail
- Thoroughfares
- Streets
- Hydrology
- Lakes
- County Boundaries

*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 On 10-30-08.

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

Mecklenburg County and
Union County

MONROE CONNECTOR/ BYPASS

FEASIBLE and REASONABLE NOISE BARRIERS

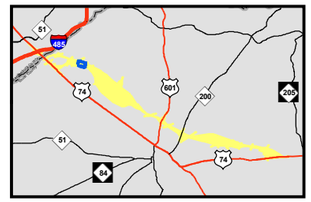
Figure 5c

Feas&ReasNoiseBarriers.mxd 11.18.08 AKH

Legend

Noise Receptors

- Benefited Receptor Point
- Receptor Point
- Noise Barriers
- Stationing
- Preliminary Road Design
- Segment Breaklines
- Right of Way



Source: Mecklenburg County and Union County GIS.
Map Printed On 10-30-08.

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

Mecklenburg County and Union County

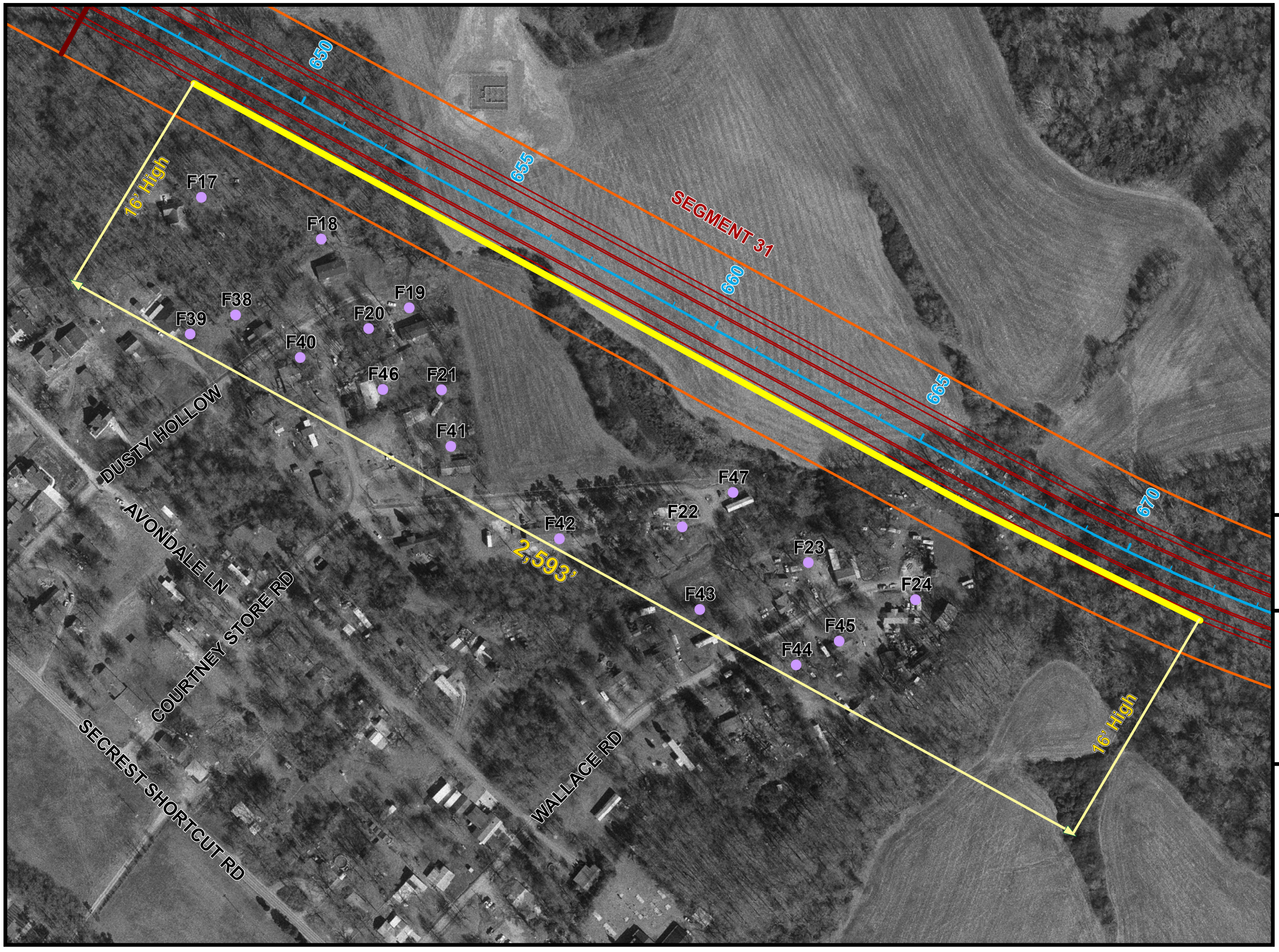
MONROE CONNECTOR/ BYPASS

BARRIER EVALUATION AREA

BARRIER N4-1

Figure 6

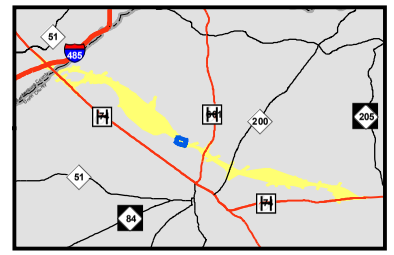
BarrierEvalAreas.mxd 11.25.08 AKH (modified in Illustrator)



Legend

Noise Receptors

- Benefited Receptor Point
- Receptor Point
- Noise Barriers
- Stationing
- Preliminary Road Design
- Segment Breaklines
- Right of Way



Source: Mecklenburg County and Union County GIS.
Map Printed On 10-30-08.

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Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

Mecklenburg County and Union County

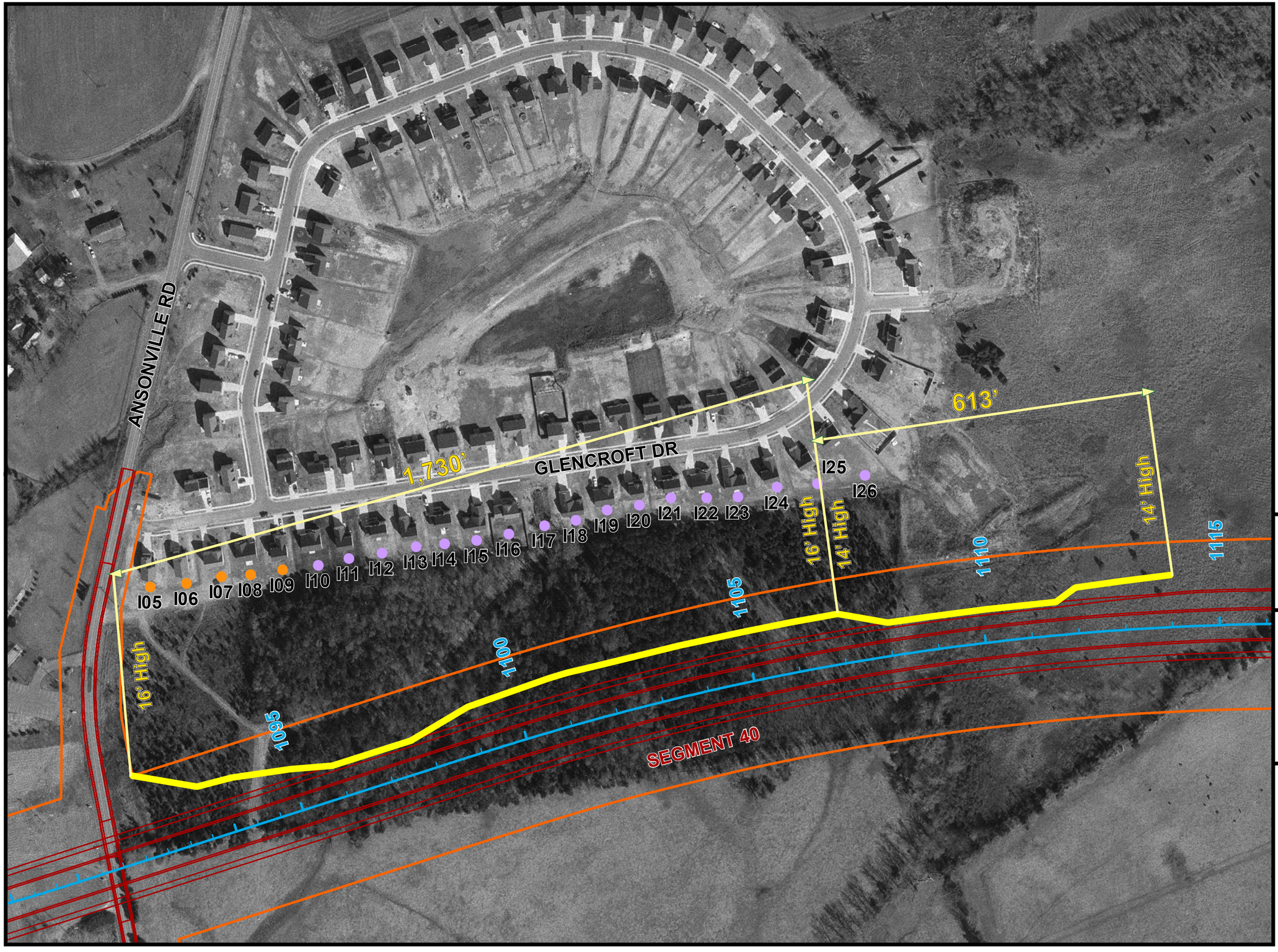
MONROE CONNECTOR/ BYPASS

BARRIER EVALUATION AREA

BARRIER N7-2

Figure 7

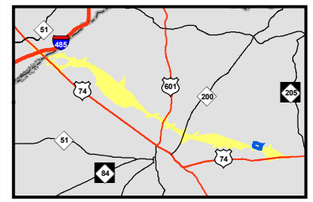
BarrierEvalAreas.mxd 12.15.08 AKH (modified in Illustrator afterward)



Legend

Noise Receptors

- Benefited Receptor Point
- Receptor Point
- Noise Barriers
- Stationing
- Preliminary Road Design
- Segment Breaklines
- Right of Way



Source: Mecklenburg County and Union County GIS.
Map Printed On 10-30-08.

N

0 100 200
Feet

NORTH CAROLINA Turnpike Authority

STIP PROJECT
NO. R-3329/R-2559

Mecklenburg County and Union County

MONROE CONNECTOR/ BYPASS

BARRIER EVALUATION AREA

BARRIER N9-1b

Figure 8

BarrierEvalAreas.mxd 11.25.08 AKH (modified in Illustrator)