5.10 Highway Noise

For purposes of this section, Preferred Alternative 8 that was identified in the Draft Environmental Impact Statement (DEIS) will be referred to as "Alternative 8." The Preferred Alternative for the Final Environmental Impact Statement (FEIS) will be referred to as the "Refined Preferred Alternative 8."

Since the publishing of the DEIS, the following substantive change has occurred to this section:

- The total number of impacts for Alternative 6 was incorrectly stated in **Section 5.10.6**, *Summary*, and has been updated.
- Assessment of impacts and noise barrier evaluation associated with Refined Preferred Alternative 8 have been included.
- Public involvement survey results have been included.

5.10.1 Introduction

As Indiana's transportation system expands and the traffic volumes increase, the communities through which these facilities run experience higher levels of highway-related noise. Highway noise is becoming a growing environmental concern, especially in high-density urban settings and outlying urban/suburban areas. FHWA is cognizant of the potential for such adverse off-site effects associated with Type I[1] projects and has taken measures to assess these impacts in noise sensitive environments and establish mitigation procedures, as mandated by the Federal-Aid Highway Act of 1970.

This project entails the upgrade of an existing Principal Arterial road (SR 37) which already has high traffic levels and partial access control (a combination of interchanges with at-grade intersections). The existing road is a source of traffic noise for receptors near the project area. It already has significant noise impacts upon surrounding areas. This analysis considers as its baseline conditions the noise impacts of existing and future traffic levels on SR 37 in the absence of any upgrade of SR 37 to I-69.

FHWA requires that all states have an approved policy to identify and address highway traffic noise impacts. The *INDOT Traffic Noise Analysis Procedure* (INDOT, 2011) was developed to implement the requirements of 23 CFR Part 772 and the noise-related requirements of the National Environmental Policy Act of 1969. FHWA approved the INDOT policy, made effective July 13, 2011. The structure of the policy focuses on the following principal elements:

1. Identification of Noise-Sensitive Land Uses.

[1] For purposes of evaluating noise impacts, a Type I project is one that (1) proposed to construct a highway on new location, or (2) significantly changes the alignment and/or number of through-traffic lanes of an existing highway. See 23 CFR §772.5 for further detail.

2. Determination of Existing Noise Levels.
3. Prediction of Future Noise Levels.
4. Identification of Traffic Noise Impacts.
5. Identification and Consideration of Abatement.
6. Consideration of Construction Noise.
7. Coordination with Local Government Officials.

The following sections document the project's compliance with FHWA and INDOT policies regarding highway noise.

5.10.2 Regulatory Policy

The *INDOT Traffic Noise Analysis Procedure* adopts the noise abatement criteria (NAC) established by FHWA (23 CFR Part 772) for determining noise impacts for a variety of land uses. The land-use Activity Categories along with the criteria are presented in **Table 5.10-1**. In accordance with the *INDOT Traffic Noise Analysis Procedure*, traffic noise impacts occur when a receptor[2] meets either of the two following conditions: 1) predicted noise levels approach or exceed the Noise Abatement Criteria (NAC) for the particular "activity category"; or, 2) predicted traffic noise levels substantially exceed the existing noise level. The *INDOT Traffic Noise Analysis Procedure*, defines "approach or exceed" to mean that future levels are higher than 1 dBA Leq(h) below the appropriate NAC. "Substantially exceed" means the predicted traffic noise levels exceed existing noise levels by 15 dBA or more. Severe noise impacts are defined as predicted noise levels that are expected to be 15 dBA or more over the NAC.

Table 5.10-1: FHWA Noise Abatement Criteria

Hourly A-Weighted Sound Level - Decibels (dBA)			
Activity Category	Activity Leq(h)	Evaluation Location	Description of Activity
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	Residential.
C	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.

2 A receptor represents a point where noise levels are measured or modeled for each applicable Activity Category land use classification located within the limits of the noise analysis. See 23 CFR §772.5 for further information.

Table 5.10-1: FHWA Noise Abatement Criteria

Hourly A-Weighted Sound Level - Decibels (dBA)			
Activity Category	Activity Leq(h)	Evaluation Location	Description of Activity
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F	-	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	-	Undeveloped lands that are not permitted.

Source: *Federal Highway Administration (23 CFR Part 772, Table 1).*

Note: *These sound levels are only to be used to determine impact. These are the absolute levels above which abatement must be considered. Noise abatement is designed to achieve a substantial noise reduction. Noise abatement is not designed to achieve the noise abatement criteria.*

5.10.3 Methodology

A Highway Traffic Noise Analysis for the Section 5 project (**Appendix W**, *Final Noise Technical Report*) was performed to determine the likely traffic noise impacts for the Section 5 build alternatives. The *Final Noise Technical Report* provides a comprehensive description and evaluation of the existing noise levels, the predicted Future No-Build noise levels, and the predicted year 2035 noise levels for each of the build alternatives, as well as a Highway Noise Mitigation Assessment for the predicted traffic noise impacts associated with all of the alternatives.

5.10.3.1 Determination of Existing Noise Levels

Existing noise levels are defined in 23 CFR Part 772 - Procedures for Abatement of Highway Traffic Noise and Construction Noise, as the noise, resulting from the natural and mechanical sources and human activity, considered to be usually present in a particular area during the period of the noise analysis. In accordance with the *INDOT Traffic Noise Analysis Procedure* Traffic Noise Prediction, the existing noise levels are to be determined by the measurements taken at a time of the day that reflects the worst (noisiest) traffic hour. This period is generally the Design Hourly volume (DHV).

Since there were approximately 2,327 receptors located within the Section 5 corridor, it was determined that existing measurements would be collected at representative sets of receptors. The representative sets were developed based on an evaluation of the topography, the level of service of the existing local roadway and highways, and the density and proximity of the receptors to the local roadways and highways.

The 31 existing noise level measurement locations and the number of receptors and the land-use activity description being represented by that location are shown on **Figure 5.10-1** and described in **Table 5.10-2**. (Figures are located at the end of the chapter.) Note: Receptor labels 19, 30 and 33 are not listed. These locations were selected early in the noise study planning phase (in 2005) in the and ultimately were not needed for the assessment because they were deemed to be outside the noise anlaysis area per the 2011 INDOT *Traffic Noise Analysis Procedure*. The table was not renumbered to keep the continuity of the other number labels intact.

Table 5.10-2: Existing Noise Level Measurement Locations

Site No.	Site Description and Land Use Classification
M-1	One-story, vinyl sided / bricked, single-family residential home with attached garage offset to the side of home. Front porch faces SR-37. Residence located off of SR-37 at 3139 Big Sky Road. Site near STA. 1061+00 to WB side of existing SR-37.The site is classified as land use category B, and represents one receptor for validation purposes only.
M-2	Split level, single-family residential home with attached garage. Residence located at 3300 Wood Creek Court in Woodhaven Estates subdivision. Measurement taken in backyard at the base of patio facing SR-37. Site near STA. 1124+00 to WB side of existing SR-37. This site is classified as land use category B, and represents one receptor for validation purposes only.
M-3	One-story, single-family residential brick home located at 3131 South Yonkers Street in Van Buren subdivision. Site near STA. 1147+00 to WB side of existing SR-37. This site is classified as land use category B, and represents one receptor for validation purposes only.
M-4	Two-story, vinyl sided (2nd floor) / bricked (1st floor), six unit apartment residence. Part of Oakdale Square Apartment Complex. T he six residential units are listed as 1602 – 1610 Oakdale West Drive. Measurement taken at sidewalk entrance location to apartment unit # 1602. Site near STA. 1195+00 to EB side of existing SR-37. This site is classified as land use category B, and represents one receptor for validation purposes only.
M-5	Tennis courts located at the Basswood Apartment Complex. Tennis courts located in open grassy area between apartment units. Site near STA. 1214+00 to EB side of existing SR 37. This site is classified as land use category C, and represents one receptor for validation purposes only.
M-6	Children's basketball court with park bench and surrounding open grassy play area. Recreational area located between 90-degree corner-bend of two apartment building units within the Canterbury House Townhouse Complex. Site near STA. 1249+00 to EB side of existing SR 37. This site is classified as land use category C, and represents one receptor for validation purposes only.
M-7	One-story, vinyl sided, single-family residential home. Residence located at intersection of Evergreen Drive and Kimble Drive in the Kimble Drive Neighborhood. Site near STA. 1292+00 to EB side of existing SR 37. This site is classified as land use category B, and represents one receptor for validation purposes only.
M-8	One-story, vinyl sided, single-family residential home with porch that extends entire front length of home, facing SR 37. Residence located at end of Hickory Lane. Site near STA. 1357+00 to EB side of existing SR 37. This site is classified as land use category B, and represents one receptor for validation purposes only.
M-9	Calvary Baptist Church located at 3501 N. Prow Road. Church is brick building. Measurement taken at playground area on south side of church. Site near STA. 1416+00 to EB side of existing SR 37. The site is classified as land use category C, and represents one receptor for validation purposes only.
M-10	Northside Christian Church located at 3993 N. Prow Road. Site near STA. 1435+00 to EB side of existing SR 37. Church is brick building. Measurement taken at playground area on north side of church. The site is classified as land use category C, and represents one receptor for validation purposes only.

Table 5.10-2: Existing Noise Level Measurement Locations

Site No.	Site Description and Land Use Classification
M-11	One-story, bricked, single-family residential home with attached garage. Residence located off of Kinser Pike. Site near STA. 1495+50 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-12	One-story, vinyl-sided, single-family residential home with attached garage. Residence located on Purcell Drive. Site near STA. 1620+50 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only
M-13	One-story, vinyl sided, single-family residential home with elevated wooden deck on backside of house. Residence located on East Sample Road. Site near STA. 1677+00 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-14	One-story, bricked, single-family residential home with attached garage. Residence located at 7809 Wildrose Road. Site near STA. 1705+00 to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-15	Simpson Chapel Methodist Church and cemetery located on Williams Road, directly behind the Candle Factory Outlet. No outside activities noted on the Church grounds. Site near STA. 1720+50 to WB side of existing SR 37. The site is classified as land use category C, and represents one receptor for validation purposes only.
M-16	One-story, vinyl-sided, single-family residential home with attached garage on Fox Hollow Road immediately adjacent to south of the United Pentecostal Assembly Worship Center located on Fox Hollow Road. Site near STA. 1749+00 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-17	One-story, wood-sided, single-family residential home with attached garage. Residence located at end of N. Norm Anderson Road, south of utility substation. Site near STA. 1789+50 to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes.
M-18	One-story, split-level, vinyl-sided, single-family residential home with detached garage situated beside and to the back corner of the house. Residence located at the intersection of Chambers Pike and SR 37. Site near STA. 1814+00 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-20	Mobile home located off Wyatt Road. Gravel access entrance to residence. Partial (minimal) visual blockage by trees to SR 37 from residence. Site near STA. 1942+50 to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-21	One-story, bricked, single-family residential home with attached garage. Residence located at 5185 Turkey Track Road. Site near STA. 1993+00 to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-22	Two-story, vinyl-sided, single-family residential home—no garage, only half-circle gravel driveway to the side of the house. Residence located on unnamed road off Paragon Road. Front of residence faces Paragon Road. Site near STA. 2004+50 to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-23	One-story, wood-sided, single-family residential home with detached garage. Residence located off of SR 37. Partial visual blockage by trees to SR-37 along property line between residence and highway (minimal vegetative barrier) on north side. Measurement taken in playground area by detached garage. Site near STA. 2046+50 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-24	New Testament Baptist Church located on unnamed road that parallels SR 37 highway. Lower half of church building is fieldstone with upper half covered with red-stained veneer wood paneling. Site near STA. 2064+00 to WB side of existing SR 37. The site is classified as land use category C, and represents one receptor for validation purposes only.
M-25	Two-story, vinyl-sided, single-family residential home with attached garage—2nd story over garage only. Residence located on Old State Road 37 with back yard facing SR 37. Site near STA. 2080+00 to EB side of existing SR 37. The site is classified as land use category B, and represents one receptor for

Table 5.10-2: Existing Noise Level Measurement Locations

Site No.	Site Description and Land Use Classification
	validation purposes only.
M-26	Hillview Motel located at intersection of Old State Road 37 and SR 37 highway. Site near STA. 2169+00 to EB side of existing SR 37. The site is classified as land use category E, and represents one receptor for validation purposes only.
M-27	One-story, bricked, single-family residential home. Residence in retirement community and located at 925 Plaza Drive. Site near STA. 2255+00 to WB side of existing SR 37. The site is classified as land use category B, and represents one receptor for validation purposes only.
M-28	Bloomington High School (North) softball field. Softball field is situated between actual school building and Prow Road. Site near STA. 1409+00 to EB side of existing SR 37. The Site is classified as land use Category C, and represents one receptor for validation purposes only.
M-29	One-story, single-family residential home with front porch. Residence located in the Maple Grove Historic District at 3888 N. Maple Grove Road, at the corner of Acuff Road and Maple Grove Road. The Site is classified as land use Category B, and represents one receptor for validation purposes only.
M-31	Wapehani Mountain Bike Park. Site is at closest point to SR 37 highway. Site near STA. 1179+50 to EB side of existing SR 37. The Site is classified as land use Category C (Section 4(f) Resource), and represents one receptor for validation purposes only.
M-32	The Oliver Winery Shop, outdoor garden area. Site near STA. 1731+50 to EB side of existing SR 37. The site is classified as land use Category E, and represents one receptor for validation purposes only.
M-34	Graceway Community Church and cemetery located on Maple Grove Road in the Maple Grove Historic District. Evidence of exterior activities—playground swing set located on the west side of church—use exterior noise level. Cemetery is located on the west side of church building. The Site is classified as land use Category C, and represents one receptor for validation purposes only.

Note: *Measurements were taken during the week of May 21, 2012.*

Measurement of the existing noise levels at the representative sites were collected during the week of May 21, 2012 using a Norsonics 132 Sound Level Meter. Traffic data was simultaneously recorded during the noise measurements and classified into five vehicle types — buses, automobiles, medium trucks (two-axles with six wheels), heavy trucks (three or more axles) and motorcycles — for subsequent entry into the Traffic Noise Model (TNM) 2.5 noise prediction computer model for validation purposes.

5.10.3.2 Prediction of Future Noise Levels

The future noise levels for the Design Year No-Build[3] and build alternatives were performed using the FHWA Traffic Noise Model (TNM), Version 2.5. The FHWA TNM was first released in March 1998. Version 2.5 of the model was released in April 2004. It is the latest approved version of the model.

[3] Future Design Year No-Build refers to the "do nothing" alternative for the design year, which is understood to be the year 2035 for this project.

The FHWA TNM estimates vehicle noise emissions based on mean (average) noise emission levels for three classes of vehicles used for this analysis: automobiles, medium trucks, and heavy trucks. The TNM computer model has capabilities for additional vehicular classes but only three were provided as part of the updated traffic analysis for the Refined Preferred Alternative 8. Buses were included in the initial analysis for Alternatives 4 through 8, but they accounted for only 0.3% of the peak period traffic. This small percentage was assimilated in the total heavy vehicle volumes and did not skew the anlaysis results. The predicted noise levels for the Design Year No-Build and Build alternative conditions were based on peak hour volumes and vehicular fleet mixes for the year 2035.

Terrain and other roadway features were input into TNM. These inputs include roadway widths (including inner and outer shoulders) and elevations, receptor elevations, intervening terrain, and ground cover (tree zones). In accordance with *INDOT's Traffic Noise Analysis Procedure,* all receptors located within 500 feet of the edge of pavement of all reasonable alternatives were assessed for traffic noise impacts. Additional receptors located at distances of up to 600 feet were included in the model as a conservative measure so that potential impacts would not inadvertently be omitted.

Based on all this input data, TNM uses its acoustic algorithms to predict noise levels at receptor locations by taking into account sound propagation variables such as atmospheric absorption, divergence, intervening ground, barriers, building rows, and vegetation.

5.10.3.3 TNM 2.5 Program Model Validation

Model validation is a process for testing a model to ensure that it produces reliable results and to confirm that traffic noise is the predominant noise source at the receptor locations. In general, validation involves comparing actual noise measurements with the noise levels predicted by the model for existing conditions at the same location. The model is considered to be verified if the model results are within ±3 dBA of the field measurements recorded at the site for the same conditions. In situations where there is no nearby traffic or traffic volumes are very low even under peak hour conditions, validation of TNM 2.5 by this method is not possible since non-traffic existing noises not accounted for in the model (e.g. birds chirping, insects, tree leaves rustling in the wind, dogs barking, air conditioner condenser units, neighborhood activities, etc.) are the predominant noise component, rather than roadway traffic.

5.10.3.4 Abatement Assessment

Noise abatement for the build alternatives will be evaluated for all receptors that are predicted to experience noise impacts in design year 2035. The *INDOT Traffic Noise Analysis Procedure* (2011) is consistent with the FHWA guidelines to determine the feasibility and reasonableness of noise abatement measures for all major highway projects. The terms "feasibility" and "reasonableness" are discussed in **Section 5.10.5**, *Mitigation*.

In 23 CFR Part 772, FHWA has identified a number of measures to abate or eliminate noise impacts. The primary means of mitigating noise impacts, as identified by FHWA, are:

- Traffic management measures (e.g., traffic control devices and signing to prohibit certain vehicle types, modified speed limits, and exclusive lane designations).
- Alteration of horizontal and vertical alignments.
- Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development that would be adversely impacted by traffic noise.
- Construction of noise barriers within the highway right-of-way.
- Noise insulation of public use or non-profit institutional structures.
- Coordination among local authorities to govern future development along the selected corridor.

5.10.4 Analysis

5.10.4.1 TNM Validation

The measured and modeled existing noise levels for each representative receptor location are contained in **Table 5.10-3**. The existing measured L_{eq} noise levels within the project corridor ranged from 42.5 dBA at Site M-34 to 69.6 dBA at Site M-24.

Based on field observations collected during the existing noise level measurements where traffic volumes were visible and/or were the dominant noise source (26 of the 31 measurement sites), the measured noise levels recorded were all within 3 dBA of the corresponding modeled noise levels. Sites M-6, M-28, M-29, M-31 and M-34 had either no dominant traffic noise or the distant SR 37 traffic was not the dominant noise source. Based on these results, the TNM noise models constructed for the modeled existing, design year no-build and build alternatives are considered valid.

5.10.4.2 Existing Traffic Noise Results

The project study area was divided into 16 Noise Sensitive Areas (NSAs) based on a combination of land use, traffic volumes, and density. Base year traffic data from the state transportation model and the I-69 corridor model were used as input into TNM to determine the 2012 existing noise levels for the 1,034 sites that represent 2,327 receptors within the 16 NSAs throughout the Section 5 corridor. The results of the noise analysis conducted for the modeled existing condition resulted in 72 receptors that approach or exceed the applicable NAC criteria as defined in the INDOT *Traffic Noise Analysis Procedure*. These locations are comprised of 71 residences (37 single family residences and 34 apartment units) and one cemetery. The *Final Noise Technical Report* (**Appendix W**) includes the existing sound level results for each modeled site.

Table 5.10-3: Existing Noise Levels and TNM Validation Results

Site No.	Activity Category	Existing Measured L_{eq} (dBA)	Existing Modeled L_{eq} (dBA)	Measured Minus Modeled Leq (dBA)	Dominant Noise Source at Site
M-1	B	59.5	60.4	-0.9	Traffic noise from SR 37
M-2	B	59.5	60.8	-1.3	Traffic noise from SR 37
M-3	B	64.8	63.1	+1.7	Traffic noise from SR 37
M-4	B	61.6	64.2	-2.6	Traffic noise from SR 37
M-5	C	60.3	58.7	+1.6	Traffic noise from SR 37
M-6	C	51.7	N/A	N/A	Distant traffic noise from SR 37, not visible
M-7	B	58.9	59.8	-0.9	Traffic noise from SR 37
M-8	B	66.7	67.7	-1.0	Traffic noise from SR 37
M-9	C	57.3	58.2	-0.9	Traffic noise from SR 37
M-10	C	62.1	61.9	+0.2	Traffic noise from SR 37
M-11	B	67.0	65.7	+1.3	Traffic noise from SR 37
M-12	B	65.5	68.3	-2.8	Traffic noise from SR 37
M-13	B	59.2	57.2	+2.0	Traffic noise from SR 37
M-14	B	54.3	53.3	+1.0	Traffic noise from SR 37
M-15	C	58.5	57.4	+1.1	Traffic noise from SR 37
M-16	B	64.6	63.5	+1.1	Traffic noise from SR 37
M-17	B	60.2	62.2	+2.0	Traffic noise from SR 37
M-18	B	66.9	65.0	+1.9	Traffic noise from SR 37
M-20	B	65.1	65.3	-0.2	Traffic noise from SR 37
M-21	B	64.6	63.2	+1.4	Traffic noise from SR 37
M-22	B	66.9	68.3	-1.4	Traffic noise from SR 37
M-23	B	62.0	64.9	+2.9	Traffic noise from SR 37
M-24	C	69.6	67.7	+1.9	Traffic noise from SR 37
M-25	B	62.9	64.8	-1.9	Traffic noise from SR 37
M-26	E	68.1	68.2	-0.1	Traffic noise from SR 37
M-27	B	62.3	62.4	-0.1	Traffic noise from SR 37
M-28	C	51.7	N/A	N/A	Traffic noise from SR 37, not visible
M-29	B	55.8	N/A	N/A	Acuff Rd., distant SR 37, not visible
M-31	C	57.7	N/A	N/A	Traffic noise from SR 37, not visible
M-32	E	66.3	66.7	-0.4	Traffic noise from SR 37
M-34	B	42.5	N/A	N/A	No dominant noise source, no local traffic

5.10.4.3 Design Year No-Build Alternative Noise Results

The results of the noise analysis conducted for the Design Year No-Build Alternative at the existing noise monitoring locations indicate that design year 2035 predicted noise levels would increase by approximately 4 dBA (on average) over the existing condition. For the No-Build condition, L_{eq} levels are predicted to range from 38 dBA to 75 dBA. This increase results from the predicted growth in traffic volumes if the proposed project is not constructed. The predicted number of receptors that approach or exceed the appropriate NAC criteria is 253, an increase of 181 over the existing condition. These locations are comprised of approximately 234 residences, 2 churches, 2 offices, 1 hotel (12 units), 1 business, 1 hospital and 1 cemetery (all exterior impacts). The residential locations include 133 single-family units and 101 multi-family units at five apartment complexes (Bradford Ridge, Copper Beach, Forest Ridge, Oakdale Square and North Crossover). The *Final Noise Technical Report* (**Appendix W**) includes the design year predicted sound level results for each modeled site.

5.10.4.4 Design Year Build Alternative Noise Results

A noise analysis was performed to determine the predicted design year 2035 noise levels for the receptors located within the modeling limits for the proposed alignments that comprise each of the six Alternatives. The generalized results of the noise analysis conducted for Alternatives 4, 5, 6, 7, 8 and Refined Preferred Alternative 8 are relatively the same between the Alternatives because they follow the same general location along the existing route (SR 37). The primary differences in the number of impact results from the current predicted number of right-of-way acquisitions, the number of representative sites per receptor, the location of new and/or modified interchanges and the projected traffic volumes between Alternatives. The *Final Noise Technical Report* (**Appendix W**) includes the design year predicted sound level results for each modeled site.

<u>**Alternative 4**</u>

The results of the noise analysis conducted for Alternative 4 indicate that the year 2035 predicted noise levels for the build condition would range from 40 dBA L_{eq} to the 77 dBA L_{eq} for 798 modeled locations representing 1,976 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA Leq to 17 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}.

<u>**Alternative 5**</u>

The results of the noise analysis conducted for Alternative 5 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 77 dBA L_{eq} for 805 modeled locations representing 1,984 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 17 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}.

Alternative 6

The results of the noise analysis conducted for Alternative 6 indicate that the year 2035 predicted noise levels for the build condition would range from 40 dBA L_{eq} to 77 dBA L_{eq} for 896 modeled locations representing 2,090 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 15 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}.

Alternative 7

The results of the noise analysis conducted for Alternative 7 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 78 dBA L_{eq} for 900 modeled locations representing 2,099 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 16 dBA L_{eq}, with an average increase of approximately 8 dBA L_{eq}.

Alternative 8

The results of the noise analysis conducted for Alternative 8 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 77 dBA L_{eq} for 876 modeled locations representing 2,072 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 16 dBA L_{eq}, with an average increase of approximately 8 dBA Leq.

Refined Preferred Alternative 8

The results of the noise analysis conducted for Preferred Alternative 8 indicate that the year 2035 predicted noise levels for the build condition would range from 41 dBA L_{eq} to 77 dBA L_{eq} for 927 modeled locations representing 2,134 receptors. These predicted noise levels represent a difference from existing noise levels ranging from 0 dBA L_{eq} to 19 dBA L_{eq}, with an average increase of approximately 7 dBA L_{eq}.

5.10.4.5 Identification of Predicted Traffic Noise Impacts

The noise level impacts identified for the six build alternatives are summarized in **Table 5.10-4** and described below. The values in the table are for all the receptors represented by the modeled location sites.

A summary of the type of impacts for the predicted design year 2035 traffic associated with the six build alternatives is contained in **Table 5.10-5**. The *Final Noise Technical Report* (**Appendix W)** includes the locations and individual modeled sound levels for each of the receptor location sites.

Table 5.10-4: Noise Level Impacts by Land Use - 2035 Build Alternatives

Receptor (or Land Use) Type	2035 Exterior Noise Level Impacts						
	No-Build Alternative	Build Alternatives					
		4	5	6	7	8	Refined Preferred Alternative 8
Residences	234	285	279	461	435	417	396
Churches	2	2	3	4	4	3	4
Cemeteries	1	2	2	1	2	2	1
Schools	0	0	0	0	0	0	0
Parks	0	0	0	0	0	0	0
Recreation	0	0	0	1	1	1	0
Hotels/Motels*	12	0	12	0	0	0	12
Hospitals	1	1	1	1	1	1	1
Historic Sites/ National Historic Landmarks	0	0	0	0	0	0	0
Commercial (non-retail)	3	6	6	8	9	6	5
Total	**253**	**296**	**303**	**476**	**452**	**430**	**419**

Table 5.10-5: Noise Level Impact Summary

Type of Impact	2035 Exterior Noise Level Impacts					
	Build Alternatives					
	4	5	6	7	8	Refined Preferred Alternative 8
NAC Only Impact	293	300	475	451	426	408
Substantial Increase Only Impact (≥15 dBA)	3	3	1	1	4	10
NAC and Substantial Increase Impact	0	0	0	0	0	1
Total	**296**	**303**	**476**	**452**	**430**	**419**

Design Year No-Build Alternative

Results of modeling the existing SR 37 highway facility using 2035 traffic data yielded 253 receptors that approach or exceed the appropriate NAC criteria. This is an additional 181 more than the existing 2012 condition. These impacts include 234 residences, two churches, two offices, one hotel (with 12 units), one non-retail business, one hospital and one cemetery (all exterior impacts). The residential locations include 133 single-family units and 101 multi-family units at four apartment complexes (Copper Beach, Forest Ridge, Oakdale Square and North Crossover).

Build Alternatives

Alternative 4

This alternative will result in 293 NAC impacts and three substantial increase impacts for a total of 296 impacts. These predicted exterior impacts are comprised of 285 residences, two churches, two cemeteries, one hospital and six non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 102 single-family units and 183 multi-family units at four apartment complexes (Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square).

Alternative 5

This alternative will result in 300 NAC impacts and three substantial increase impacts for a total of 303 impacts. These predicted exterior impacts are comprised of 279 residences, three churches, two cemeteries, one hotel (with 12 units), one hospital and six non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 90 single-family units and 189 multi-family units at four apartment complexes (Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square).

Alternative 6

This alternative will result in 475 NAC impacts and one substantial increase impact, for a total of 476 impacts. These predicted exterior impacts are comprised of 461 residences, four churches, one cemetery, one tennis court (recreation), one hospital and eight non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 148 single-family units and 313 multi-family units at five apartment complexes (Basswood, Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square).

Alternative 7

This alternative will result in 451 NAC impacts and one substantial increase impacts for a total of 452 impacts. These predicted exterior impacts are comprised of 435 residences, four churches, two cemeteries, one tennis court (recreation), one hospital and nine non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 160 single-family units and 275 multi-family units at six apartment complexes (Basswood, Bradford Ridge, Copper Beach, Forest Ridge, Oakdale Square and North Crossover).

Alternative 8

This alternative will result in 426 NAC impacts and four substantial increase impacts for a total of 430 impacts. These predicted exterior impacts are comprised of 417 residences, three churches, two cemeteries, one tennis court (recreation), one hospital and six non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 146 single-family units and 271 multi-family units at five apartment complexes (Basswood, Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square).

Refined Preferred Alternative 8

This alternative will result in 408 NAC impacts, ten substantial increase impacts and one impact that meets both criteria for a total of 419 impacts. These predicted exterior impacts are comprised of 396 residences, four churches, one cemetery, one hospital, one hotel (with 12 units), and five non-retail commercial buildings (offices, restaurants, etc.). The residential locations include 146 single-family units and 251 multi-family units at five apartment complexes (Basswood, Bradford Ridge, Copper Beach, Forest Ridge and Oakdale Square).

5.10.5 Mitigation

Traffic noise abatement measures can be in many forms and may include traffic control measures (TCM), alteration of vertical or horizontal alignment, acquisition of buffering land, noise insulation of public use or non-profit institutional structures, and/or construction of traffic noise barriers. Due to limitations on INDOT's ability to acquire property for mitigation or to mitigate sites off of State Right-of-Way, the most common form of abatement is the construction of noise barriers. Other forms of abatement will be evaluated on a case-by-case basis. INDOT will choose the most feasible and reasonable form of abatement.

5.10.5.1 Noise Abatement Considerations

The following strategies were considered for the predicted highway traffic noise impacts.

Traffic Management Measures: Traffic management measures were not considered reasonable and feasible for abating noise impacts for any receptor. Measures such as installation of additional traffic control devices, prohibition of vehicle types, time-use restrictions, speed limit reductions, and exclusive lane designations would be detrimental to the proposed project's ability to function as a freeway and major north-south route.

Alteration of Horizontal and Vertical Alignments: The final design of the preferred alternative may include shifting the alternative both vertically and horizontally, wherever feasible, to minimize impacts to adjacent land uses. Both vertical and horizontal alignments may be altered to minimize noise impacts where other factors are not prohibitive. However, since Section 5 is primarily on existing alignment, it is not anticipated that substantial horizontal and/or vertical changes will occur that might notably affect sound levels.

Acquisition of Property Rights or Acquisition of Property: The purchase of property and/or buildings for noise barrier construction or the creation of a "buffer zone" to reduce noise impacts was considered. The amount of property required for this option to be effective would create significant additional impacts (*e.g.*, in terms of displacements), which were determined to outweigh the benefits of land acquisition.

Noise Insulation of Public Use or Nonprofit Institutional Structures: This noise abatement measure option applies only to NAC D land uses. Since no NAC D land uses have interior noise levels exceeding FHWA's interior NAC, this noise abatement option will not be applied.

Coordination Among Local Planning Authorities. Since most of the proposed project would be located on an existing highway facility, the potential for local officials and developers to help minimize adverse noise impacts through the use of careful land use planning exists only in the undeveloped areas. With regard to currently undeveloped land, the creation of a "buffer zone" or locating noise sensitive developments a reasonable distance away from the project would help minimize future noise impacts. Local planning authorities will be provided with information that identifies the limits of where 66 dBA and 71 dBA noise levels are predicted relative to the proposed facility and can be utilized to direct noise compatible land uses outside the 66 dBA and 71 dBA buffer zones along the highway. This information is provided in **Appendix W**, the *Noise Technical Report*. Copies of this FEIS will be provided to local officials.

Construction of Noise Barriers: The construction of noise barriers between the shoulder and the right-of-way limits is generally one of the most feasible and/or reasonable abatement measures available. Noise barriers can be wall structures, earthen berms, or a combination of the two. The effectiveness of a noise barrier depends on the distance and elevation difference between the roadway and receptor and the available placement location for a barrier. For those receptors experiencing a noise impact, the feasibility and reasonableness of noise abatement were evaluated using INDOT's feasible and reasonableness assessment criteria.

Possible mitigation measures were considered for sites where noise impacts were predicted to occur. Mitigation was assessed in terms of its feasibility and reasonableness.

Feasibility means that INDOT believes abatement of traffic noise impacts is prudent based on all of the following factors:

- Acoustic Feasibility. INDOT requires that noise barriers achieve a 5 dBA reduction at a majority (greater than 50%) of the impacted receptors. If a barrier cannot achieve this acoustic goal, abatement is considered to not be acoustically feasible.

- Engineering Feasibility. INDOT requires noise abatement to be based on sound engineering and evaluated at the optimum location. For instances in which the roadway is located on fill and is at a higher location than nearby receptors, a barrier will be evaluated near the shoulder. For instances in which the roadway is located below the nearby receptors, a barrier will be evaluated near the edge of the right-of-way near the receptors. In addition, noise barriers require long, uninterrupted segments of barrier to be feasible. As such, if there are existing access points and/or driveways, it is not feasible to construct effective noise barriers for the roadway.

  Engineering feasibility also takes into account topography, drainage, safety, barrier height, utilities, and access/maintenance needs (which may include right-of-way considerations). In situations where engineering considerations make noise barriers not feasible, the noise analysis will explicitly state the reasons (topography, drainage, safety, etc.).

Reasonableness means that INDOT believes abatement of traffic noise impacts is prudent based on all of the following factors:

- Cost effectiveness. A barrier is determined to be cost-effective if a five decibel (5 dBA) reduction can be achieved at a cost of no more than $25,000 per benefited receptor if a majority of the nearby receptors in a common noise environment were not constructed prior to the roadway. Using current bid prices, this corresponds to approximately 833 square feet of noise barrier per receptor. The allowed cost is $30,000 per benefited receptor if a majority of the nearby receptors in a common noise environment were constructed prior to the roadway being constructed. This corresponds to approximately 1,000 square feet of noise barrier per receptor using recent bid prices.

  Note: Placing noise barriers on structures creates additional challenges, since reinforcement of the structure may be necessary to support the increased load. In these situations, other options should be assessed to determine whether cost-effective abatement can be provided without requiring complicated and expensive structural modifications. These could include lighter-weight barriers, shorter barriers, or other considerations. Any variations will be worked out in coordination between the FHWA division office and INDOT's Offices of Structural Services, Environmental Services, and Construction Management.

- INDOT Design Goal for Noise Abatement. FHWA requires that traffic noise abatement achieve a substantial noise reduction. INDOT's goal for substantial noise reduction is to provide at least a 7.0 dBA reduction for impacted first row receptors in the design year. However, conflicts with adjacent lands may make it impossible to achieve substantial noise reduction at all impacted first row receptors. Therefore, the noise reduction design goal for Indiana is 7.0 dBA for a majority (greater than 50%) of the impacted first row receptors.

- Consideration and obtaining views of residents and property owners. The viewpoints of the affected property owners and residents are important to FHWA and INDOT. All communication with the public regarding the potential for noise abatement must be coordinated with INDOT's Office of Communication. The public involvement requirement can be handled either through a public hearing or via a mailed survey as outlined in the INDOT *Traffic Noise Analysis Procedure*.

5.10.5.2 Noise Mitigation Assessment

Using INDOT's *Traffic Noise Analysis Procedure*, receptors that were categorized as having design year (2035) traffic noise impacts for the six build alternatives were assessed to determine if the construction of noise barriers would be a feasible and reasonable form of noise abatement. As part of the barrier analysis, the most current available data was used.

During the NEPA process, there is normally insufficient design information to fully commit to construction of noise abatement. This analysis identifies locations where noise impacts are predicted to occur, where noise abatement is likely to be feasible and reasonable, and locations with impacts that are likely to have no feasible or reasonable noise abatement alternatives. The information is completed to the extent that design information on the alternatives under study is available at the time the environmental document is completed. Projects may eventually have a narrower scope, updated survey information, or another change that affects the future noise environment. As such, noise abatement recommendations during the NEPA stage do not constitute commitments by INDOT. All Type I projects are reevaluated in the FEIS to determine if noise abatement still meets the feasibility and reasonability standards set forth in this policy. A final determination on noise abatement for Refined Preferred Alternative 8 will be made during the design phase. At that time, additional noise analysis will be performed to more accurately determine barrier performance, barrier characteristics (length and height), and the optimal barrier location for any potential noise barriers recommended for noise abatement.

Collectively, noise barrier analysis was conducted at 80 locations for the six alternatives. Three barriers were found to be both feasible and reasonable for this preliminary analysis (see **Figure 5.10-2**). Barrier 1 involves impacted receptors along southbound I-69 between Fullerton Pike and Tapp Road. Barrier 3 involves impacted receptors along northbound I-69 between Tapp Road and SR 45 (West Bloomfield). Barrier 4 involves impacted receptors along northbound I-69 between SR 45 (West Bloomfield) and SR 48 (West 3rd Street).

Potentially affected property owners and/or tenants at the three potential barrier locations that meet INDOT feasible and reasonableness criteria were surveyed in accordance with the requirements set forth in the INDOT *Traffic Noise Analysis Procedure* to determine whether they do or do not want noise abatement. The majority of the responding residences voted in favor of noise barrier construction. Additional public involvement will be completed as necessary (for change in land uses) or if the decision is changed.

Alternative 4

The results of the barrier analysis for Alternative 4 are shown in **Table 5.10-6**.

***Feasibility* -** There were 9 barriers out of the 35 analyzed for Alternative 4 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the impacted receptors. The other barriers assessed for Alternative 4 met the feasibility criteria.

***Reasonableness* -** There were 23 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor, and are therefore not considered "reasonable".

Barriers 1, 3, and 4 met INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owner for feedback as part of the public involvement phase.

Alternative 5

The results of the barrier analysis for Alternative 5 are shown in **Table 5.10-7**.

Feasibility **-** There were 11 barriers out of the 40 analyzed for Alternative 5 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the impacted receptors.

Reasonableness **-** There were 26 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor, and are therefore not considered "reasonable".

Barriers 1, 3, and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

Alternative 6

The results of the barrier analysis for Alternative 6 are shown in **Table 5.10-8**.

Feasibility **-** There were 12 barriers out of the 46 analyzed for Alternative 6 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the impacted receptors.

Reasonableness **-** There were 31 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3, and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

Alternative 7

The results of the barrier analysis for Alternative 7 are shown in **Table 5.10-9**.

Feasibility **-** There were 13 barriers out of the 50 analyzed for Alternative 7 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the impacted receptors.

Reasonableness **-** There were 34 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3, and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

Alternative 8

The results of the barrier analysis for Alternative 8 are shown in **Table 5.10-10**.

***Feasibility* -** There were 14 barriers out of the 50 analyzed for Alternative 8 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the impacted receptors.

***Reasonableness* -** There were 33 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria for of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3, and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

Refined Preferred Alternative 8

The results of the barrier analysis for Refined Preferred Alternative 8 are shown in **Table 5.10-11**.

***Feasibility* -** There were 8 barriers out of the 42 analyzed for Refined Preferred Alternative 8 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the impacted receptors.

***Reasonableness* -** There were 31 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria for of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3, and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria, and were presented to the affected residents and property owners for feedback as part of the public involvement phase.

Noise Survey Results

In the first series of 527 surveys sent to potentially benefited residents, there were 24 responses received from the Barrier 1 area (23 in favor, 1 no-commitment), 3 responses from the Barrier 3 area (all in favor) and 16 responses from the Barrier 4 area (13 in favor, 3 opposed).

According to *INDOT Traffic Noise Analysis Procedure*, if the total respondents to the survey do not total a majority (more than 50%) of the benefited receptors and affected property owners for a specific mitigation measure, then a second survey of those that did not respond will be performed. Surveyed residents were aware of the minimum response requirements. (A third survey will not be performed regardless of the percentage of the responses.)

Consequently, due to the low number of responses (39, 7, and 5 percent for barrier areas 1, 3 and 4, respectively), a second mailing of 402 letters were sent. (Note: the second mailing did not include apartment units that turned out to be vacant.) In the second series, there were only 7 responses received from the Barrier 1 area, 5 responses from the Barrier 3 area and 12 responses from the Barrier 4 area. As a result of the responses that were collected, the majority of the responding residences voted in favor of noise barrier construction. The results of the noise survey are shown in **Table 5.10-12**.

Statement of Likelihood

This Statement of Likelihood is applicable to all Build Alternatives as the same preliminary barrier area locations are deemed to be feasible and reasonable. This is because the six Build Alternatives generally follow the same alignment of existing SR 37 and affect the same relative receptors plus/minus the receptors that may be acquired through right-of-way purchase as a result of the proposed action. The number of impacted receptors and barrier costs reflect the range of the six Build Alternatives.

A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement processes.

The viewpoints of the impacted residents and property owners have been sought and considered in determining the reasonableness of highway traffic noise abatement measures for proposed highway construction projects. As a result of the responses that were collected, the majority of the responding residences voted in favor of noise barrier construction. INDOT will incorporate highway traffic noise consideration in on-going activities for public involvement in the highway program.

Barrier 1: Based on the studies completed to date, the State of Indiana has identified 27 to 42 impacted receptors (32 receptors for Refined Preferred Alternative 8) and has determined that noise abatement is likely, but not guaranteed, between Fullerton Pike and Tapp Road. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement in these locations at this time has been estimated to cost $1.73 million to $2.01 million ($1.73 million for Refined Preferred Alternative 8) and will reduce the noise level by a minimum of 7 dBA at a majority of the identified impacted receptors. A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement processes.

Barrier 3: Based on the studies completed to date, the State of Indiana has identified 26 to 88 impacted receptors (26 receptors for Refined Preferred Alternative 8) and has determined that noise abatement is likely, but not guaranteed, south of SR 45 at Oakdale Apartments. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement in these locations at this time has been estimated to cost $0.76 million to $0.92 million ($0.76 million for Refined Preferred Alternative 8) and will reduce the noise level by a minimum of 7 dBA at a majority of the identified impacted receptors. A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed such that noise abatement is not feasible and reasonable, the abatement measures might not be provided. The final decision on the installation of any abatement measure(s) will be made upon the completion of the project's final design and the public involvement processes.

Barrier 4: Based on the studies completed to date, the State of Indiana has identified 135 to 226 impacted receptors (225 receptors for Refined Preferred Alternative 8) and has determined that noise abatement is likely, but not guaranteed, at the Basswood, Bradford Ridge, Cooper Beach, Forest Ridge and Canterbury Apartments north of 2nd Street/Bloomfield Road. Noise abatement at these locations is based upon preliminary design costs and design criteria. Noise abatement in these locations at this time has been estimated to cost $1.71 million to $1.79 million ($1.78 million for Refined Preferred Alternative 8) and will reduce the noise level by a minimum of 7 dBA at a majority of the identified impacted receptors.

Table 5.10-6: Alternative 4 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4851	14	27	80	16	Yes	$2,010,557	$25,132	Yes
2	1923	20	4	25	16	Yes	$1,038,487	$41,540	No
3	1530	20	48	49	14	Yes	$917,996	$18,735	Yes
4	3722	16	135	358	13	Yes	$1,786,415	$4,990	Yes
5	3177	14	8	19	12	Yes	$1,334,354	$70,229	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	6	10	10	Yes	$1,713,062	$171,306	No
10	1625	18	5	5	6	Yes	$877,306	$175,461	No
12	1908	14	8	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
16	1,200	16	1	1	2	Yes	$576,000	$576,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
36	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
43	500	16	1	1	7	Yes	$240,000	$240,000	No
47	1,000	16	1	1	8	Yes	$480,000	$480,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
52	-	-	1	0	9	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-
61	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 5.10-7: Alternative 5 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4606	14	11	73	16	Yes	$1,934,492	$26,500	Yes
2	2043	18	4	18	16	Yes	$980,446	$54,469	No
3	1492	20	54	55	14	Yes	$894,950	$16,271	Yes
4	3562	16	135	319	13	Yes	$1,709,585	$5,359	Yes
5	3177	14	10	25	12	Yes	$1,344,354	$53,774	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	7	10	10	Yes	$1,713,062	$171,306	No
10	1625	20	5	4	6	Yes	$974,785	$243,696	No
11	-	-	5	0	4	No	-	-	-
12	1908	14	20	24	1	Yes	$801,168	$33,382	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
15	1,600	16	2	2	2	Yes	$768,000	$384,000	No
16	1,200	16	1	1	2	Yes	$576,000	$576,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
36	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
43	500	16	1	1	8	Yes	$240,000	$240,000	No
47	1,000	16	1	1	8	Yes	$480,000	$480,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
52	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-

Table 5.10-7: Alternative 5 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
61	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 5.10-8: Alternative 6 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4851	14	42	80	16	Yes	$2,010,557	$25,132	Yes
2	1923	20	13	25	16	Yes	$1,038,487	$41,540	No
3	1530	20	88	49	14	Yes	$917,996	$18,735	Yes
4	3722	16	226	358	13	Yes	$1,786,415	$4,990	Yes
5	3177	14	11	12	12	Yes	$1,334,354	$111,196	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	7	10	10	Yes	$1,713,062	$171,306	No
9	2557	14	1	9	8	Yes	$1,074,088	$119,343	No
10	1625	18	5	5	6	Yes	$877,306	$175,461	No
11	-	-	7	0	4	No	-	-	-
12	1908	14	7	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
20	1,400	16	3	3	3	Yes	$672,000	$224,000	No
21	1,400	16	3	3	3	Yes	$672,000	$224,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
28	1,800	16	4	4	4	Yes	$864,000	$216,000	No
29	600	16	1	1	5	Yes	$288,000	$288,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
33	800	16	1	1	6	Yes	$384,000	$384,000	No
34	600	16	1	1	7	Yes	$288,000	$288,000	No
35	-	-	1	0	7	No	-	-	-
37	1,000	16	2	2	7	Yes	$480,000	$240,000	No
38	1,100	16	3	3	7	Yes	$528,000	$176,000	No
42	500	16	1	1	7	Yes	$240,000	$240,000	No
48	800	16	1	2	8	Yes	$384,000	$192,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No
51	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
54	-	-	2	0	9	No	-	-	-

Table 5.10-8: Alternative 6 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
55	-	-	1	0	10	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	16	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 5.10-9: Alternative 7 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4606	14	40	73	16	Yes	$1,934,492	$26,500	Yes
2	2043	18	15	18	16	Yes	$980,446	$54,469	No
3	1492	20	46	43	14	Yes	$894,950	$20,813	Yes
4	3562	16	226	319	13	Yes	$1,709,585	$5,359	Yes
5	3177	14	12	18	12	Yes	$1,344,354	$74,686	No
6	-	-	2	1	11	No	-	-	-
7	3172	18	8	10	10	Yes	$1,713,062	$171,306	No
8	2279	14	3	6	8	Yes	$957,293	$159,548	No
9	2557	14	2	8	8	Yes	$1,074,088	$134,261	No
10	1625	20	5	4	6	Yes	$974,785	$243,696	No
11	-	-	6	0	4	No	-	-	-
12	1908	14	9	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
21	1,400	16	3	3	3	Yes	$672,000	$224,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
28	1,800	16	4	4	4	Yes	$864,000	$216,000	No
29	600	16	1	1	5	Yes	$288,000	$288,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
31	-	-	2	0	6	No	-	-	-
32	800	16	1	1	6	Yes	$384,000	$384,000	No
33	800	16	1	1	6	Yes	$384,000	$384,000	No
35	-	-	1	0	7	No	-	-	-
37	1,000	16	2	2	7	Yes	$480,000	$240,000	No
39	1,000	16	1	1	7	Yes	$480,000	$480,000	No
40	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
44	500	16	1	1	7	Yes	$240,000	$240,000	No
47	1,000	16	1	1	8	Yes	$480,000	$480,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No

Table 5.10-9: Alternative 7 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
50	600	16	1	1	8	Yes	$288,000	$288,000	No
51	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
54	-	-	2	0	9	No	-	-	-
55	-	-	1	0	10	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
63	1,000	16	3	3	15	Yes	$480,000	$160,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 5.10-10: Alternative 8 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4524	14	32	62	16	Yes	$1,841,718	$29,705	Yes
2	1745	17	14	15	16	Yes	$891,427	$59,428	No
3	1492	20	46	43	14	Yes	$894,950	$20,813	Yes
4	3562	16	226	328	13	Yes	$1,709,585	$5,212	Yes
5	3177	14	8	18	12	Yes	$1,344,354	$74,686	No
6	-	-	2	1	11	No	-	-	-
7	3172	16	8	10	10	Yes	$1,522,722	$152,272	No
9	2554	12	1	3	8	Yes	$919,564	$306,521	No
10	1625	20	5	3	6	Yes	$974,785	$324,928	No
11	-	-	7	0	4	No	-	-	-
12	1908	14	9	9	1	Yes	$801,168	$89,019	No
13	400	16	1	1	1	Yes	$192,000	$192,000	No
14	1,600	16	3	3	2	Yes	$768,000	$256,000	No
17	1,200	16	3	3	2	Yes	$576,000	$192,000	No
18	1,000	16	2	2	3	Yes	$480,000	$240,000	No
19	600	16	1	1	3	Yes	$288,000	$288,000	No
20	1,400	16	3	3	3	Yes	$672,000	$224,000	No
21	1,400	16	3	3	3	Yes	$672,000	$224,000	No
22	1,400	16	3	3	3	Yes	$672,000	$224,000	No
23	1,600	16	1	1	4	Yes	$768,000	$768,000	No
24	600	16	1	1	4	Yes	$288,000	$288,000	No
25	1,800	16	4	4	4	Yes	$864,000	$216,000	No
26	1,800	16	4	4	4	Yes	$864,000	$216,000	No
27	1,800	16	4	4	4	Yes	$864,000	$216,000	No
28	1,800	16	4	4	4	Yes	$864,000	$216,000	No
29	600	16	1	1	5	Yes	$288,000	$288,000	No
30	600	16	1	1	5	Yes	$288,000	$288,000	No
33	800	16	1	1	6	Yes	$384,000	$384,000	No
35	-	-	1	0	7	No	-	-	-
36	800	16	1	1	7	Yes	$384,000	$384,000	No
41	-	-	1	0	7	No	-	-	-
42	500	16	1	1	7	Yes	$240,000	$240,000	No
45	-	-	3	0	8	No	-	-	-
46	1,000	16	1	1	8	Yes	$480,000	$480,000	No
48	800	16	1	2	8	Yes	$384,000	$192,000	No
49	600	16	1	1	8	Yes	$288,000	$288,000	No

Table 5.10-10: Alternative 8 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
50	600	16	1	1	8	Yes	$288,000	$288,000	No
51	-	-	1	0	9	No	-	-	-
53	-	-	3	0	9	No	-	-	-
54	-	-	2	0	9	No	-	-	-
55	-	-	1	0	10	No	-	-	-
56	-	-	5	0	10	No	-	-	-
57	-	-	2	0	11	No	-	-	-
58	1,500	16	3	3	11	Yes	$720,000	$240,000	No
59	-	-	4	0	13	No	-	-	-
60	-	-	1	0	15	No	-	-	-
62	1,200	16	2	2	15	Yes	$576,000	$288,000	No
63	1,000	16	3	3	15	Yes	$480,000	$160,000	No
64	500	16	1	1	15	Yes	$240,000	$240,000	No
65	-	-	1	0	15	No	-	-	-

Table 5.10-11: Refined Preferred Alternative 8 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
1	4,818	12	32	65	16	Yes	$1,734,351	$26,682	Yes
2	2,016	14	7	19	16	Yes	$846,636	$44,560	No
3	1,449	18	26	50	14	Yes	$762,634	$15,253	Yes
4	4,235	14	225	414	13	Yes	$1,778,713	$4,296	Yes
5	2,031	14	9	19	12	Yes	$852,861	$44,887	No
7	3,915	14	6	6	10	Yes	$1,644,404	$274,067	No
9	1,964	20	4	3	8	Yes	$1,178,371	$392,790	No
10	3,748	20	3	7	6	Yes	$2,249,064	$321,295	No
12	2022	12	24	18	1	Yes	$727,946	$39,886	No
13	637	10	1	1	1	Yes	$190,987	$190,987	No
13A	358	10	1	1	1	Yes	$107,334	$107,334	No
14	2,262	18	4	4	2	Yes	$786,534	$196,633	No
17	1,203	18	4	4	2	Yes	$649,409	$162,352	No
18A	358	10	1	2	3	Yes	$107,334	$53,667	No
23	1,293	20	1	2	4	Yes	$387,862	$193,931	No
24A	-	-	8	0	4	No	-	-	-
24B	358	10	1	1	4	Yes	$107,334	$107,334	No
24C	2,852	16	4	4	4	Yes	$1,368,780	$456,260	No
29	400	10	1	1	5	Yes	$120,000	$120,000	No
30	400	10	1	1	5	Yes	$120,000	$120,000	No
33A	1,286	18	5	5	6	Yes	$684,713	$136,943	No
36	400	10	1	1	7	Yes	$120,000	$120,000	No
36A	7136	14	7	8	7	Yes	$2,997,182	$374,648	No
42	400	10	1	1	7	Yes	$120,000	$120,000	No
42A	2,354	18	1	4	7	Yes	$1,271,272	$317,818	No
45	-	-	2	0	8	No	-	-	-
45A	-	-	2	0	8	No	-	-	-
46	800	10	1	1	8	Yes	$240,000	$240,000	No
48	2,438	12	3	4	8	Yes	$877,775	$219,444	No
49	400	10	1	1	8	Yes	$120,000	$120,000	No
49A	400	10	1	1	8	Yes	$120,000	$120,000	No
50	1000	10	1	2	8	Yes	$300,000	$150,000	No
50A	400	10	1	1	8	Yes	$120,000	$120,000	No
51A	400	10	1	1	9	Yes	$120,000	$120,000	No
54	-	-	2	0	9	No	-	-	-
55B	-	-	4	0	10	No	-	-	-

Table 5.10-11: Refined Preferred Alternative 8 Noise Barrier Abatement Analysis

Proposed Barrier Location	Total Barrier Length (feet)	Average Height (feet)	No. of Impacted Receptors	Number of Benefited Receptors	NSA Area	Feasibility Criteria Met?	Cost of Barrier ($30/sq ft)	Cost per Benefited Receptor	Cost Reasonableness Criteria Met?
57A	2,031	20	2	3	11	Yes	$1,218,837	$406,279	No
57B	400	10	1	1	11	Yes	$120,000	$120,000	No
58	-	-	5	0	10	No	-	-	-
60	-	-	1	0	15	No	-	-	-
64	400	10	1	1	15	Yes	$120,000	$120,000	No
65	-	-	1	0	15	No	-	-	-

Table 5.10-12 Benefited Residents Survey Summary for Refined Preferred Alternative

Barrier Area	Number of Benefited Receptors	Number of Surveys Sent	Number of Surveys Received	Total Percent of Surveys Returned	Percent Favorable of those returned	Percent Not Favorable of those returned
Barrier Area 1	65	70	31	44	96%	0%
Barrier Area 3	50	63	8	13	100%	0%
Barrier Area 4	414	384	28	7	82%	18%

5.10.5.3 Construction Noise Impacts

In addition to permanent impacts, there will be temporary impacts during highway construction. Project construction would result in short term noise impacts from construction vehicles, driving of piles and/or blasting (if necessary), etc. Refer to Section 5.12, *Construction Impacts*, for more information relative to probable impacts and suggested abatement measures.

5.10.6 Summary

A Noise Analysis was performed for Section 5 Alternatives 4, 5, 6, 7, 8 and Refined Preferred Alternative 8 to determine the predicted traffic noise impacts.

Thirty-one existing ambient measurements were recorded. Seven of the ambient levels approached or exceeded the NAC criteria. A total of 1,034 location sites representing 2,327 receptors were modeled for the existing, design year build and no-build alternatives. Existing modeled L_{eq} noise levels ranged from 33 dBA to 70 dBA. There were 72 receptors that approached or exceeded the NAC criteria in the existing condition. An evaluation of the design year no-build scenario resulted in the identification of 252 receptors that approached or exceeded the NAC criteria. The following is a summary of the predicted impacts for each build alternative.

<u>Alternative 4</u>

This alternative will result in 293 NAC impacts and three substantial increase impacts for a total of 296 impacts.

There were 9 barriers out of the 35 analyzed for Alternative 4 that did not meet INDOT's criteria for "feasibility".

There were 23 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 5

This alternative will result in 300 NAC impacts three substantial increase impacts for a total of 303 impacts.

There were 11 barriers out of the 40 analyzed for Alternative 5 that did not meet INDOT's criteria for "feasibility".

There were 26 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 6

This alternative will result in 475 NAC impacts and one substantial increase impact for a total of 476 impacts.

There were 12 barriers out of the 46 analyzed for Alternative 6 that did not meet INDOT's criteria for "feasibility".

There were 31 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 7

This alternative will result in 451 NAC impacts and one substantial increase impact for a total of 452 impacts.

There were 13 barriers out of the 50 analyzed for Alternative 7 that did not meet INDOT's criteria for "feasibility".

There were 34 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3, and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Alternative 8

This alternative will result in 426 NAC impacts and three substantial increase impacts for a total of 430 impacts.

There were 14 barriers out of the 50 analyzed for Alternative 8 that did not meet INDOT's criteria for "feasibility".

There were 33 barriers that met the feasibility criteria and INDOT's design goal criteria, but did not meet the cost effectiveness criteria of $30,000 per benefited receptor.

Barriers 1, 3 and 4 met INDOT's feasible criteria, as well as the design goal and cost effectiveness reasonableness criteria.

Refined Preferred Alternative 8

This alternative will result in 408 NAC impacts, ten substantial increase impacts, and one impact that meets both the NAC impact and substantial increase impact criteria, for a total of 419 impacts.

There were 8 barriers out of the 42 analyzed for Refined Preferred Alternative 8 that did not meet INDOT's criteria for "feasibility" since it was not structurally and acoustically capable of providing a 5 dBA reduction in noise levels at the majority of the first row receptors.

There were 31 barriers that met the feasibility criteria and met the design goal of 7 dBA noise reduction at the majority of the first row receptors, but did not meet INDOT's cost-effectiveness criteria for of $30,000 per benefited receptor and are therefore not considered "reasonable".

Barriers 1, 3 and 4 meet INDOT's feasibility criteria as well as the design goal and cost effectiveness reasonableness criteria.

Noise Survey Results

As a result of the responses that were collected, the majority of the responding residents voted in favor of noise barrier construction.

A final determination on noise abatement for the Preferred Alternative will be made during the final design phase of the project. At such time, additional noise analysis will be performed to more accurately determine barrier performance, barrier characteristics (length and height), and the optimal barrier location for any potential noise barriers that may be recommended for noise abatement.

Section 5.10 Figure Index

(Figures follow this index, except as otherwise noted.)

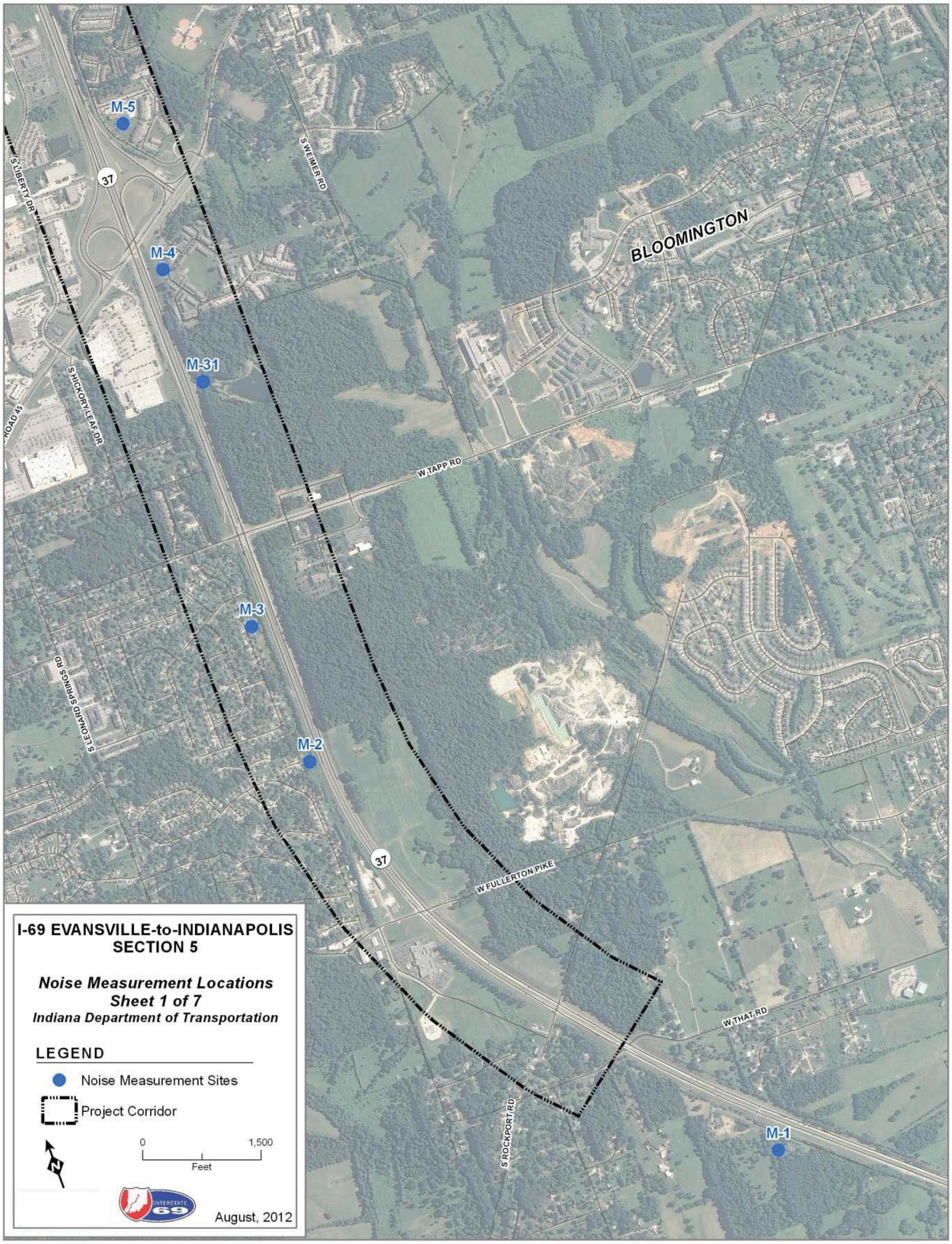

Figure 5.10-1: Noise Measurement Locations (Sheet 1 of 7)

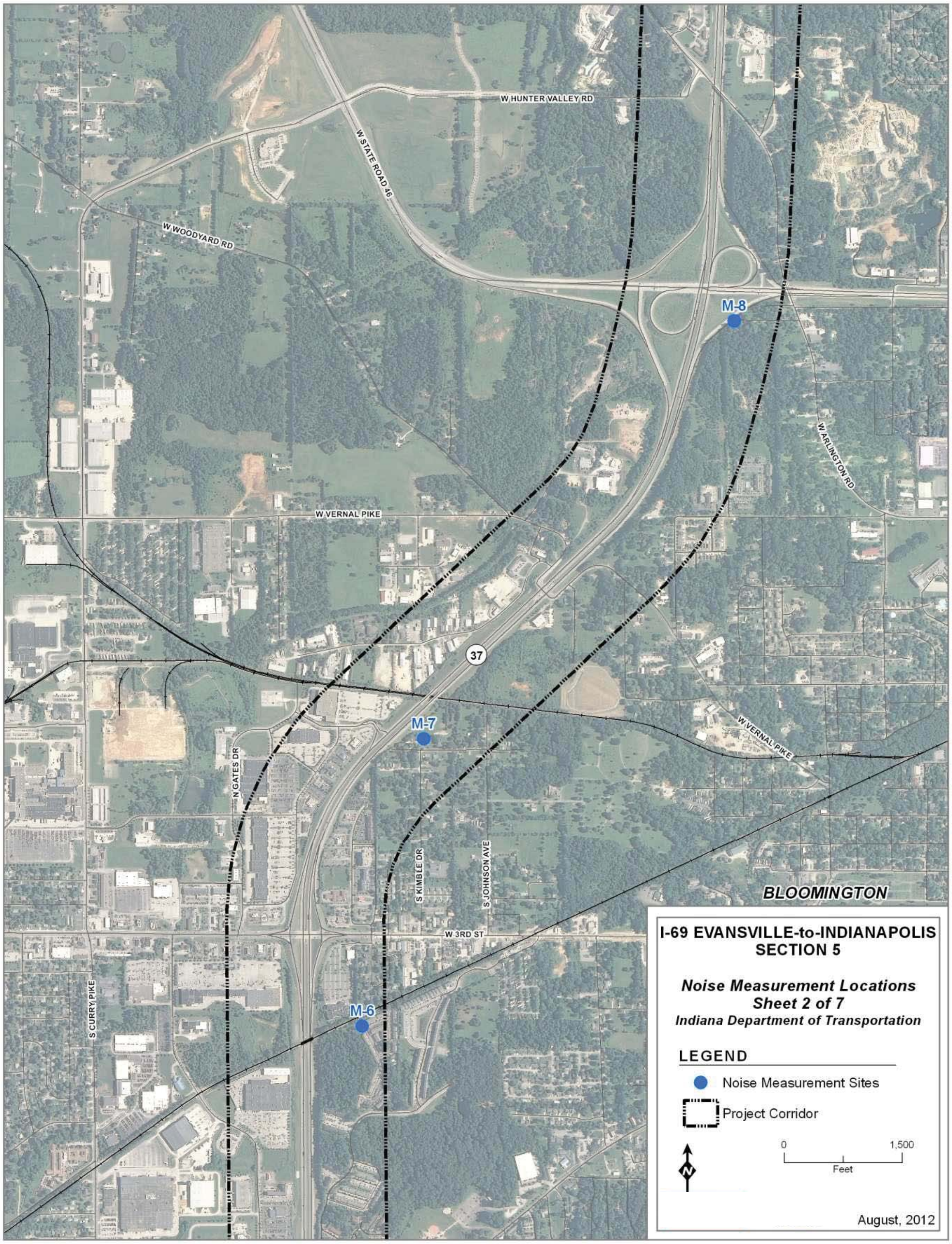

Figure 5.10-1: Noise Measurement Locations (Sheet 2 of 7)

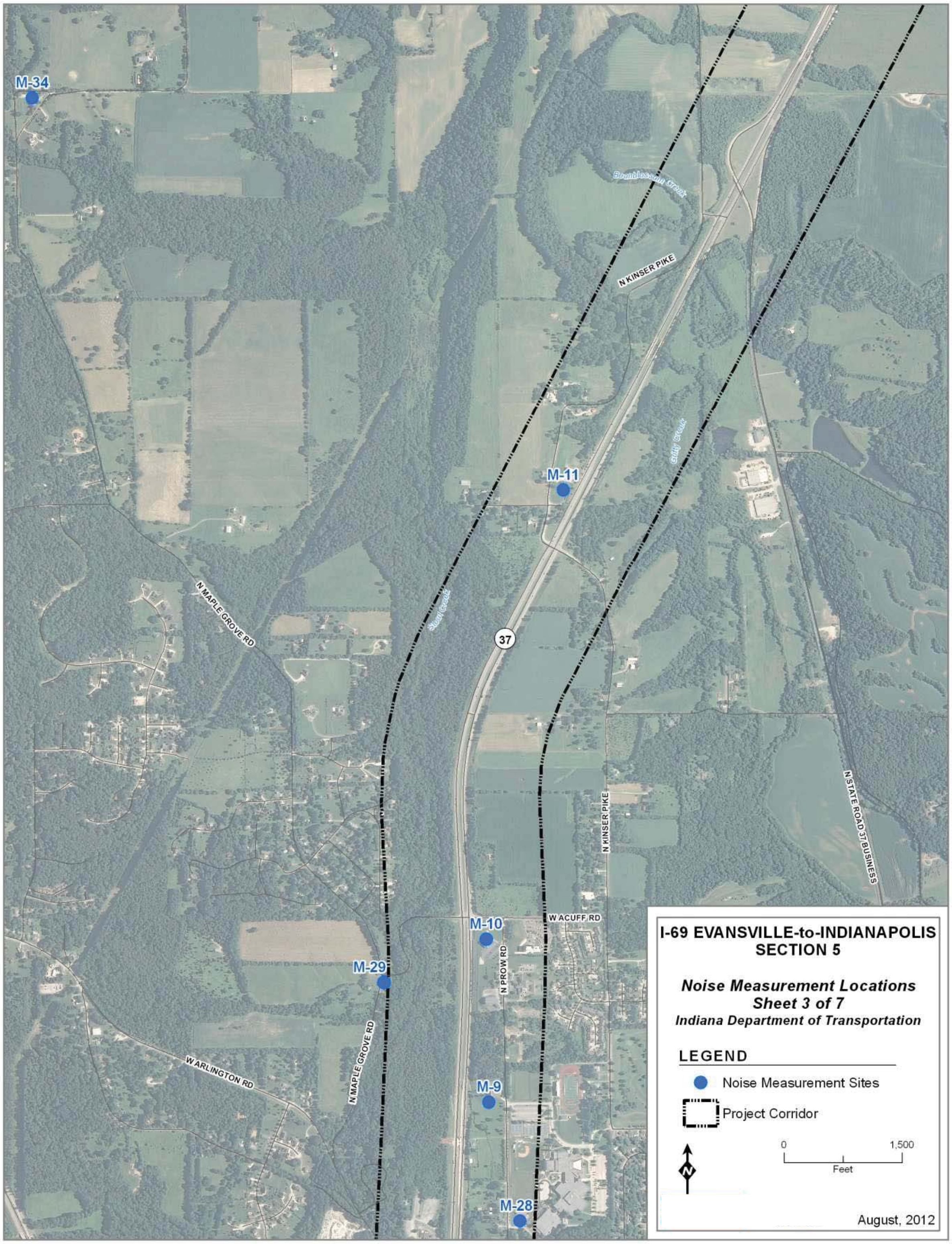

Figure 5.10-1: Noise Measurement Locations (Sheet 3 of 7)

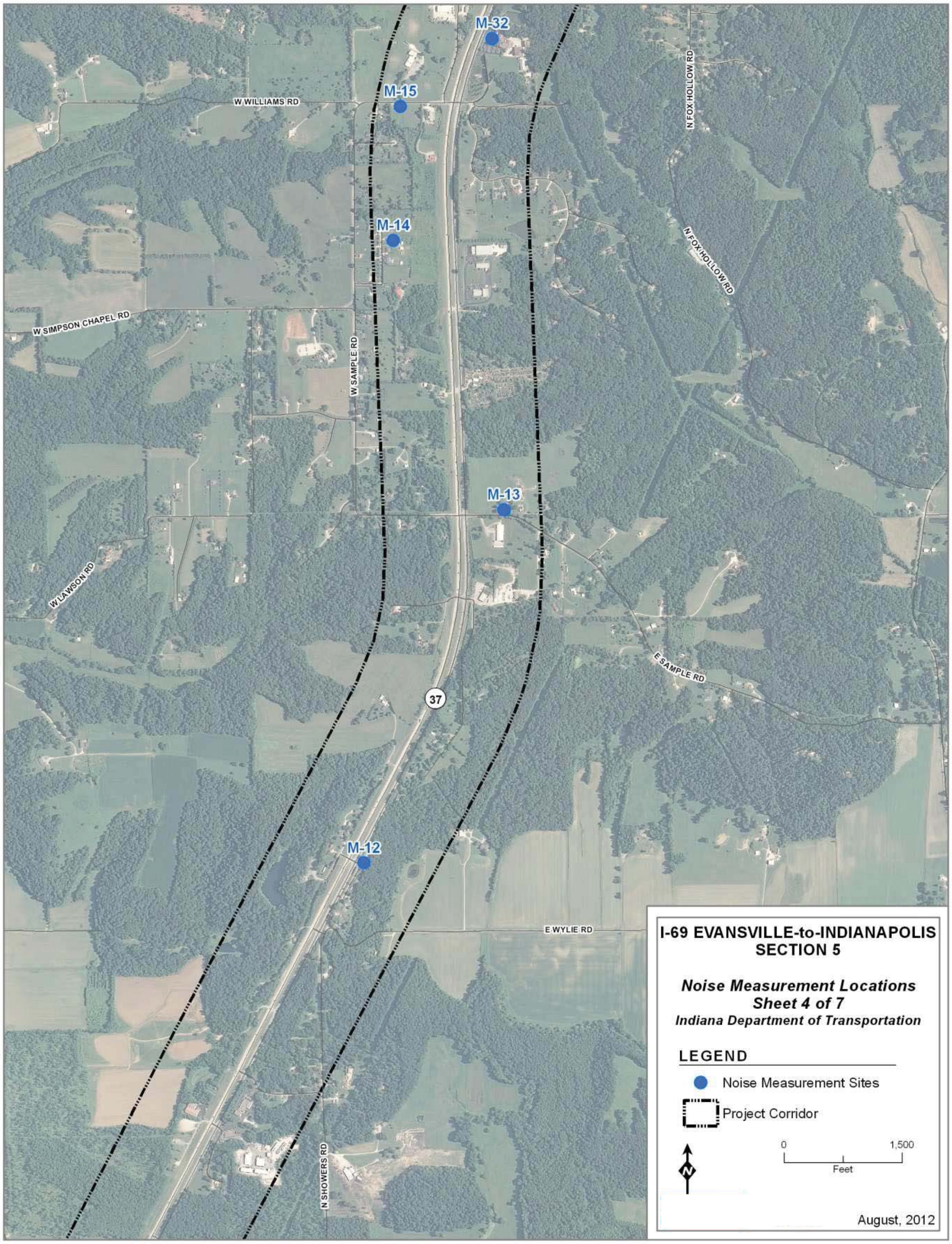

Figure 5.10-1: Noise Measurement Locations (Sheet 4 of 7)

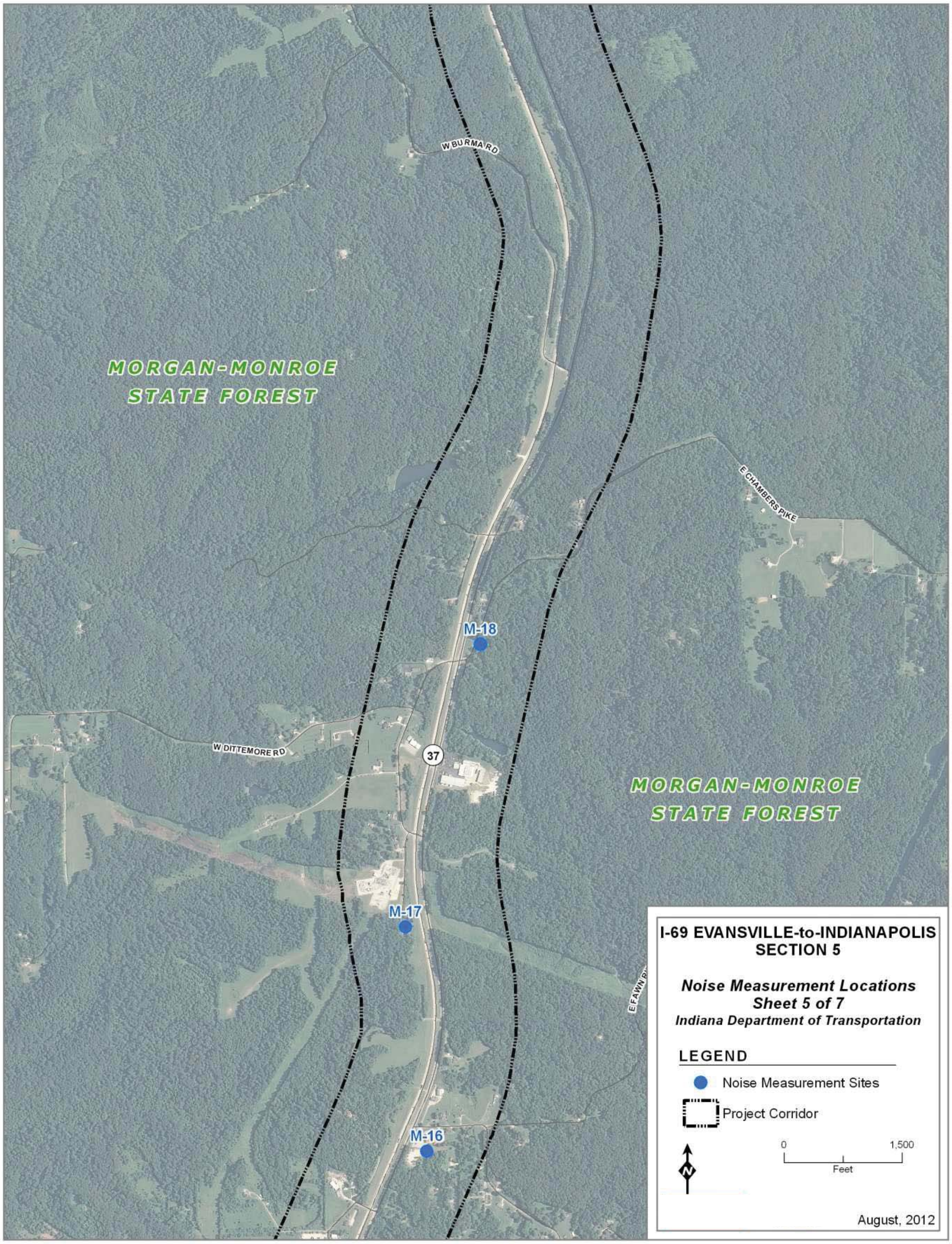

Figure 5.10-1: Noise Measurement Locations (Sheet 5 of 7)

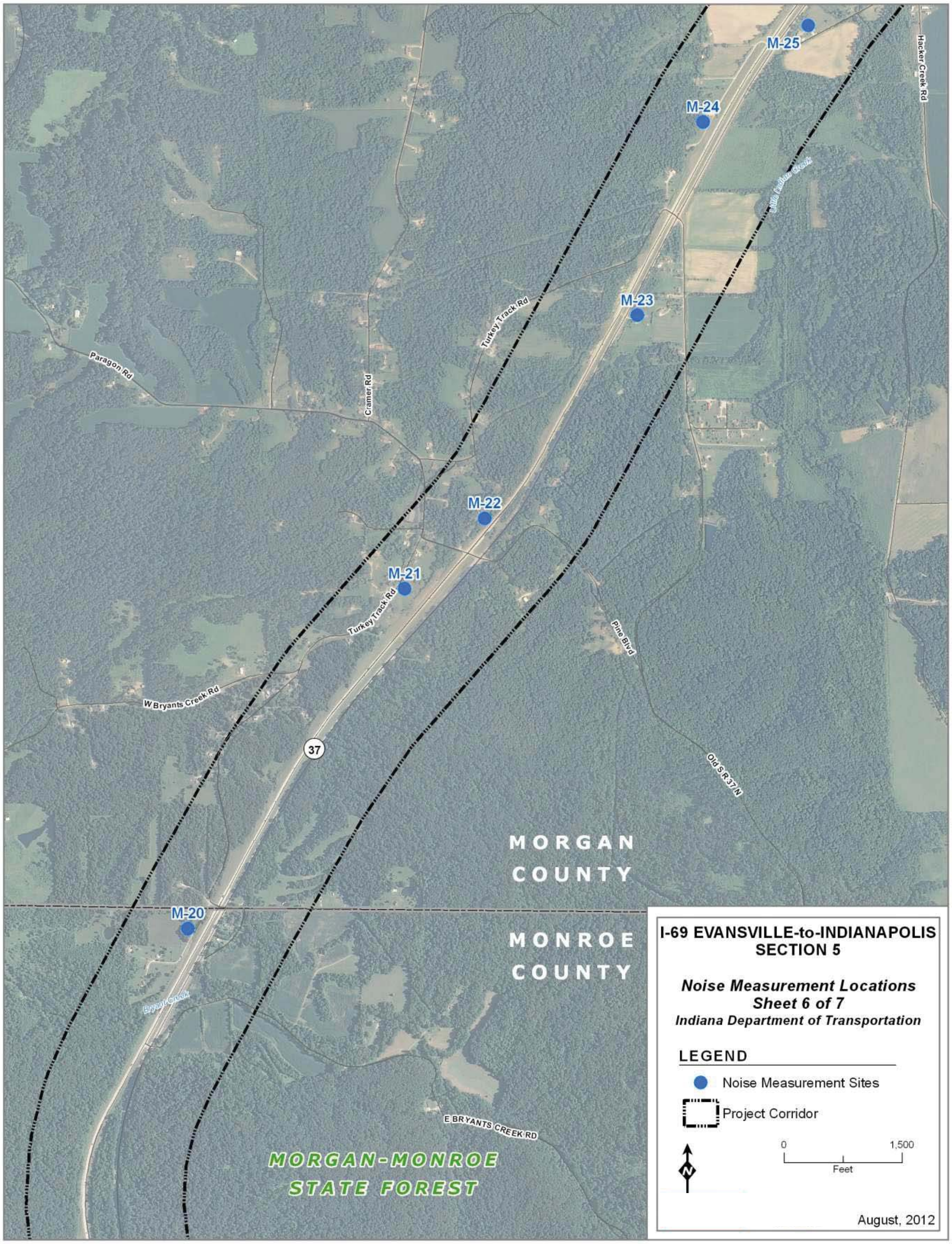

Figure 5.10-1: Noise Measurement Locations (Sheet 6 of 7)

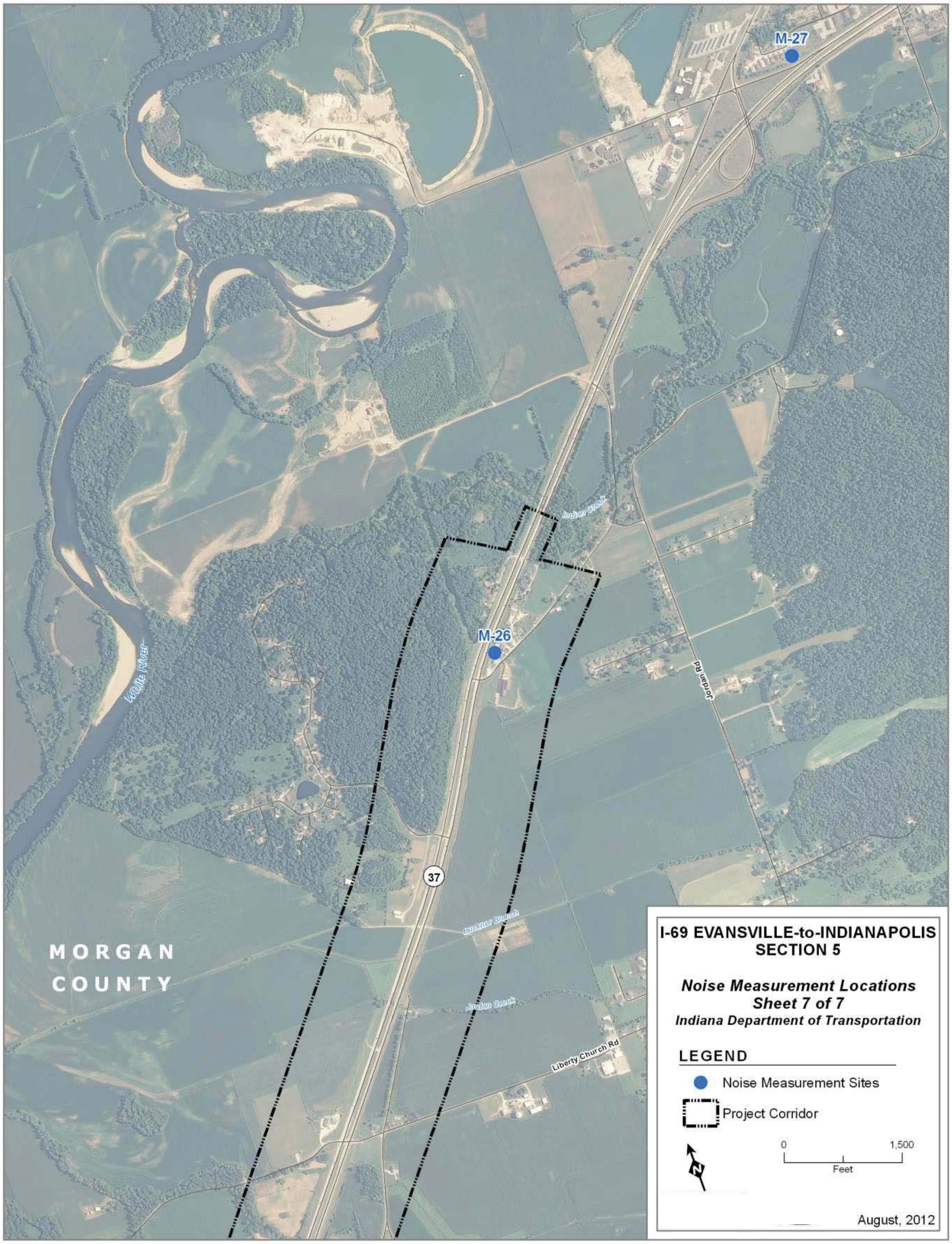

Figure 5.10-1: Noise Measurement Locations (Sheet 7 of 7)

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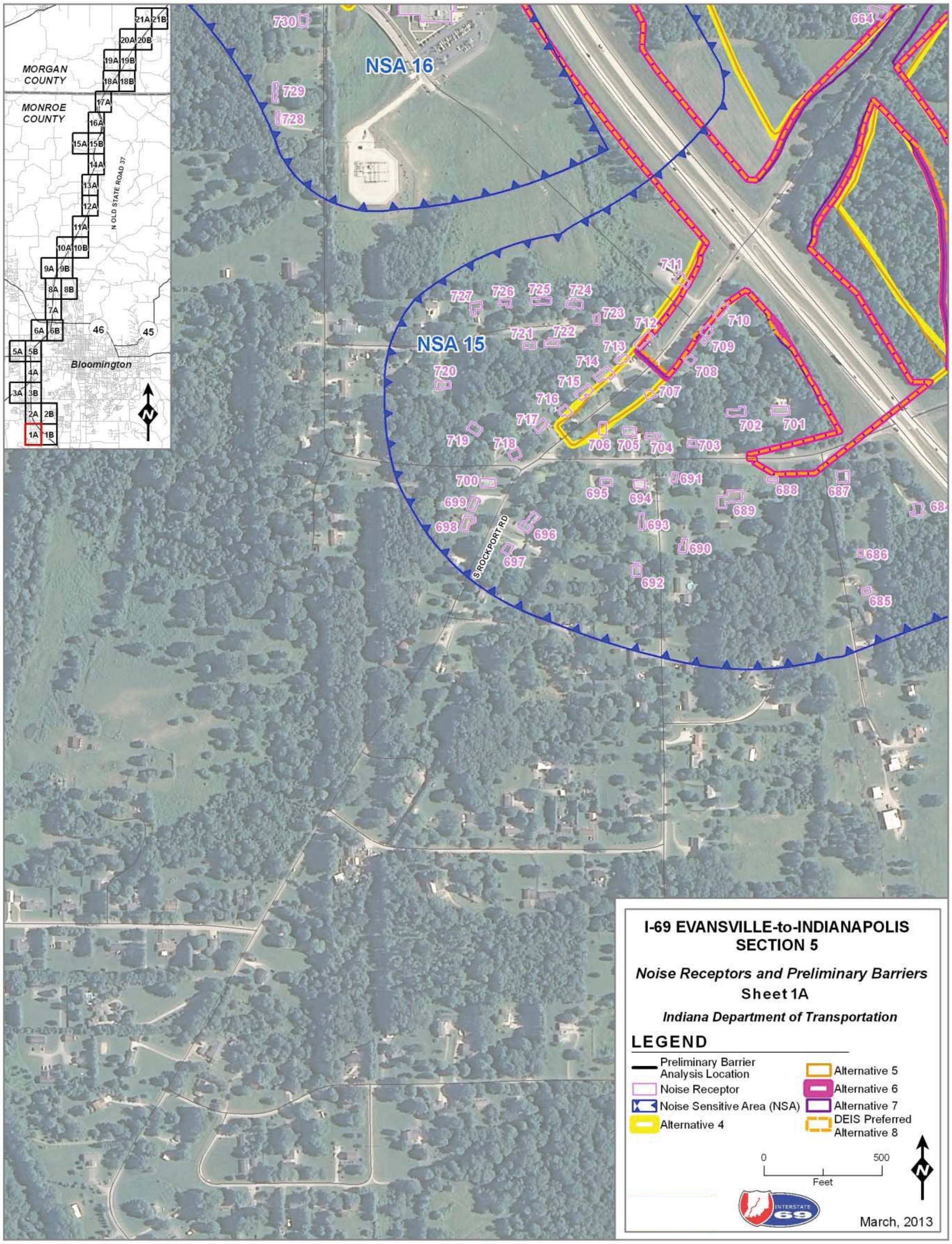


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 1A)

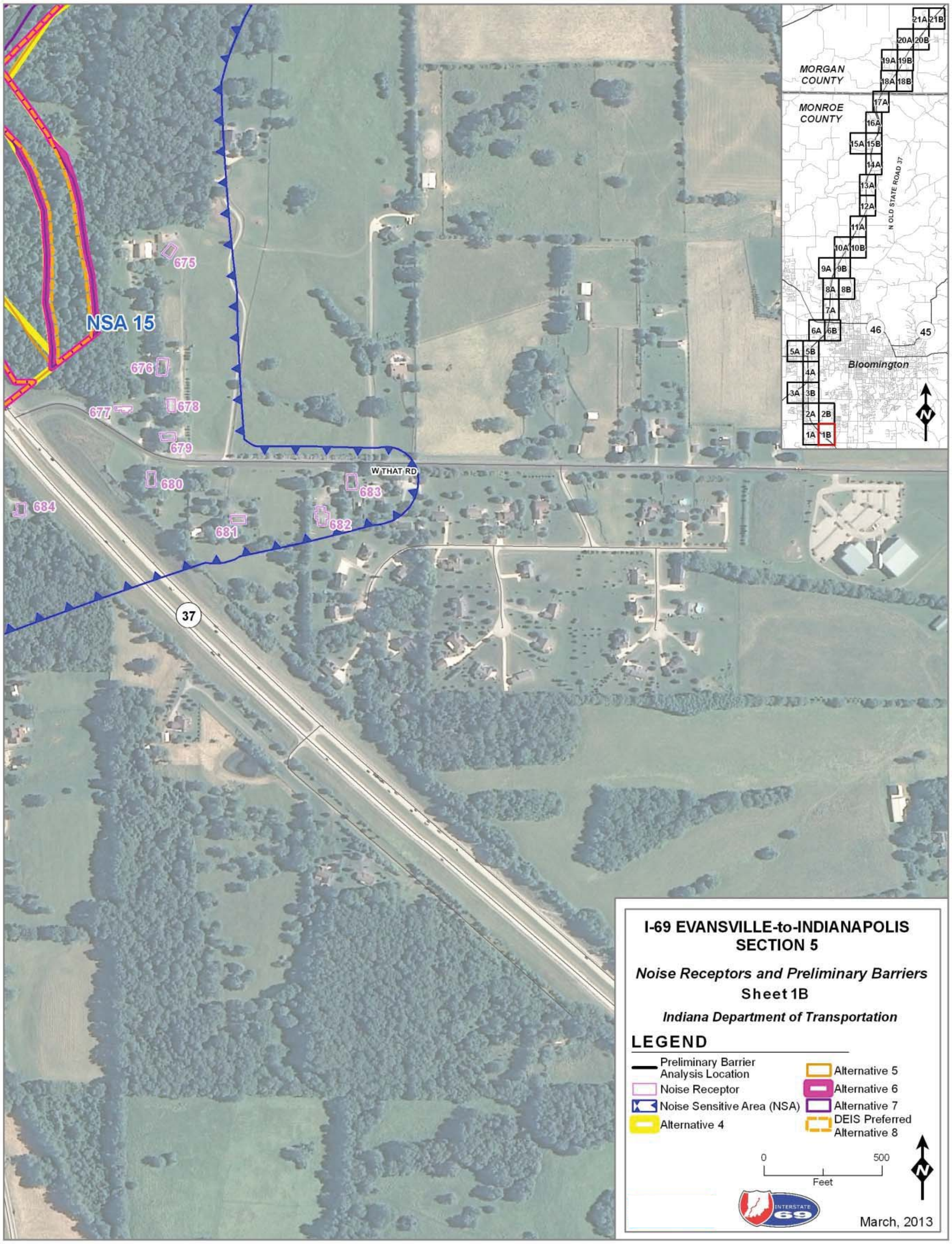


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 1B)

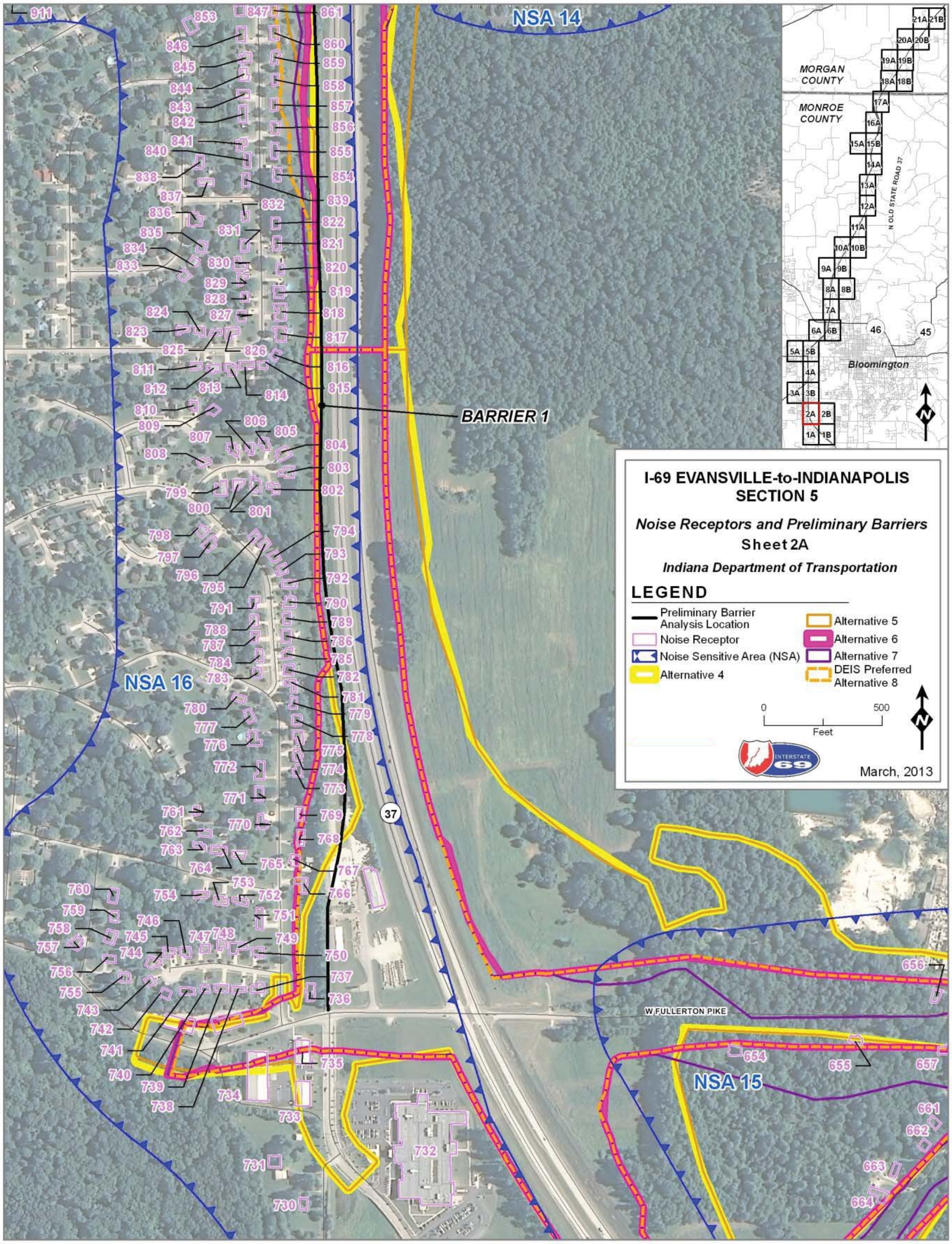


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 2A)

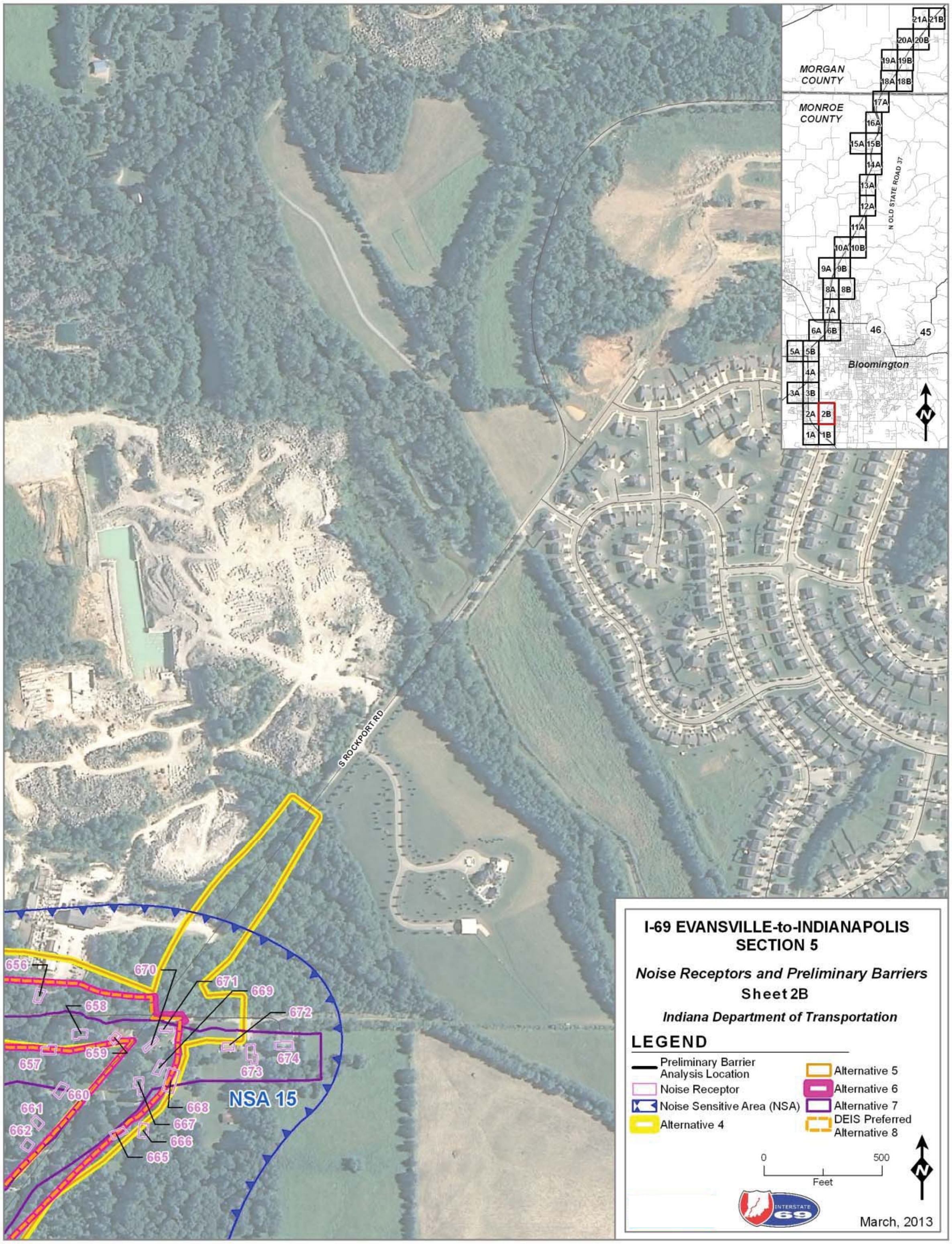


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 2B)

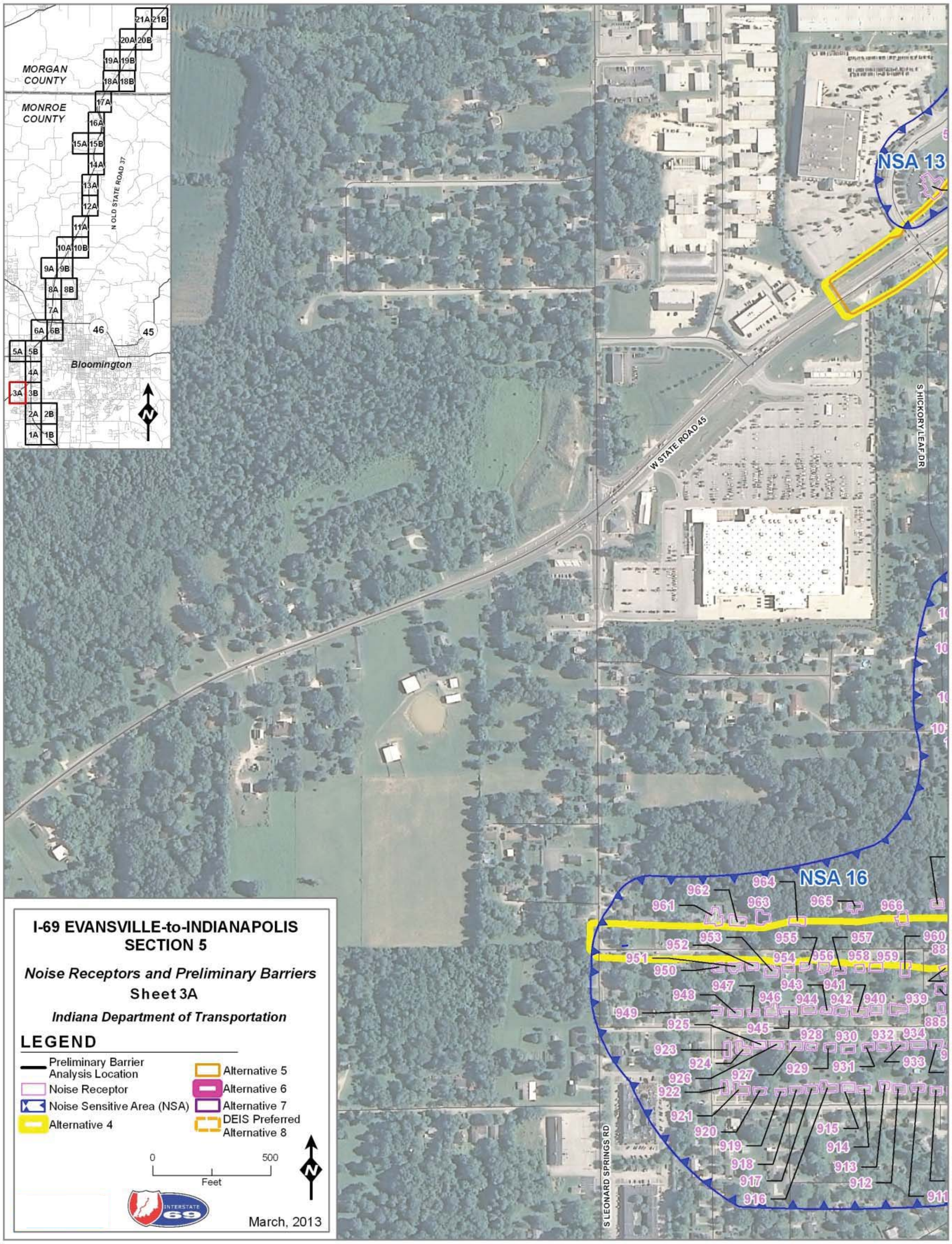


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 3A)

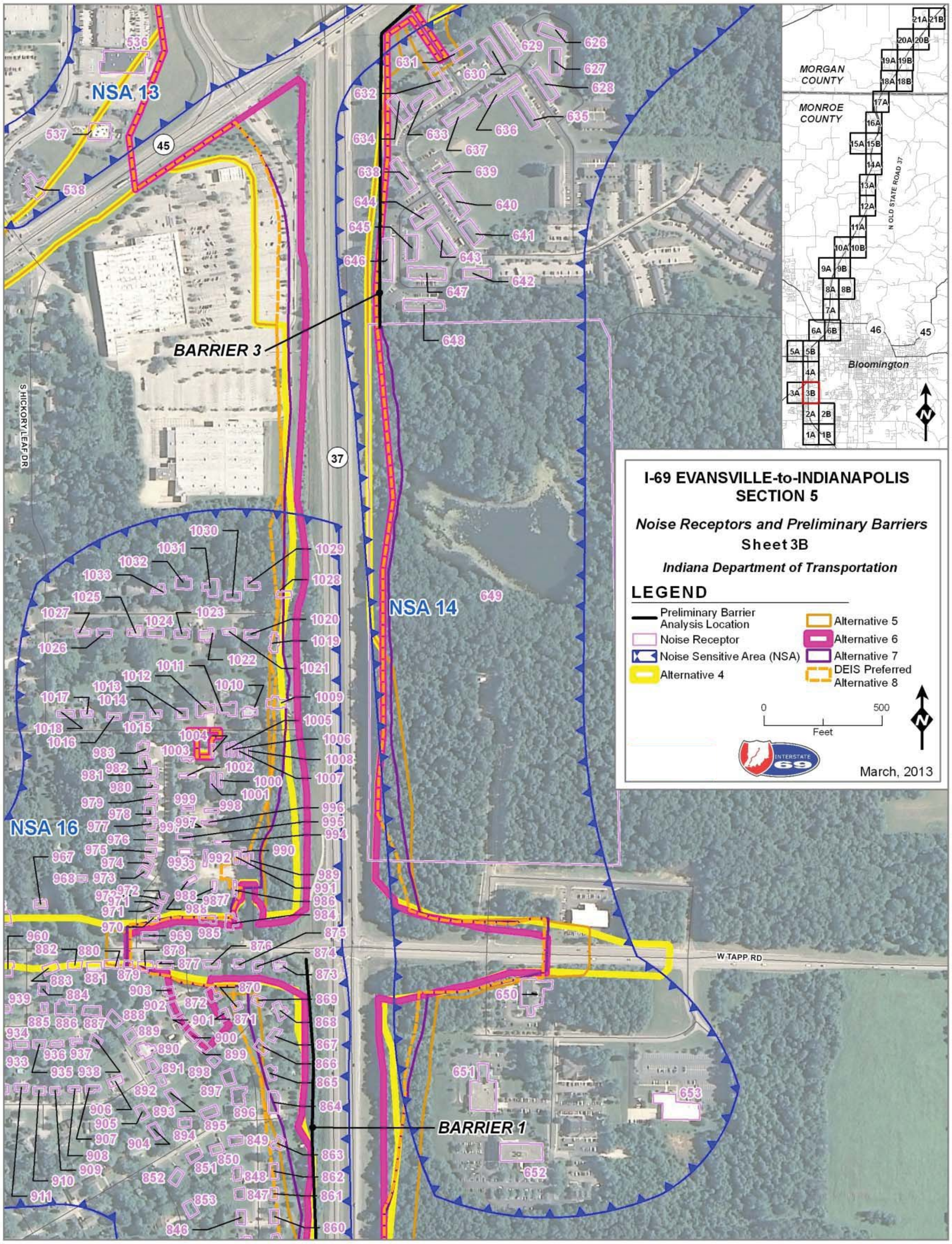


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 3B)

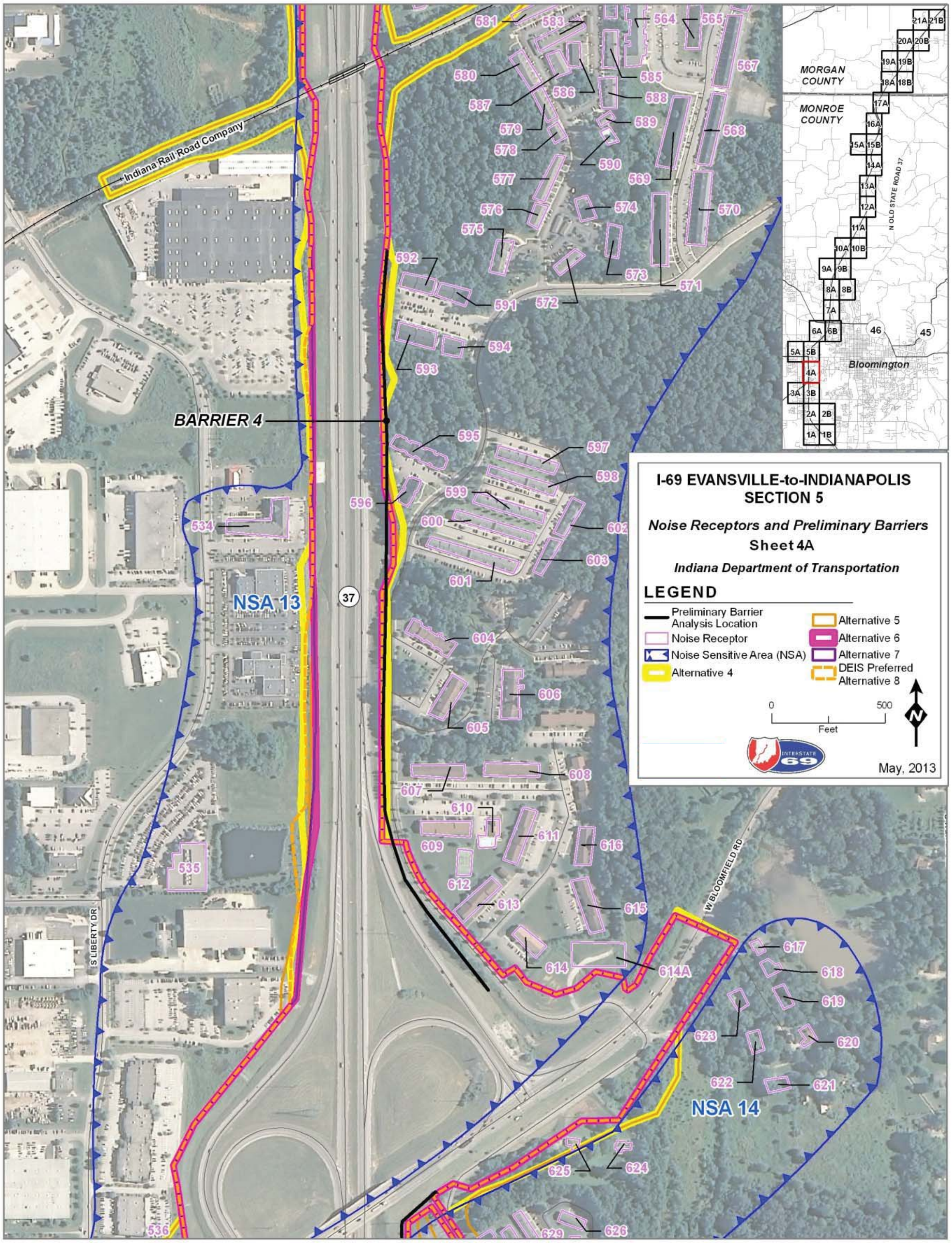


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 4A)

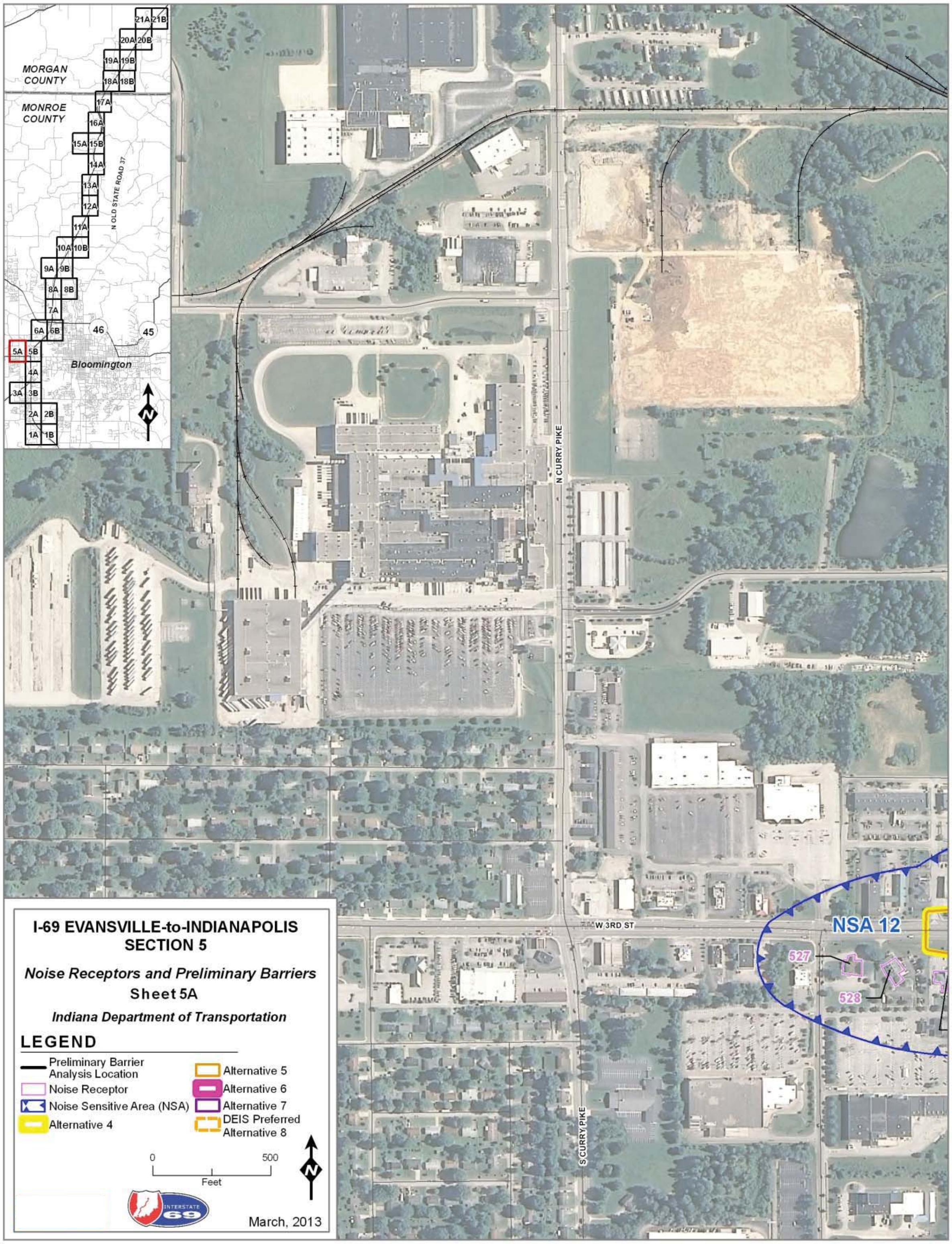


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 5A)

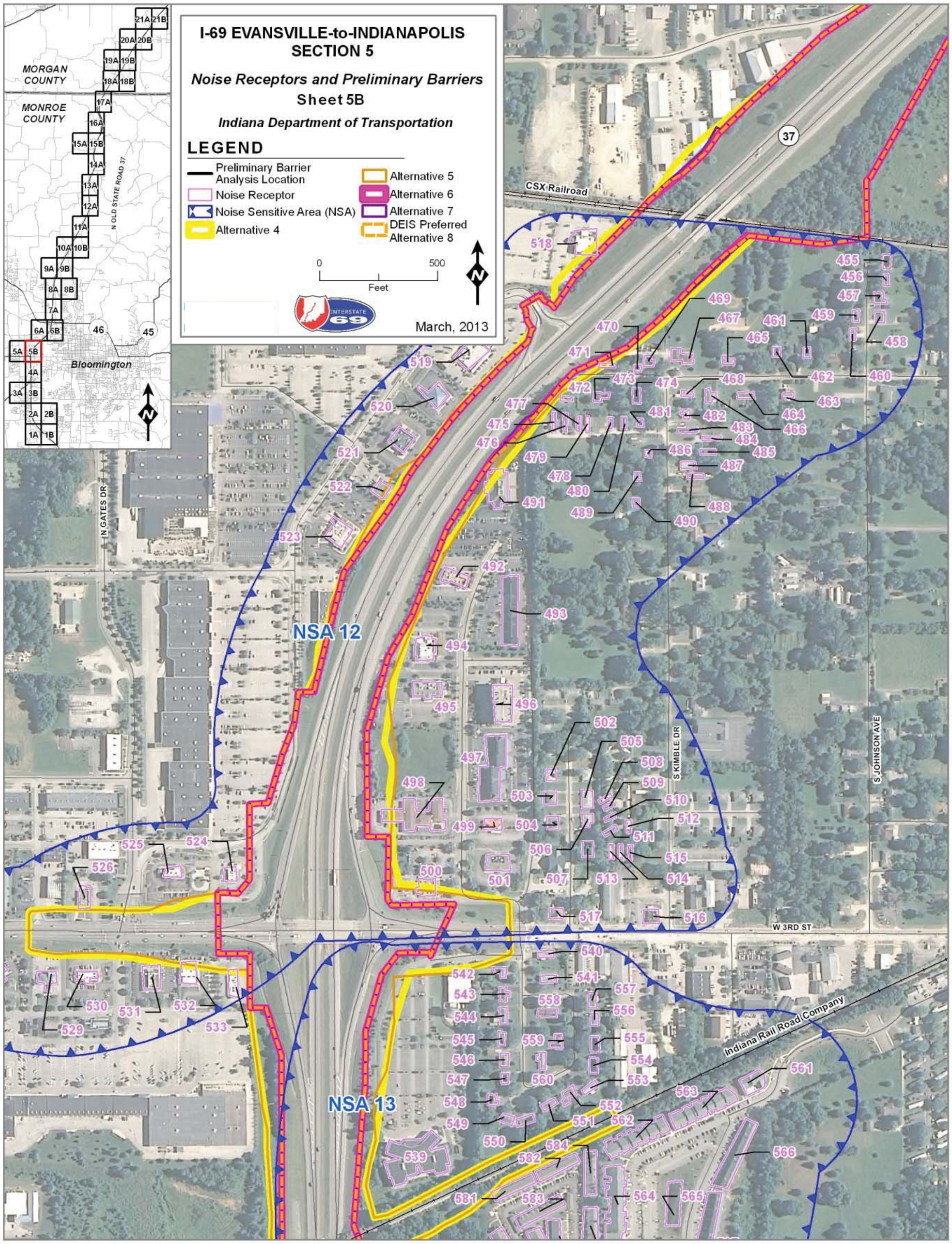


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 5B)

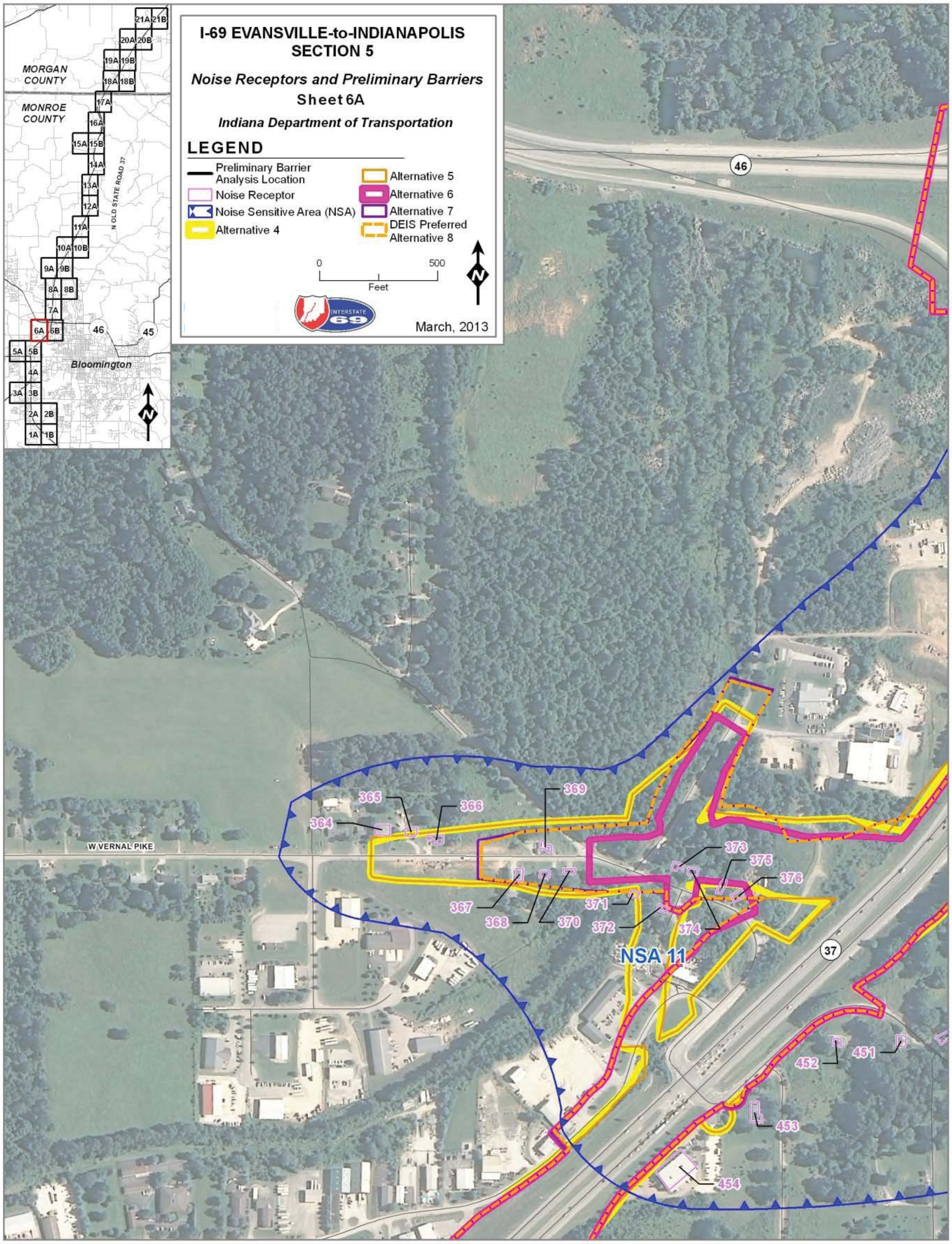


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 6A)

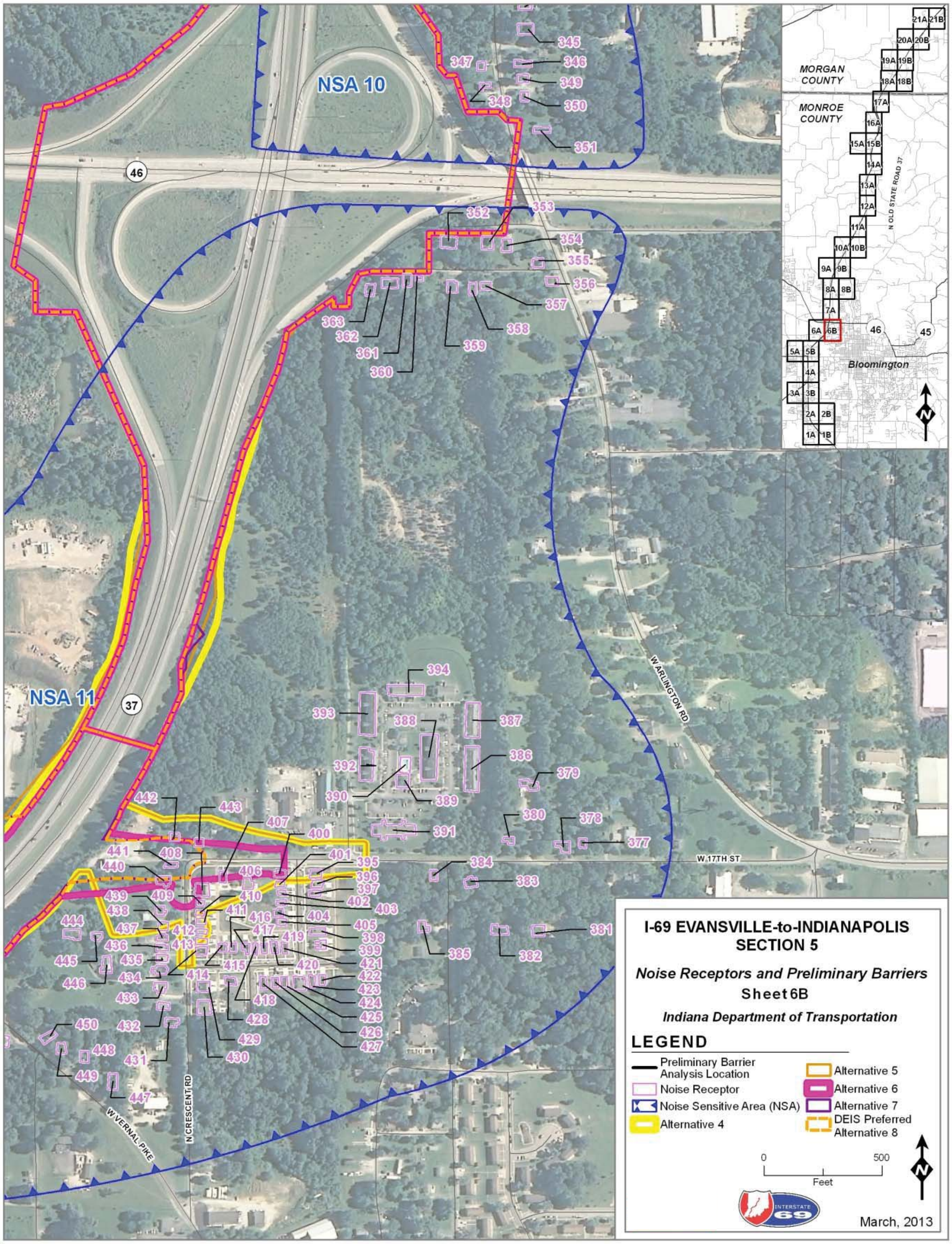


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 6B)

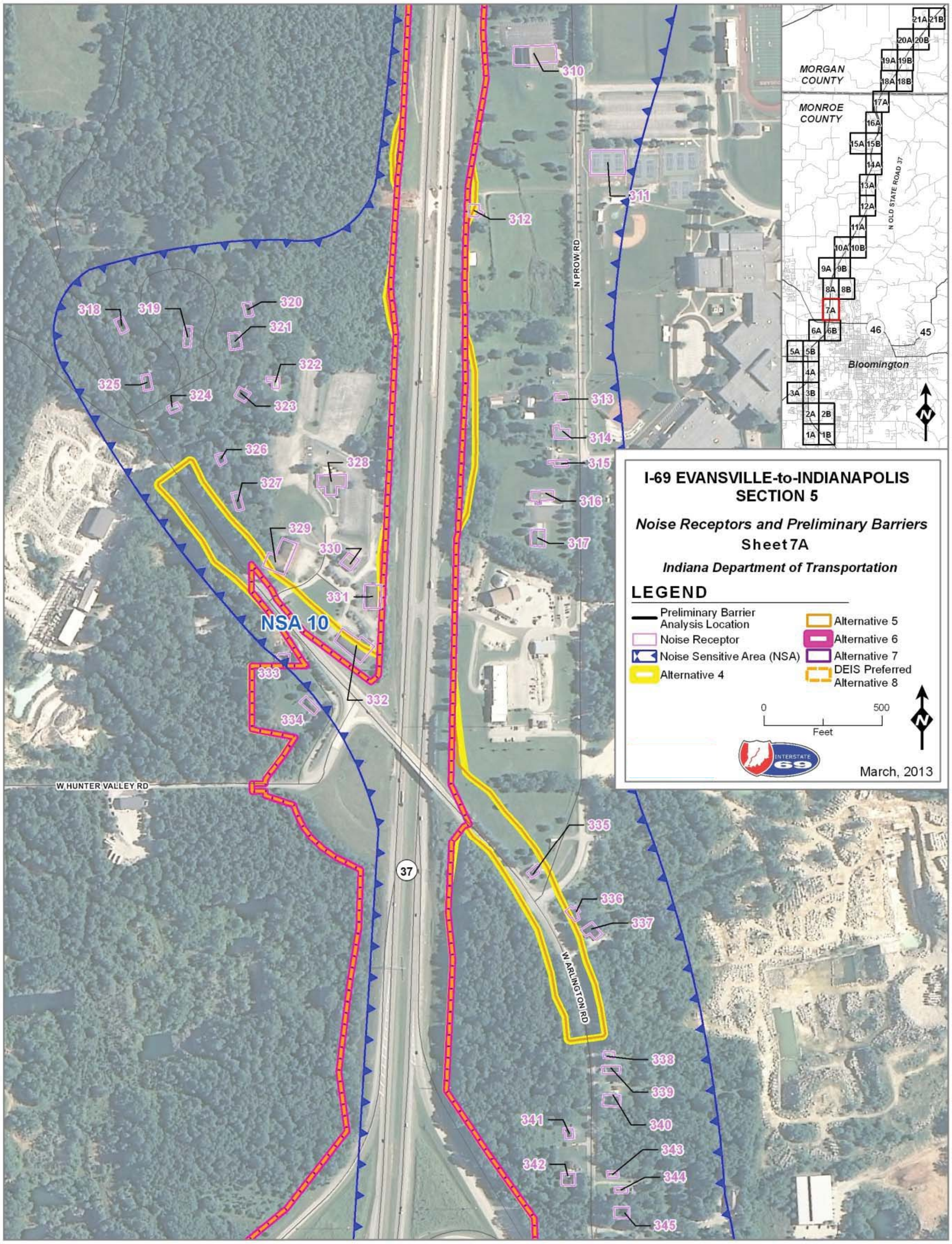


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 7A)

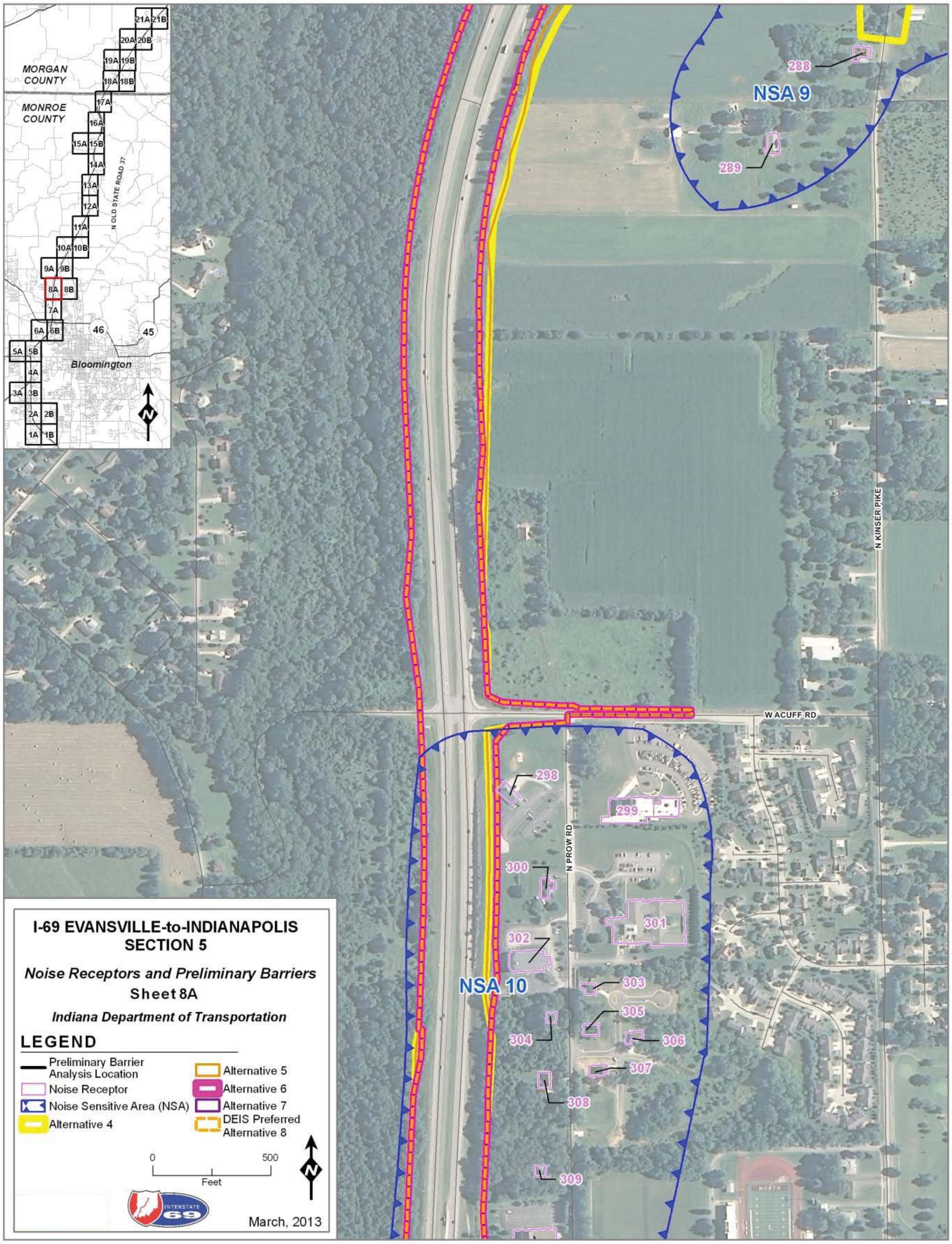


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 8A)

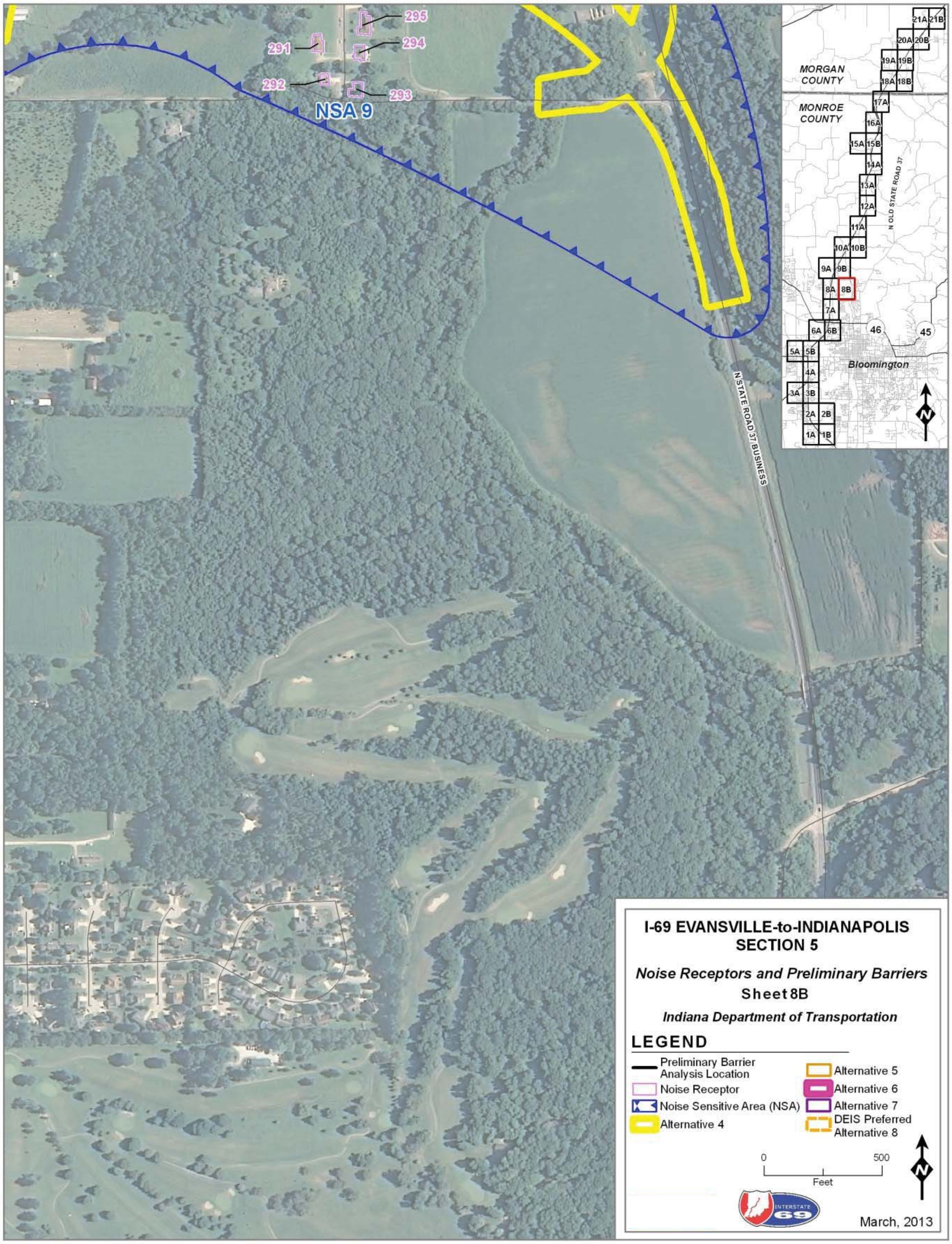


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 8B)

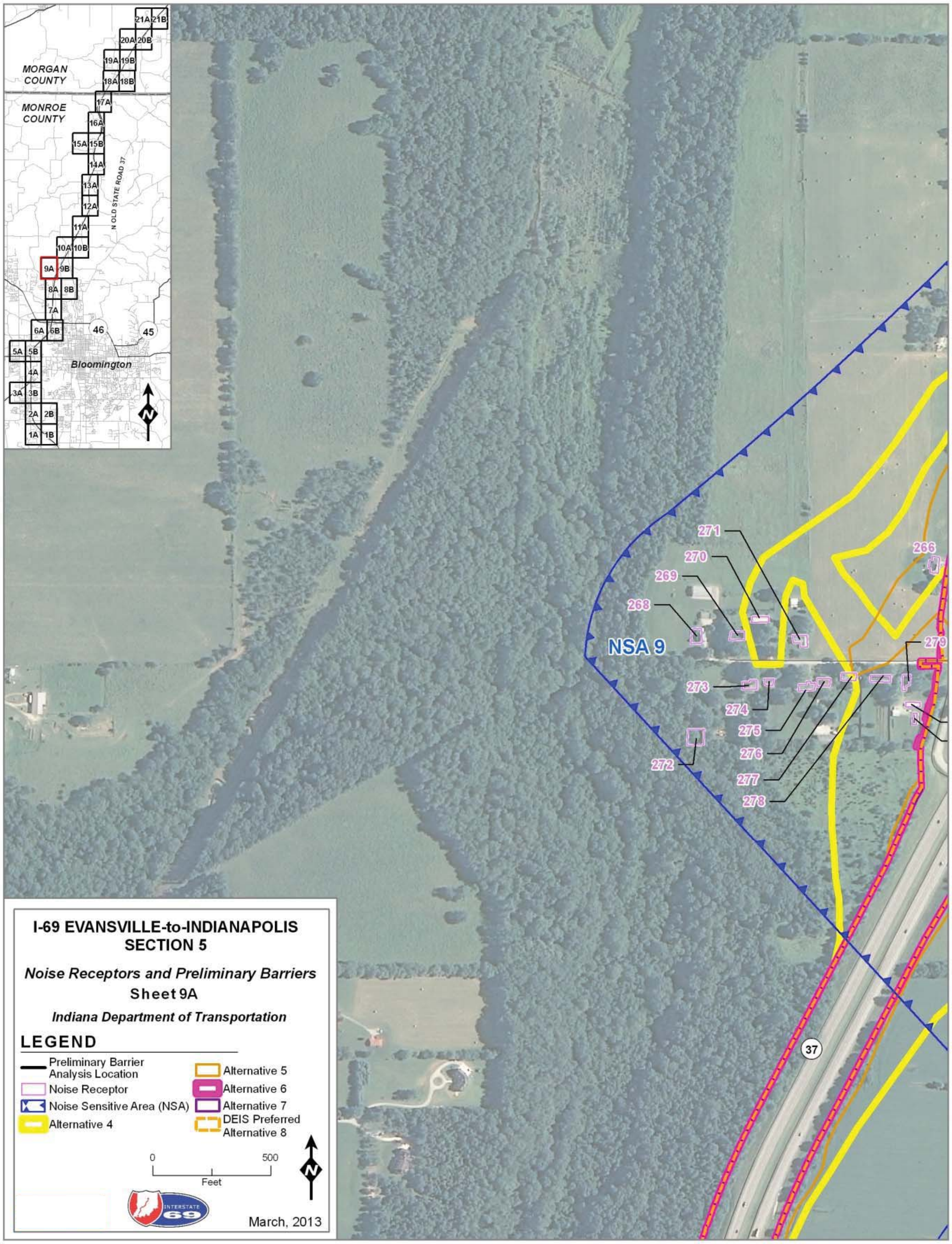


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 9A)

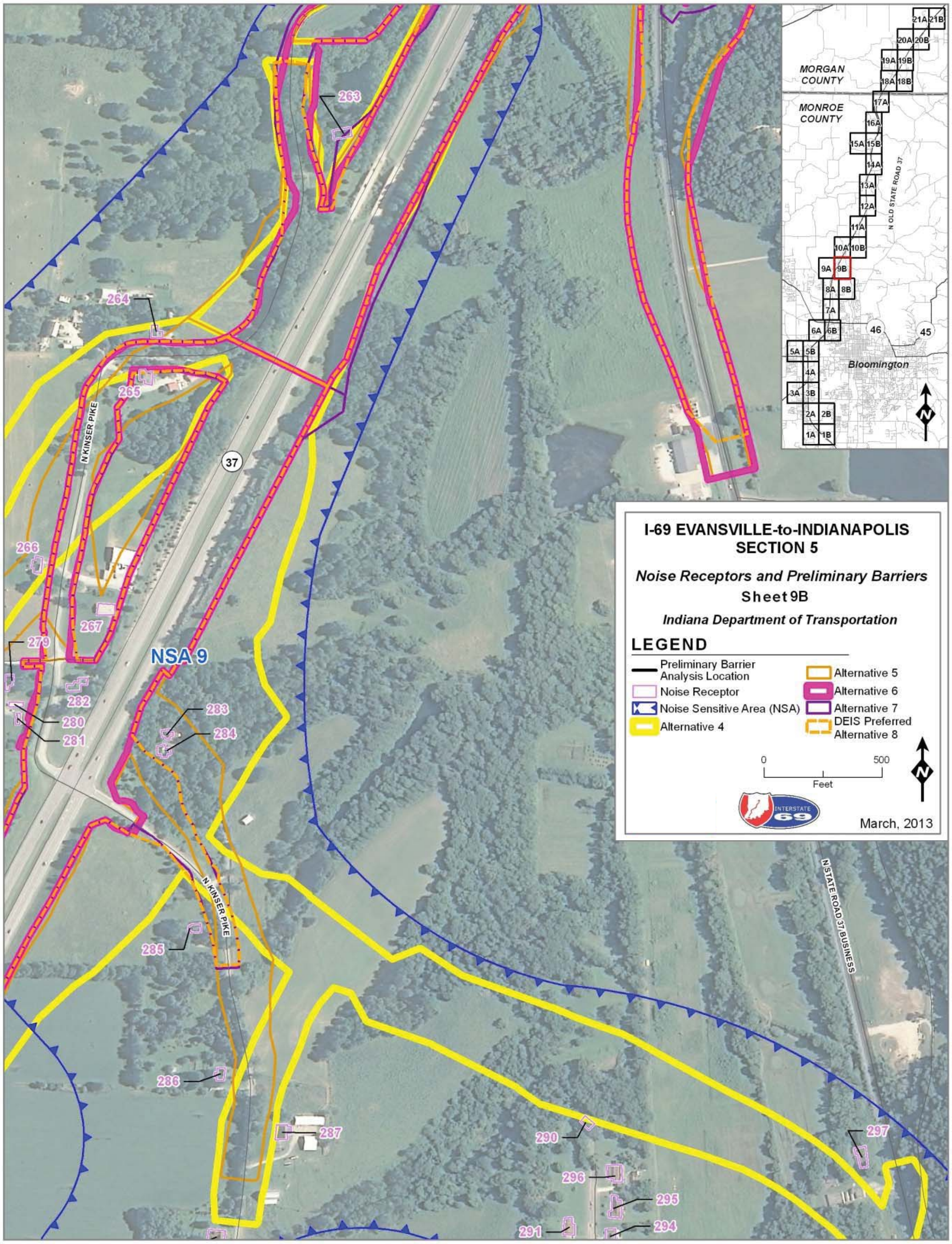


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 9B)

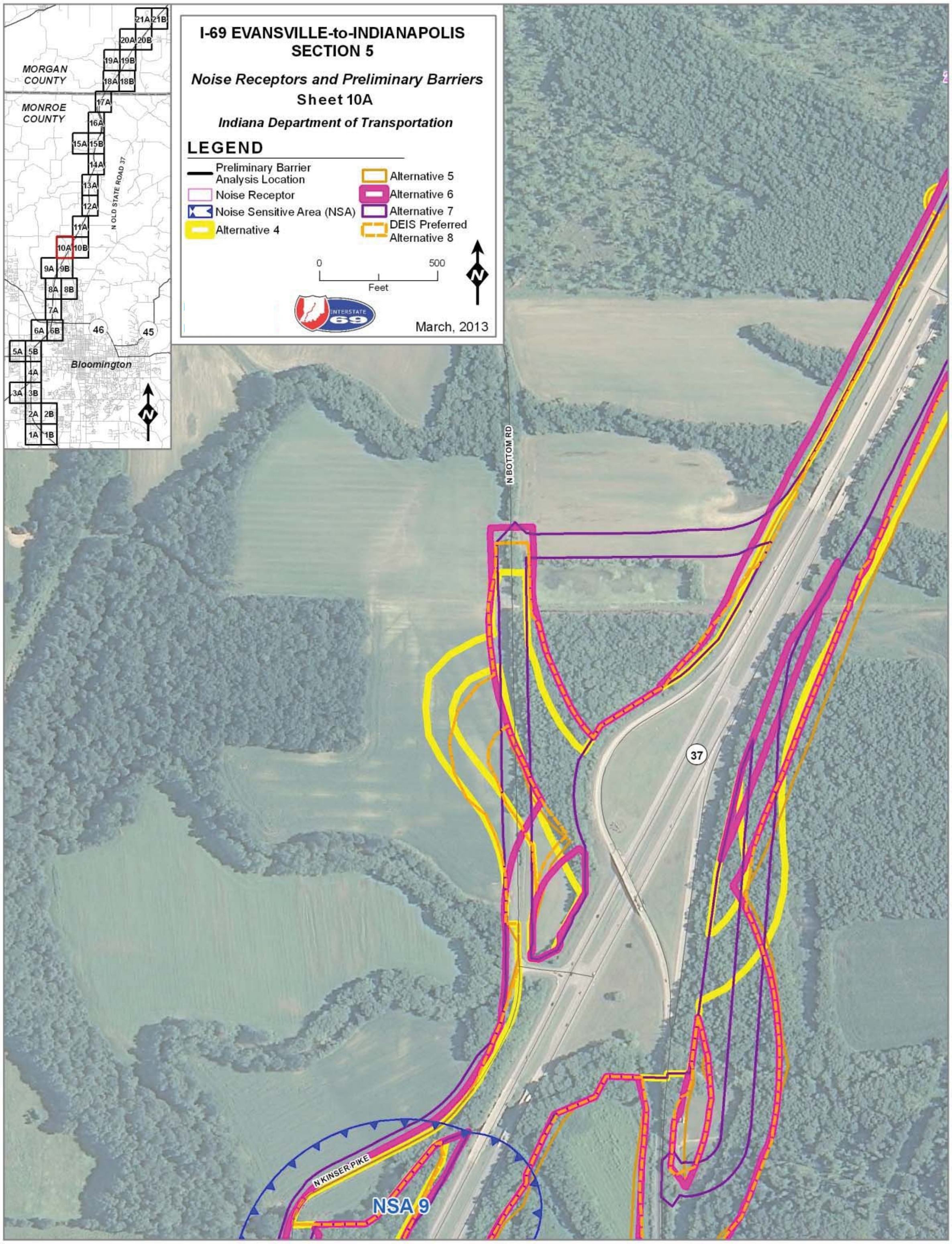


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 10A)

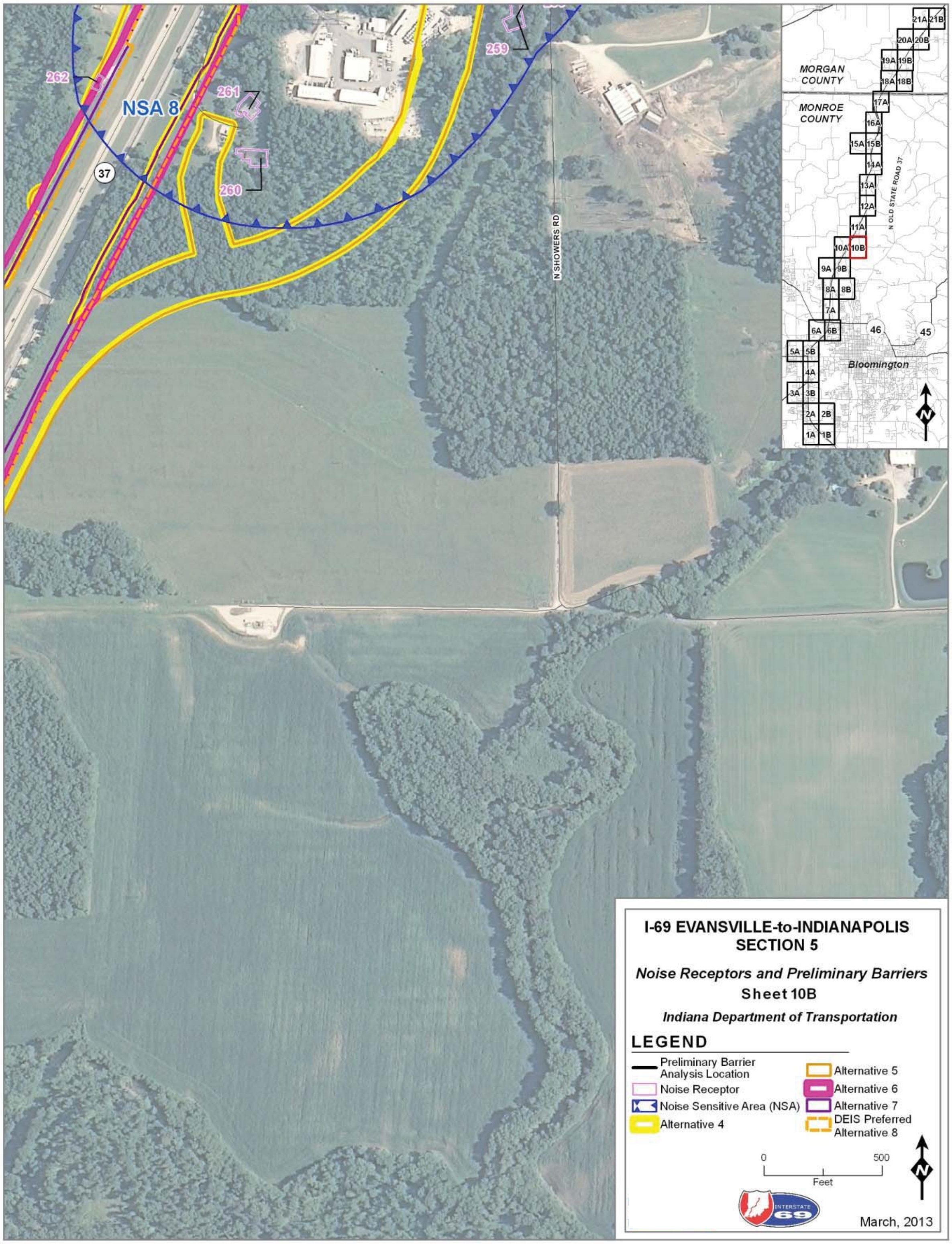


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 10B)

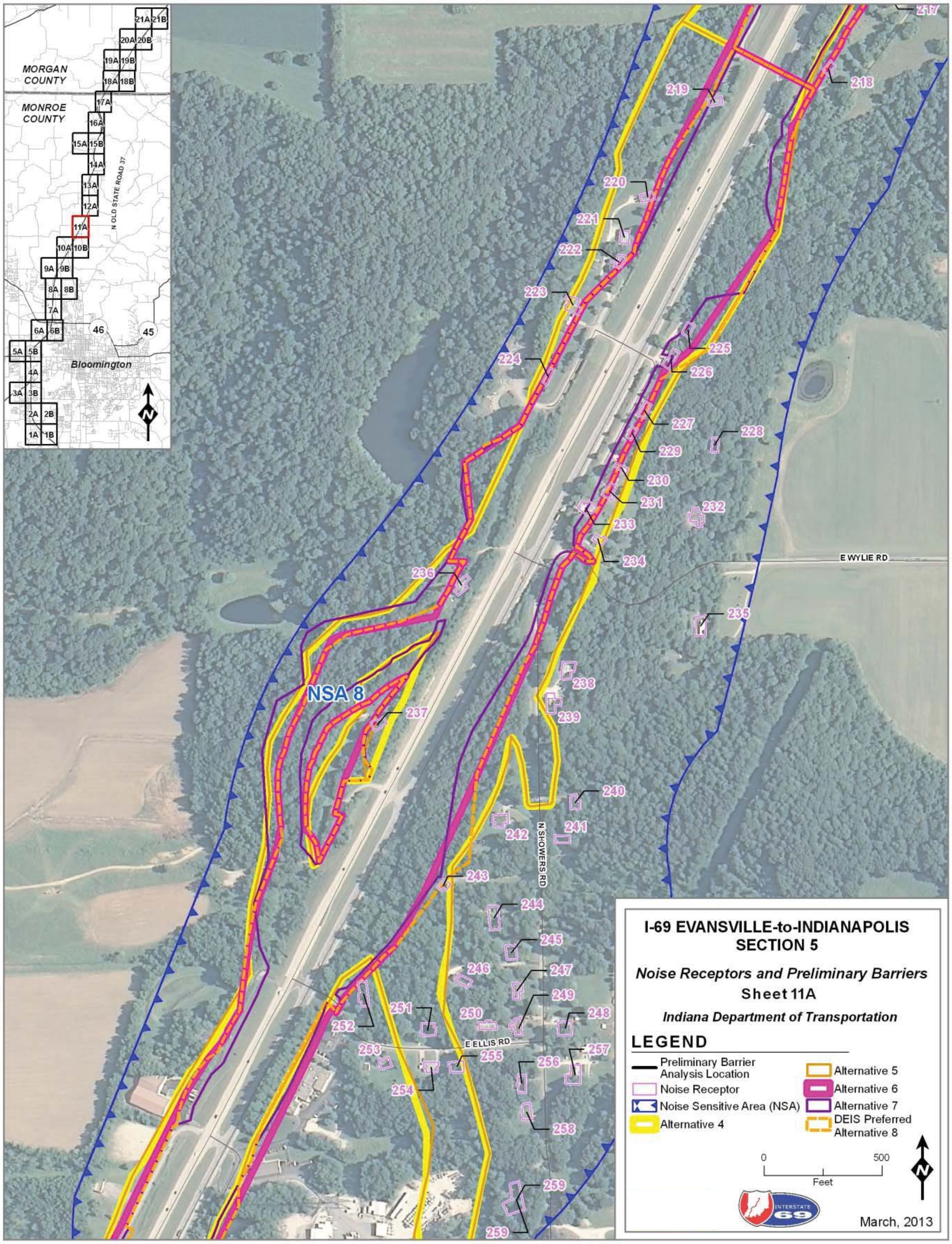


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 11A)

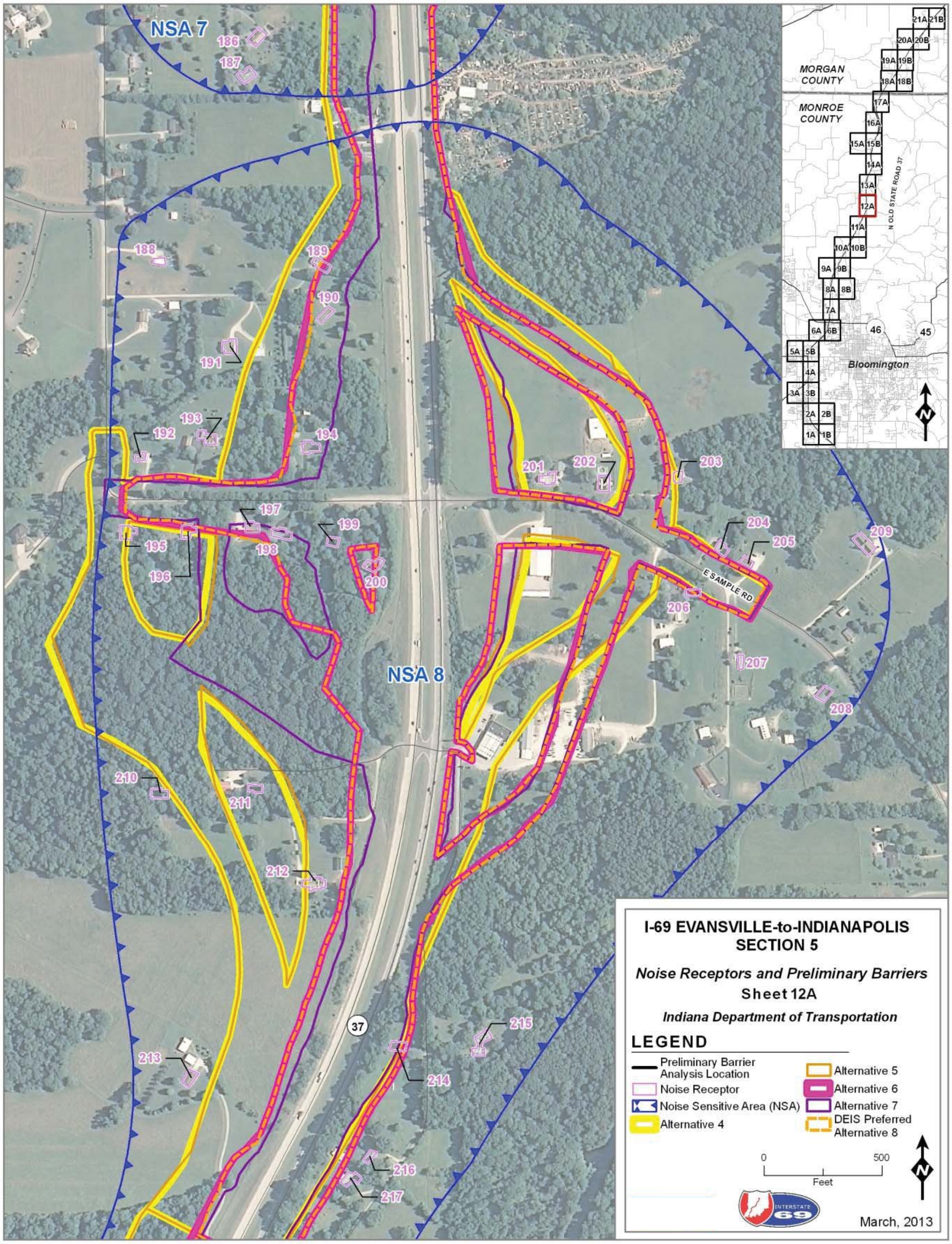


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 12A)

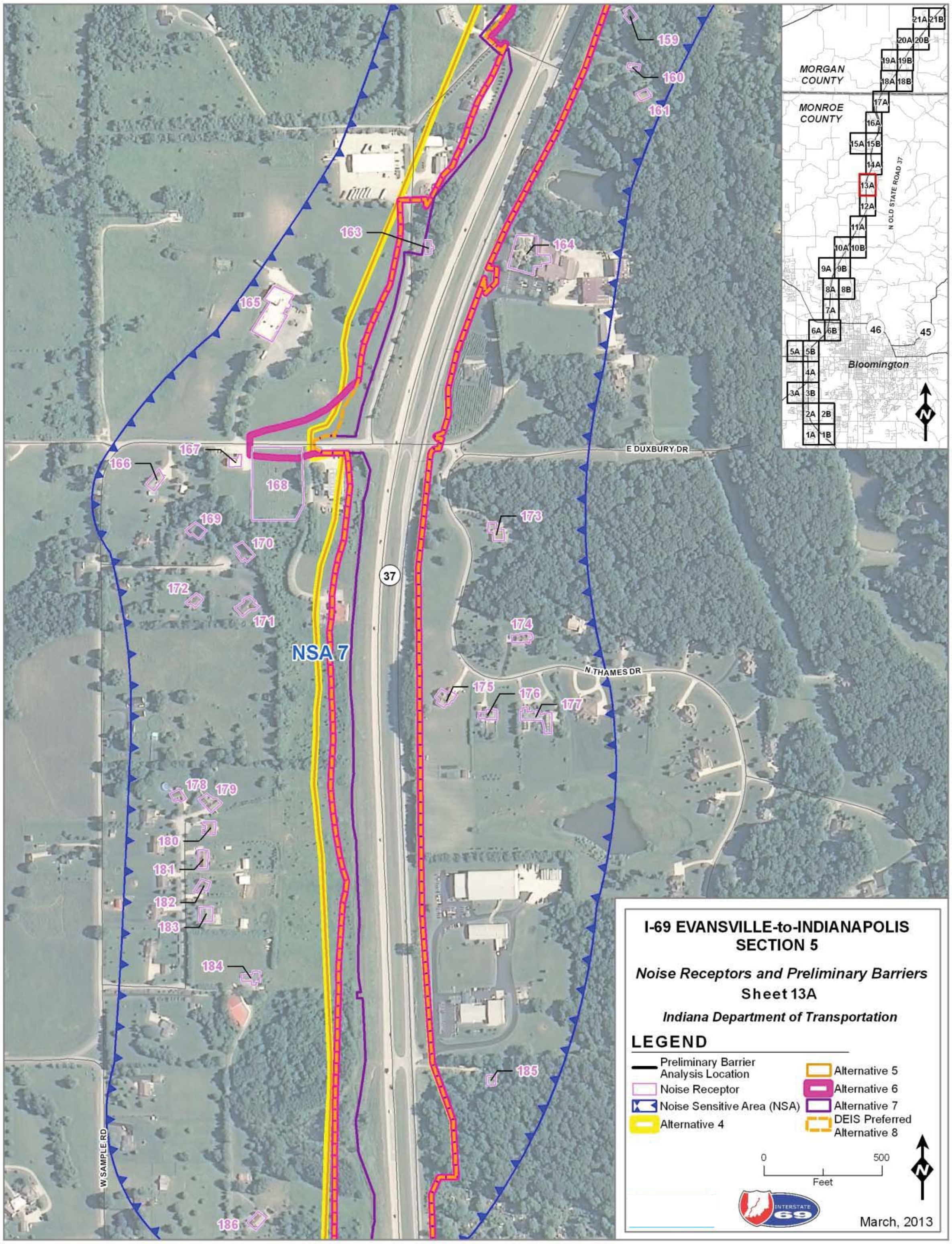


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 13A)

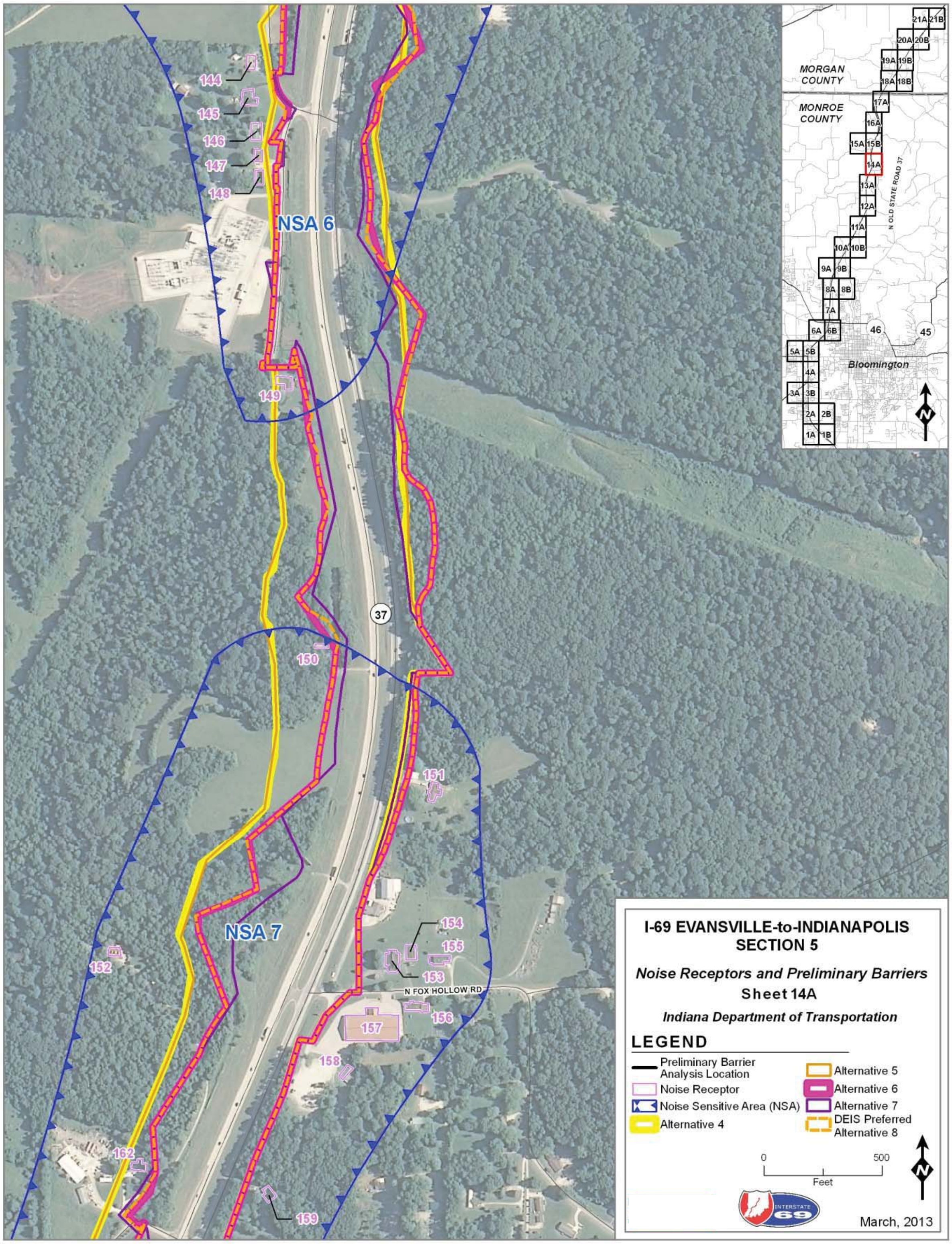


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 14A)

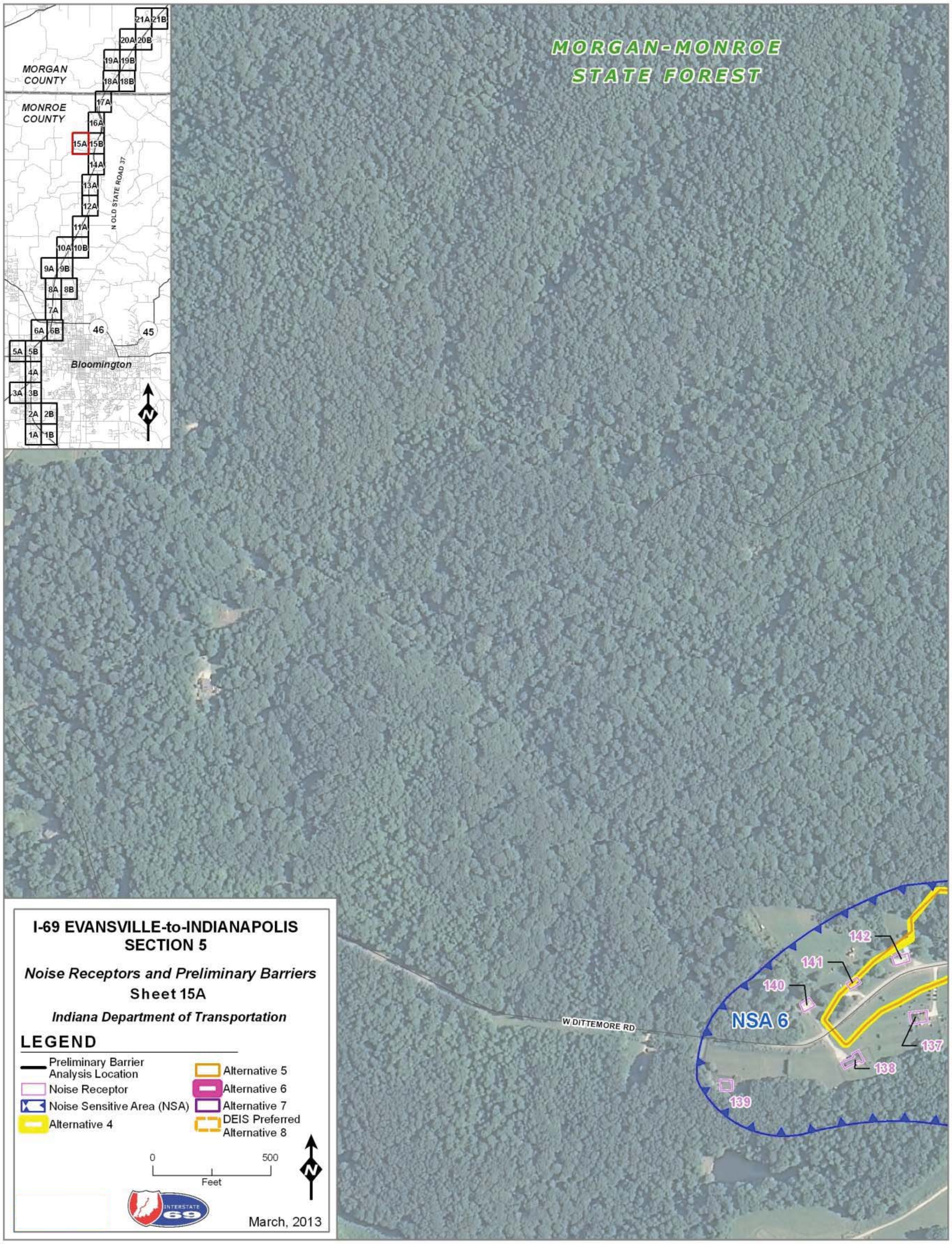


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 15A)

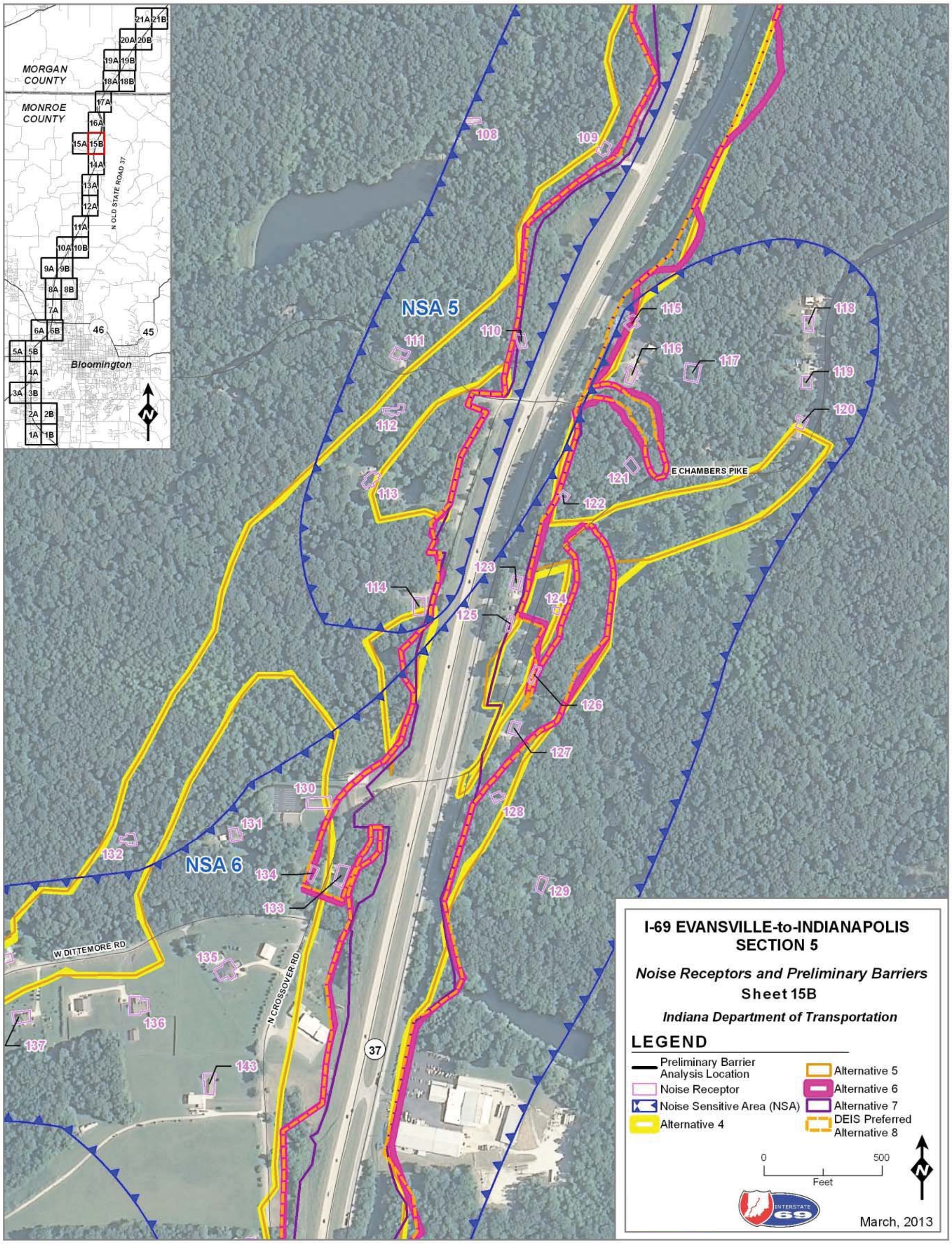


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 15B)

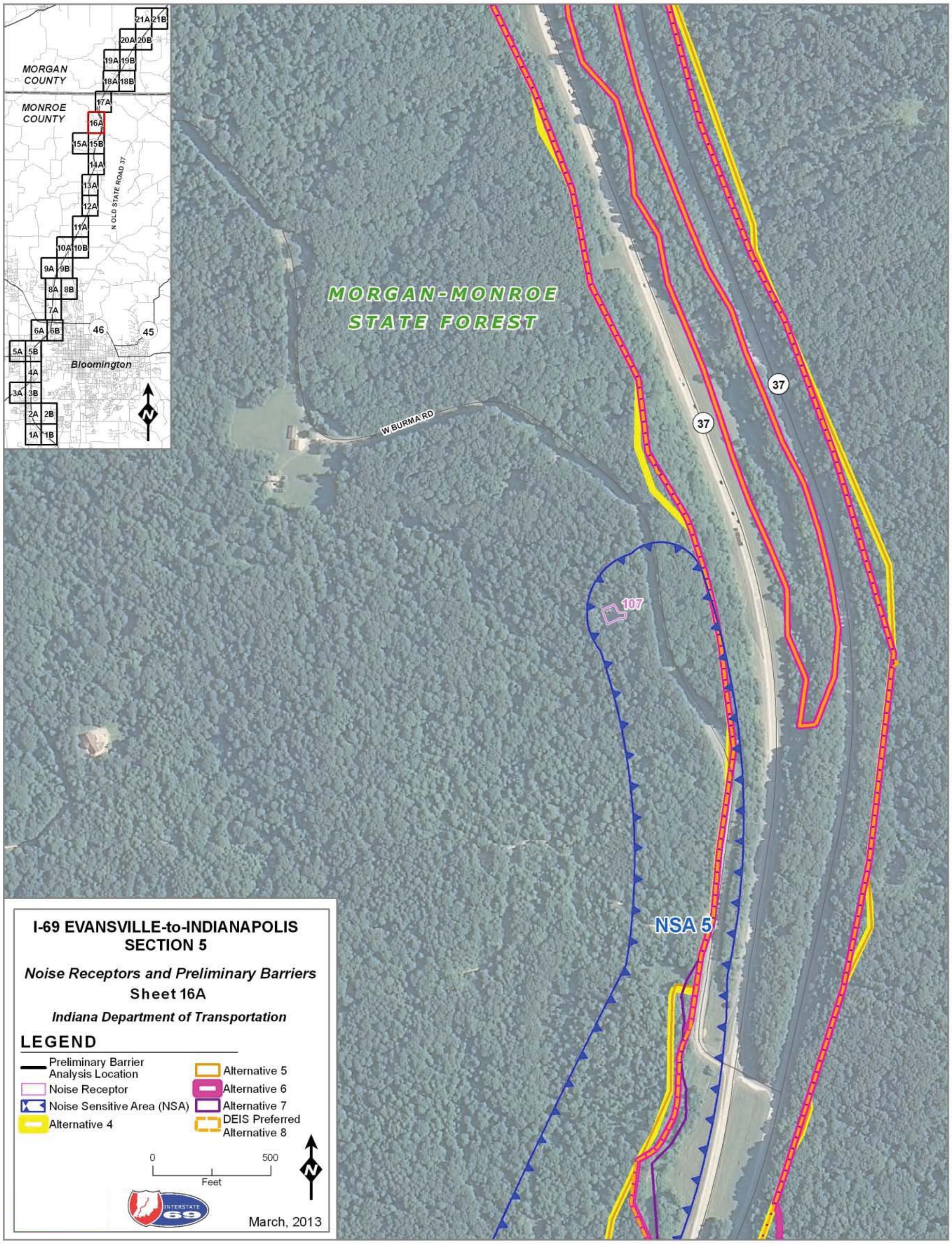


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 16A)

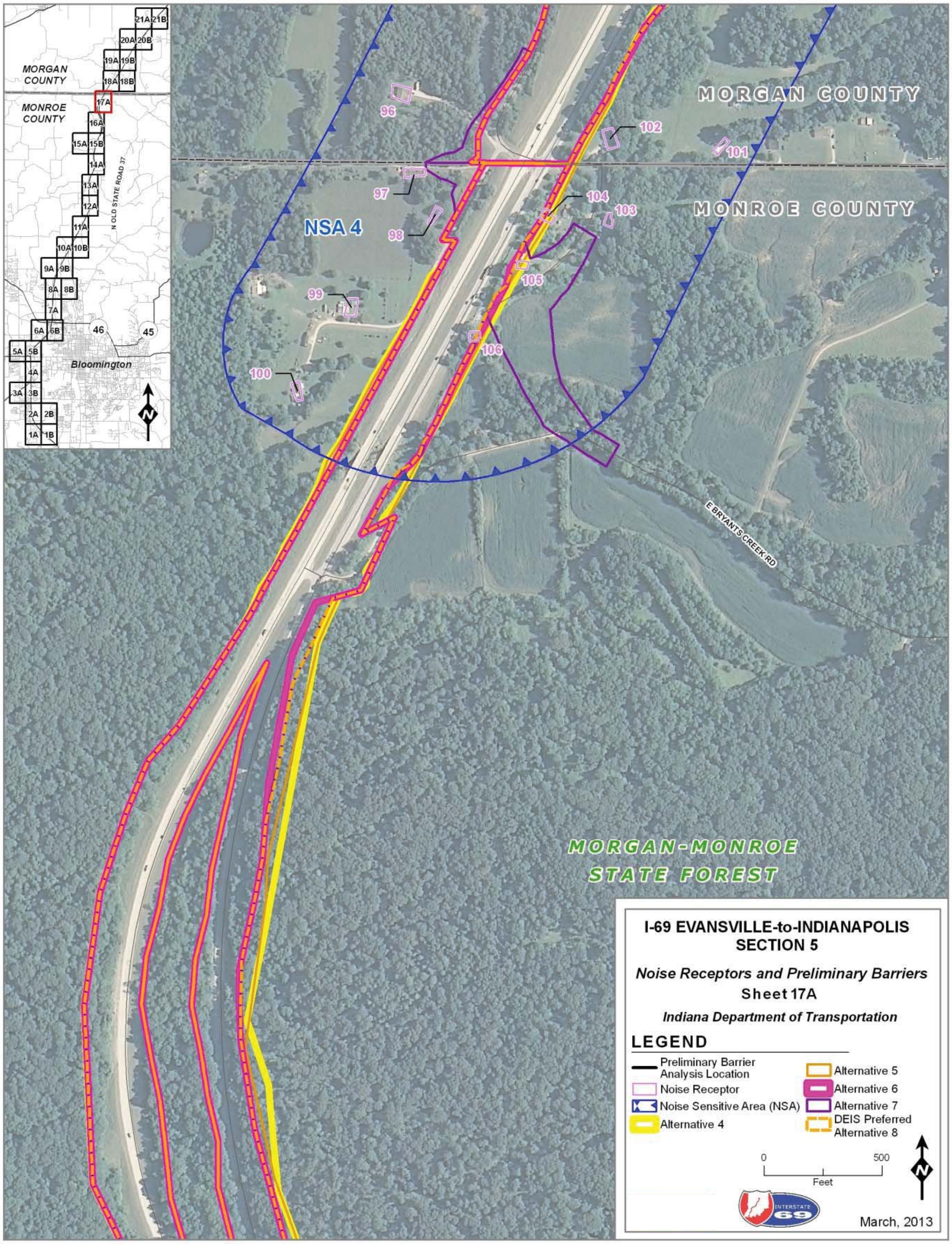


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 17A)

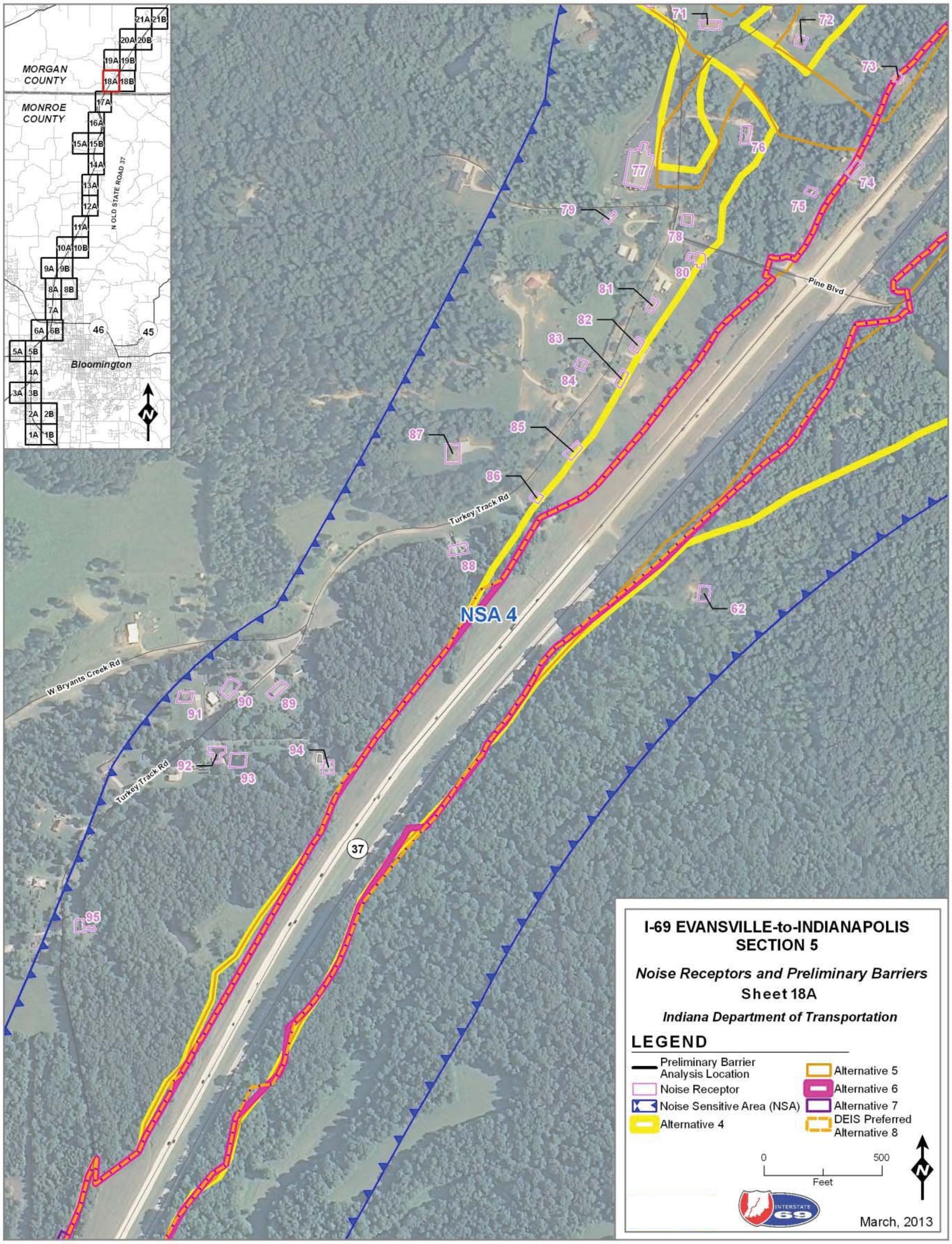
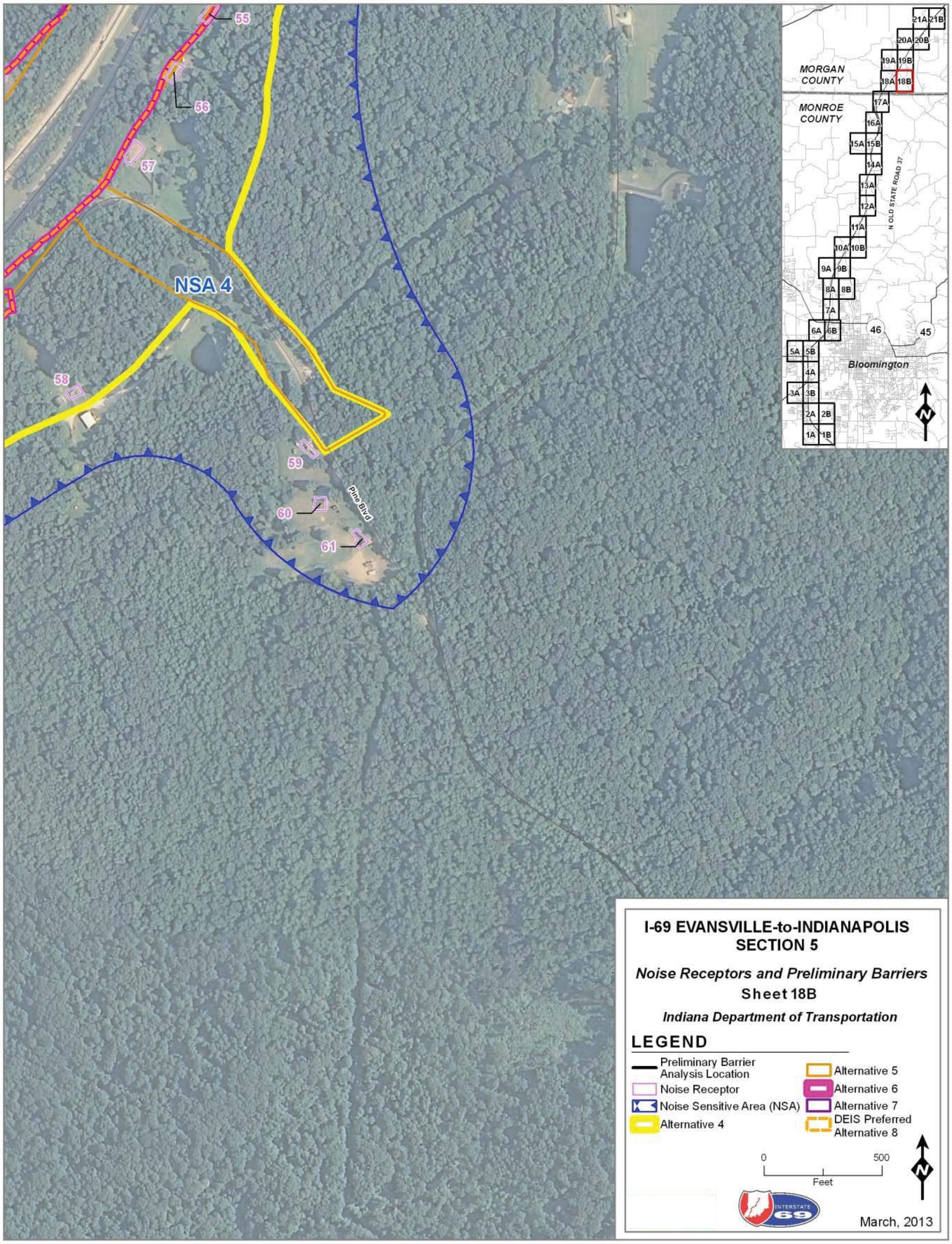


Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 18A)



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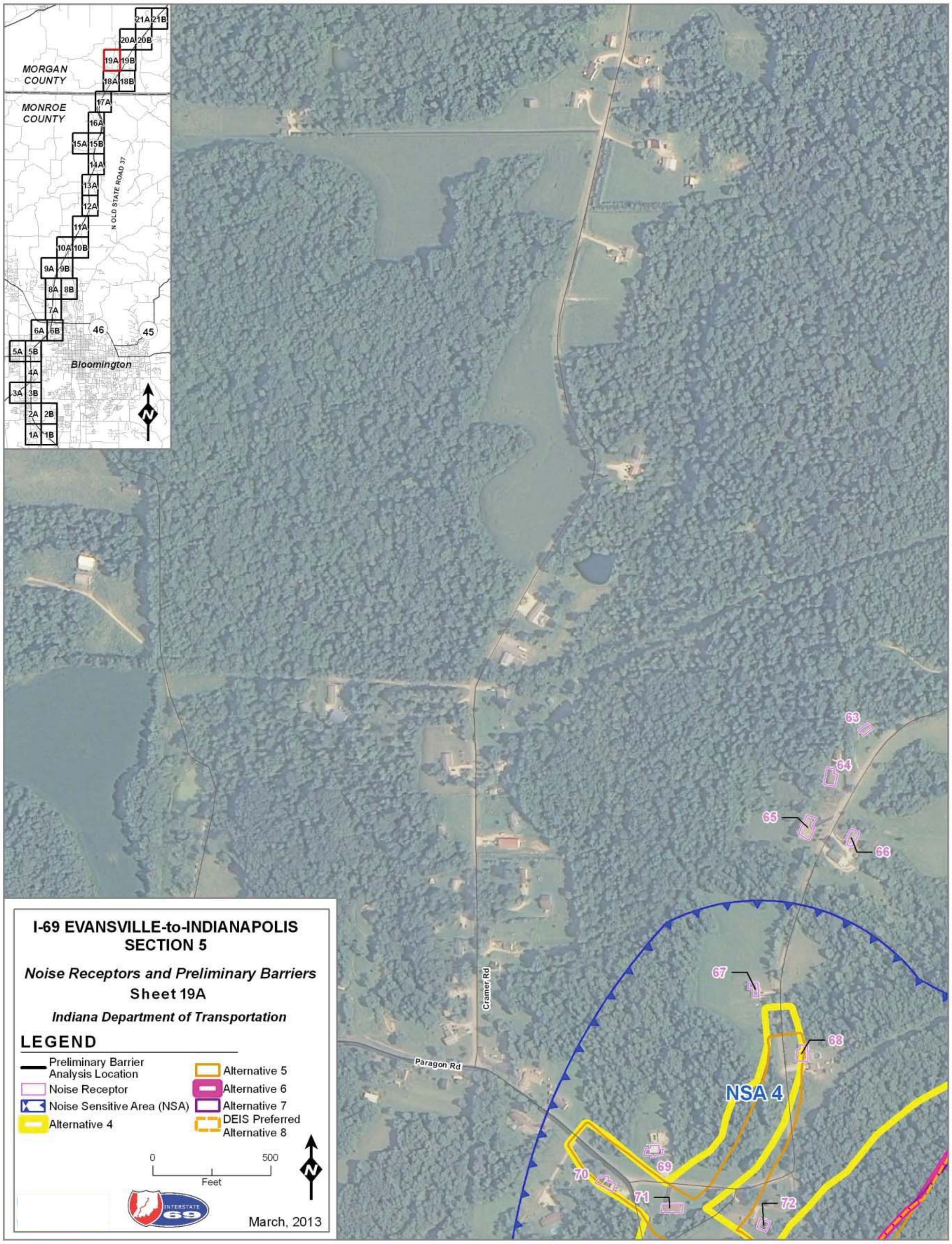

Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 19A)

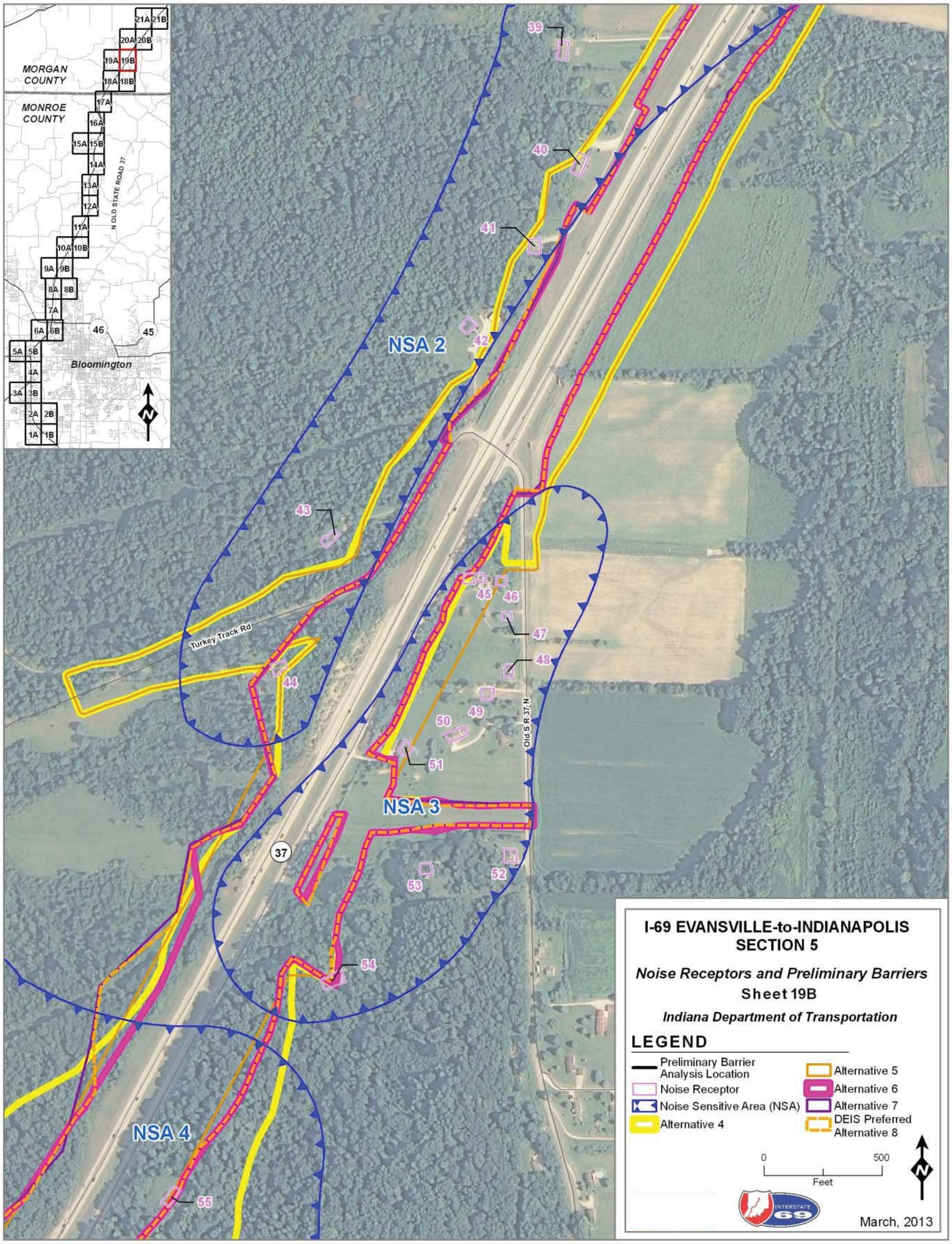

Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 19B)

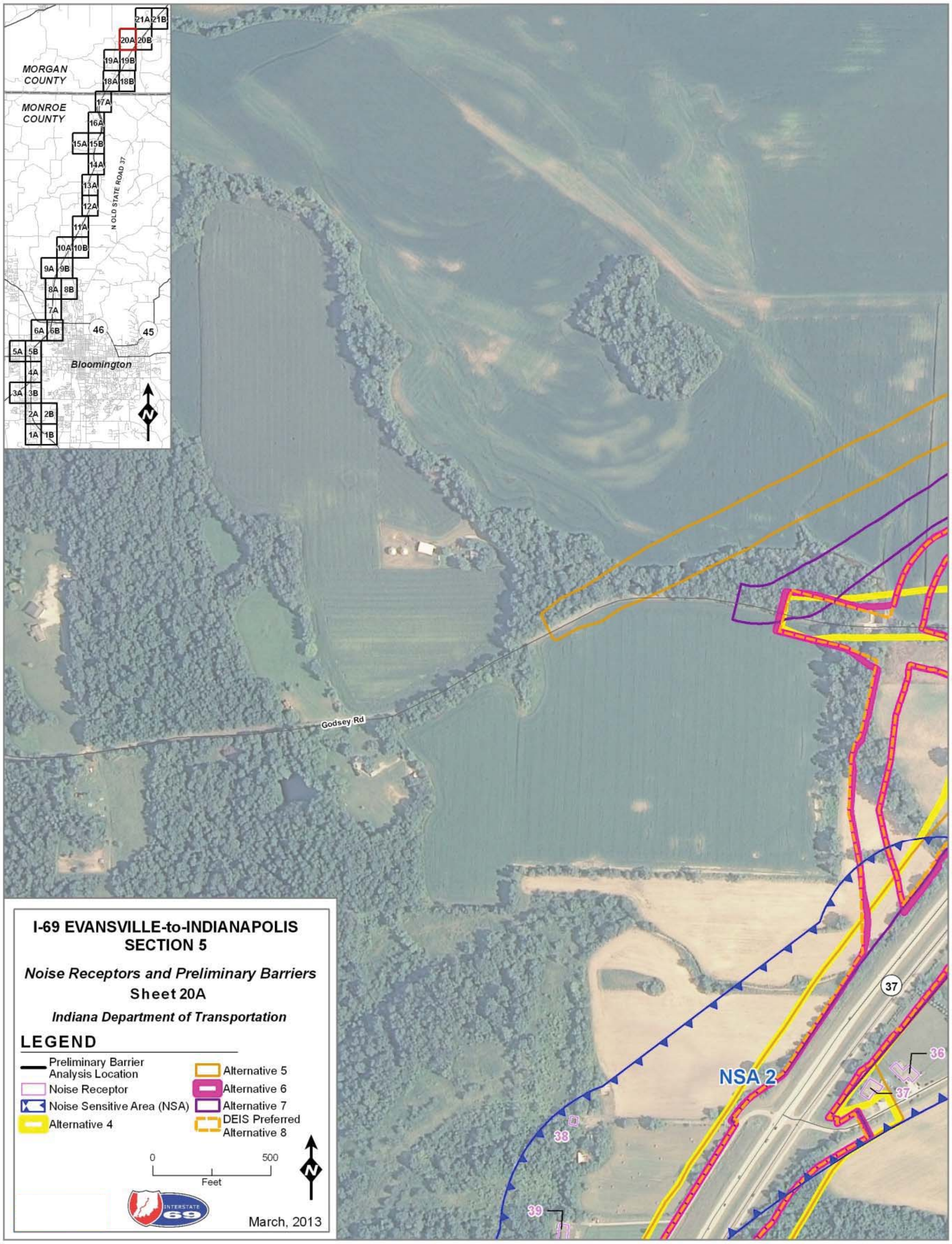

Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 20A)

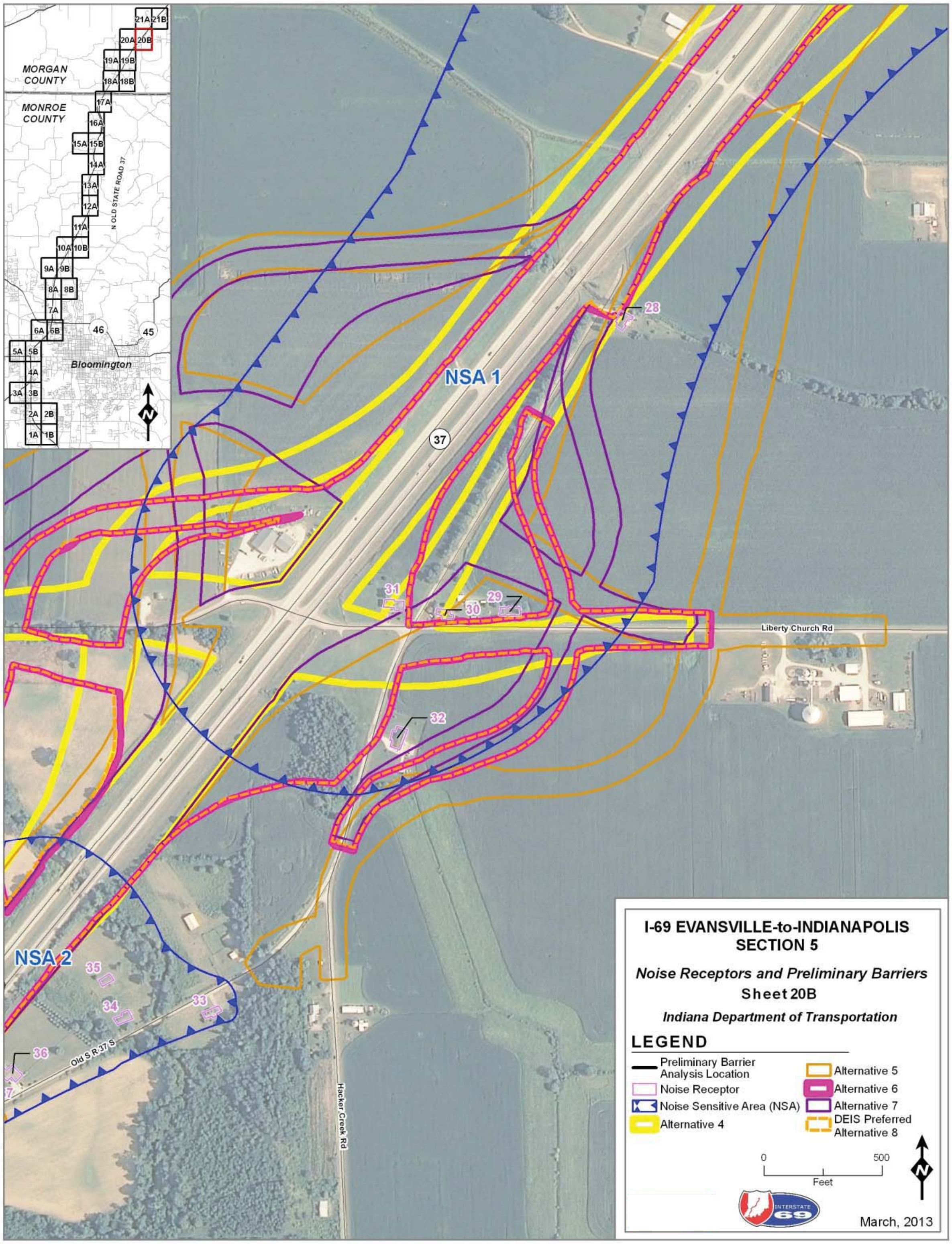

Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 20B)

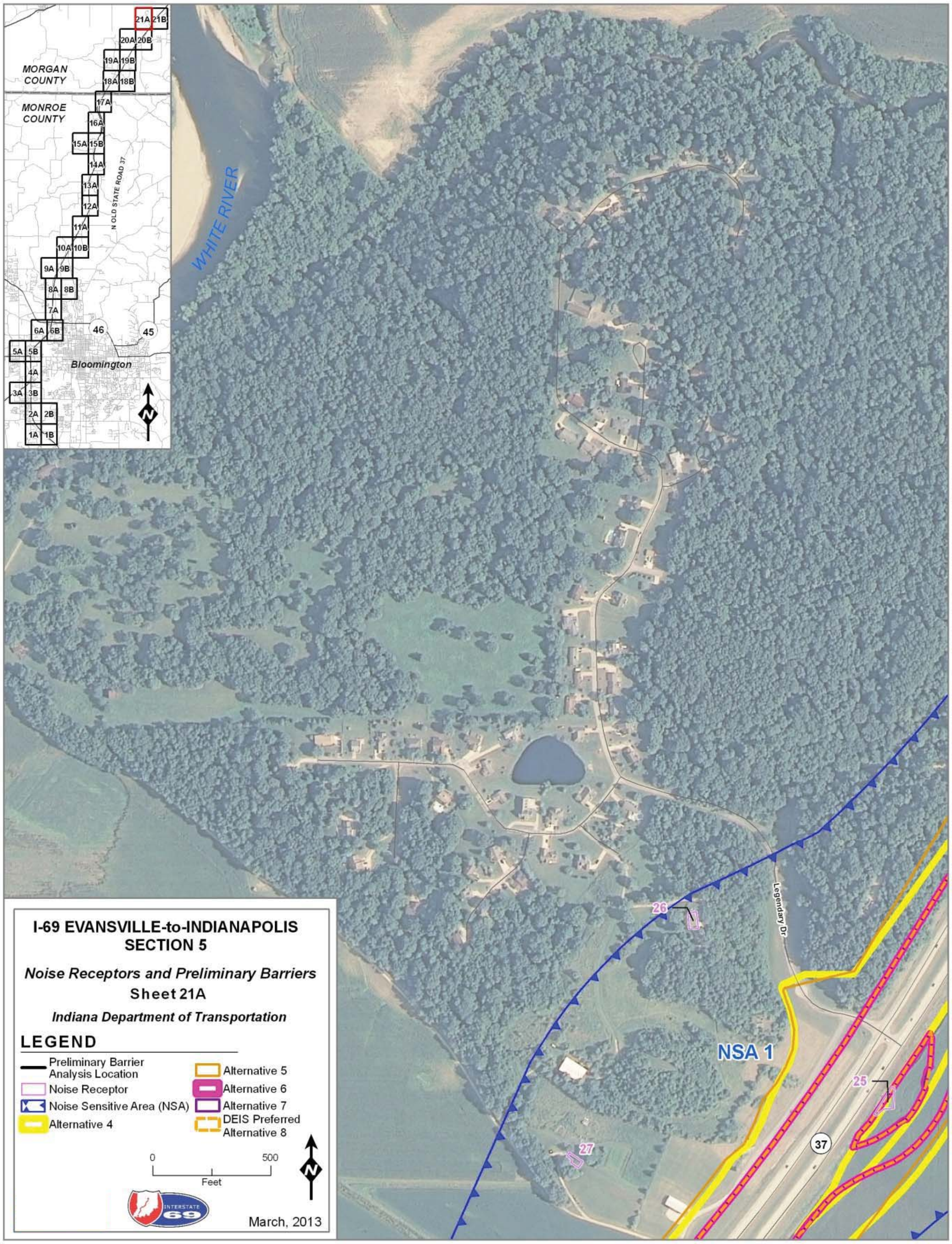

Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 21A)

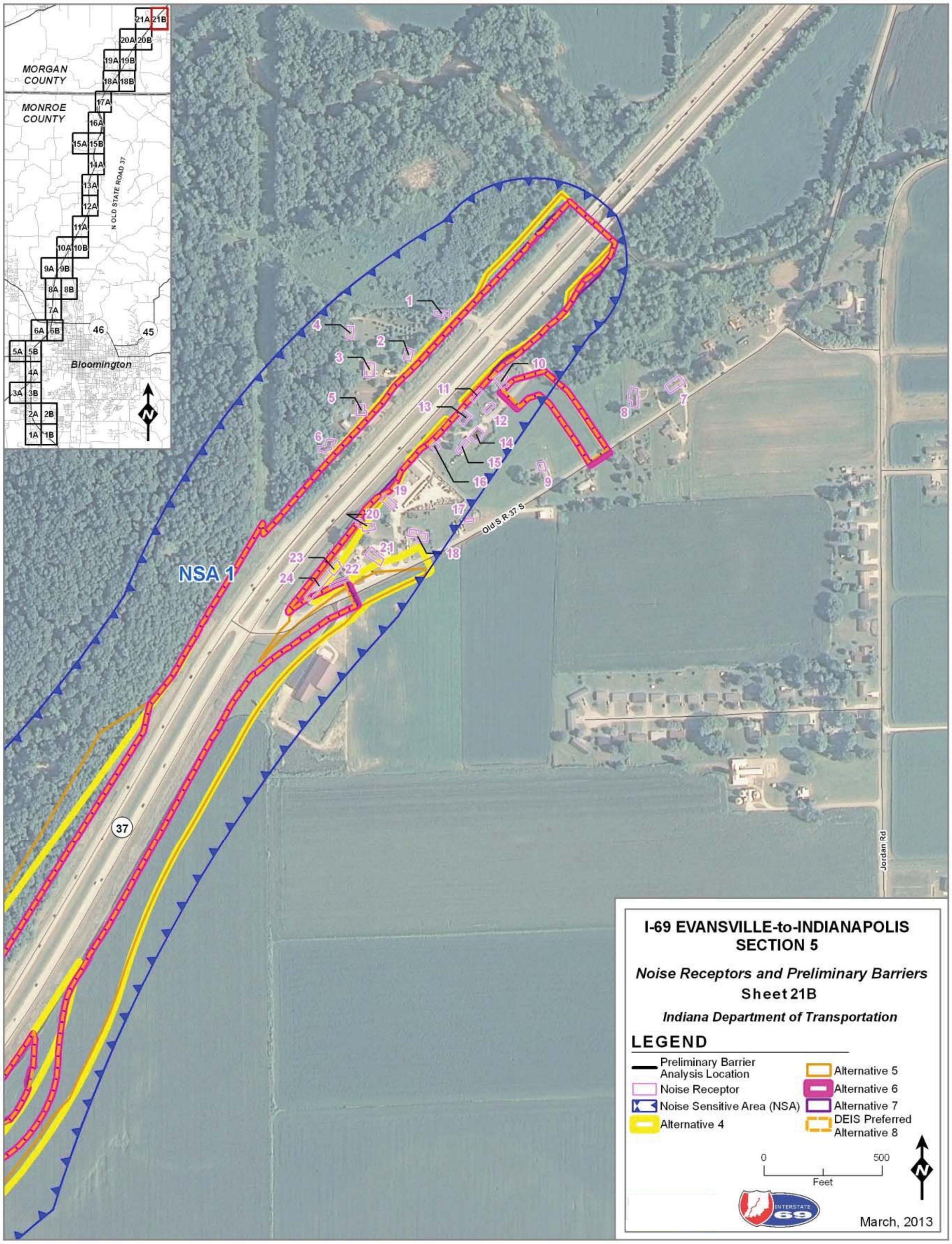

Figure 5.10-2: Noise Receptors & Preliminary Barrier Locations for Alternatives 4 through 8 (Sheet 21B)

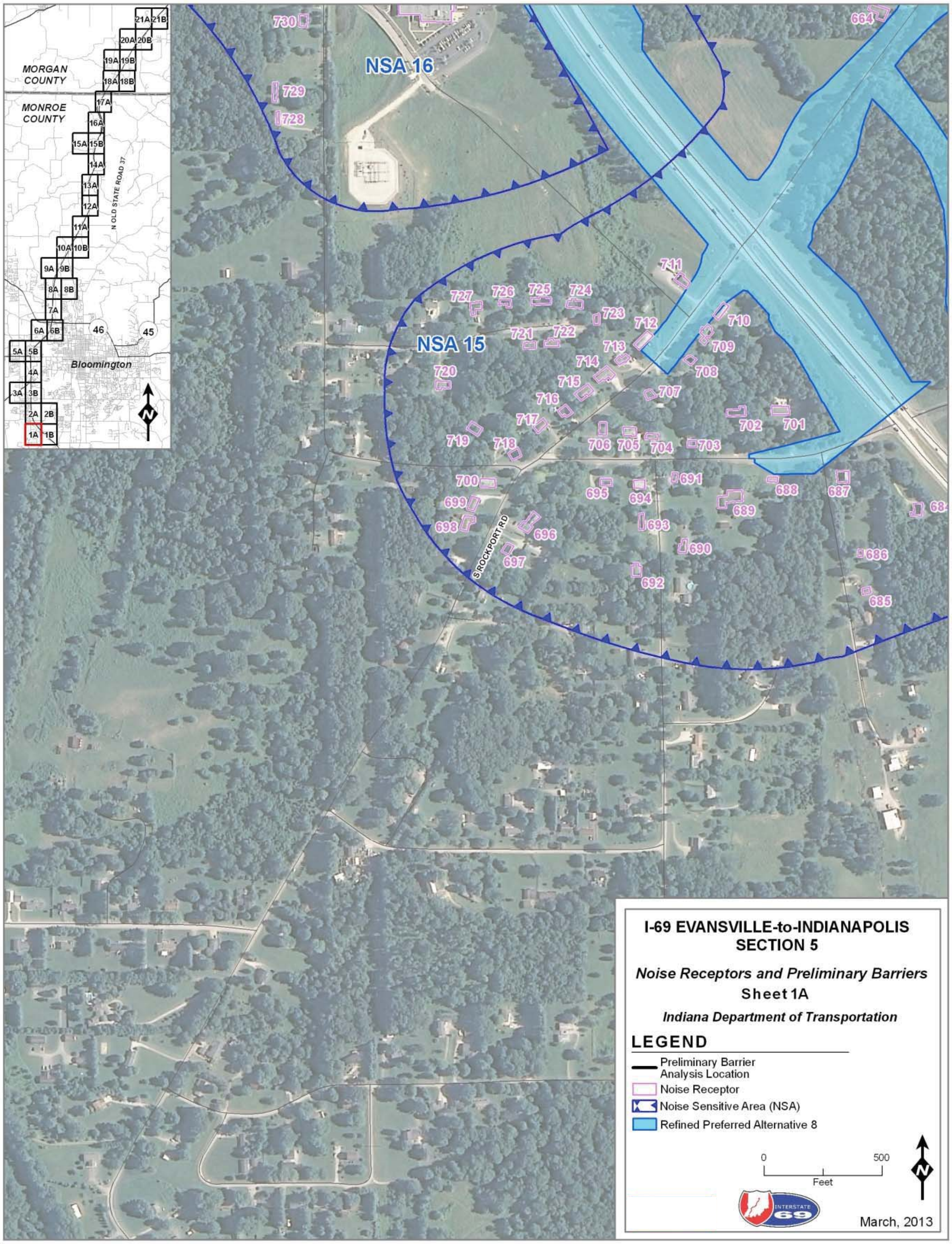

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 1A)

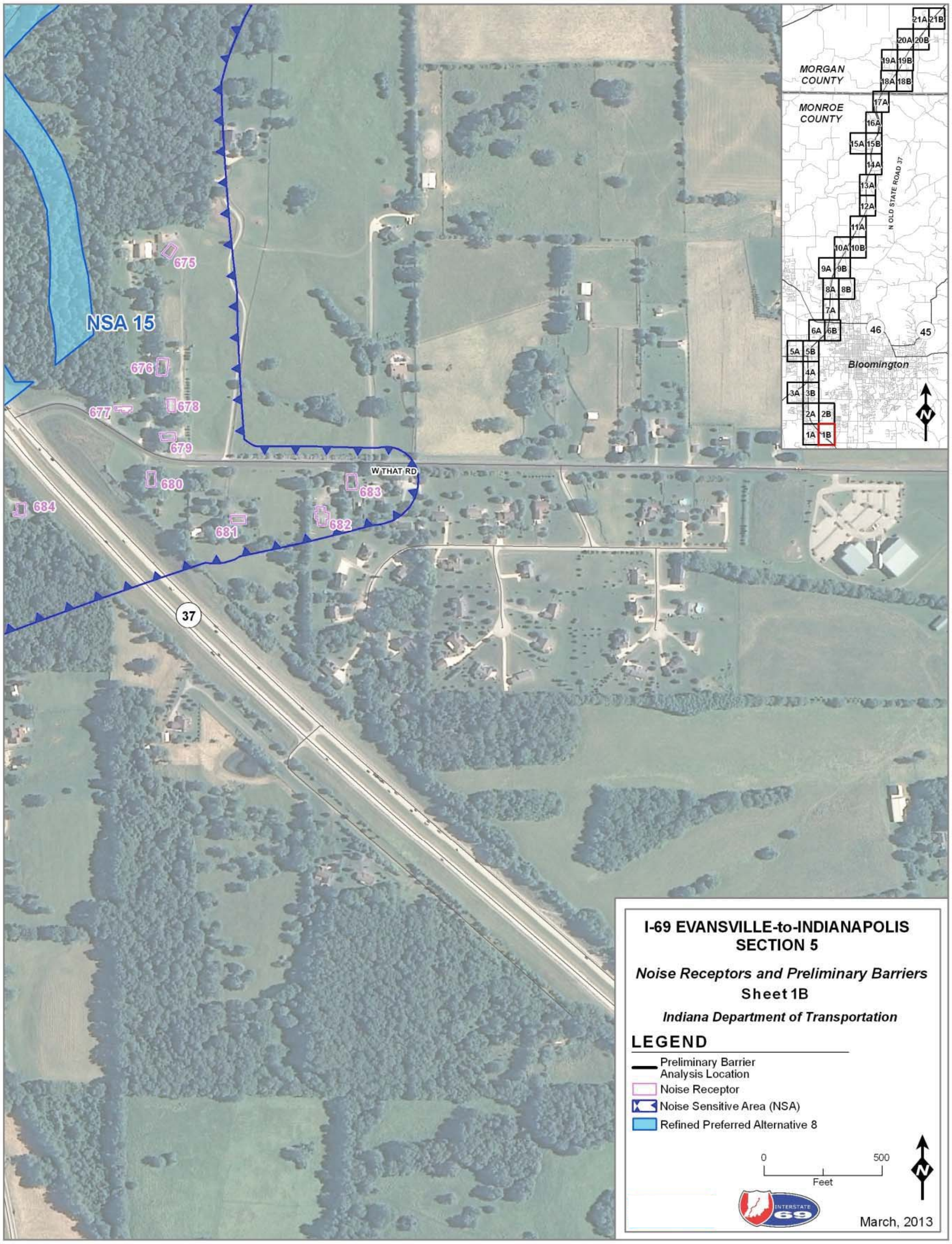

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternatives 8 (Sheet 1B)

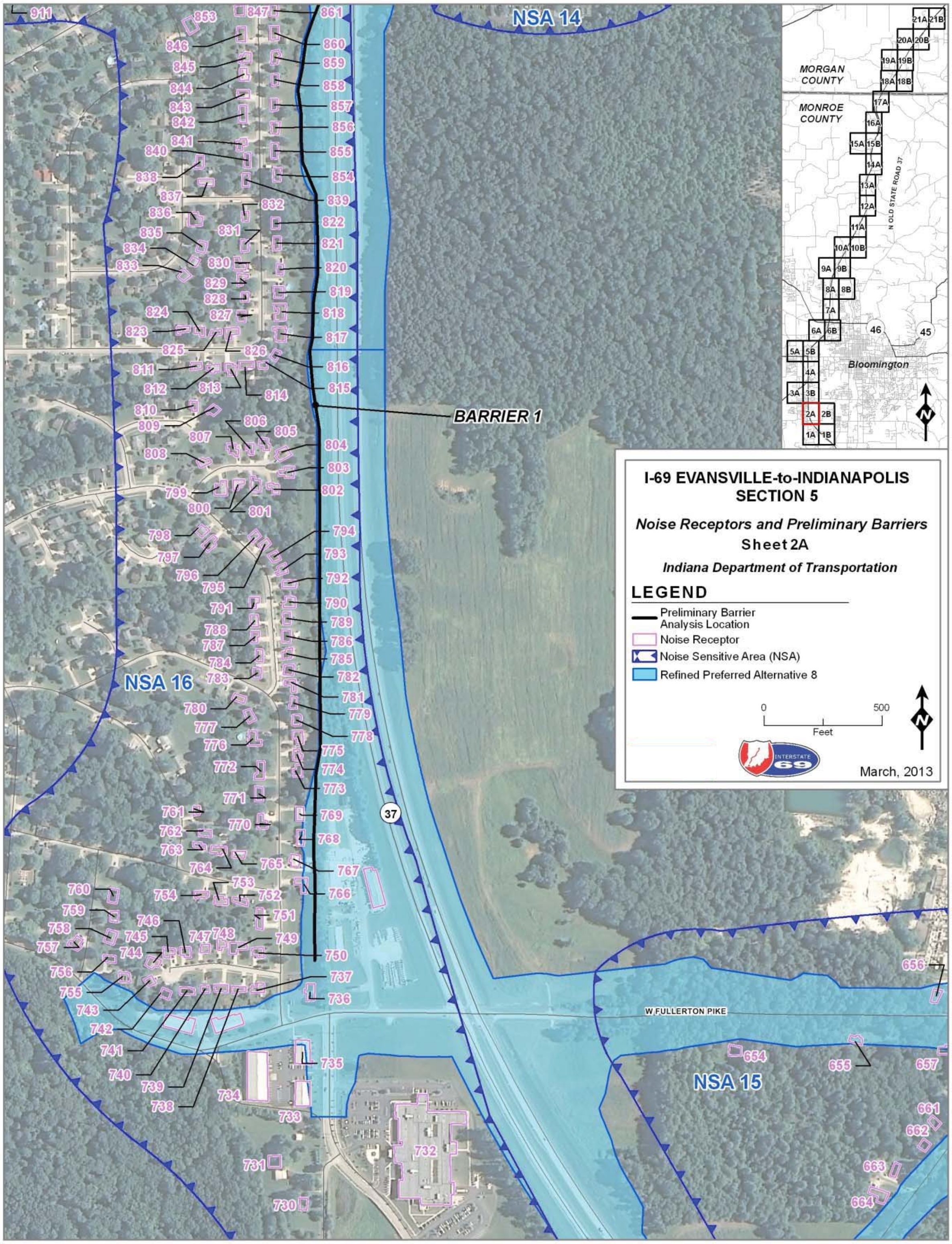

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 2A)

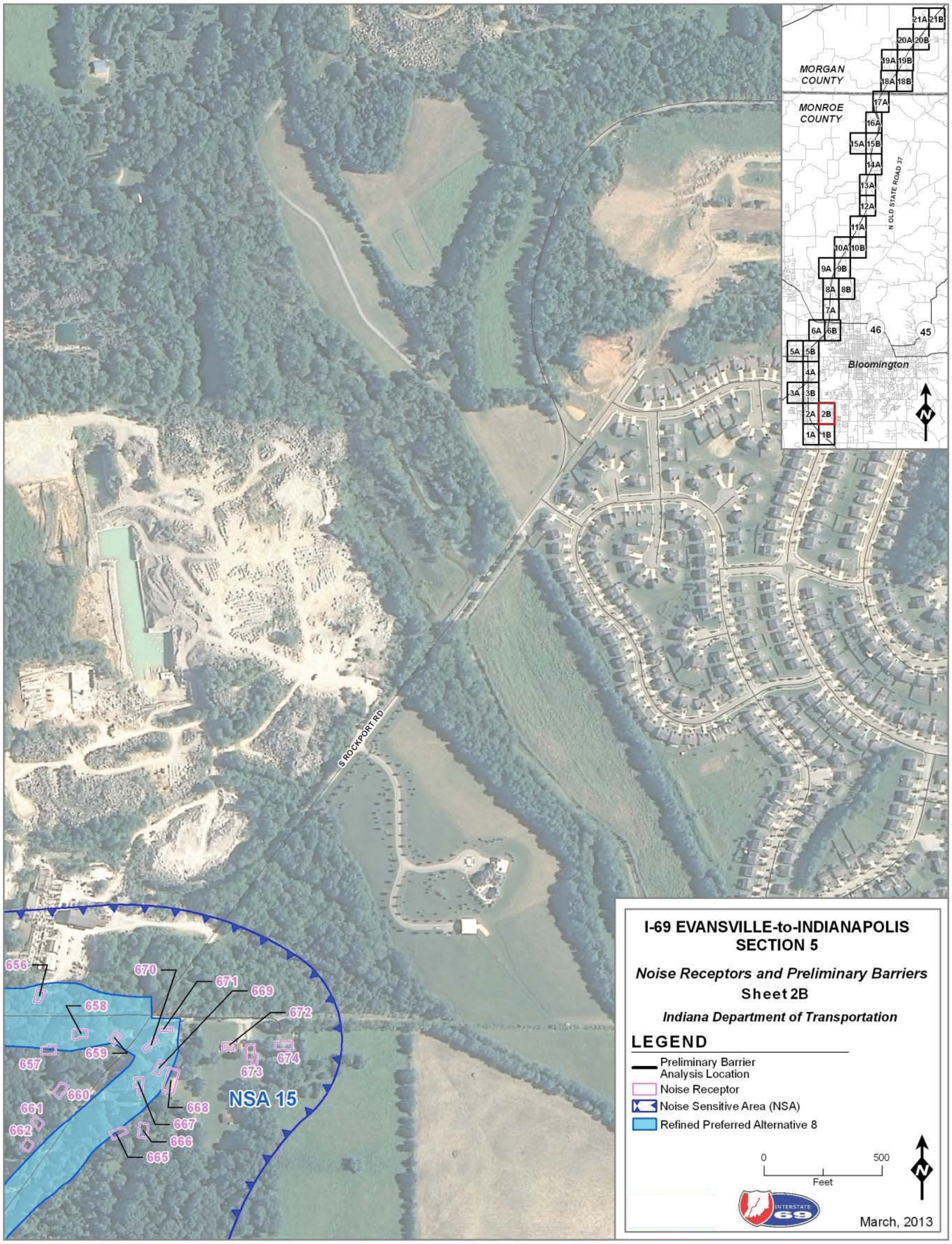

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 2B)

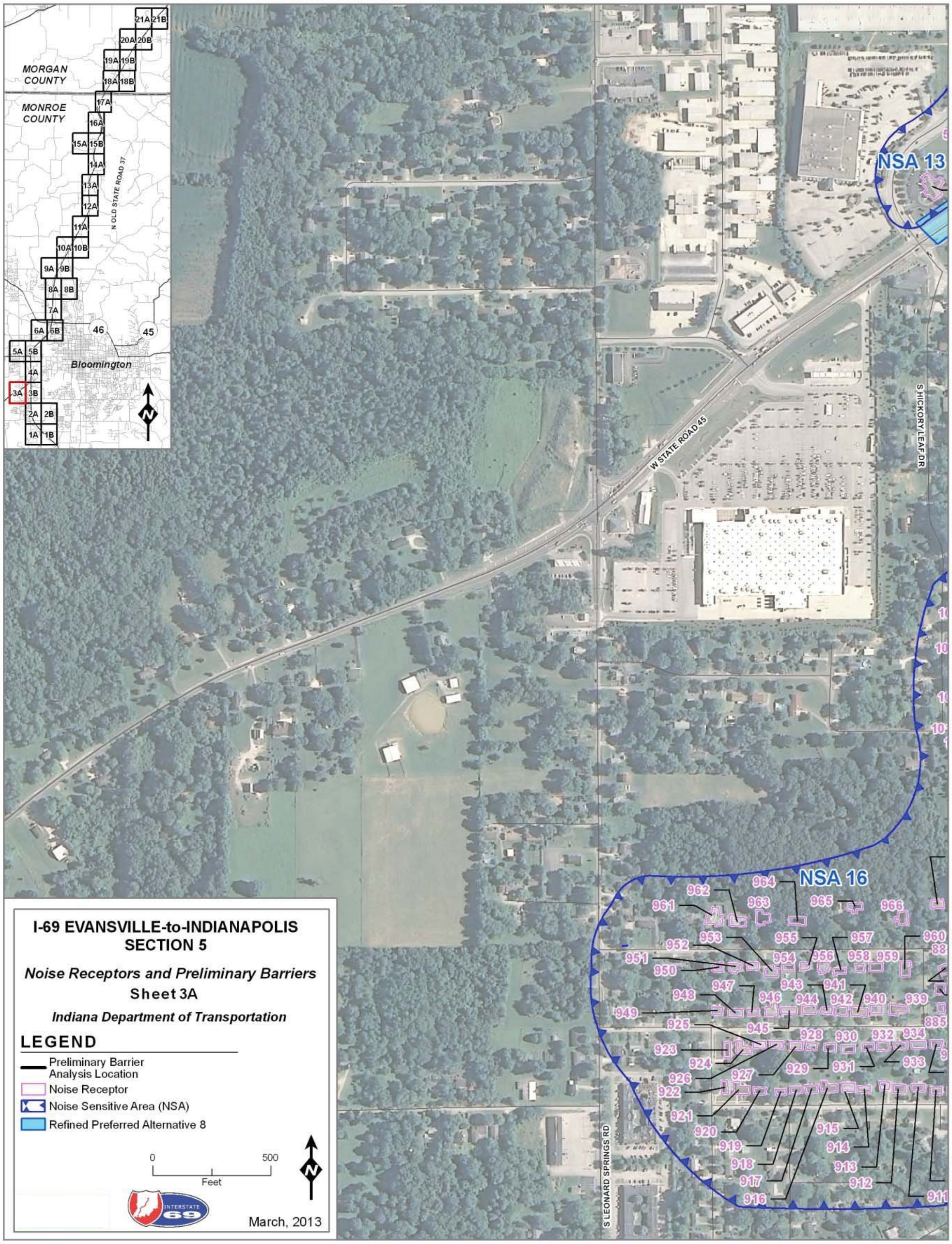

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 3A)

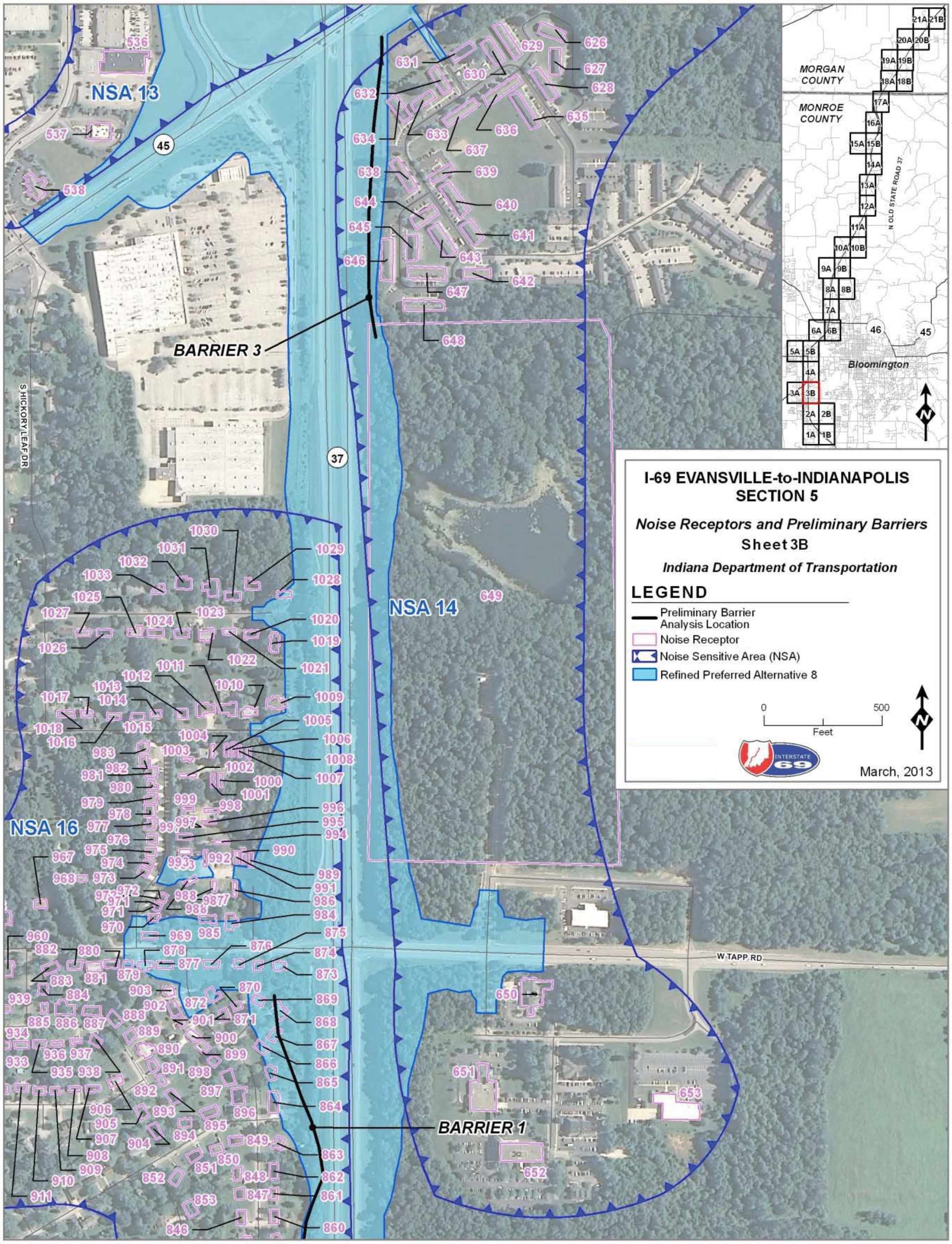

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 3B)

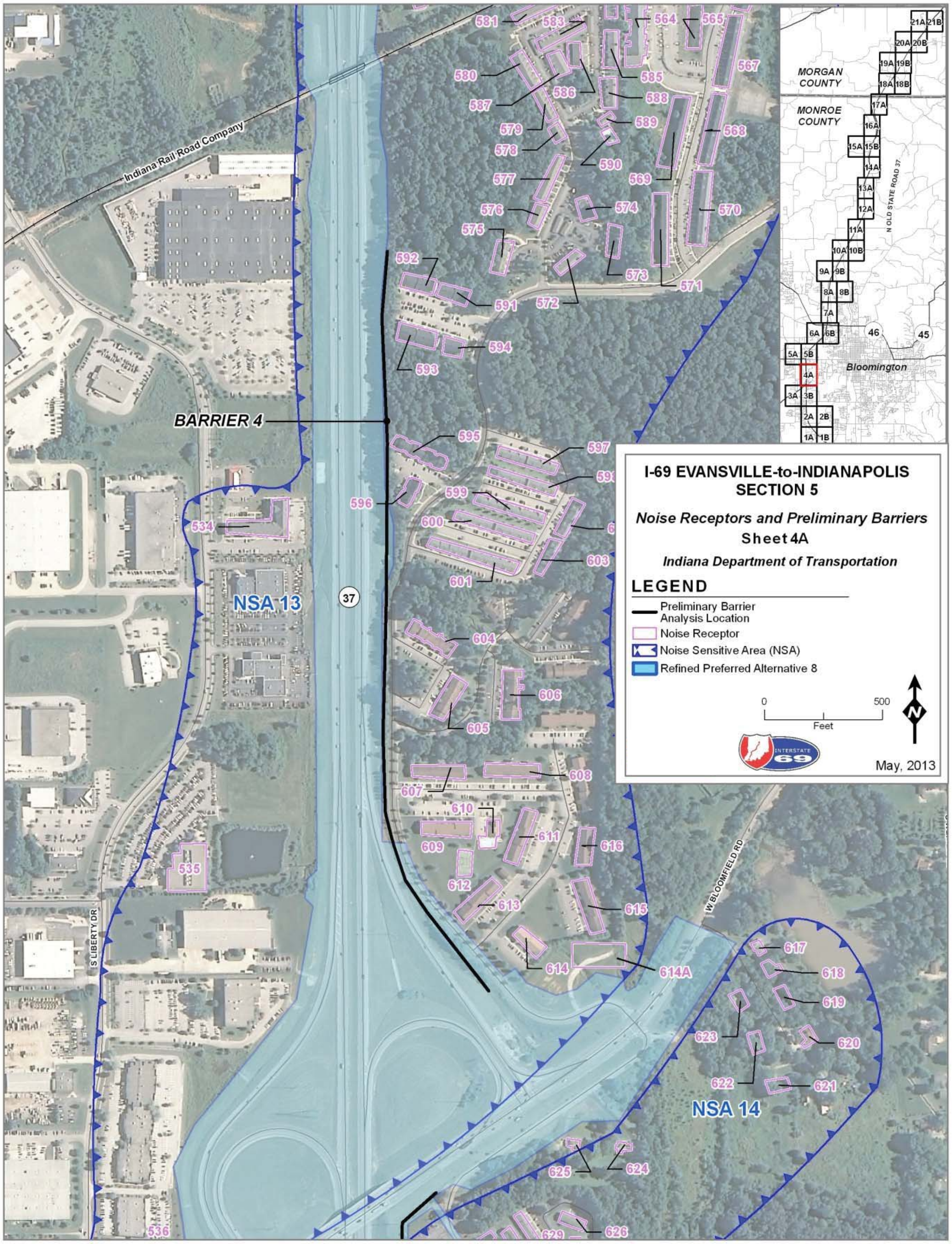

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 4A)

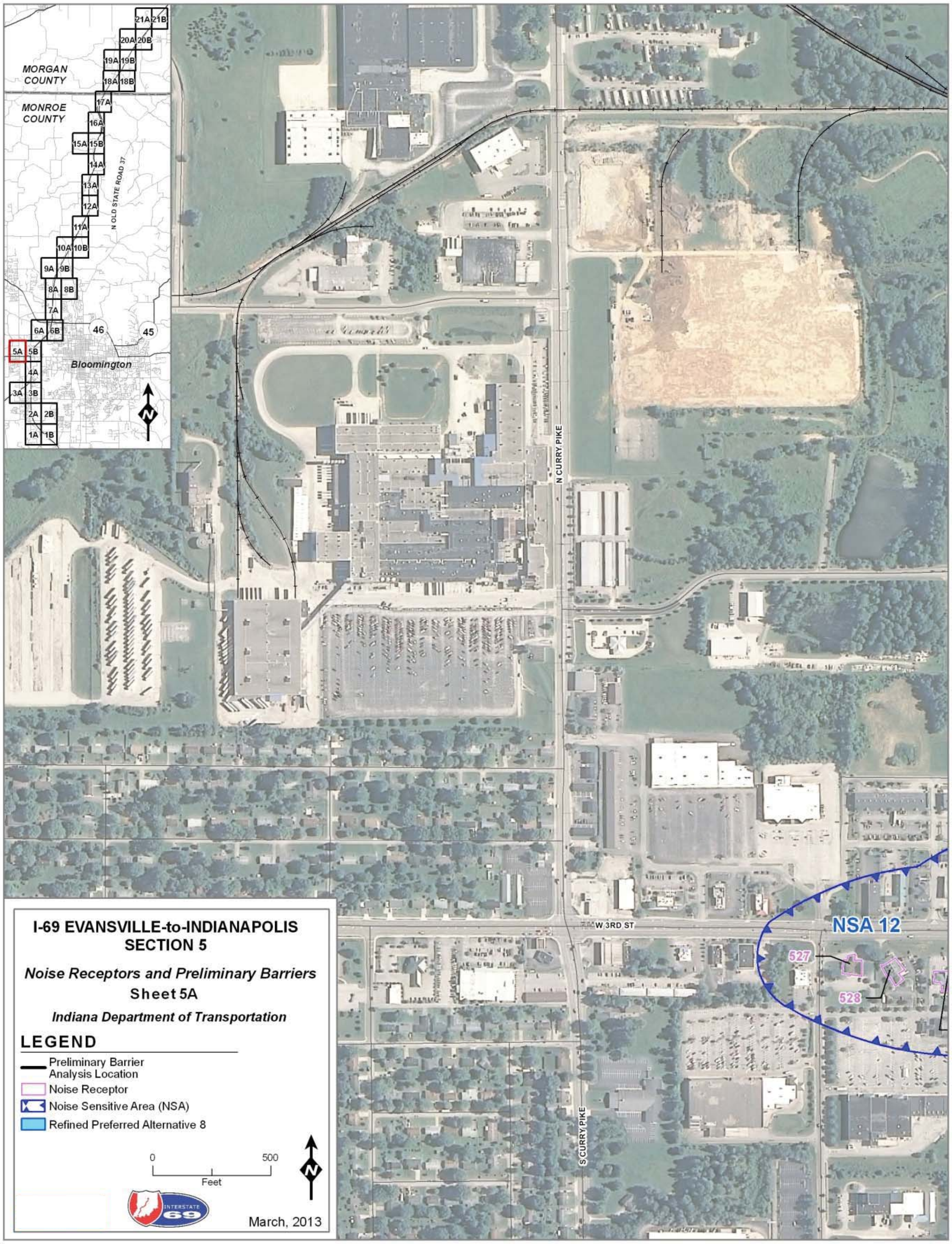

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 5A)

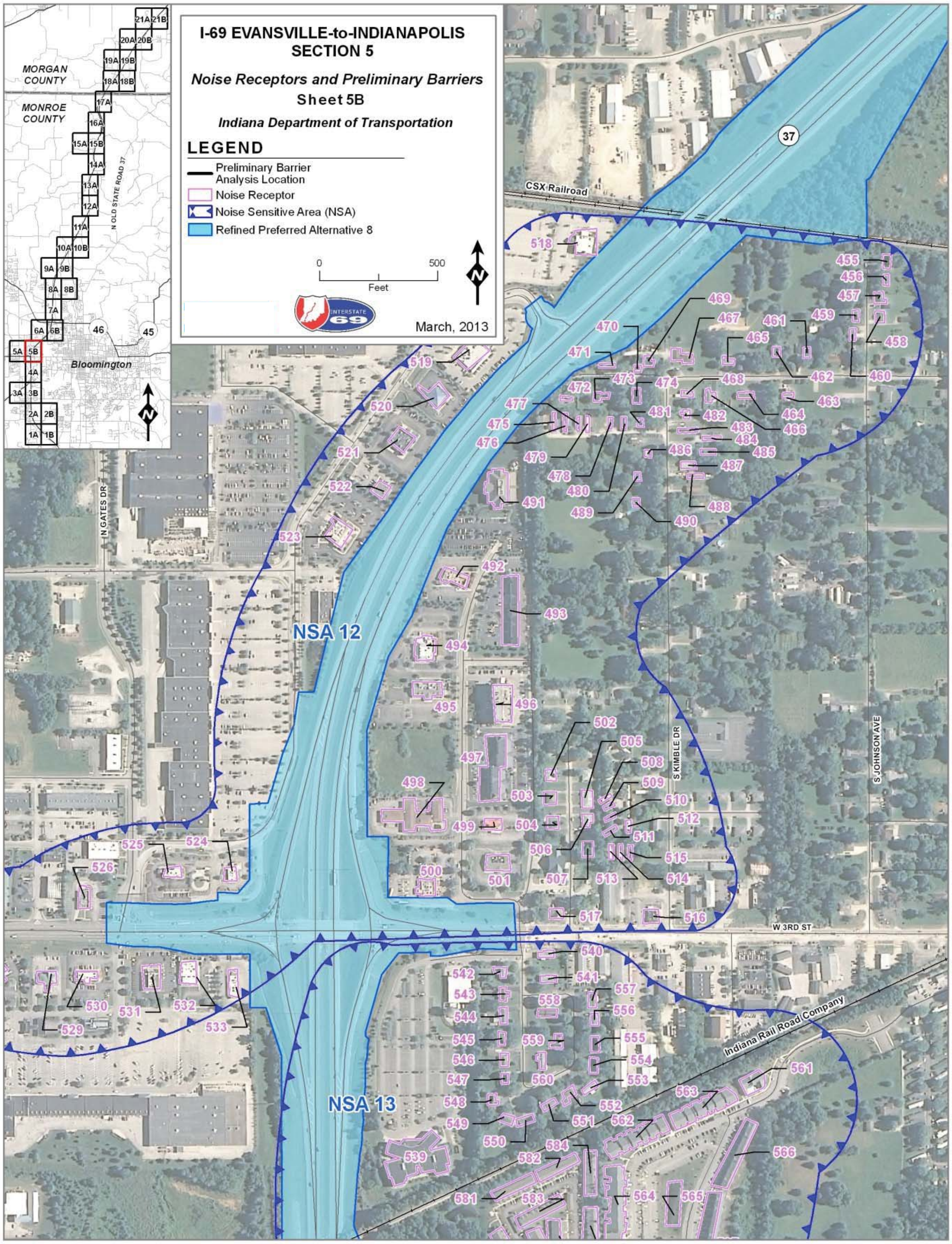

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 5B)

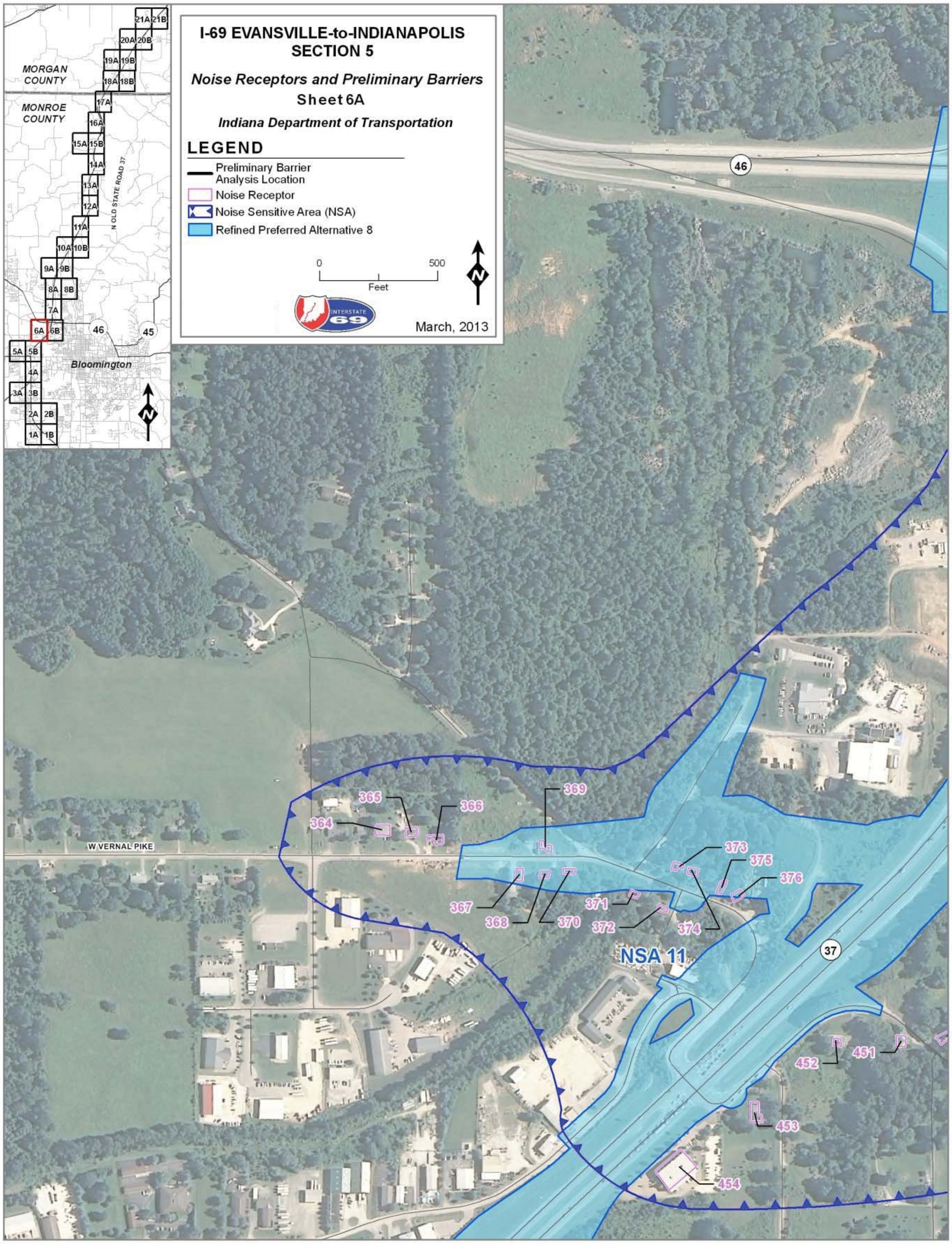

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 6A)

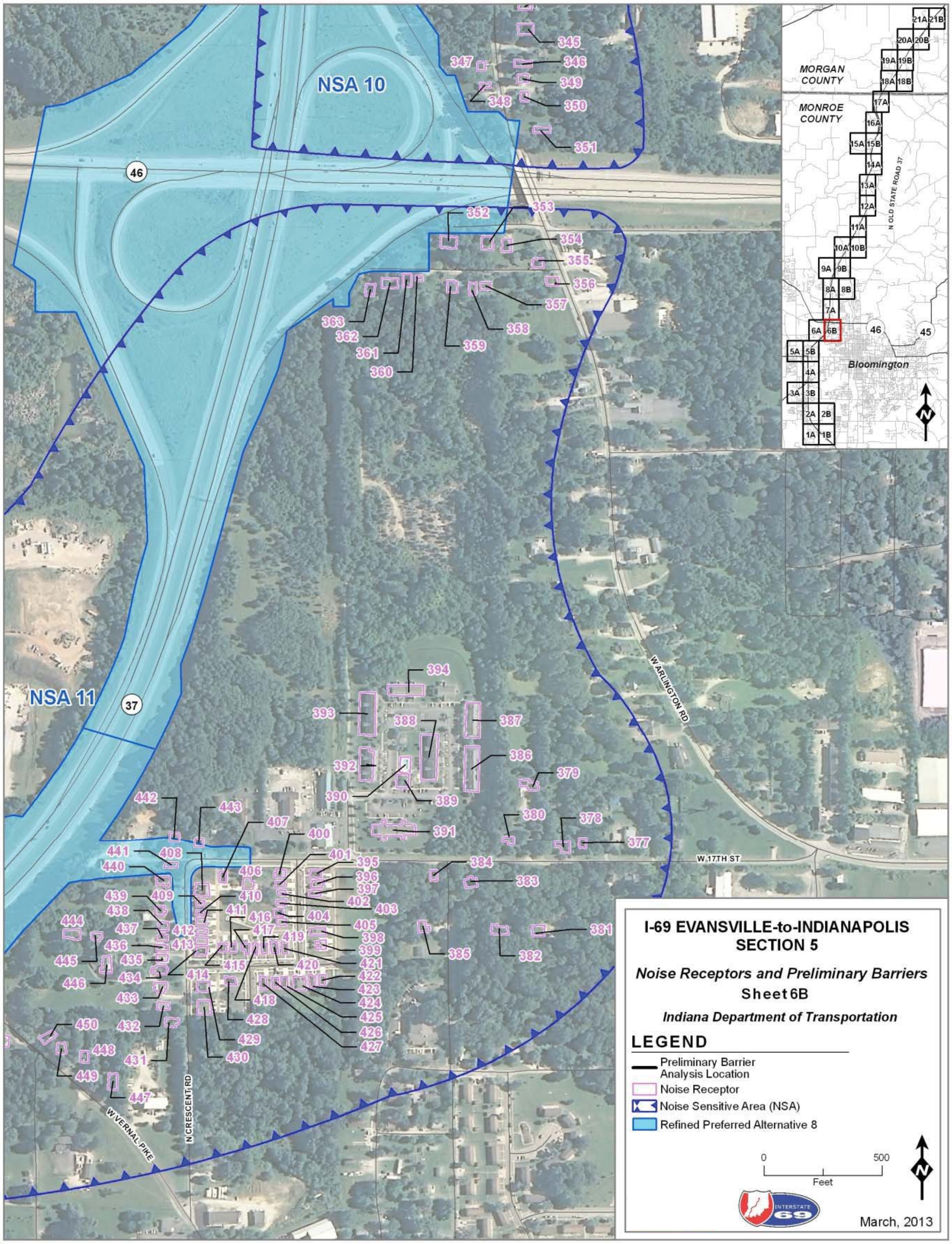

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 6B)

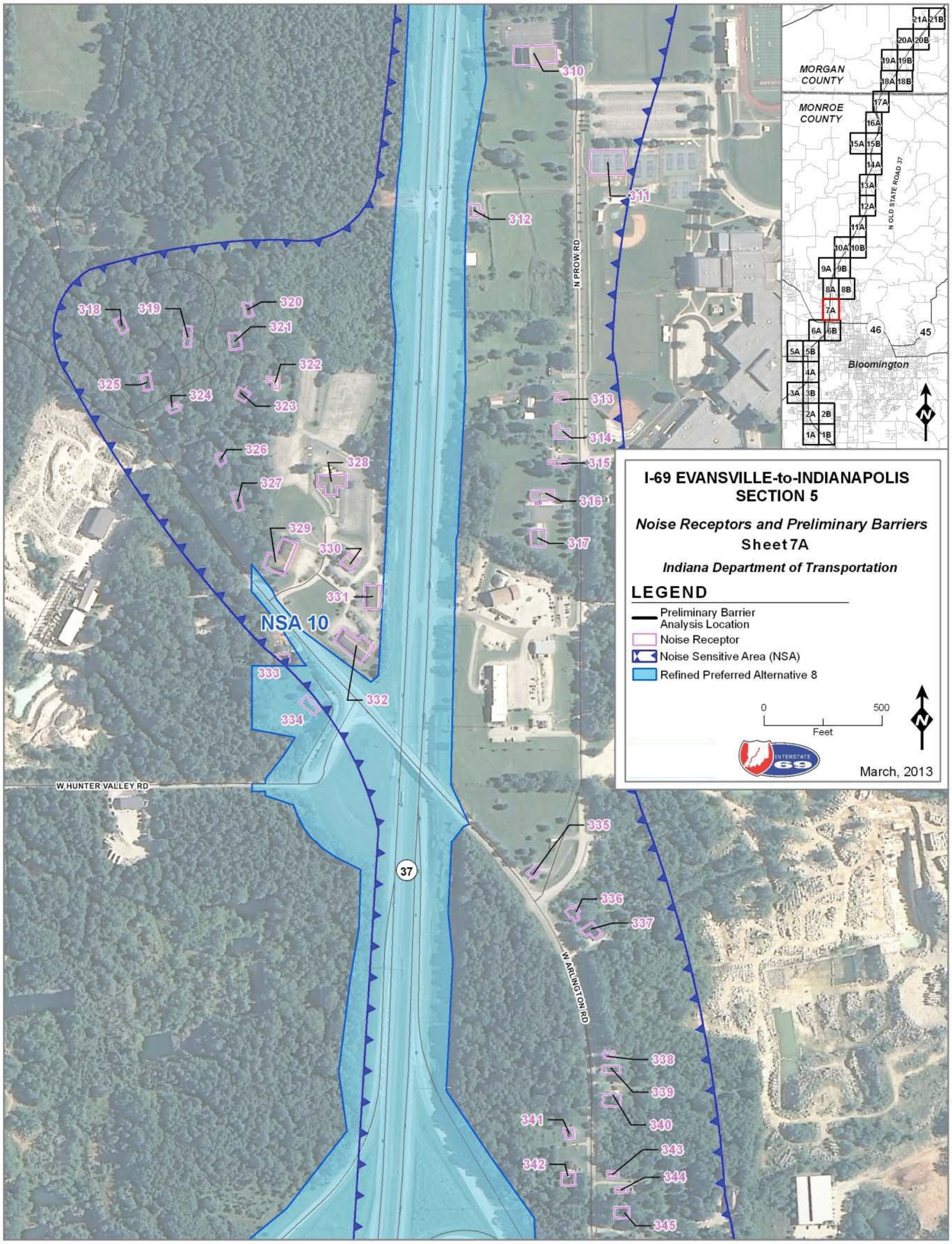

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 7A)

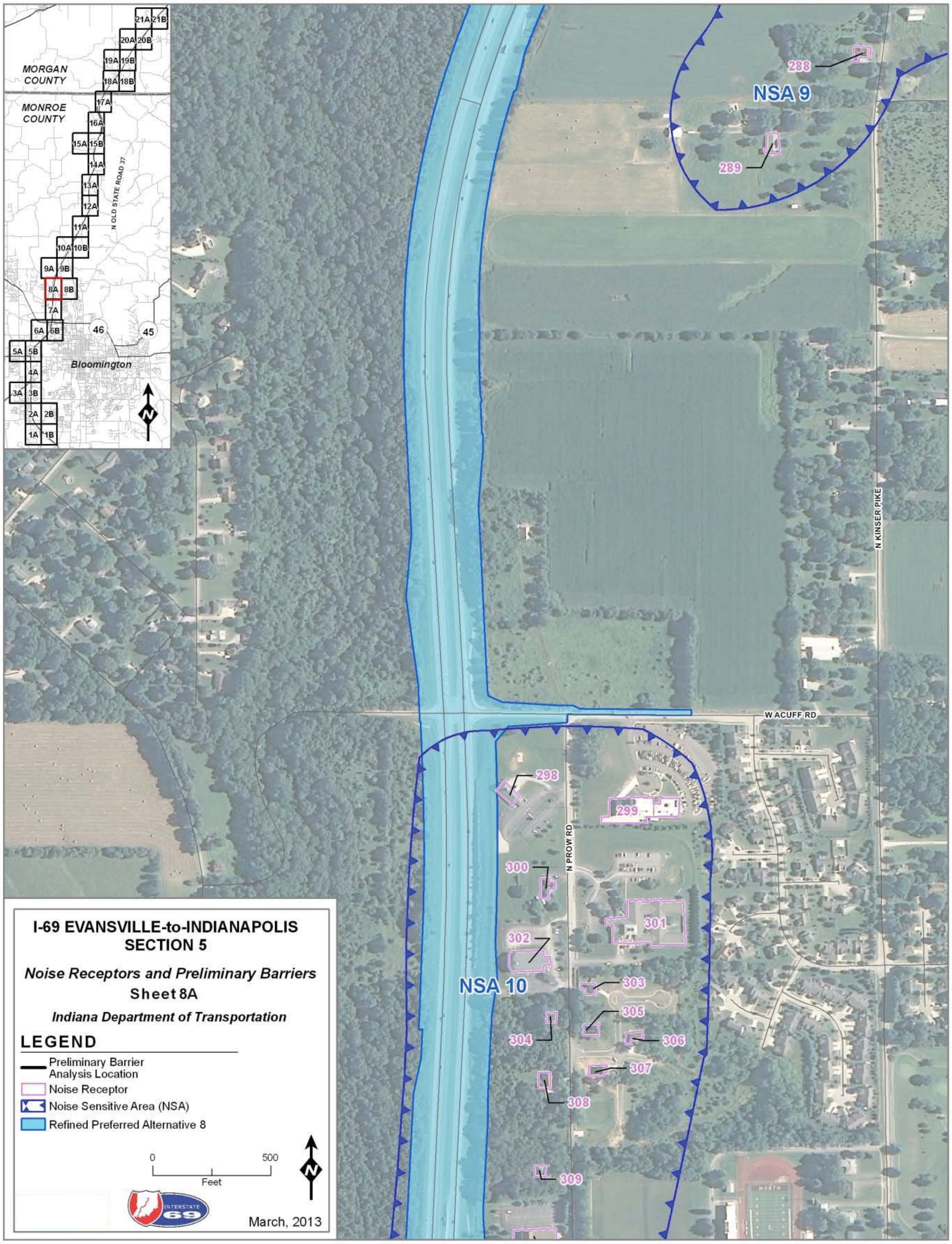

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 8A)

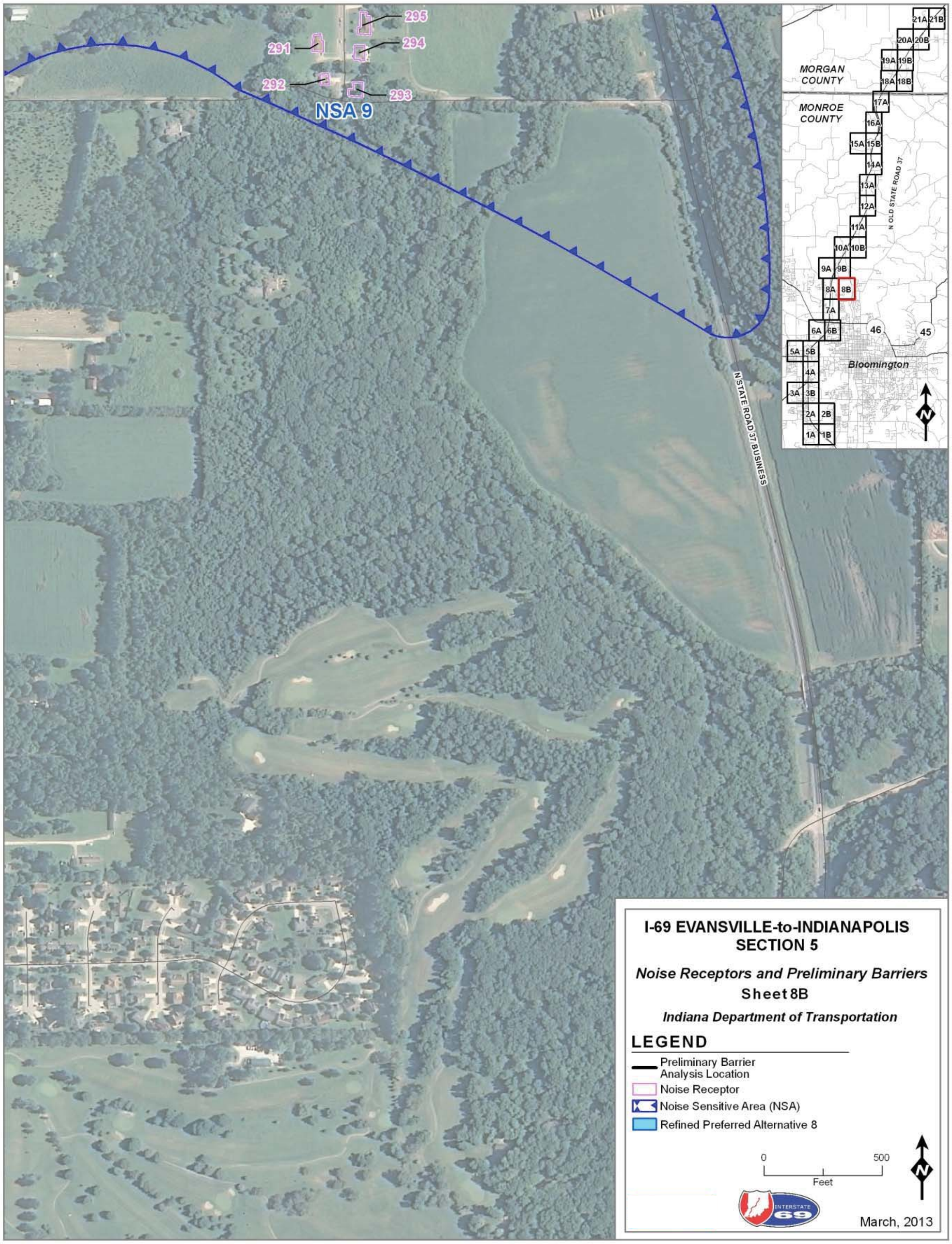

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 8B)

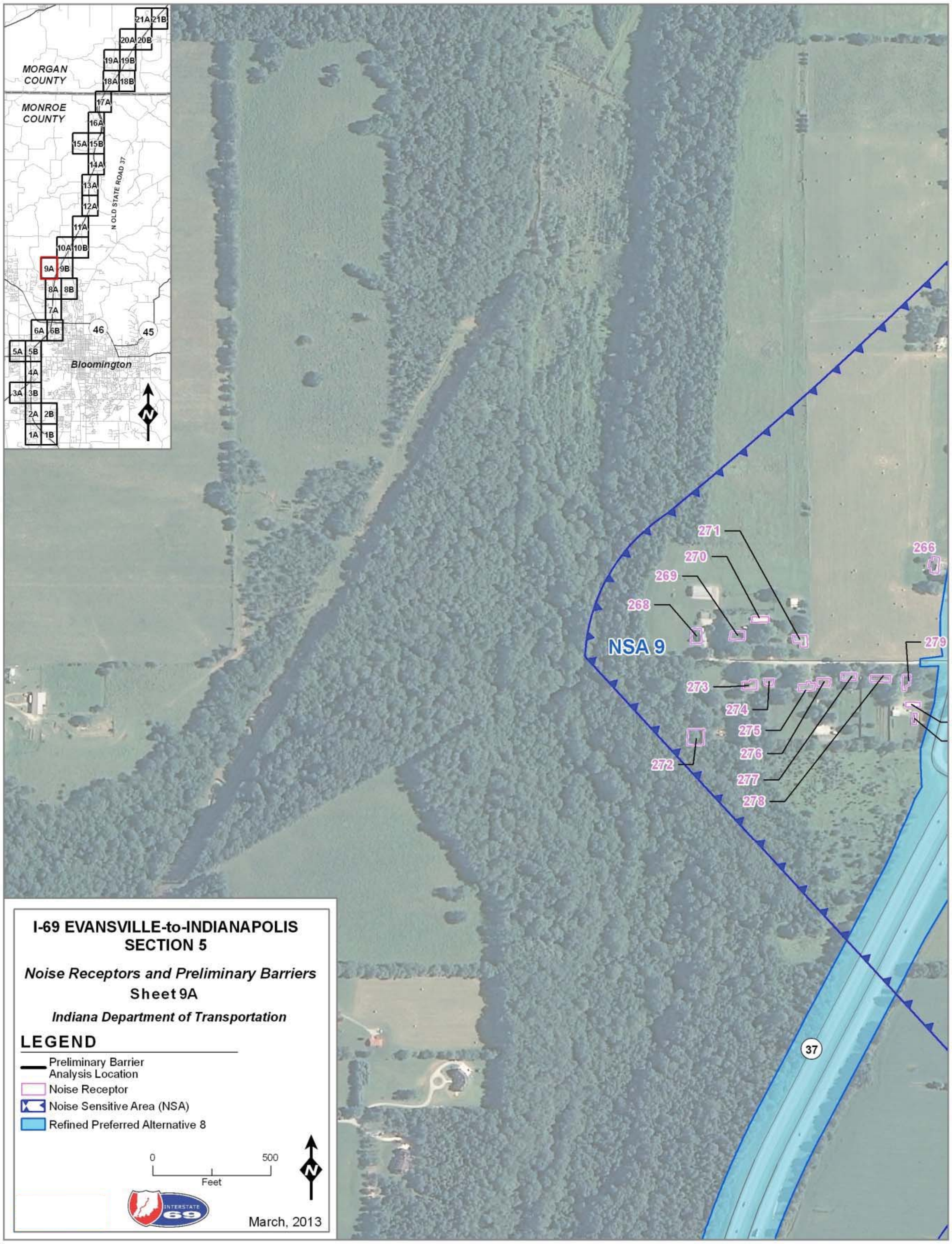

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 9A)

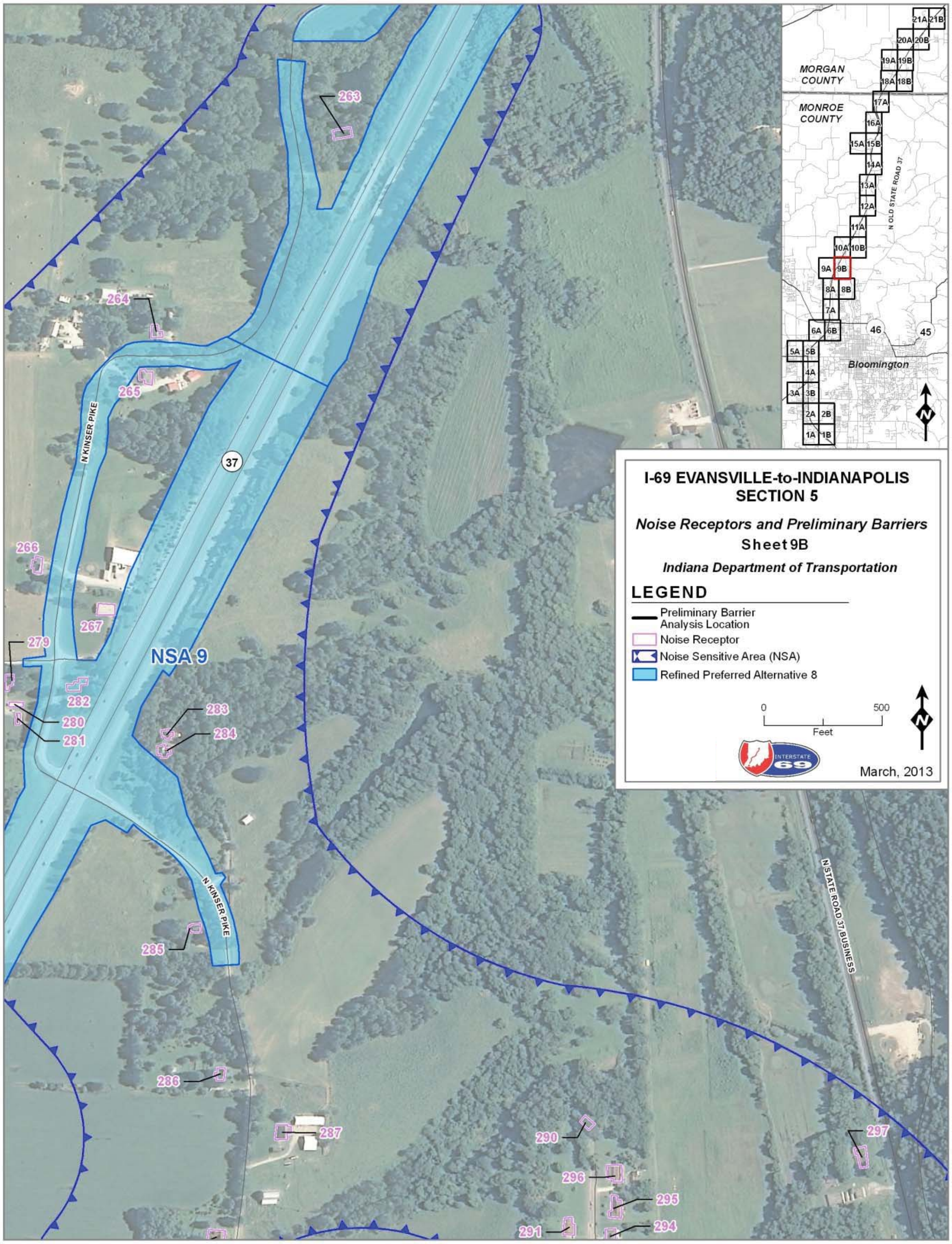

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 9B)

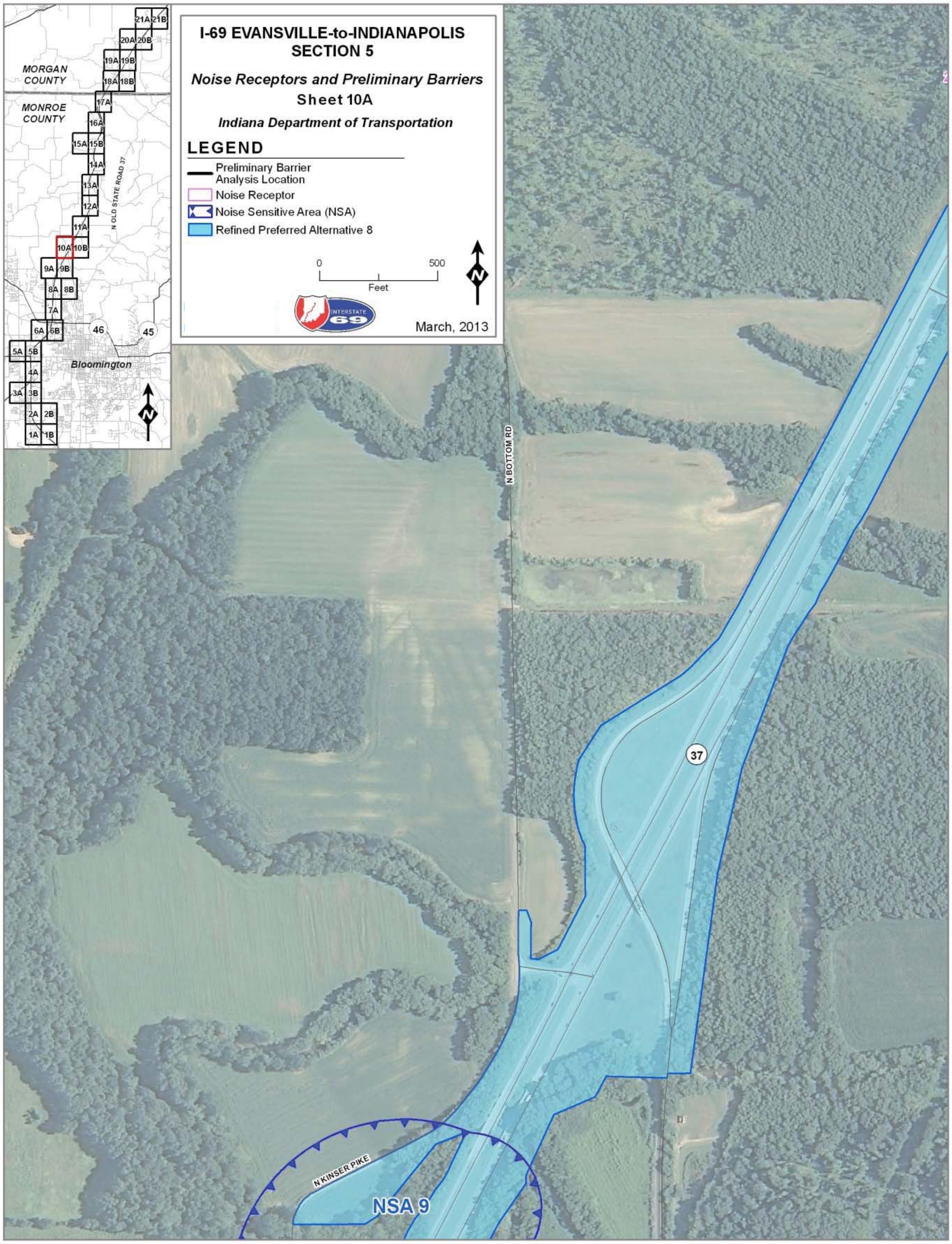

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 10A)

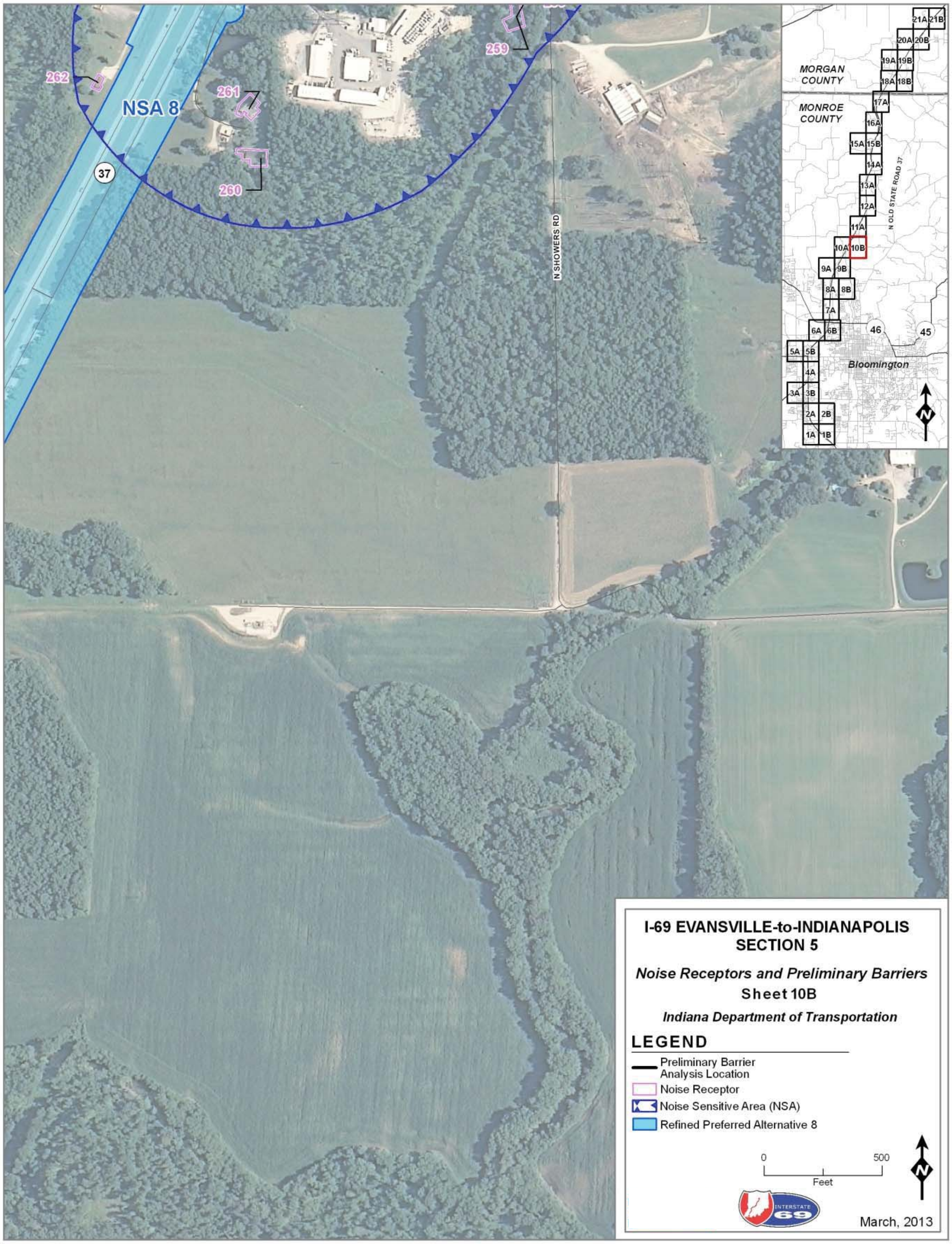

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 10B)

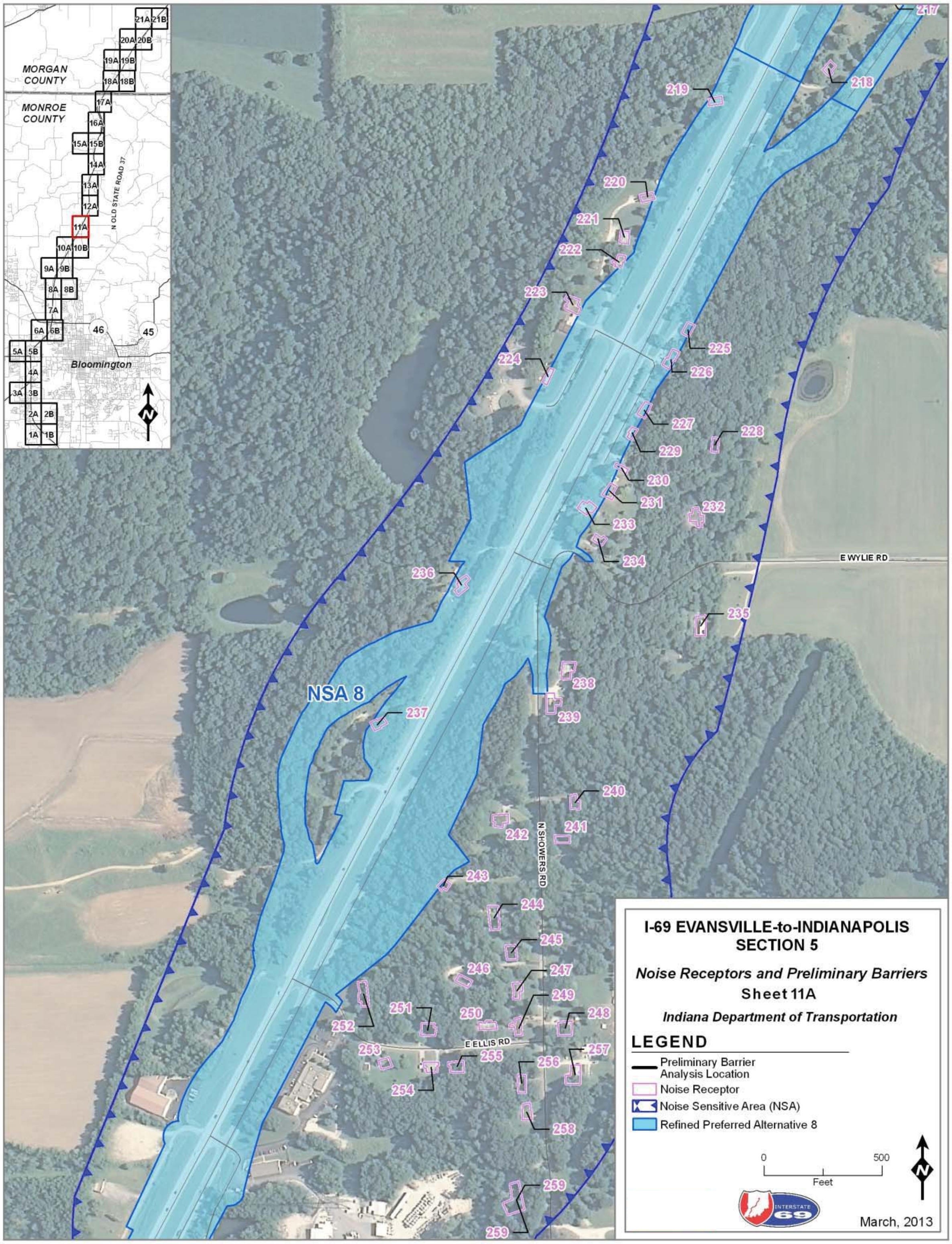

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 11A)

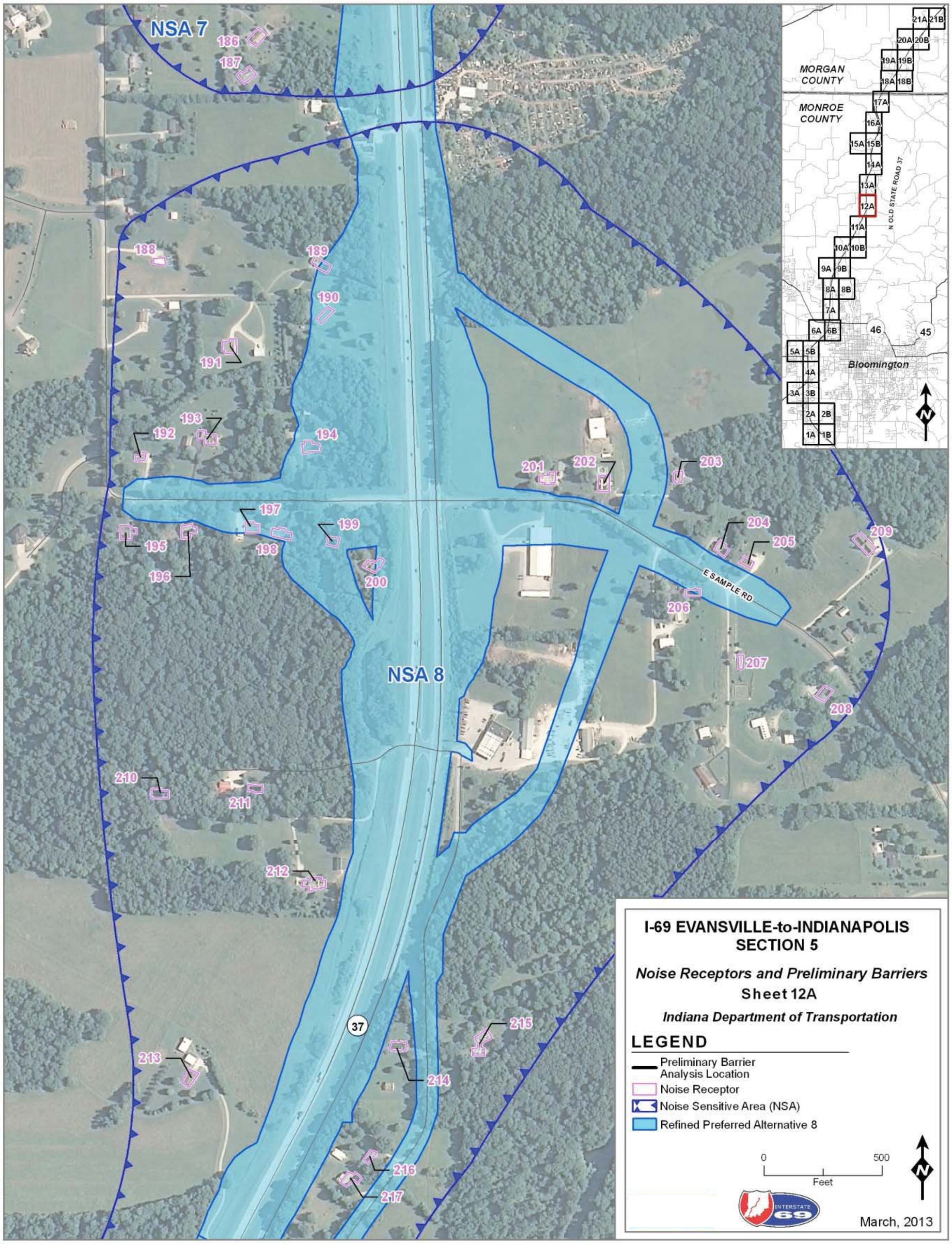

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 12A)

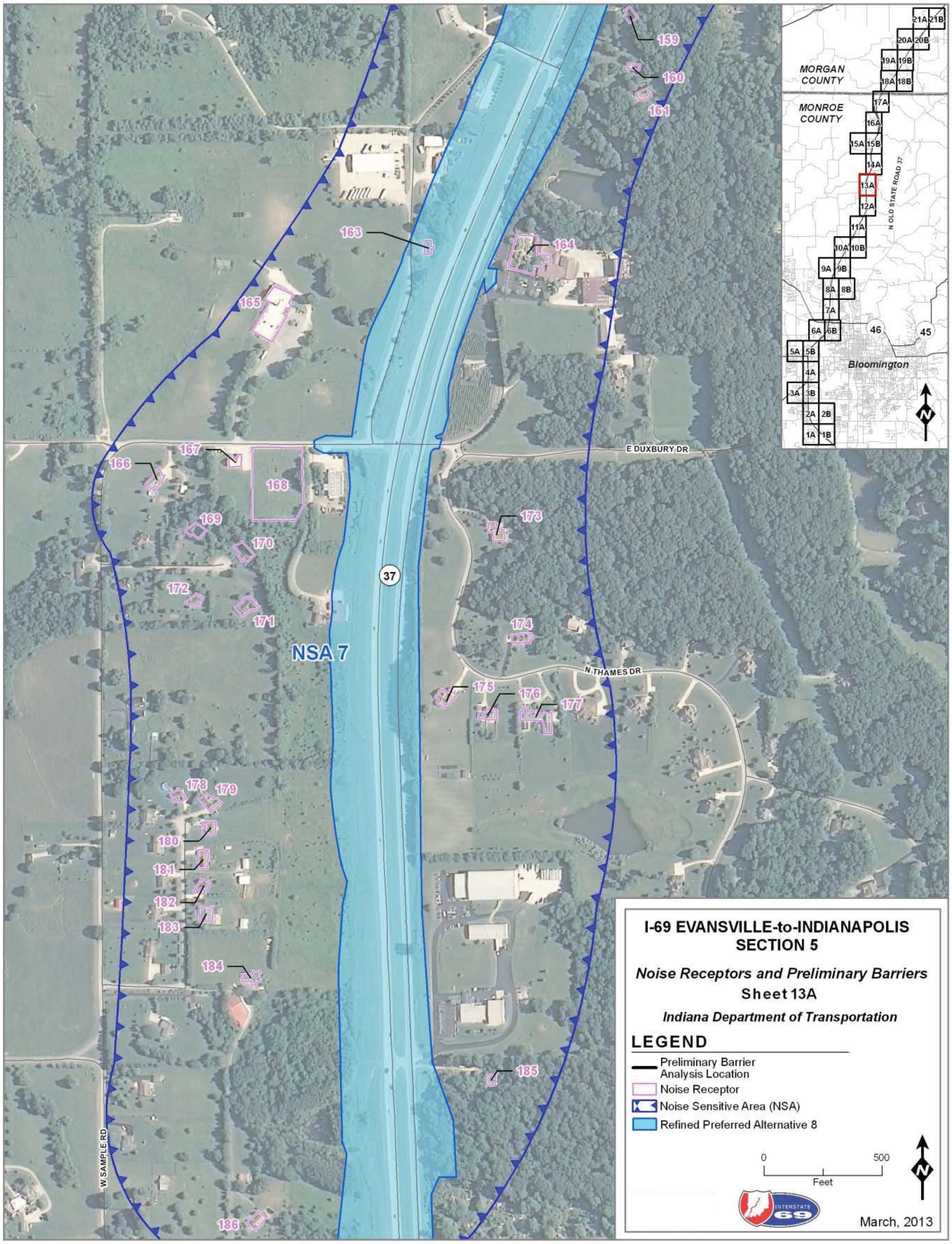

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 13A)

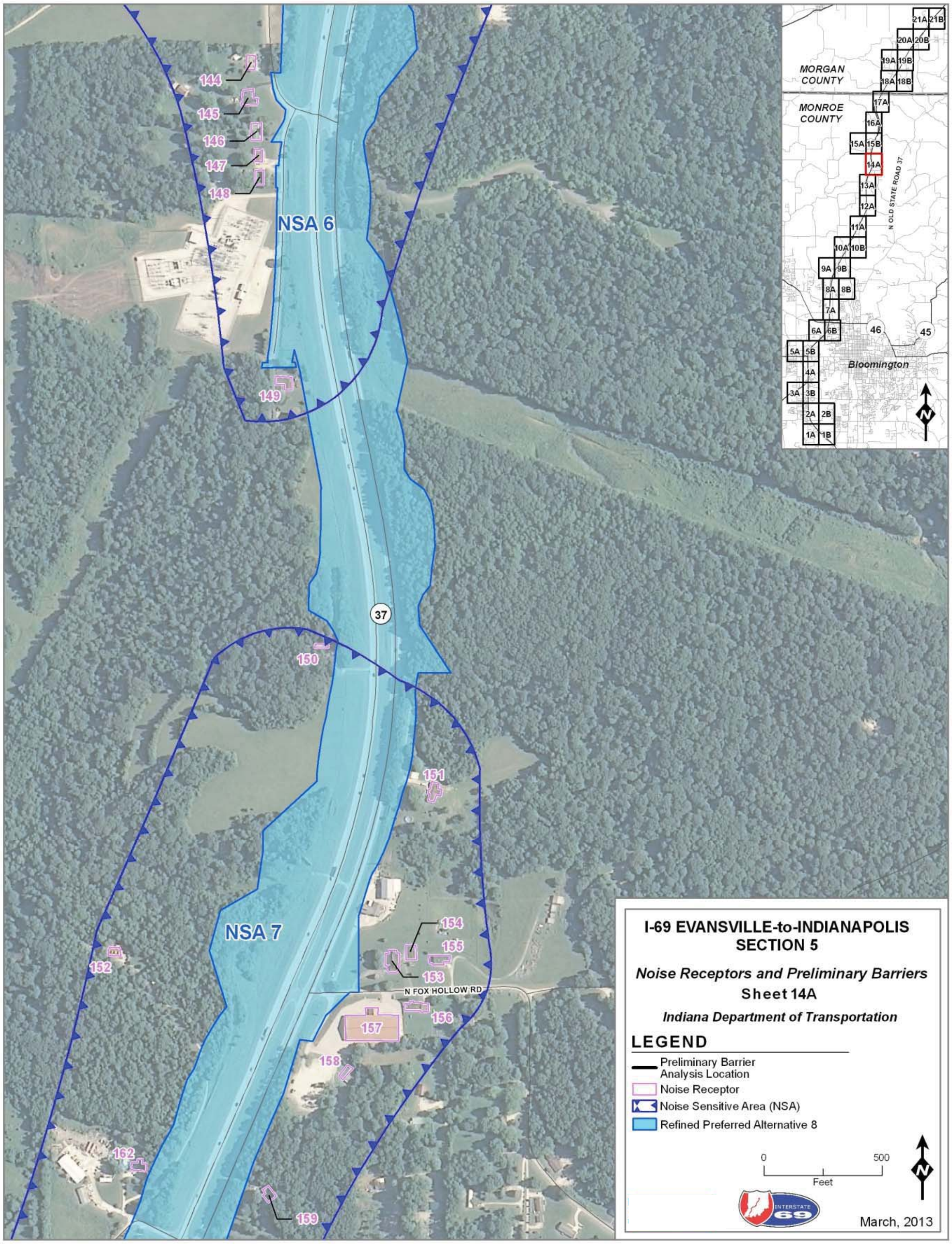

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 14A)

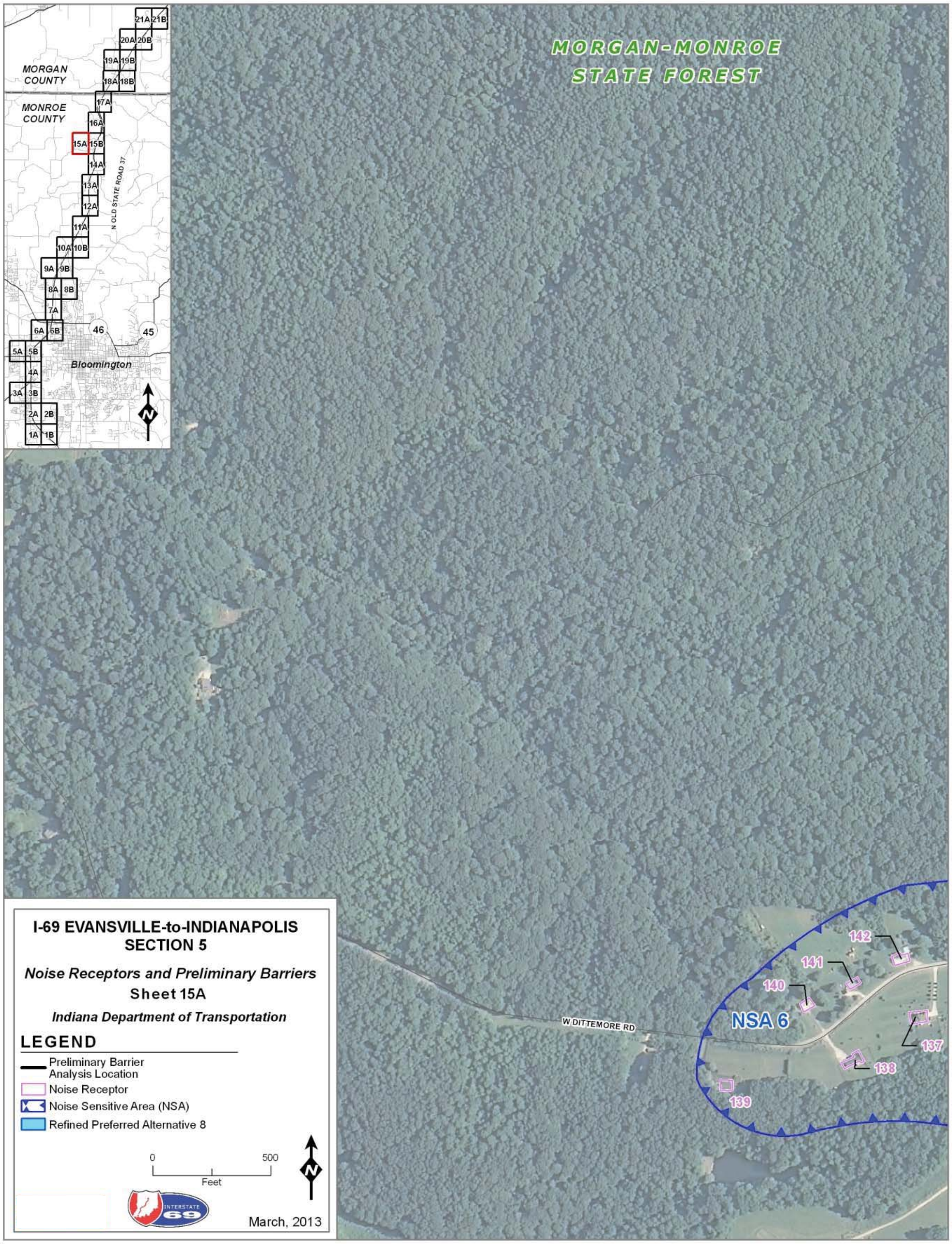

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 15A)

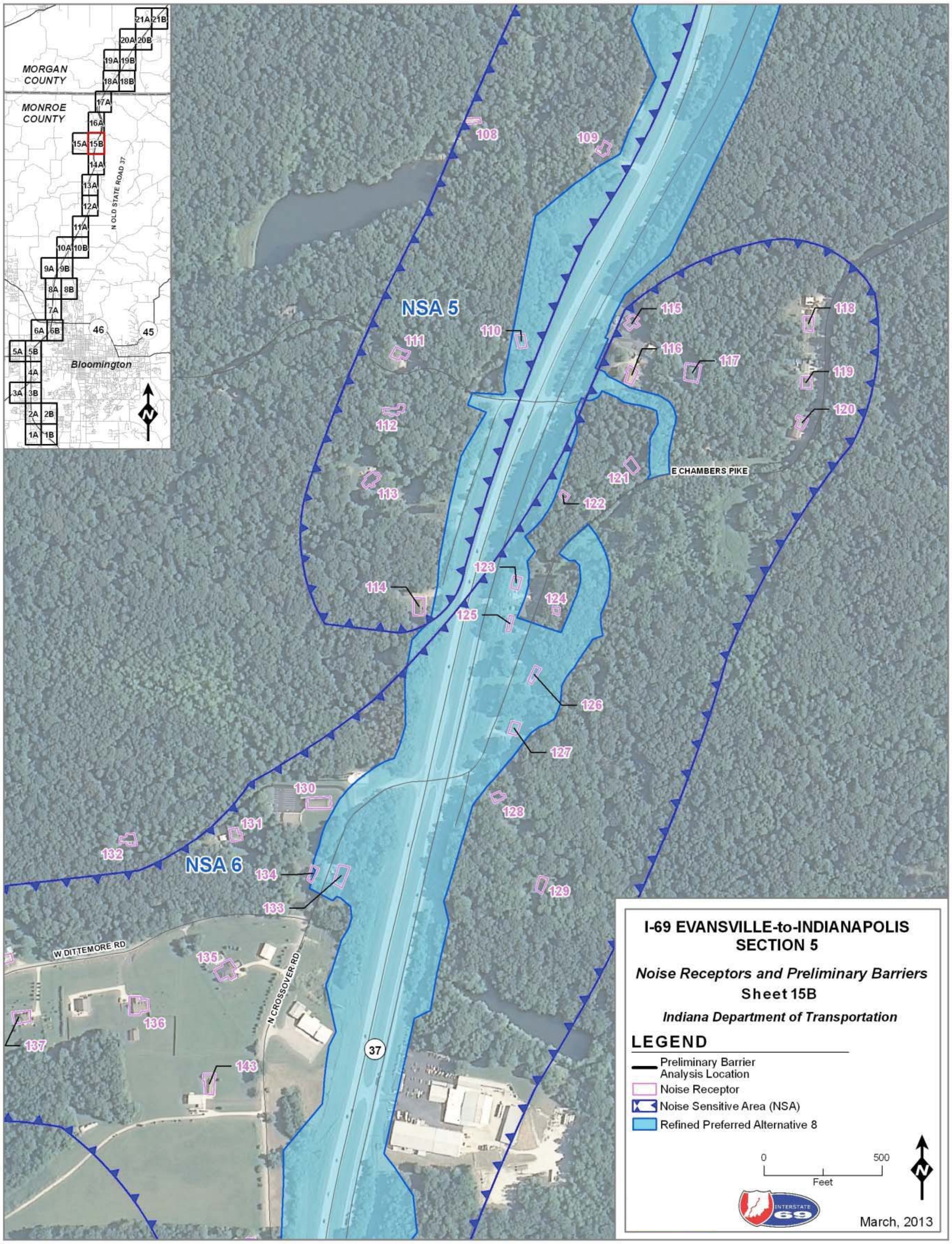

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 15B)

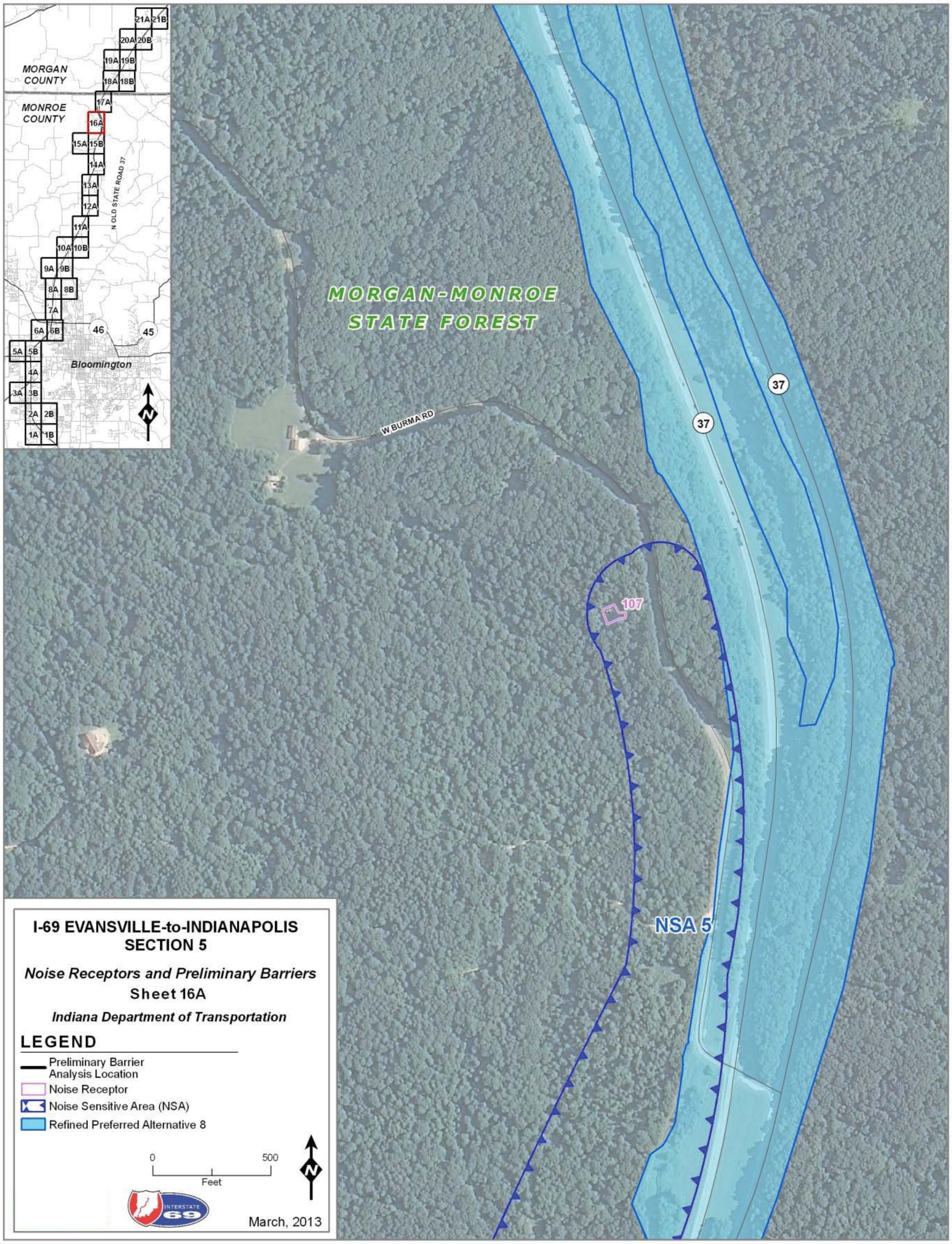

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 16A)

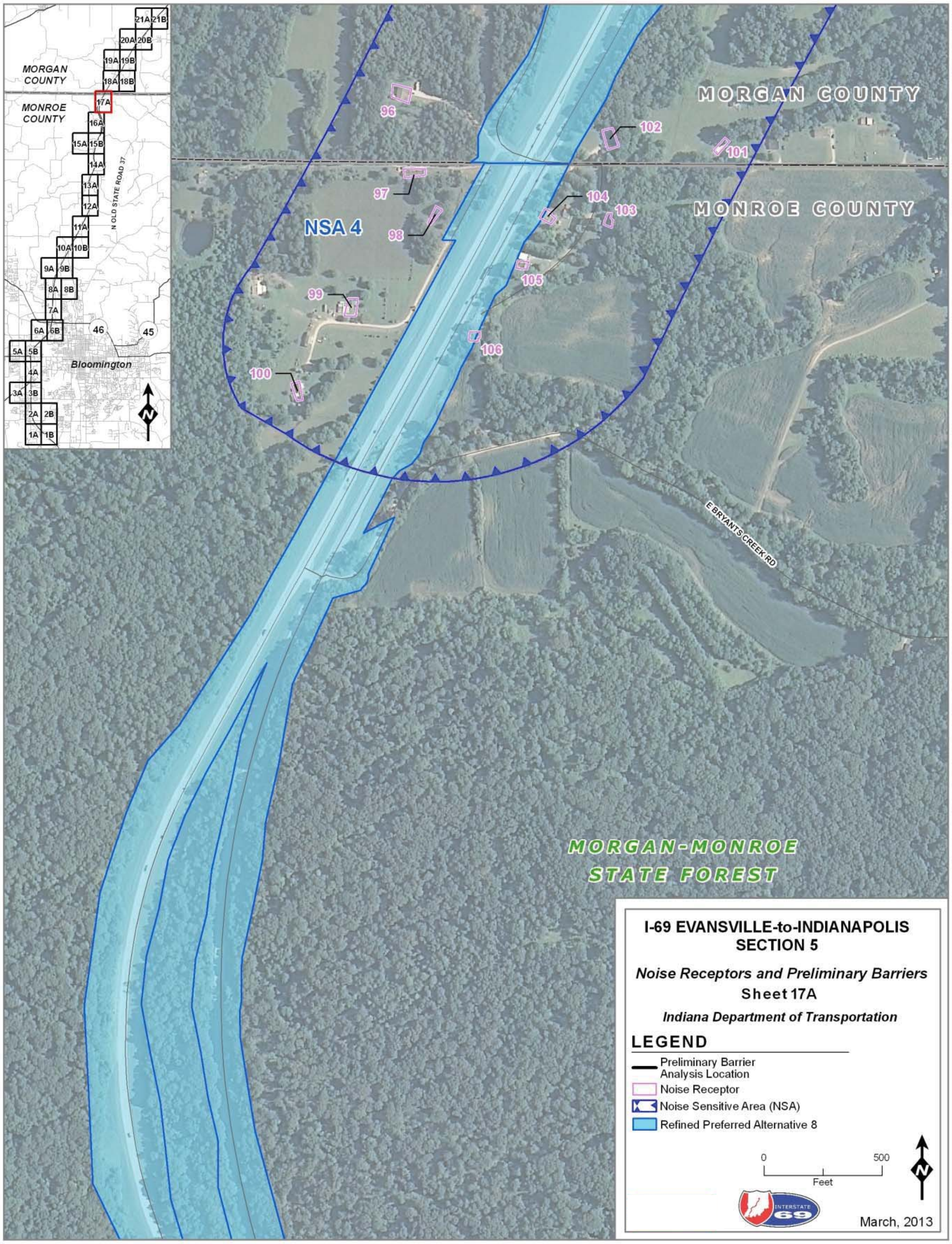

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 17A)

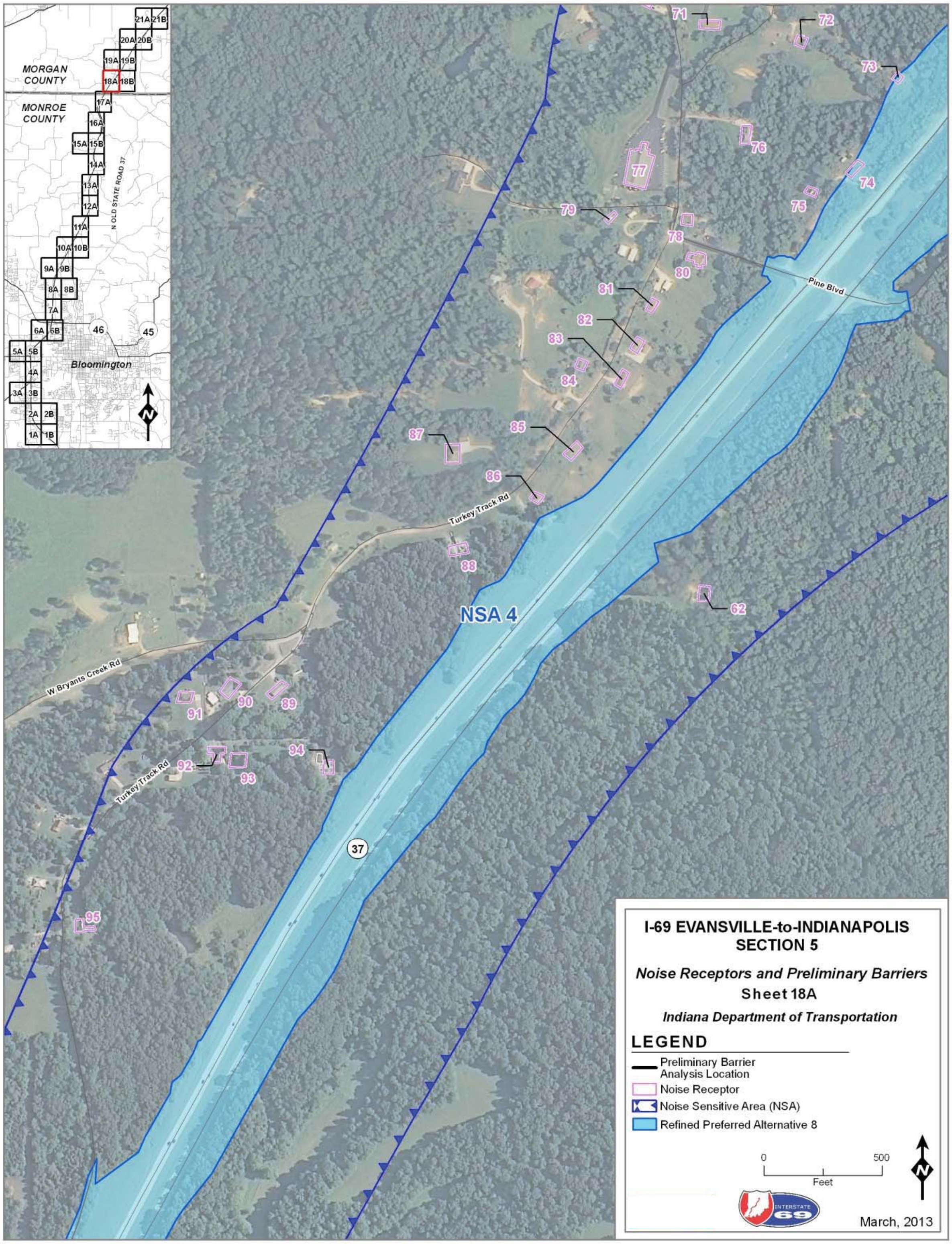

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 18A)

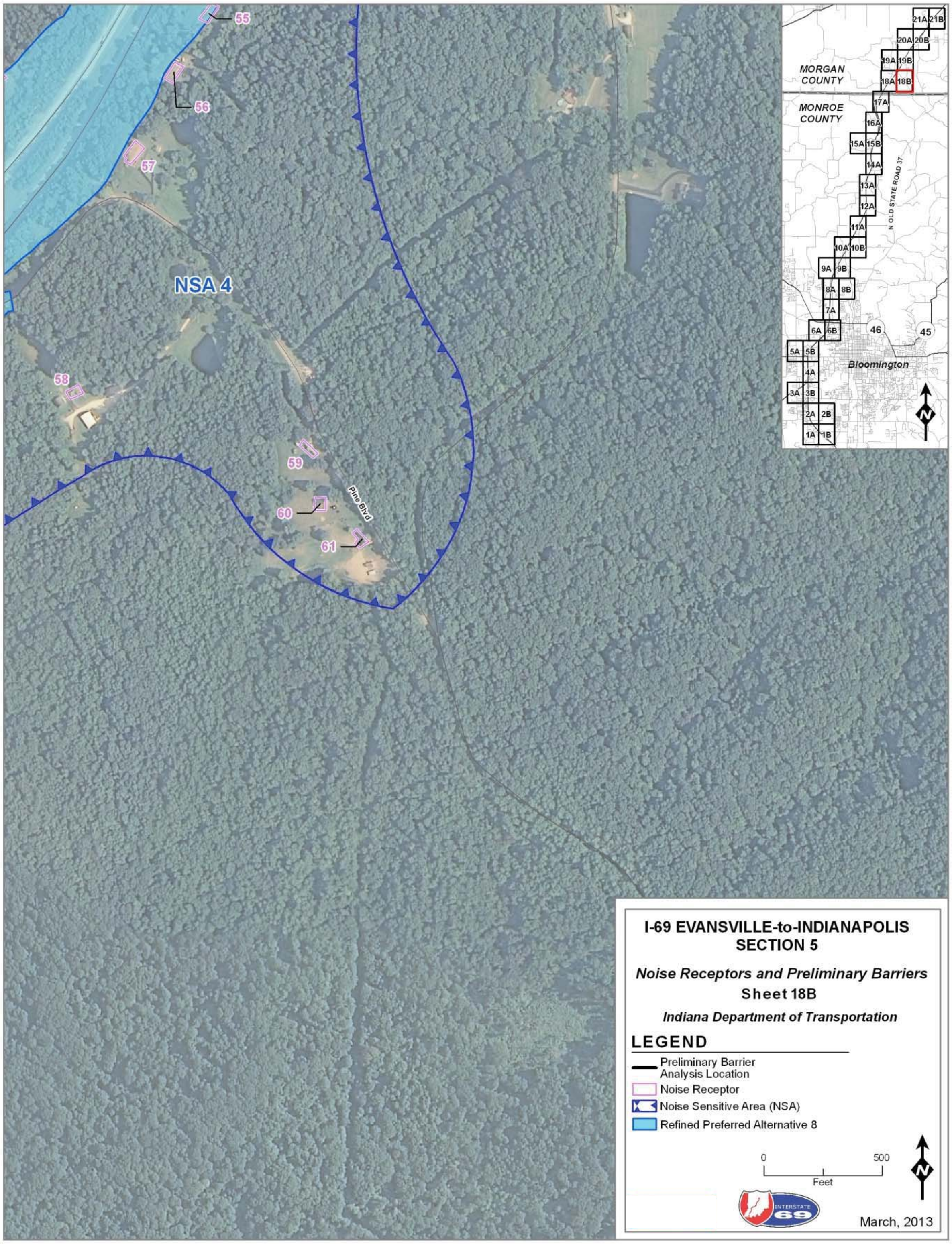

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 18B)

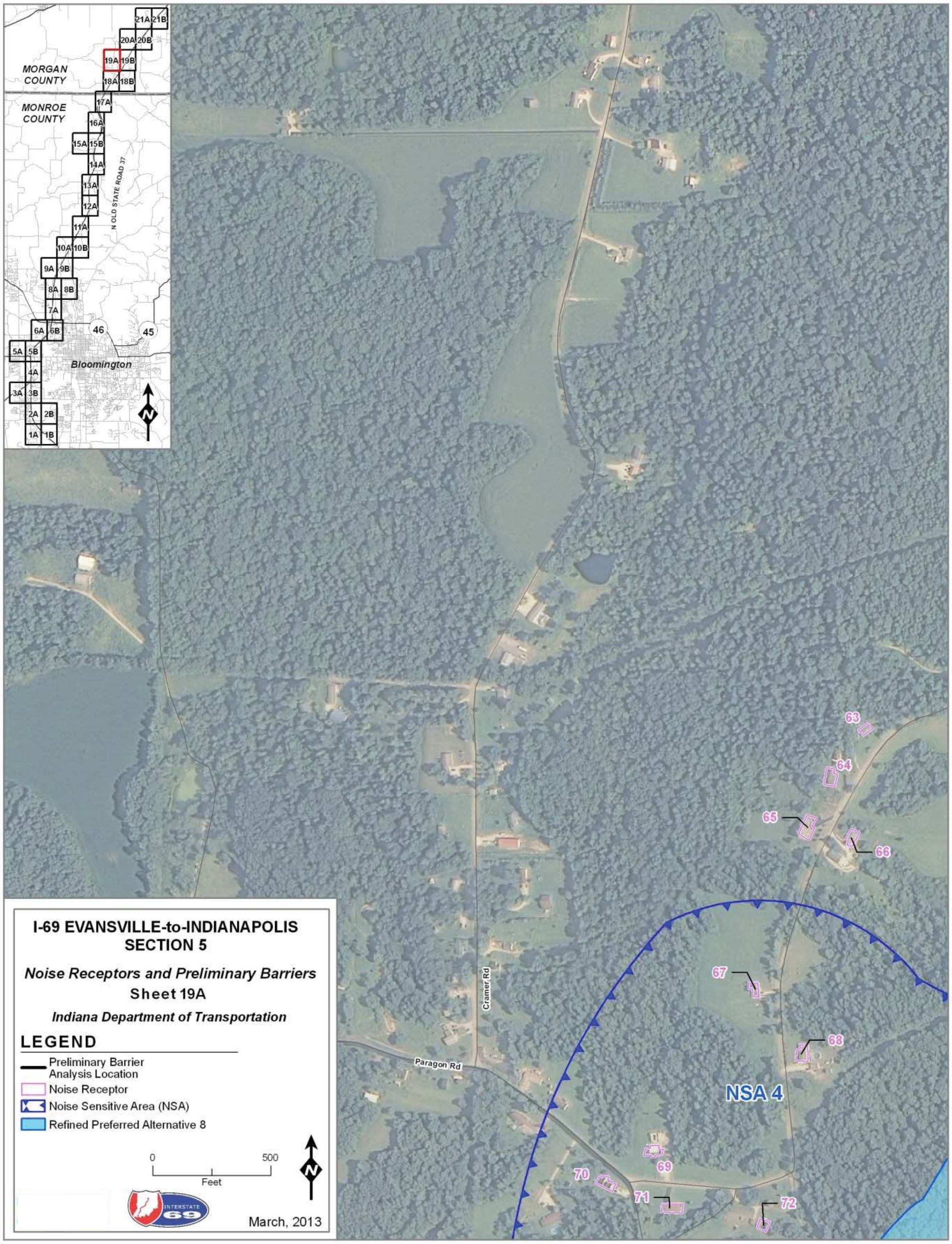

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 19A)

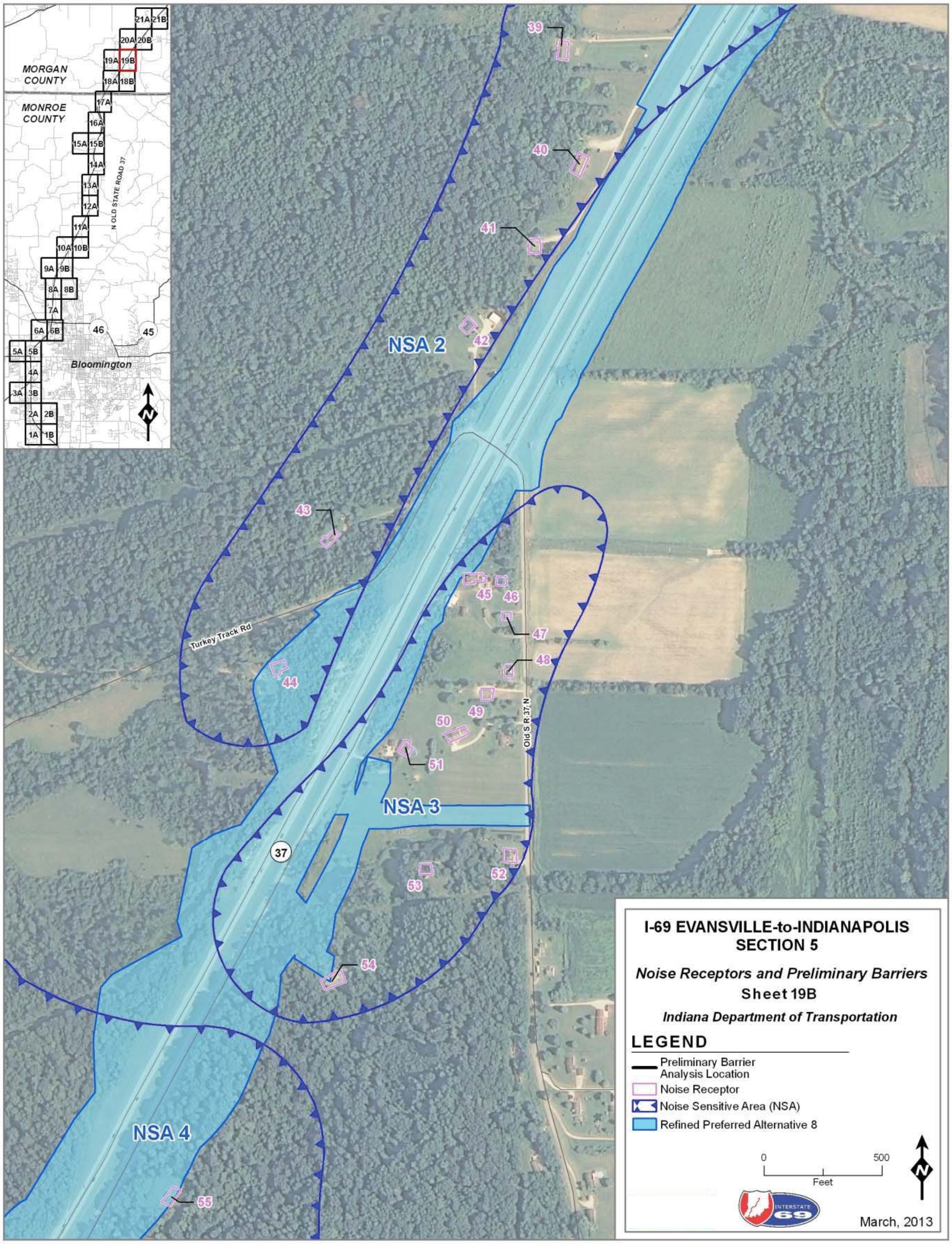

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 19B)

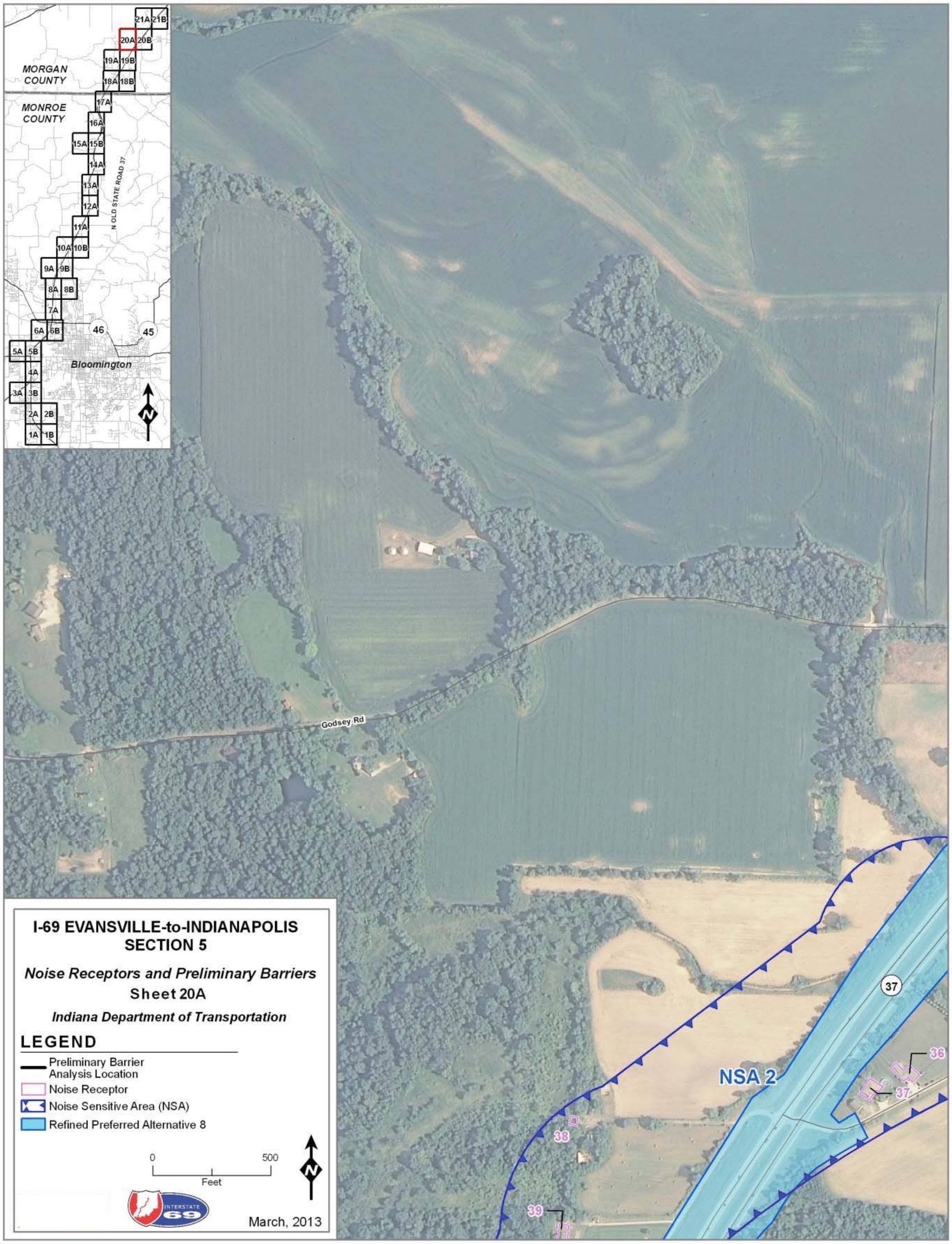

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 20A)

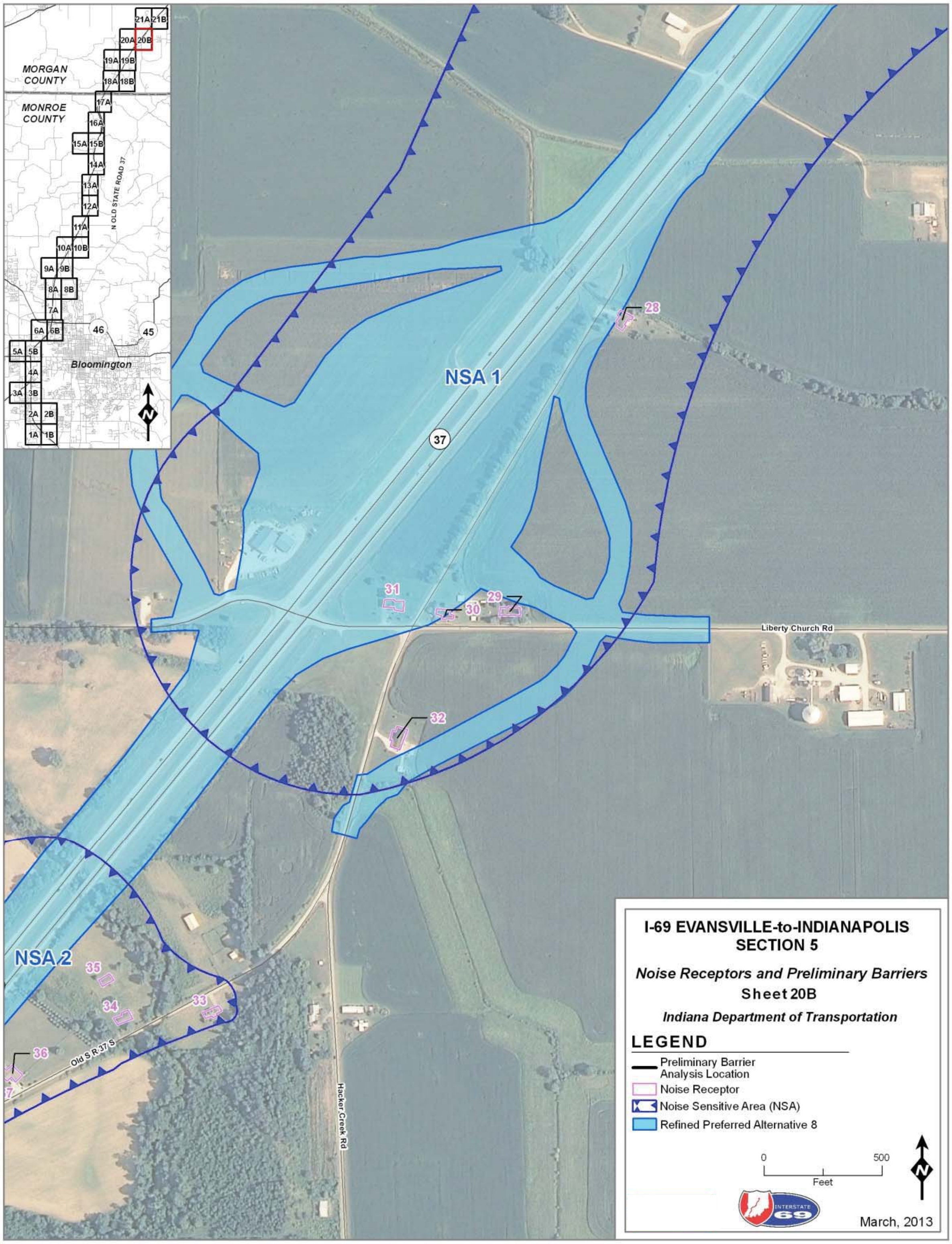

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 20B)

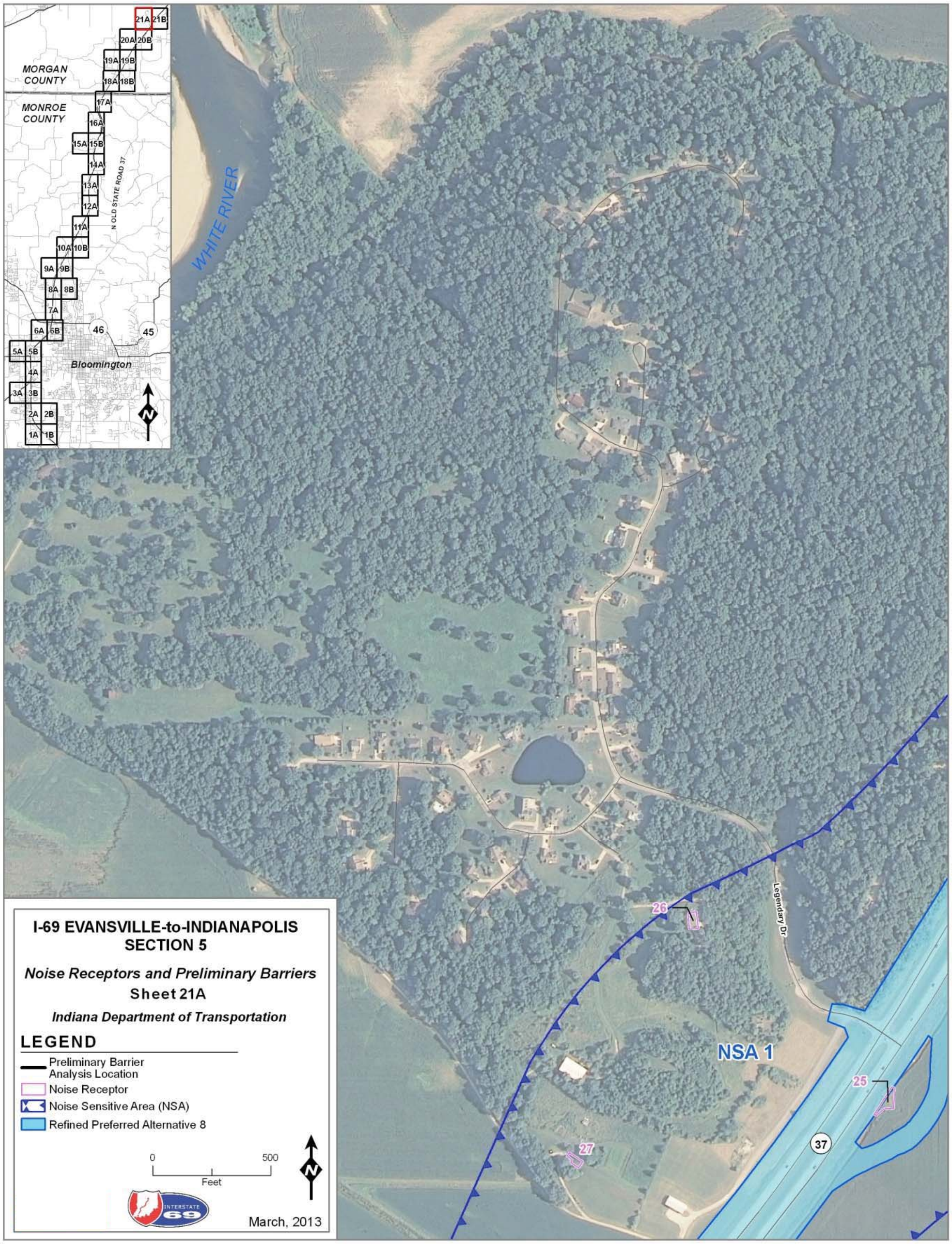

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 21A)

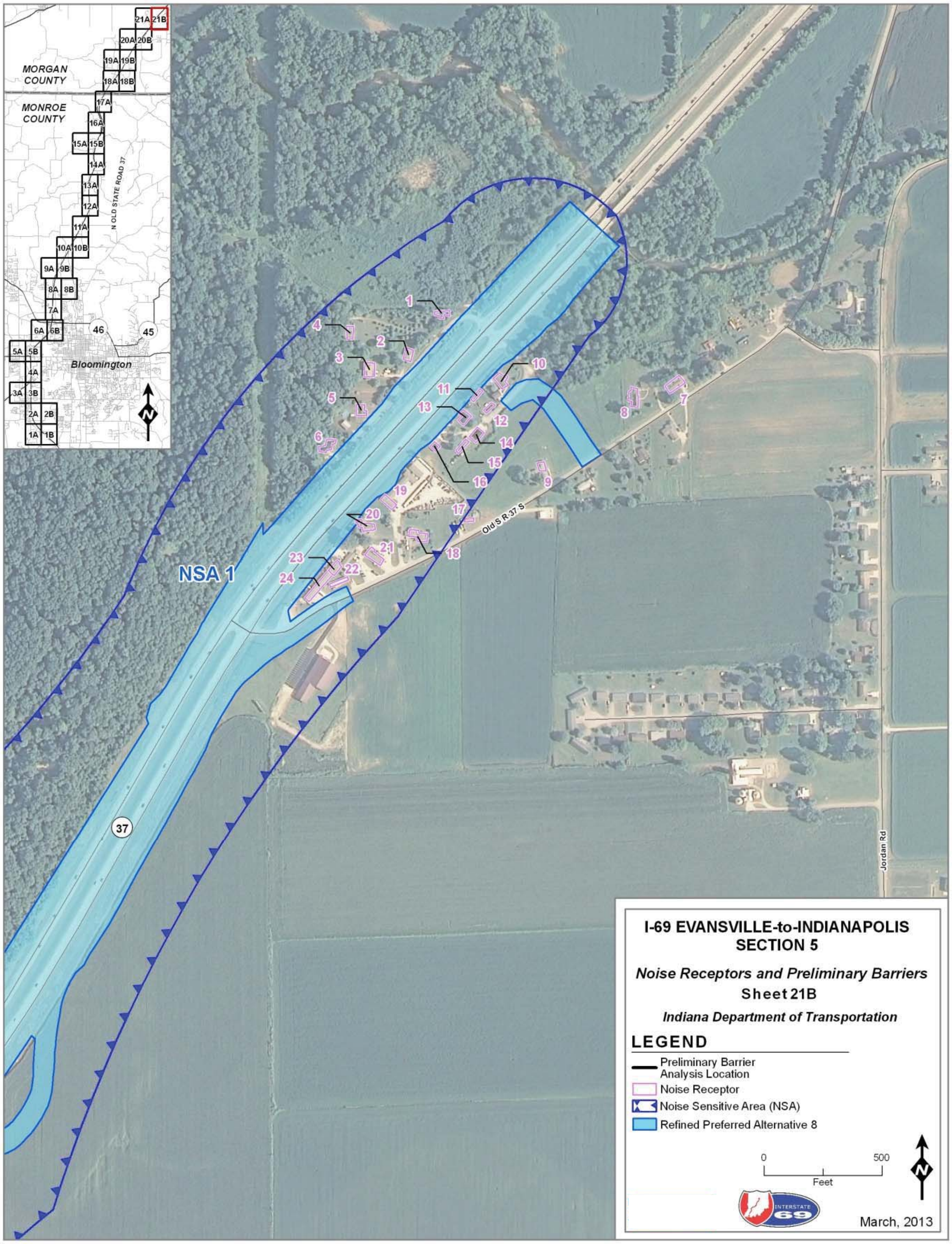

Figure 5.10-3: Noise Receptors & Preliminary Barrier Locations for Refined Preferred Alternative 8 (Sheet 21B)

5.11 Wild and Scenic Rivers

No substantive changes have been made to this section since the publication of the Draft Environmental Impact Statement (DEIS).

5.11.1 Introduction

The rivers of the United States are valuable resources that provide a variety of scenic, recreational, geological, wildlife, historic, and cultural values. Many of these rivers are protected under federal and state laws. The National Wild and Scenic Rivers System (which includes the nation's premier rivers) and the Nationwide Rivers Inventory (NRI) protect rivers at the national level. The Indiana Department of Environmental Management (IDEM) and the Indiana Department of Natural Resources (IDNR) protect Indiana's rivers at the state level.

The National Wild and Scenic Rivers System was created in 1968 by the Wild and Scenic Rivers Act. The Wild and Scenic Rivers Act states that it is "the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geological, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations" (16 U.S.C. §§1271-1287). The National Wild and Scenic Rivers System list is maintained by the National Park Service (NPS).

In addition to the National Wild and Scenic Rivers System, the NPS has compiled and maintains the NRI. The NRI is a register of rivers that may be eligible for inclusion in the National Wild and Scenic Rivers System. The intent of the NRI is to provide information to assist in making balanced decisions regarding use of the nation's river resources.

Rivers and streams considered to have special importance and that merit special protection by the State of Indiana must also be taken into consideration. These rivers are listed in either the IDEM Waters Designated for Special Protection or the IDNR Natural and Scenic River Segments.

5.11.2 Methodology

The National Park Service National Wild and Scenic Rivers System internet website was reviewed to determine if National Wild and Scenic Rivers are present within the Section 5 Study Area.

The Geographic Information System (GIS) data layer, "Designated Rivers in Southwestern Indiana," was used to determine if proposed alternatives would cross rivers listed on the Nationwide Rivers Inventory, the IDEM Waters Designated for Special Protection, and/or the IDNR Natural and Scenic River Segments.

5.11.3 Analysis

There are no rivers listed in the National Wild and Scenic Rivers System in the Section 5 Study Area. Therefore, this project will not adversely affect these resources. The West Fork of the White River is listed on the NRI and is located more than 1,700 feet west of the Section 5 Study Area, and therefore would not be crossed as part of this project. There are no rivers listed on the IDEM Waters Designated for Special Protection or the IDNR Natural and Scenic River Segments within this Study Area.

5.11.4 Mitigation

No Wild and Scenic Rivers are present in the proposed Study Area; therefore, no mitigation for impacts to such resources will be required.

5.11.5 Summary

There are no National Wild and Scenic Rivers present within the Section 5 Study Area. Therefore, the proposed project will have no adverse impacts to those resources. No rivers listed on the NRI, IDEM Waters Designated for Special Protection, or IDNR Natural and Scenic River Segments are crossed by this project; therefore, the project will have no adverse impacts to those resources.

5.12 Construction Impacts

For purposes of this section, Preferred Alternative 8 that was identified in the Draft Environmental Impact Statement (DEIS) will be referred to as "Alternative 8." The Preferred Alternative for the Final Environmental Impact Statement (FEIS) will be referred to as the "Refined Preferred Alternative 8."

Since the publishing of the DEIS, the following substantive changes have been made to this section:

- The number of receptors modeled for noise in the DEIS was corrected to over 2,200 receptors instead of 1,500 in **Section 5.12.1.1**, *Noise*; and,
- Temporary pavement removal right-of-way impacts have been added to **Section 5.12.2.7**.

5.12.1 Introduction

Section 5 of I-69 entails upgrading an existing multi-lane, divided transportation facility to a full freeway design, rather than construction of a facility on new alignment. Most of the right-of-way used for the Section 5 project is already devoted to transportation use. Accordingly, the impacts to most natural resources in Section 5 will be lessened (on a per-mile basis) in comparison to Sections 1 through 4, which are being constructed on new terrain.

Construction of any of the alternatives will impact the existing environment in several ways. Maintenance of traffic impacts associated with reconstructing an existing road, as well as from detours associated with construction, may result in motorist inconveniences and damage to local roads by construction equipment. Additional construction impacts for this project may include noise generated by construction equipment, air pollution as a result of construction activities, water pollution due to soil erosion and construction activities, and impacts due to heavy blasting. Refined Preferred Alternative 8 is identified as the Section 5 Preferred Alternative.

Section 5.12.2, *Analysis*, describes the types of impacts that could occur during construction. **Section 5.12.3**, *Mitigation*, identifies mitigation measures that could be implemented to avoid and/or minimize these potential impacts. **Section 5.12.4**, *Summary*, summarizes the impacts associated with the Build Alternatives.

5.12.2 Analysis

5.12.2.1 Noise

Construction equipment used to build a highway may generate noise and vibrations temporarily affecting sensitive receivers. The presence of a potentially affected noise receiver within close proximity of project construction limits could result in construction noise impacts. Generally speaking, the potential for construction-related noise impacts is much higher where an alternative would pass through an urban or suburban area and where an alternative would pass near existing development, than one going through an undeveloped area. The high number of noise receptors in close proximity to the construction activity in these areas increases the potential for noise impacts.

The Section 5 corridor generally consists of developed residential and commercial land in the southern areas of the project and open-space undeveloped and agricultural land with sparse development in the northern areas. There are more than 2,200 receptors analyzed for highway noise impacts in the Section 5 project corridor. Construction noise abatement measures may be required in areas where residences or other sensitive noise receivers are subjected to excessive noise from highway. Consideration will be given to providing reasonable and feasible noise abatement early in the construction phase to mitigate construction noise. Construction noise abatement measures that could be implemented during construction include regulating construction time and hours worked near noise sensitive receptors, using noise-controlled construction equipment, limiting construction vehicles during evening and weekend hours, and locating equipment storage areas away from noise sensitive areas.

5.12.2.2 Air Pollution

The main component of air pollution derived from construction activities is fugitive dust. Fugitive dust is the generation of sufficient particulate matter that some portion of the material escapes beyond the right-of-way or construction boundary. Fugitive dust emissions can be created by many construction related activities. Reasonable precautions are typically sufficient to control fugitive dust emissions during construction. Best management practices as outlined in the Indiana Department of Transportation (INDOT) *Standard Specifications*[1] for roadway construction will be followed to minimize air quality impacts from fugitive dust.

Fine particulate matter ($PM_{2.5}$) is a product of combustion. During construction activities, equipment engines, increased vehicle emissions due to traffic delays, and burning cleared vegetation are the major sources of $PM_{2.5}$. Air quality impacts may be reduced by scheduling construction activities to minimize traffic delays. Impacts will also be reduced by adhering to state and local air pollution control laws and regulations regarding open burning.

5.12.2.3 Groundwater and Karst

Within 1,000 feet of the right-of-way identified for Alternatives 4, 5, 6, 7, 8 and Refined Preferred Alternative 8 the number of Indiana Department of Natural Resources (IDNR)-listed groundwater wells ranges from 69 to 86. Construction activities could impact and/or be adjacent to these wells. Recorded wells within the corridor are at least 50 feet deep and it is not anticipated that temporary surface disturbance from construction activities would impact any wells outside of the right-of-way. Any wells encountered within the right-of-way will be

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[1] INDOT, "Department of Transportation Standard Specifications 2012," http://www.in.gov/indot/files/2012Master.pdf.(Last accessed 4/5/13).

properly capped to prevent contamination of the groundwater. Grassy swales to facilitate infiltration and associated recharge of groundwater supplies, and construction methods to reduce erosion, sedimentation, and turbidity that road construction could temporarily cause would be among the measures employed to protect groundwater resources. Stormwater best management practices (BMPs) will be used during construction of this project to reduce groundwater impacts.

Three distinct areas of karst features (Bloomington Karst, Bloomington North Karst, and Simpson Chapel Karst) are present either in the Section 5 corridor or outside the corridor, but interconnected with the corridor. These features are identified and potential impacts described in **Section 5.21**, *Karst Impacts*. Procedures to reduce the impacts to karst during construction will be implemented in accordance with INDOT's *Standard Specifications* and the *1993 Karst Memorandum of Understanding* (MOU) between INDOT, IDNR, Indiana Department of Environmental Management (IDEM), and the United States Fish and Wildlife Service (USFWS). This MOU was developed for construction of transportation projects in karst regions of the state. This includes provisions for erosion control and handling of potential fuel spills from construction equipment in karst areas. Further discussion of the Karst MOU is provided in **Section 5.21.2**, *Methodology (in Karst Resources)*; and **Section 7.3.17**, *Karst (in Mitigation and Commitments)*; see **Appendix Y**, *Karst Report*, for a copy of Karst MOU.

5.12.2.4 Erosion Control

There are a total of 465 stream segments, including existing culverts, identified within the Section 5 that are crossed by the proposed alternatives and, thus, could be adversely affected by construction activities. Multiple stream segments (indicating a change in habitat) can make up one stream reach. These streams are identified and potential impacts described in **Section 5.19.2**, *Surface Waters*. Procedures to reduce the impact of erosion and runoff into streams—stormwater BMPs, including temporary sediment basins and silt fencing—will be implemented and enforced. **Figure 5.12-1** illustrates a typical sediment basin, which is used to detain sediment-laden runoff from areas disturbed during construction.

Figure 5.12-1: Typical Sediment Basin

5.12.2.5 Heavy Blasting

It is anticipated that heavy blasting may be used for portions of the construction of the highway in Section 5. Blasting within areas where dimensional limestone (or limestone in block form) is being quarried will be completed following specifications developed in consultation with limestone industry representatives as well as the Indiana Geological Survey and other geologic experts. In addition, blasting within the Indiana bat Winter Action Area (WAA) will be completed following guidelines developed in coordination with USFWS. No blasting will be conducted during the period from September 15 through April 15 within 0.5-mile of any identified Indiana bat hibernaculum. Blasting in all other areas will be performed in accordance with the *INDOT Standard Specification 203.15*, entitled "Excavating Rock".

5.12.2.6 Damage to Local Roads

Local public roads could be damaged by the movement of heavy construction equipment to and from the construction site. INDOT's *Standard Specifications* will be followed, including Section 105.12, which states: "legal load restrictions shall be complied with on public roads beyond the limits of the project. A special permit will not relieve the Contractor of liability for damage which may result from the moving of equipment. The operation of equipment of such weight or so loaded as to cause damage to structures or the roadway or to any other type of construction will not be permitted…The Contractor shall be responsible for all damage done by the Contractor, its employees, agents, or subcontractors."

5.12.2.7 Temporary Pavement Removal Right-of-Way

Throughout the Section 5 corridor, there will be some areas where existing pavement will need to be removed. These include areas of roadway that once connected to existing SR 37 that now serve no purpose because the access is closed, such as short sections of That Road, Whitehall Crossing, Vernal Pike, Kinser Pike, Legendary Drive, and Old SR 37. There will also be pavement removal along Rockport Road and Lee Paul Road due to minor relocation of these local roads. Judd Avenue at Fullerton Pike, two areas along Yonkers Court south of Tapp Road, and Hickory Heights Trailer Park Road just north of Tapp Road will also have small areas of pavement removed as these roads are being closed and reconnected to other roads. Pavement removal would also occur in the vicinity of the new or reconfigured interchanges, such as Liberty Church Road/Godsey Road, Sample Road, and SR 45/2nd Street.

Figure 3-13 in **Chapter 3** shows each of the areas where temporary pavement removal right-of-way easements are needed for Refined Preferred Alternative 8. In total, 3.06 acres of temporary pavement right-of-way easements would be needed. For removal of pavement in areas not on INDOT property, INDOT will acquire temporary easements from the land owner. In terms of impacts for the Refined Preferred Alternative 8, no impacts are anticipated for streams, wetlands, open waters, riparian areas, core forests, forests, the Monroe-Morgan State Forest, managed lands, historic districts, Section 4(f) properties, mines, quarries (active or abandoned), oil/gas wells (active or abandoned), or springs. The following resources shown in **Table 5.12-1** would be minimally impacted by the Refined Preferred Alternative 8.

Alternatives 6, 7, and 8 would require similar amounts of temporary right-of-way, because they are the minimal footprint alternatives and would generally affect the same existing roads. Alternatives 4 and 5 would need greater amounts of temporary right-of-way for pavement removal due to their larger footprints.

Table 5.12-1: Temporary Pavement Removal Right-of-way Impacts for Refined Preferred Alternative 8

Feature	Impact
100-year Floodplain	0.02-acre
Cave Recharge Area	0.3-acre
Sinking Streams Watershed	0.2-acre
Sinkhole Drainage	0.4-acre
Buried Sink Features	< 0.05-acre
IDNR Groundwater Listed Wells within 1,000 feet (excluding monitoring wells)	20
Sand and Gravel Resources (high potential)	0.11-acre
Potentially Marketable Limestone	1.81 acres
Potentially Marketable Limestone minus Overlying Developed Land Cover	0.01-acre
Agricultural Land	0.02-acre
Upland Habitat	0.01-acre

5.12.2.8 Borrow Sites/Waste Disposal

The locations of borrow and waste disposal sites generally are not known until the project is let for construction. In general practice, the contractor selects the sites based on free market economics (i.e., negotiations with property owners). Contractors must comply with all permitting requirements for borrow locations, and follow other applicable INDOT *Standard Specifications*. Prior to their use, these sites would be assessed for impacts to resources such as archaeological resources, wetlands, etc., and appropriate measures would be employed to avoid or minimize impacts, if any. Where impacts would warrant, the contractor, with INDOT oversight, would obtain required permits. Due to the cost of mitigation that is often required when these sites are identified and would be impacted by its use for borrow or waste disposal, contractors often elect to identify and choose other sites in a different location that would avoid the impacts. Solid waste generation resulting from construction should be short-term and confined to the vicinity of the project area. In most cases the construction contractors use existing agricultural fields near the construction sites for borrow/waste sites as they are much easier to use and have low potential to impact protected environmental resources.

5.12.2.9 Traffic Flow and Travel Patterns

Existing travel patterns will be impacted during construction of the project along existing roadways. Motorist inconveniences and safety concerns will be greatest where construction occurs along the existing State Roads (SR 45, SR 48, SR 46, and existing SR 37). There will be some detours and traffic restrictions during construction at these locations. Every opportunity will be taken, where feasible, to utilize partial-width construction to keep each of these roads open during construction. Though maintenance of traffic plans (see **Section 5.12.3**, *Mitigation*) will be prepared for the entire length of the corridor, and efforts will be made to notify the public of road closures and temporary activities that would impede traffic flow (such as reducing travel to one lane of traffic), unannounced traffic delays could occur. Such delays would entail unexpected delays to motorists and could require some motorists to seek alternate routes without prior notification. Should detours be necessary, proper signage would be in place to help motorists to navigate through the area.

5.12.2.10 Threatened and Endangered Species/Tree Clearing

Based on field studies for Section 5, the federally listed Indiana bat, and federally protected bald eagle are known to occur in the Section 5 study area. In addition, habitat is present for the following state-protected species: troglobitic crayfish, Barr's commensal cave ostracod, Indiana cave springtail, Mayfield cave beetle, hidden springtail, Packard's groundwater amphipod, Bollman's cave millipede, Barr's cave amphipod, crawfish frog, common mudpuppy, barn owl, Henslow's sparrow, northern harrier, red-shouldered hawk, evening bat, little brown bat, Eastern tricolored or pipistrelle, Eastern red bat, Northern myotis, silver-haired bat, hoary bat, bobcat, and Eastern box turtle. For further information, please refer to **Section 5.17**, *Bald Eagles, Federal and State Threatened and Endangered Species*.

Tree clearing has the highest potential to directly affect the Indiana bat during construction. This species' nocturnal habits and its preference for large trees with loose bark as summer roosts presents the potential for disturbance during day time roosting. The presence of these bats may go undetected during clearing activities, resulting in the potential for direct takes of this species. For this reason, no trees with a diameter of three or more inches will be removed between April 1 and November 15 within the WAA, and April 1 and September 30 within the Summer Action Area (SAA) to avoid any direct take of Indiana bats. Tree clearing will be allowed in the WAA from November 16 to March 31, and tree clearing will be allowed from October 1 through March 31 in the SAA. These tree clearing restrictions are requirements of the Revised Tier 1 Biological Opinion (BO); see **Appendix BB**, *Revised Tier 1 BO and Amendments*.

Construction activities will be minimized and mitigated in accordance with standard INDOT specifications for construction contracts and in accordance with the USFWS BO as identified in **Section 5.17.3**, *Mitigation*. These specifications address issues such as tree clearing restrictions to avoid the potential for direct impacts to Indiana bats, as well as the minimization of construction-related air quality and noise impacts, erosion and sediment control, and spill prevention and control.

In consultation with IDNR, tree clearing will take into account the possible presence of the emerald ash borer. This consultation will determine appropriate measures during tree clearing to address these concerns.

5.12.2.11 Wetlands

Section 5 has approximately 37.52 acres of forested wetland, 3.41 acres of shrub-scrub wetland, 10.34 acres of emergent wetland, 2.23 acres of palustrine aquatic bed, and 29.68 acres of open water for a total of 83.18 acres within the project corridor. Depending on the alternatives considered, the total impacts to wetlands and open water based upon conceptual design criteria ranges from approximately 10.70 acres to 20.24 acres. Wetland impacts, not including open water impacts, from the Refined Preferred Alternative 8 are approximately 3.43 acres. Wetland areas within the right-of-way but outside the construction limits will be identified and protected from use as borrow or waste disposal sites and construction staging areas. Wetlands adjacent to the construction limits will be protected with silt fences or other erosion control measures.

5.12.3 Mitigation

5.12.3.1 Construction Noise

Construction noise abatement measures may be required in areas where residences or other sensitive noise receptors are subjected to excessive noise from highway operations. Noise and vibration control measures will include those contained in INDOT *Standard Specifications*. In addition, consideration will be given to providing reasonable and feasible noise abatement early in the construction phase to mitigate construction noise. Noise and vibrations impacts originate from heavy equipment movement and construction activities such as pile driving and vibratory compaction of embankments. Abatement of construction noise impacts could be controlled through the regulation of construction time and hours worked near noise sensitive receptors, using noise-controlled construction equipment, limitations of construction vehicles during evening and weekend hours and by locating equipment storage areas away from noise-sensitive areas.

5.12.3.2 Air Quality

Construction equipment will be maintained in proper mechanical condition. MSAT and diesel emission reduction strategies may also be employed to limit the amount of diesel emissions from construction equipment, such as limiting idling times, or reducing the number of trips. These and other strategies are detailed in **Appendix J**, *Final Air Quality Technical Report.* Fugitive dust generated during land clearing and demolition procedures will be controlled by proper techniques. INDOT's *Standard Specifications* include vegetative cover, mulch, spray-on adhesive, calcium chloride application, water sprinkling, stone, tillage, wind barriers, and construction of a temporary graveled entrance/exit to the construction site. These specifications will be followed.

All bituminous and Portland cement concrete proportioning plants and crushers would meet the requirements of the IDEM. For any portable bituminous or concrete plant or crusher, the contractor must apply for and obtain a permit-to-install from the Permit Section, Air Quality Division of IDEM. Dust collectors must also be provided on all bituminous plants. Dry, fine aggregate material removed from the dryer exhaust by the dust collector must be returned to the dryer discharge unless otherwise directed by the project engineer.

5.12.3.3 Groundwater and Karst

BMPs will be implemented during construction to protect ground water. Potable water sources will be protected through the use of BMPs such as diversion of stormwater into grassy swales, and the use of construction BMPs such as rock check dams to reduce sediment erosion. Stormwater runoff protection measures will be installed at all karst features in the right-of-way at the initiation of construction and maintained until all stormwater drainage has been diverted away from the feature, or final permanent stormwater treatment measures are in place.

Procedures to reduce the impacts to karst will be implemented in accordance with INDOT's *Standard Specifications* and the 1993 Karst MOU between the INDOT, IDNR, IDEM and the USFWS.

5.12.3.4 Erosion Control

As part of the construction plan required under 327 IAC 15-5, an erosion control plan and storm water pollution prevention plan (SWPPP) will be developed and approved by INDOT and IDEM prior to construction. BMPs will be used in the construction of this project to minimize impacts of erosion. Erosion and sediment control measures will be put in place as a first step in construction and maintained throughout construction. Temporary erosion control devices such as silt fencing, check dams, sediment basins, inlet protection, sodding and other appropriate BMPs will be used to minimize sediment and debris in tributaries within the project area. Timely re-vegetation after soil disturbance will be implemented and monitored. Any riprap used will be of a large diameter in order to allow space for habitat for aquatic species after placement. Prior to construction, heavy equipment parking and turning areas will be located outside the construction limits but within the right-of-way to minimize soil erosion. Soil bioengineering techniques for bank stabilization will be considered where appropriate. INDOT will complete contractor compliance inspections on a regular basis to help control erosion and sediment on the project.

5.12.3.5 Heavy Blasting

Heavy blasting may be considered for some portions of the construction of the highway in Section 5. If used, strict blasting specifications will be followed, as found in Section 203.15 of INDOT's *Standard Specifications*. Consideration will be given to the timing of blasting in order to minimize noise impacts to sensitive receptors during periods of occupancy.

Blasting will be avoided between September 15 and April 15 in areas within 0.5-mile of known Indiana bat hibernacula. All blasting in the WAA will follow the specifications developed in consultation with the USFWS and will be conducted in a manner in attempt to avoid compromising the structural integrity or alter the karst hydrology of nearby caves serving as Indiana bat hibernacula. Blasting in karst areas and within areas where dimension limestone is being quarried will be completed following special provisions developed in consultation with limestone industry representatives as well as the Indiana Geological Survey and other geologic experts.

Blasting is not anticipated and will not be allowed adjacent to the Lemon Lane Landfill and Bennett's Dump Superfund Sites.

5.12.3.6 Borrow Sites/Waste Disposal

BMPs will be used in the construction of this project to minimize impacts related to borrow and waste disposal activities. Solid waste generated by clearing and grubbing, demolition or other construction practices will be removed from the location and properly disposed. Contractors are required to follow safeguards established in INDOT's *Standard Specifications* (Section 203.08 Borrow or Disposal) that include obtaining required permits. Prior to their use, borrow sites would be assessed for impacts to resources such as archaeological resources, wetlands, etc., and appropriate measures taken to avoid or mitigate impacts to these resources. Special Provisions will include prohibiting tree clearing from April 1 to November 15 within the WAA of the Indiana bat, and from April 1 to September 30 in the SAA, as identified in the revised Tier 1 and Tier 2 BOs. Tree clearing will be allowed in the WAA from November 16 to March 31, and tree clearing will be allowed from October 1 through March 31 in the SAA. Special Provisions will also include prohibiting the filling or other damaging of wetlands within the right-of-way outside the construction limits. Note that this does not include certain isolated ponds such as farm ponds or those developed from old borrow sites since these are exempt from regulation because they are man-made bodies of water constructed in uplands.

Burning of construction-related debris would be conducted in accordance with all local, state, and federal regulations and INDOT's *Standard Specifications*. All burning will be conducted at a reasonable distance from all homes and care will be taken to alleviate any potential atmospheric conditions that may be a hazard to the public. All burning will be monitored.

5.12.3.7 Traffic

Coordination with local government officials, emergency service providers, and schools will be conducted to ensure that all access is maintained during construction with as little disturbance to emergency routes (including existing SR 37) as possible. Traffic flow maintenance and construction sequences will be planned and scheduled to minimize traffic delays on existing public crossroads, where necessary. Signs will be used to notify the traveling public of road closures and other pertinent information.

Local law enforcement officials, fire departments, and other emergency responders will be notified in advance of road closings and other construction-related activities that could affect their response times and routes so they can plan alternative routes in advance. Likewise, the local news media will be notified in advance of road closings and other construction-related activities that could excessively inconvenience the community so motorists can be advised and plan alternative travel routes.

5.12.3.8 Threatened and Endangered Species/Tree Clearing

The potential construction impacts to the Indiana bat's summer and winter habitat will be addressed in accordance with the requirements of the USFWS's revised Tier 1 BO for the I-69

Evansville to Indianapolis project, which was issued on August 24, 2006 and amended on May 25, 2011 and July 24, 2013 (see **Appendix BB**, *Revised Tier 1 Biological Opinion and Amendments*), and subsequent formal consultation conditions specific to Section 5, which can be found in **Appendix LL2**, *Section 5 Tier 2 Biological Opinion*. These measures include the following (with revisions based on USFWS's updated dates in above-referenced revised Tier 1 BO): Tree and snag removal will be avoided or minimized. No trees with a diameter of three or more inches will be removed between April 1 and November 15 within the WAA and April 1 and September 30 within the SAA to avoid any direct take of Indiana bats. Tree clearing will be allowed in the WAA from November 16 to March 31, and tree clearing will be allowed from October 1 through March 31 in the SAA. Tree clearing and snag removal will be kept to a minimum and limited to within the construction limits. Tree clearing will be kept to a minimum outside of the clear zone with woods kept in as much of a natural state as reasonable in bifurcated sections with widened medians. Forested medians will be managed following the IDNR State Forest timber management plan.

Although protection afforded to state-listed species differs from that accorded federally-listed species, efforts made during the Tier 2 study to avoid or minimize impacts to wildlife habitat (see **Section 5.18**, *Wildlife Considerations*) would be expected to benefit state-listed as well as federally-threatened or endangered species.

INDOT will comply with the requirements of 312 IAC 18-3-18 and Title 312 Natural Resources Commission Emergency Rule (LSA Document #12-195(E))[2] in regards to handling and transportation of cleared trees to prevent the spread of the emerald ash borer.

5.12.3.9 Spill Prevention/Containment

To fulfill Rule 5 (327 IAC 15-5) requirements, contractors will be required to provide a spill response plan acceptable to INDOT. This response plan will include telephone numbers for emergency response personnel, Material Safety Data Sheets and copies of agreements with any agencies which are part of the spill-response effort. An emergency contact telephone number also is required.

5.12.3.10 Wetlands

Wetlands and wetland complexes will be avoided as much as possible in alignment planning. If unable to be avoided completely, wetland impacts will be minimized by shifts in the alignment. Where direct impacts are unavoidable, wetlands will be replaced in accordance with the MOU

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2 Temporarily adds noncode provisions to amend 312 IAC 18-3-18, which provides standards and locations for the control or quarantine of emerald ash borers, to include all counties except Crawford County, Daviess County, Gibson County, Greene County, Knox County, Martin County, Perry County, Pike County, Posey County, Spencer County, Sullivan County, Vanderburgh County, and Warrick County in the areas of control or quarantine based upon inspections by the Division of Entomology and Plant Pathology of sites in Indiana where agricultural, horticultural, or sylvan products are being grown, shipped, sold, or stored, and where the director of the Department of Natural Resources has determined under IC 14-24-4-2 that emerald ash borers are present so as to warrant their quarantine and control. Effective May 1, 2012.

between INDOT, USFWS, and IDNR as dated January 28, 1991, or any successor agreement entered into by these agencies. The following measures will be taken to avoid/minimize impacts during construction:

- BMPs will be followed for erosion control in the project.
- Disturbed in-stream habitats will be returned to their original condition, when possible, upon completion of construction in the area.
- Prior to construction, heavy equipment parking and turning areas will be identified outside the construction limits but within the right-of-way. These areas will be located in areas that do not require tree clearing, , as well as avoid environmentally-sensitive areas, such as wetlands or areas prone to soil erosion. Special Provisions will prohibit filling or damaging non-isolated wetlands in the right-of-way outside the construction limits. (Note: this prohibition would not extend to certain isolated ponds such as farm ponds and those developed from old borrow sites. These are exempt from regulation because they are man-made bodies of water constructed in uplands.)

5.12.4 Summary

Construction activities for the proposed project will have air, noise, water quality, karst, traffic flow, and other impacts. All alternatives utilize the existing SR 37 right-of-way, which currently serves the greater Bloomington and Martinsville areas. Substantial savings in resource impacts were realized by using this existing roadway as compared to a new terrain alignment. Due to the variety of potential impacts to existing population and, the preferred alternative selection criteria is not limited to the lowest impacts or lowest cost. Alternatives 4 and 5, developed with the initial design criteria, would have a wider construction footprint, which would result in more construction impacts than Alternatives 6, 7, 8 and Refined Preferred Alternative 8 developed with the minimal impact design criteria. There are also differences between each of the alternatives in regards to the locations of access with interchanges, overpasses, and local access roads. Refined Preferred Alternative 8 is a modification of Alternative 8, which uses a combination of features of Alternatives 4, 5, 6, and 7. Impacts resulting from construction as well as impacts to the natural and human environment were considered in the determination of the preferred alternative.

As a result of the differences between each of the alternatives, each would also have different construction impacts. During construction, measures to minimize such impacts would be controlled in accordance with proposed mitigation measures and commitments, and INDOT *Standard Specifications.* For further detail of Mitigation Measures and Commitments made for design and construction of this project, refer to **Chapter 7**, *Mitigation and Commitments*.

Section 5.12 Figure Index