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Traffic Noise Analysis Report

Illinois Route 97
Smith Road to Veterans Parkway
Traffic Noise Analysis
Sangamon County, Illinois

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PREPARED FOR:
Illinois Department of Transportation

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1.0 INTRODUCTION

This traffic noise study has been prepared to evaluate traffic noise for the roadway improvements to Illinois Route 97 (IL 97) from Smith Road to Veterans Parkway. The noise study area, shown in Figure 1, is in Sangamon County, Illinois. An additional lane will be added to IL 97 in each direction with a center median added. IL 97 will also be realigned up to 0.2 miles from existing alignment for portions of the project limits, principally to the north of existing IL 97. The proposed study will evaluate existing and future traffic noise conditions, and if appropriate, potential noise abatement measures. The existing land use adjacent to the road is a mixture of commercial, residential, institutional, agricultural, and open land.

This report presents the federal and state noise regulations (Section 2), a discussion of noise sensitive receptors (Section 3), field noise monitoring (Section 4), a description of the noise analysis methodology (Section 5), the analysis of the existing and future noise levels (Section 6), the noise abatement analysis (Section 7), the likelihood statement (Section 8), coordination with local officials for undeveloped lands (Section 9), construction noise (Section 10), and the noise analysis conclusion (Section 11).

2.0 NOISE BACKGROUND AND REGULATIONS

2.1 NOISE BACKGROUND

Sound is caused by the vibration of air molecules and its loudness is measured on a logarithmic scale using units of decibels (dB). Sound is composed of a wide range of frequencies; however, the human ear is not uniformly sensitive to all frequencies. Therefore, the "A" weighted scale was devised to correspond with the ear's sensitivity. The A-weighting generally weighs noise levels in the humanly audible range more heavily and screens out noise levels that cannot be heard but are still generated, such as a high frequency dog whistle. The A-weighted unit is used because:

1) It is easily measured.
2) It approximates the human ear's sensitivity to sounds of different frequencies.
3) It matches attitudinal surveys of noise annoyance better than other noise measurements.
4) It has been adopted as the basic unit of environmental noise by many agencies around the world for assessing community noise issues.

The equivalent sound level (L_{eq}) is the steady-state, A-weighted sound level that contains the same amount of acoustic energy as the actual time-varying, A-weighted sound level over a specified period. If the period is 1 hour, the descriptor is the hourly equivalent sound level or L_{eq}(h), which is widely used by state highway agencies as a descriptor of traffic noise. It is generally the equivalent level of sound (in decibels or dB(A)) that represents the level of sound, held constant over a specified period that reflects the same amount of energy as the actual fluctuating noise over that period. L_{eq} is based on the energy average, not a noise level average.

2.2 FEDERAL REGULATIONS

Traffic noise analyses are required for all projects considered a Type I project. Federal regulations[1] define Type I projects as any of the following:

- The construction of a highway on new location,
- The physical alteration of an existing highway where there is either:
  - *Substantial Horizontal Alteration*. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition, or
  - *Substantial Vertical Alteration*. A project that removes shielding, therefore exposing the line-of-sight between the receptor and the traffic noise source (This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor.).
- The addition of a through-traffic lane(s) (This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane.),
- The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane,

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[1] Based on 23 Code of Federal Regulations Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (adopted 2010).

- The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange,

- Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane, or,

- The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

This proposed improvement to IL 97 would be characterized as a Type I noise project, as it includes additional through-lanes and the construction of a roadway on new location (the addition of several intersecting streets at IL 97, including Hazlett, Bradforton/Moore Road, and the extension of IL 97 south at IL 125).

Federal regulations establish noise abatement criteria (NAC), which are noise levels where noise abatement should be evaluated. Five separate NAC based upon land use are used by the Federal Highway Administration (FHWA) to assess potential noise impacts. A traffic noise impact occurs when noise levels approach, meet, or exceed the NAC listed in Table 1.[2] In determining the applicable noise activity category for the study area, existing and proposed land uses were reviewed. The applicable NAC for all residential noise receptors evaluated is 67 dB(A).

TABLE 1. NOISE ABATEMENT CRITERIA - HOURLY WEIGHTED SOUND LEVELS

Activity Category[1]	L_{eq}(h)	Evaluation Location	Activity Description
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[1]	67	Exterior	Residential.
C[1]	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.
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[1]	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.

[1] Includes undeveloped lands permitted for this activity category.

[2] Based on 23 Code of Federal Regulations Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (adopted 2010).

2.3 IDOT POLICY

Based on the Federal regulations, State Highway Authorities are allowed to establish the noise level determined to 'approach' the NAC as well as the increase in noise levels that determines a substantial increase. The Illinois Department of Transportation (IDOT) defines noise impacts as follows:

- Design-year traffic noise levels approach, meet, or exceed the NAC, with 'approach' defined as 1 dB(A) (for example, the approach value for the residential NAC of 67 dB(A) would be 66 dB(A)).

- Design-year traffic noise levels are a substantial increase over existing traffic-generated noise levels, defined as an increase of 15 dB(A) or greater.

3.0 NOISE RECEPTOR SELECTION

The land use within the study limits consists of residences, places of worship, commercial properties, and agricultural and open land. Figure 2 depicts land use based on field reviews and available aerial photography.

Receptor locations were selected based on land use adjacent to the IL 97 project corridor to represent the land uses with established NAC. For this project, this includes residential areas (land use Activity Category B) and a place of worship and a school (land use Activity Category C). The remaining commercial areas, agricultural and open lands along the project corridor are characterized as land use Activity Category F or G, which do not have an established NAC.

The traffic noise study evaluates the study area using common noise environments (CNEs). A CNE is a group of receptors within the same activity category that are exposed to similar noise sources and levels. Within each of the CNEs, the closest receptor was selected to represent the CNE, thereby representing the worst-case traffic noise condition (known as the representative receptor). The remaining receptors within the CNEs (known as represented receptors) will have similar traffic noise levels as the representative receptor. CNEs typically are studied within 500 feet from the edge of roadway improvements. The distance of 500 feet is based on FHWA's 2010 performance evaluation of the Traffic Noise Model 2.5 (TNM), the model that will be used to predict existing, no-build, and build noise levels for the proposed project.

Seventeen receptors have been selected to represent the study area. Each receptor represents a CNE. According to IDOT policy, when determining traffic noise impacts, primary consideration shall be given to exterior areas where frequent human use occurs for Activity Categories A, B, C and E. Additionally, IDOT policy states that traffic noise impacts for land uses within Activity Category D shall be predicted for interior areas only if no exterior use areas are identified. Receptor locations were identified at outdoor locations of frequent human use for all noise receptors studied. Because exterior areas of frequent human use were identified for all receptors, no interior noise monitoring or prediction occurred.

Table 2 lists the receptor/CNE number, the receptor type, the land use category and associated NAC, and the approximate distance to the existing and proposed edges of pavement. Figure 3 depicts the aerial photography of the study area with the receptors and CNEs depicted. Receptor locations are between 55 feet and 1,345 feet from the IL 97 proposed edge of pavement. Those receptors that are further than 500 feet from the IL 97 proposed edge of pavement are within 500 feet of secondary roadways that have proposed improvements as part of the overall IL 97 project.

The vacant and undeveloped areas within the project area, shown as land use Activity Category G in Figure 2, were reviewed to determine if any were permitted for development. Based on the information available from the governing agencies with permitting jurisdiction, there are no existing permits for development within the project limits.

TABLE 2. NOISE RECEPTOR LOCATIONS

Receptor/CNE Number	Receptor Type	Activity Category / NAC (dB(A))	Distance to IL 97 Mainline Existing Edge of Pavement, ft.	Distance to IL 97 Mainline Proposed Edge of Pavement, ft.
R1	SFR	B / 67	100	100
R2	SFR	B / 67	315	385
R3	SFR	B / 67	500	495
R4	SFR	B / 67	255	210
R5	SFR	B / 67	90	280
R6	SFR	B / 67	140	525*
R7	SFR	B / 67	370	1,345*
R8	SFR	B / 67	200	1,235*
R9	SFR	B / 67	105	245
R10	SFR	B / 67	50	365
R11	SFR	B / 67	120	200
R12	School	C / 67	250	290
R13	SFR	B / 67	175	110
R14	SFR/MFR	B / 67	140	125
R15	SFR	B / 67	55	55
R16	Church	C / 67	110	110
R17	MFR	B / 67	105	105

SFR denotes Single Family Residential
MFR denotes Multi-Family Residential
* Within 500 feet of secondary improvement

4.0 FIELD NOISE MEASUREMENTS

Actual noise level measurements (noise monitoring) provide a "snapshot" of existing site conditions. The traffic volumes and conditions during the actual noise level measurements need to be considered when evaluating if field measurements are typical for the area. The following methodology was used to collect noise level measurements.

Traffic noise levels measured during noise monitoring events are representative of the traffic characteristics (volume, speed and composition) for the period measured. This may or may not be the peak-hour noise condition at the location being measured. In addition, the noise levels also are influenced by other noise sources in the area other than the traffic noise and the characteristics of the location, such as shielding afforded by existing berms or structures. Consequently, comparison of the noise levels between locations should consider the variations in site characteristics in addition to varying traffic conditions. Noise monitoring was conducted at seven representative receptor locations – R1, R5, R9, R12, R14, R16, and R17. The noise monitoring results were compared with TNM results for existing conditions to validate the noise model.

4.1 TRAFFIC VOLUMES

Traffic volumes along roadways adjacent to receptors were counted during field monitoring where traffic was present. The number of cars and trucks were recorded separately along with any other noise sources observed during monitoring. The traffic volumes were counted as a total for each direction during the noise monitoring periods. The traffic volumes counted were extrapolated to hourly volumes for use in noise model validation. This procedure is accepted by the FHWA as a representative noise monitoring method, detailed in IDOT's "Highway Traffic Noise Assessment Manual" (IDOT HTNA Manual) Section 3.5.2.

4.2 TIME AND DAY FOR MEASUREMENTS

Typically, noise monitoring is conducted during free-flow traffic conditions. Noise monitoring was conducted at all locations on September 24, 2019 between the hours of 9 am to 4 pm. This follows the noise monitoring methodology to define existing noise levels as described in FHWA's "Noise Measurement Handbook" (FHWA June 2018).

4.3 WEATHER CONDITIONS

Weather conditions have some effect on noise measurement readings. Noise measurements cannot be taken if wind speed exceeds 11 mph. A wind screen was used at all times during the monitoring to reduce wind noise. The conditions during the monitoring are summarized as follows:

WEATHER CONDITIONS DURING THE NOISE MONITORING

Condition	Required	Actual*
Pavement	Dry	Dry
Humidity	Less than 90%	40 - 75%
Temperature	14 to 112 degrees F	60 - 80 degrees F
Wind Speed	Less than 11 mph	5 to 10 mph

* NWS Data

The weather conditions during the noise monitoring were within the recommended ranges for all parameters listed.

4.4 INSTRUMENTATION

A Brüel & Kjær Type 2250L sound level meter was used for monitoring the actual noise level. The L_{eq} was recorded using the "A" weighted scale. L_{eq} is the equivalent level of sound (in decibels or dB(A)) held constant over a specified period that has the same amount of energy as the actual fluctuating noise over that time period. The instrument was calibrated prior to each use. The instrument was set up approximately five (5) feet from the ground and the measurement was conducted until an equilibrium was reached, which was generally between 10 minutes and 15 minutes. The noise meter was placed in an outdoor location where human activity typically occurs or in a location representative of that location.

4.5 FIELD NOISE MONITORING RESULTS

Table 3 compares the noise monitoring results for the seven monitored locations to the TNM modeled existing noise levels. Noise monitored levels ranged from 53 dB(A) to 61 dB(A). The difference between modeled and monitored noise levels indicates that the TNM model accurately represents the project area and its characteristics. Sections 5 and 6 describe the TNM modeling methodology and results. Monitored noise levels are within 3 dB(A) of the modeled noise levels using the traffic volumes observed during the monitoring period, which validates the TNM model. The impact analysis and abatement evaluation will be conducted using the build traffic noise model results.

TABLE 3. NOISE MONITORING RESULTS, L_{eq}

Receptor	Noise Level Monitored, dB(A)	Modeled Existing Noise Level, dB(A)*	Difference Between Modeled and Monitored, dB(A)
R1	61	59	2
R5	58	60	-2
R9	61	59	2
R12	53	52	1
R14	59	57	2
R16	61	61	0
R17	61	59	2

*Modeling methodology and results are presented in Section 5 and Section 6, respectively.

5.0 NOISE ANALYSIS METHODOLOGY

Modeling traffic noise levels at receptors within the project limits was conducted utilizing the FHWA-approved TNM. Prediction of noise levels is one step in assessing potential noise impacts and abatement strategies. Traffic noise levels for the receptor sites were predicted using existing (2020) and future (2040) traffic volumes.

Inputs into TNM include traffic volume, traffic mix (cars, heavy trucks, and medium trucks), traffic controls, receptor distance, elevation, and average speeds during free-flowing traffic conditions. Information sources used in the analysis are briefly described in the following subsections.

5.1 TRAFFIC VOLUMES

Peak hourly volumes were provided by the project team for the years 2020 and 2040 for IL 97. The PM peak hour represents the worst-case peak hour volume for both the existing and future conditions.

5.2 TRAFFIC COMPOSITION

Three types of vehicles (cars, medium trucks, and heavy trucks) were input into TNM. Truck composition for the roadways was estimated based on the truck percentages provided. The percentage of automobiles within the project area is estimated to range from 93 percent to 97 percent, with medium and heavy trucks combined accounting for between 3 percent and 7 percent. Heavy trucks account for between 21 percent and 61 percent of the total truck traffic, with medium trucks accounting for the remainder.

5.3 RECEPTOR DISTANCE/ELEVATION

Table 2 includes the distances of the receptors from the nearest proposed edge of pavement. The selected representative receptors include residences and churches. The distance to IL 97 and elevation of each receptor directly affects the predicted traffic noise level. These distances vary from 55 feet at Receptor R15 to 1,345 feet at Receptor R7. Receptor R7 is adjacent to Bradfordton Road and existing IL 97. IL 97 is proposed to be realigned farther from R7. The specific location of each receptor is based upon identifying the location where outdoor activity occurs.

5.4 SPEED CONDITIONS

The existing posted speed limit for the individual roadways was used for the noise analysis and has been input into the model.

6.0 TNM RESULTS

Existing (2020), No-Build (2040), and Build (2040) traffic noise levels were predicted for the 17 receptor sites utilizing TNM. Table 4 presents the existing (2020) and projected (2040) noise levels for the 17 receptor sites, as well as the anticipated difference in noise levels for these two time periods.

The existing 2020 noise levels range from 51 dB(A) at R3 to 65 dB(A) at R10 and R15. The projected No-Build 2040 traffic noise levels range from 52 dB(A) at R3 to 66 dB(A) at R10 and R15. Generally, receptor noise levels either remain the same or increase 1 dB(A) from the existing scenario to the 2040 No-Build scenario. Any increase in traffic noise levels is due to an increase in traffic volumes.

The projected Build 2040 traffic noise levels range from 49 dB(A) at R8 to 69 dB(A) at R15. The projected Build 2040 noise levels vary from the existing condition depending on the receptor's proximity to the proposed new alignment. Several receptors (R2, R5, R6, and R8 through R12) have noise levels that remain the same despite traffic increase or have projected decreases in noise levels from the existing scenario to the build scenario. This occurs because the proposed alignment moves IL 97 through traffic away from these receptors. The remaining receptors increase in noise levels from the existing scenario to the build scenario by between 1 dB(A) and 8 dB(A). None of the receptors have an increase in noise of 15 dB(A) or greater.

Under the proposed 2040 Build scenario there are four receptor locations that exceed the FHWA NAC and are traffic noise impacts, warranting a noise abatement analysis (R13, R14, R15, and R17). None of the impacted receptors are considered impacted due to a substantial increase (15 dB(A) increase or greater) in traffic noise levels.

TABLE 4. NOISE IMPACT SUMMARY – TNM MODELING RESULTS

Receptor / CNE Number	Activity Category / NAC (dB(A))	Distance to IL 97 Mainline Proposed Edge of Pavement, ft.	Existing 2020 Noise Level, dB(A)	No-Build 2040 Noise Level, dB(A)	Build 2040 Noise Level, dB(A)	Increase in Build Noise Levels over Existing Noise Levels, dB(A)
R1	B / 67	100	62	62	64	2
R2	B / 67	385	56	56	55	-1
R3	B / 67	495	51	52	53	2
R4	B / 67	210	57	58	59	2
R5	B / 67	280	64	65	57	-7
R6	B / 67	525*	62	63	54	-8
R7	B / 67	1,345*	62	63	63	1
R8	B / 67	1,235*	56	57	49	-7
R9	B / 67	245	60	61	57	-3
R10	B / 67	365	65	66	54	-11
R11	B / 67	200	61	61	60	-1
R12	C / 67	290	61	62	61	0
R13	B / 67	110	58	59	**66**	8
R14	B / 67	125	60	60	**66**	6
R15	B / 67	55	65	66	**69**	4
R16	C / 67	110	61	61	65	4
R17	B / 67	105	60	60	**66**	6

Bold and highlighted data indicates the noise levels approach, meet, or exceed the NAC in future build condition
* Within 500 feet of secondary improvement

7.0 ABATEMENT ANALYSIS

7.1 ABATEMENT ALTERNATIVES

Traffic noise abatement measures were considered for the four impacted receptors that approach, meet, or exceed the appropriate FHWA NAC and/or have a substantial increase in noise impact, as shown in Table 4. The most feasible approach to abating noise impacts in this area would be to construct a noise barrier. A noise barrier may be a noise wall, an earth berm, or a combination of both. Noise barriers placed adjacent to the roadway will attenuate traffic-related noise and are the most practical measure for this project. An effective noise barrier must be tall enough to break the line-of-sight between the receptor and source and typically extends beyond the last receptor four times the distance between the receptor and noise barrier. Noise barriers have a zone of effectiveness, or shadow zone, which is generally within 200 feet of the noise barrier; therefore, less noise reduction is achieved as the distance between the receptor and the noise barrier increases.

TNM was used to perform the noise barrier feasibility and reasonableness evaluation for the impacted receptors. When determining if an abatement measure is feasible and reasonable, the noise reductions achieved, number of residences benefited, total cost, and total cost per residence benefited are considered.

7.2 FEASIBILITY AND REASONABLENESS

An analysis of noise abatement measures (noise barriers) was conducted in conformance with FHWA requirements contained in Title 23 *Code of Federal Regulations* Part 772, and IDOT policy (Chapter 26 of the IDOT Bureau of Design and Environmental Manual) for the impacted receptors. In order for a noise abatement measure to be recommended for construction, it must meet both the feasibility and reasonableness criteria, described below.

Feasibility

The feasibility evaluation is a combination of acoustical and engineering factors considered in the evaluation of a noise abatement measure. The acoustical portion of the IDOT policy, as required by FHWA regulations, considers noise abatement to be feasible if it achieves at least a 5 dB(A) traffic noise reduction at two impacted receptors. Factors including but not limited to safety, barrier height, topography, drainage, utilities, maintenance, and access issues also are considered.

Reasonableness

As per the FHWA regulations, a noise abatement measure is determined to be reasonable when all three of the following reasonableness criteria are met:

- achievement of IDOT's noise reduction design goal;
- cost effectiveness of the highway traffic noise abatement measure; and,
- consideration of the viewpoints of the benefited receptors (property owners and residents) if all other criteria are achieved.

A noise abatement measure is considered cost-effective to construct if the noise wall construction cost per benefited receptor is less than the allowable cost per benefited receptor. A benefited receptor is any receptor that is afforded at least a 5 dB(A) traffic noise reduction from the proposed noise abatement measure. The FHWA regulations allow each State Highway Authority to establish cost criteria for determining cost effectiveness.

IDOT policy[3] establishes that the actual cost per benefited receptor be based on a noise wall cost of $30 per square foot, which includes engineering, materials, and construction. The base value allowable cost is $30,000 per benefited receptor, which can be increased based on three factors as summarized below:

- the absolute noise level of the benefited receptors in the design year build scenario before noise abatement;
- the incremental increase in noise level between the existing noise level at the benefited receptor and the predicted build noise level before noise abatement; and
- the date of development compared to the construction date of the highway. These factors are considered for all benefited receptors.

ABSOLUTE NOISE LEVEL CONSIDERATION

Predicted Build Noise Level Before Noise Abatement	Dollars Added to Base Value Cost per Benefited Receptor
Less than 70 dB(A)	$0
70 to 74 dB(A)	$1,000
75 to 79 dB(A)	$2,500
80 dB(A) or greater	$5,000

Source: IDOT Highway Traffic Noise Assessment Manual

INCREASE IN NOISE LEVEL CONSIDERATION

Incremental Increase in Noise Level Between the Existing Noise Level and the Predicted Build Noise Level Before Noise Abatement	Dollars Added to Base Value Cost per Benefited Receptor
Less than 5 dB(A)	$0
5 to 9 dB(A)	$1,000
10 to 14 dB(A)	$2,500
15 dB(A) or greater	$5,000

Source: IDOT Highway Traffic Noise Assessment Manual

[3] Chapter 26 of the IDOT Bureau of Design and Environment Manual

NEW ALIGNMENT / CONSTRUCTION DATE CONSIDERATION

Project is on new alignment OR the receptor existed prior to the original construction of the highway	Dollars Added to Base Value Cost per Benefited Receptor
No for both	$0
Yes for either	$5,000

Note: No single optional reasonableness factor shall be used to determine that a noise abatement measure is unreasonable.
Source: IDOT Highway Traffic Noise Assessment Manual

The IDOT noise reduction design goal is to achieve an 8 dB(A) traffic noise reduction for at least one benefited receptor. If a noise abatement measure is feasible, achieves the cost-effective criterion, and achieves the IDOT noise reduction design goal, then the viewpoints of benefited receptors are solicited on the construction of the noise wall.

7.3 NOISE WALL ANALYSIS

TNM was used to perform the noise wall feasibility and reasonableness analyses for the potential noise barriers. When determining if an abatement measure was feasible and reasonable, the noise reductions achieved, number of residences benefited, total cost, and total cost per residence benefited are considered.

Three potential noise walls were evaluated for the four impacted receptors. This includes a shared noise wall for receptors R14 and R17, due to their close proximity. Noise walls were generally modeled along the proposed right-of-way (ROW).

One noise wall (B2) was found to be feasible, meaning it could achieve at least a 5 dB(A) reduction at two or more impacted receptors. The remaining noise walls were found to not be acoustically feasible, either because there is only a single impacted receptor present (B1), or because gaps in the barriers to maintain driveway access limit the wall's effectiveness (B3) as proven through noise modeling.

The feasible noise wall B2 would meet the first criterion of reasonableness, as it achieves the IDOT noise reduction design goal of at least an 8 dB(A) traffic noise reduction at one or more benefited receptors.

The feasible noise wall B2 that also achieves the noise reduction design goal was then evaluated for cost-effectiveness. Table 5 summarizes the results of the adjusted allowable cost per benefited receptor determination. Each benefited receptor received a base allowable barrier cost of $30,000, which could be increased based upon absolute noise level considerations, increase in noise level considerations, and new alignment/construction data considerations. The range of these cost adjustment considerations per barrier is summarized as "Adjustment Factor Range" in Table 5. Table 6 summarizes the results of the noise abatement evaluation.

TABLE 5. ADJUSTED ALLOWABLE COST PER BENEFITED RECEPTOR SUMMARY

Barrier Name	CNE(s) Benefited	Benefited Receptors	Adjustment Range	Adjusted Allowable Cost Per Benefited Receptor
B1	R13	Does not meet Feasibility Criteria of 2 Impacted Receptors Receiving at least a 5 dB(A) Reduction		
B2	R14/R17	45	$0	$30,000
B3	R15	Does not meet Feasibility Criteria of 2 Impacted Receptors Receiving at least a 5 dB(A) Reduction		

Note: No values are provided in the table for barriers that are not reasonable or feasible.

TABLE 6. NOISE WALL COST REASONABLENESS EVALUATION

Barrier	CNE(s) Benefited	Benefited Receptors[1]	Barrier Length (ft)[2]	Average Barrier Height (ft)[2]	Barrier Construction Cost[3]	Actual Cost per Benefited Receptor	Adjusted Allowable Cost per Benefited Receptor[4]	Ratio[5]	Finding
B1	R13	Does not meet Feasibility Criteria of 2 Impacted Receptors Receiving at least a 5 dB(A) Reduction						N/A	Not Feasible
B2	R14/R17	45	2,076	16.3	$1,013,719	$22,527	$30,000	0.75	Cost-Effective
B3	R15	Does not meet Feasibility Criteria of 2 Impacted Receptors Receiving at least a 5 dB(A) Reduction						N/A	Not Feasible

[1] Any receptor receiving at least a 5 dB(A) reduction due to the proposed barrier
[2] Barrier length and height are not listed for barriers that are not reasonable or feasible
[3] Based on the IDOT policy value of $30 per square foot
[4] Per IDOT traffic noise policy and the reasonableness analysis
[5] Ratio of actual build cost of a barrier per benefitted receptor to the adjusted allowable cost per benefitted receptor. This is used to determine if a barrier can be cost-effective through cost averaging. For a single noise abatement measure to be considered as part of a cost-averaging evaluation, this ratio must not exceed 2.0 (the cost of noise abatement per benefitted receptor may not exceed two times the adjusted allowable noise abatement cost per benefitted receptor).

Noise wall B2 is considered cost-effective, as the actual cost per benefited receptor meets the allowable cost per benefited receptor.

8.0 LIKELIHOOD STATEMENT

Noise barrier B2 was determined to meet the feasibility criteria, the noise reduction design goal, and the cost effectiveness criteria as identified in Table 6. In order to determine if noise barrier(s) will be implemented, viewpoints solicitation still needs to occur. Viewpoints solicitation will occur after the project's final design is approved. If the project's final design is different from the preliminary design, IDOT will determine if revisions to the traffic noise analysis are necessary. A final decision on noise abatement will not be made until the project's final design is approved and the public involvement processes is complete.

9.0 COORDINATION WITH LOCAL OFFICIALS FOR UNDEVELOPED LANDS

Figure 2 depicts the land use within the project limits. Undeveloped parcels of land exist throughout the corridor. For planning purposes, the Year 2040 Build scenario was analyzed to predict traffic noise levels on the undeveloped areas. Noise level contours were developed at 66 dB(A) and 71 dB(A) noise levels to determine where the NAC would be approached in the Build scenario.

Appendix A includes a draft of letters that will be sent to the local officials having jurisdiction over the undeveloped lands, and an exhibit (as an attachment to the letter), depicting the approximate distances where the NACs Activity Categories B/C, (67 dB(A)) and E (72 dB(A)) are approached.

10.0 CONSTRUCTION NOISE

Trucks and machinery used for construction produce noise that may affect some land uses and activities during the construction period. Residents along the alignment will at some time experience perceptible construction noise from implementation of the project. To minimize or eliminate the effect of construction noise on these receptors, mitigation measures have been incorporated into IDOT's Standard Specifications for Road and Bridge Construction as Article 107.35.

11.0 CONCLUSION

This traffic noise study has been conducted to evaluate traffic noise impacts for the proposed roadway improvements to IL 97 in Sangamon County, Illinois. Traffic noise was evaluated at 17 receptor locations. The Existing 2020 noise levels range from 51 dB(A) to 65 dB(A). The projected No-Build 2040 traffic noise levels range from 52 dB(A) to 66 dB(A). Receptor noise levels either remain the same or increase 1 dB(A) from the existing scenario to the 2040 No-Build scenario. Any increase in traffic noise levels is due to an increase in traffic volumes.

The projected Build 2040 traffic noise levels range from 49 dB(A) to 69 dB(A). Several receptors either remain the same despite traffic increase or have projected decreases in noise levels from the existing scenario to the build scenario as the proposed alignment moves IL 97 through-traffic away from these receptors. The remaining receptors increase in noise levels from the existing scenario to the build scenario by between 1 dB(A) and 8 dB(A).

Under the proposed 2040 Build scenario, noise levels at four receptor locations approach or exceed the FHWA NAC, and therefore warrant a noise abatement analysis. No receptors are considered impacted due to a substantial increase (15 dB(A) increase or greater) in traffic noise levels.

Three potential noise walls were evaluated for the four impacted receptors. This includes a shared noise wall for two impacted receptors due to their close proximity. One noise wall was found to be feasible, meaning it could achieve at least a 5 dB(A) reduction at two or more impacted receptors. The two remaining noise walls were found to be not acoustically feasible either because there is only a single impacted receptor present (B1), or because gaps in the barriers to maintain driveway access limit the wall's effectiveness (B3).

The feasible noise barrier (B2) would meet the first criterion of reasonableness, as it achieves the IDOT noise reduction design goal of at least an 8 dB(A) traffic noise reduction at one or more benefited receptors. The feasible noise wall that also achieves the noise reduction design goal was then evaluated for cost-effectiveness. Noise wall B2 is considered cost-effective as the actual cost per benefited receptor exceeds their allowable cost per benefited receptor.

Due to this, traffic noise abatement measures are likely to be implemented based on preliminary design. If the project's final design is different from the preliminary design, IDOT will determine if revisions to the traffic noise analysis are necessary. A final decision on noise abatement will not be made until the project's final design is approved and the public involvement processes is complete.

REFERENCES

IDOT Bureau of Design and Environment (BDE) Manual, Chapter 26-6, Noise Analyses.

IDOT Bureau of Design and Environment (BDE) Manual, Appendix D, Guidance on EA/EIS Preparation.

IDOT Highway Traffic Noise Assessment Manual, 2017 Addition.

FHWA Construction Noise Handbook, FHWA-HEP-06-015, August 2006.

FHWA Noise Measurement Handbook, FHWA-HEP-18-065, June 1, 2018.

23 CFR 772 "Procedures for Abatement of Highway Traffic Noise and Construction Noise", July 13, 2010.

FHWA Highway Traffic Noise: Analysis and Abatement Guidance, FHEA-HEP-10-025, December 2011.

FHWA Highway Noise Barrier Design Handbook, FHWA-EP-00-005, February 2000.

Figures

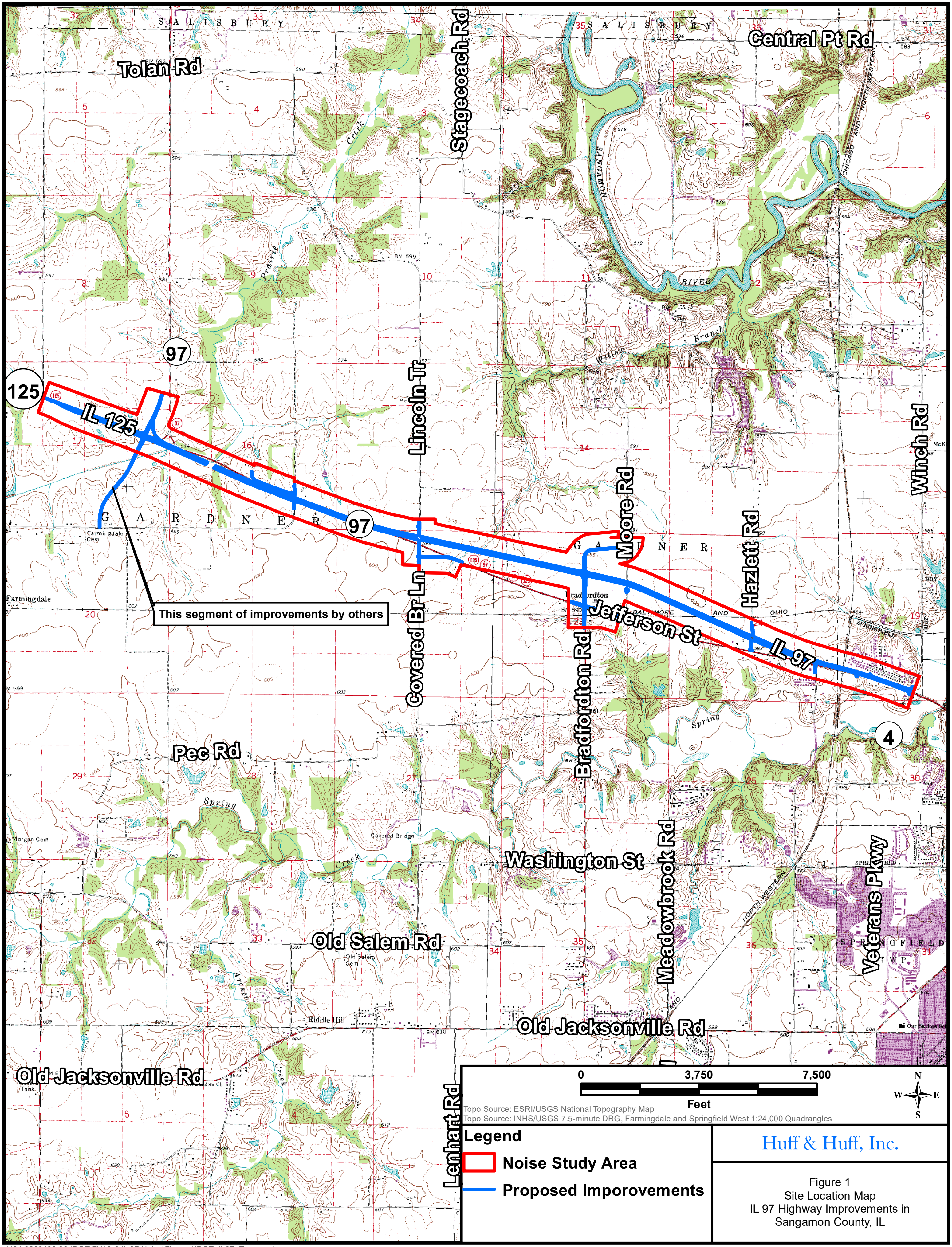

Figure 1
Site Location Map
IL 97 Highway Improvements in
Sangamon County, IL

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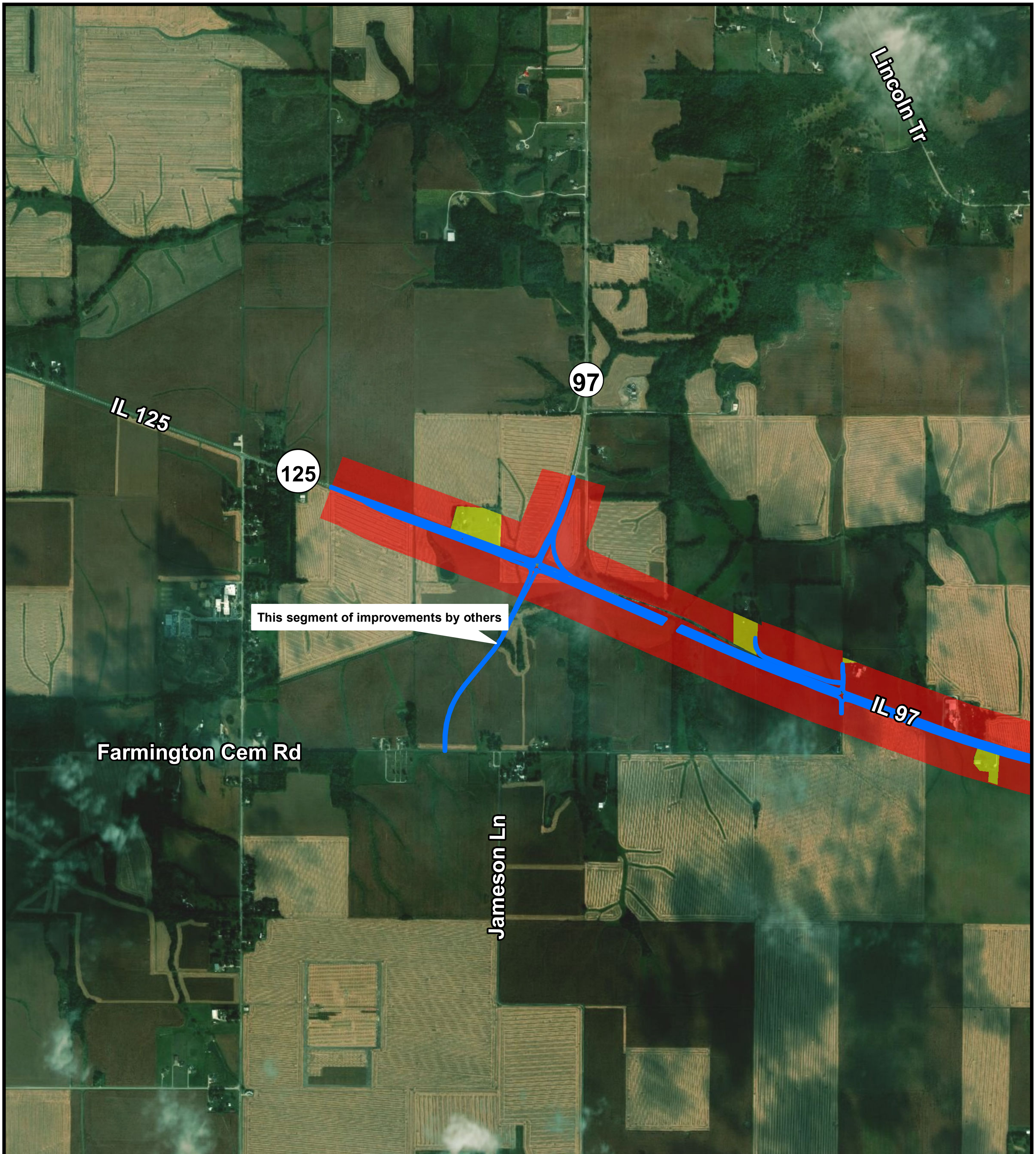

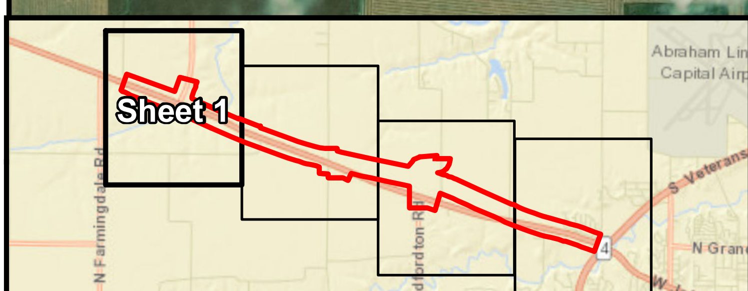

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N W E S

Aerial Source: ESRI Online World Imagery

Legend

Proposed Edge of Pavement

Activities Category

B C E F G

Huff & Huff, Inc.

Figure 2
Land Use and FHWA Activity Categories Map
IL 97 Highway Improvements in
Sangamon County, IL
Sheet 1 of 4

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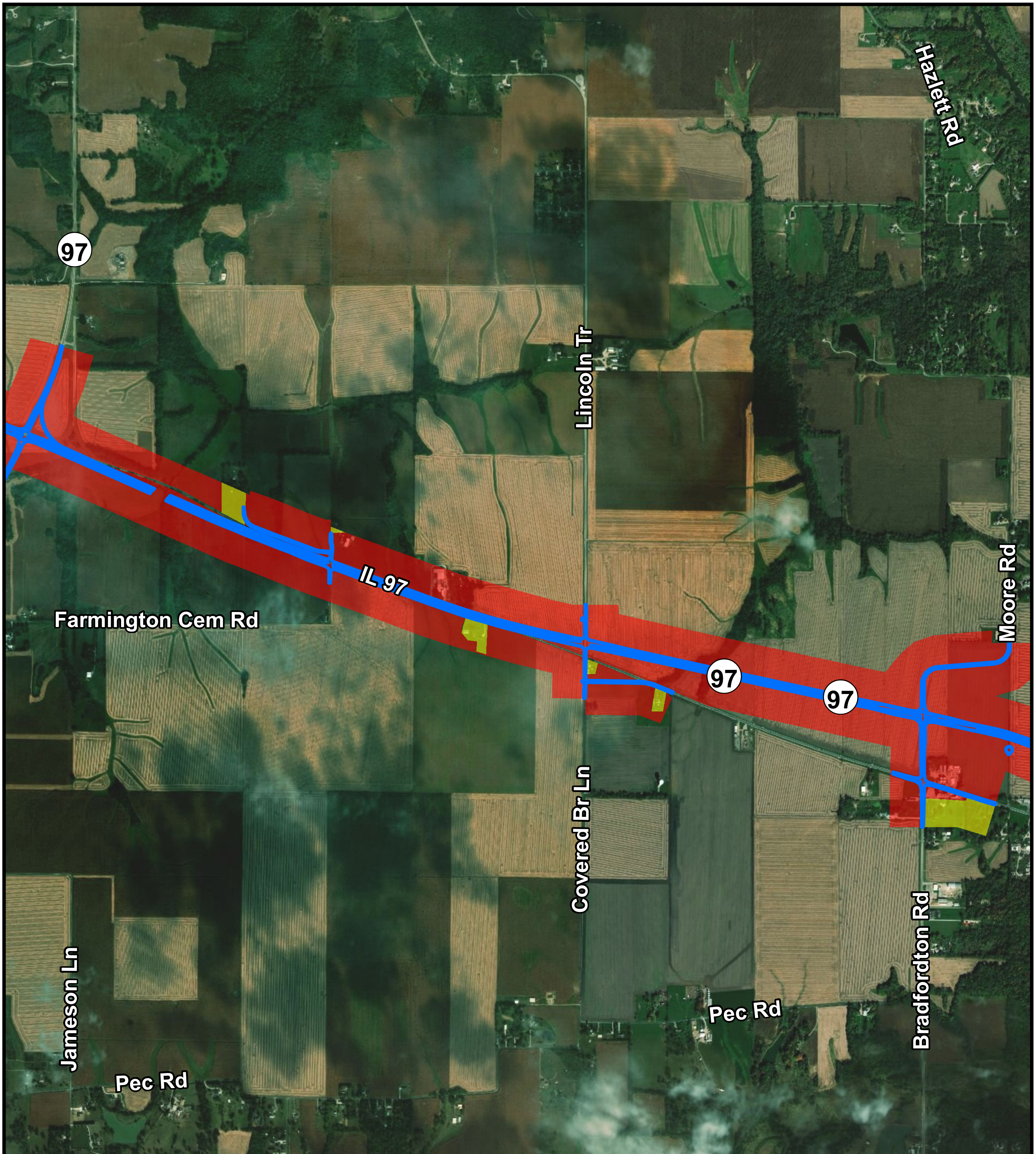

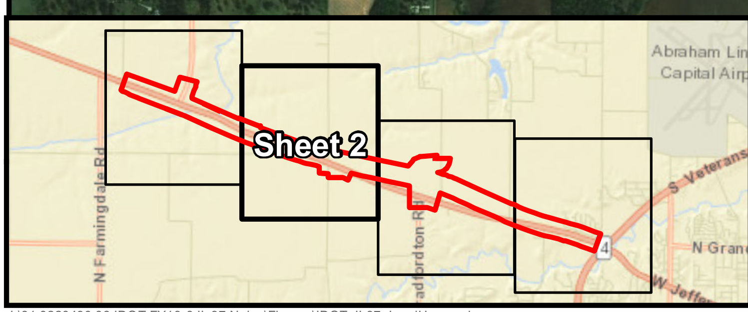

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Aerial Source: ESRI Online World Imagery

Legend

Proposed Edge of Pavement

Activities Category

B C E F G

Huff & Huff, Inc.

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IL 97 Highway Improvements in
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Sheet 2 of 4

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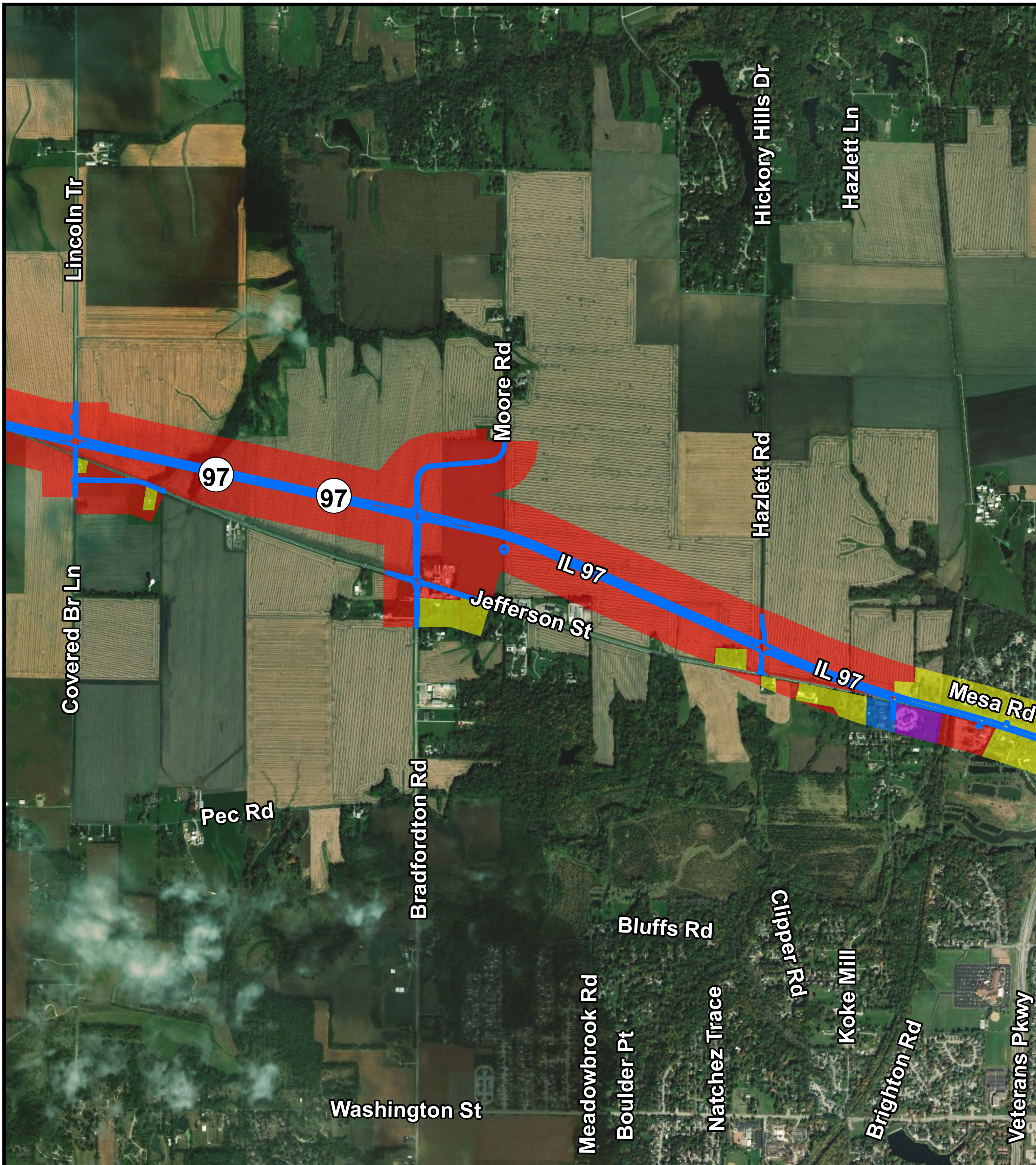

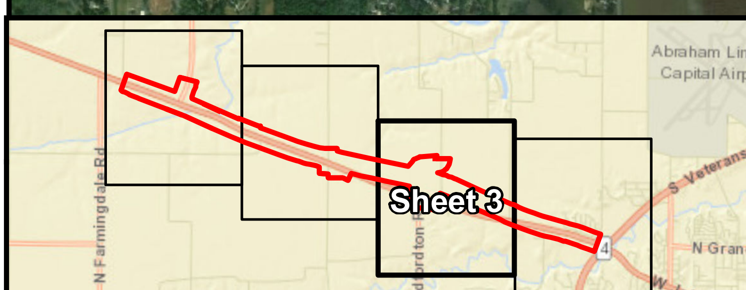

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Aerial Source: ESRI Online World Imagery

Legend

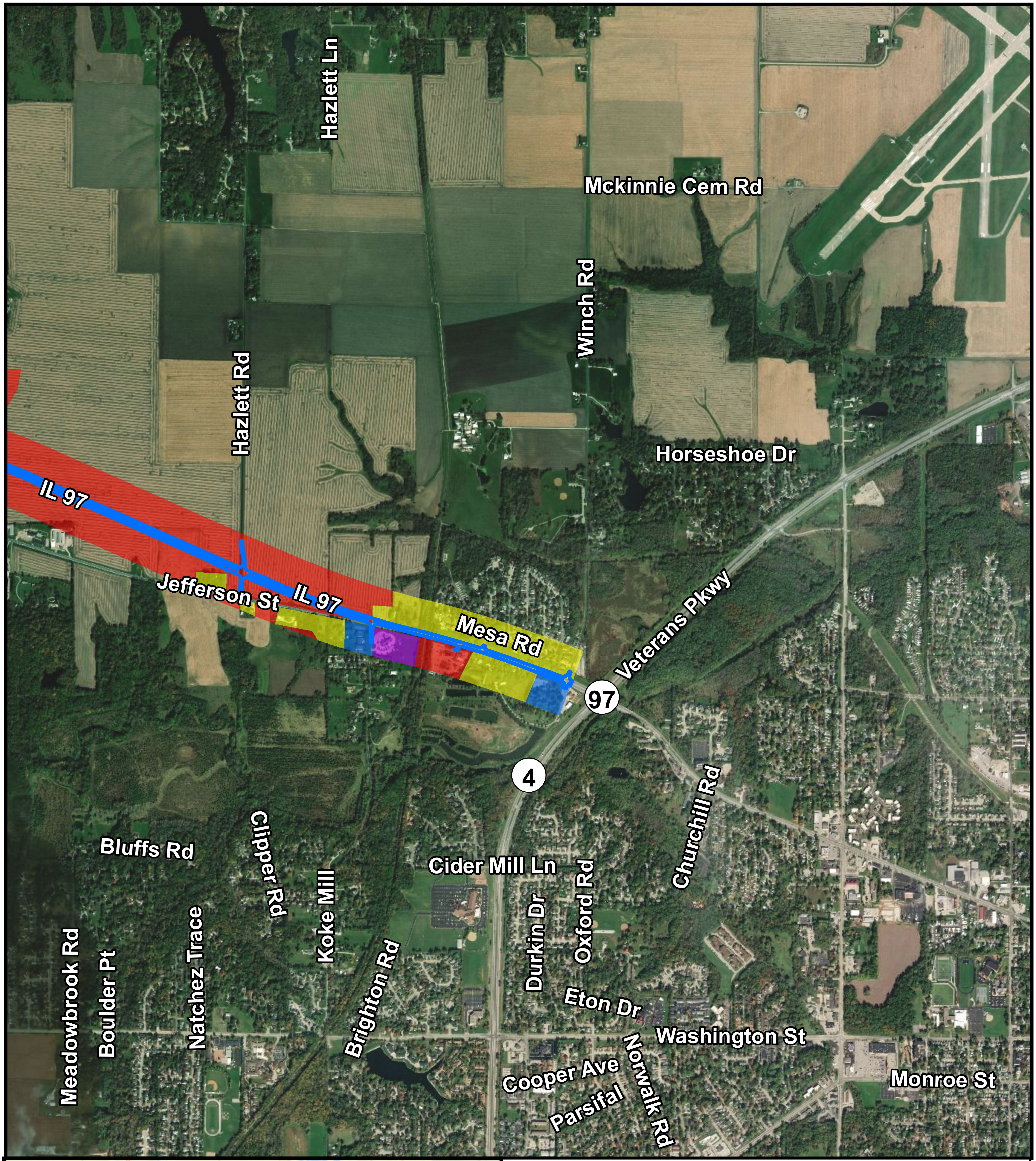
Proposed Edge of Pavement

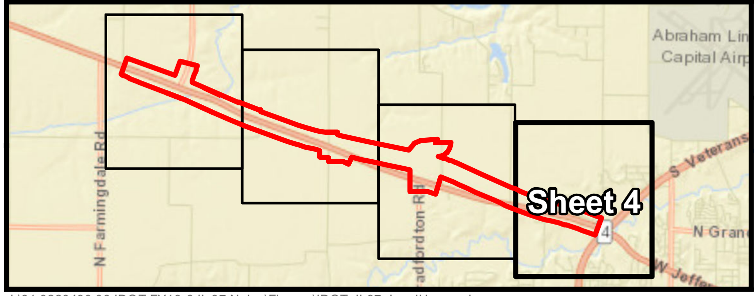
Activities Category

B C E F G

Huff & Huff, Inc.

Figure 2
Land Use and FHWA Activity Categories Map
IL 97 Highway Improvements in
Sangamon County, IL
Sheet 3 of 4





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Aerial Source: ESRI Online World Imagery

Legend

Proposed Edge of Pavement

Activities Category

B C E F G

Huff & Huff, Inc.

Figure 2
Land Use and FHWA Activity Categories Map
IL 97 Highway Improvements in
Sangamon County, IL
Sheet 4 of 4

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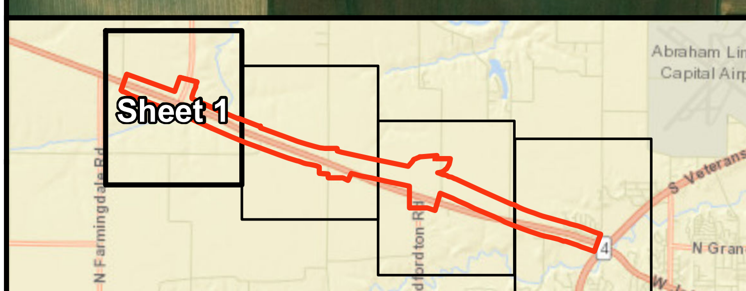

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Aerial Source: ESRI Online World Imagery

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Legend

Common Noise Environment

Receptors

Noise Study Area

Proposed Improvement

Huff & Huff, Inc.

Figure 3
Noise Receptor Location Map
IL 97 Highway Improvements in
Sangamon County, IL
Sheet 1 of 4

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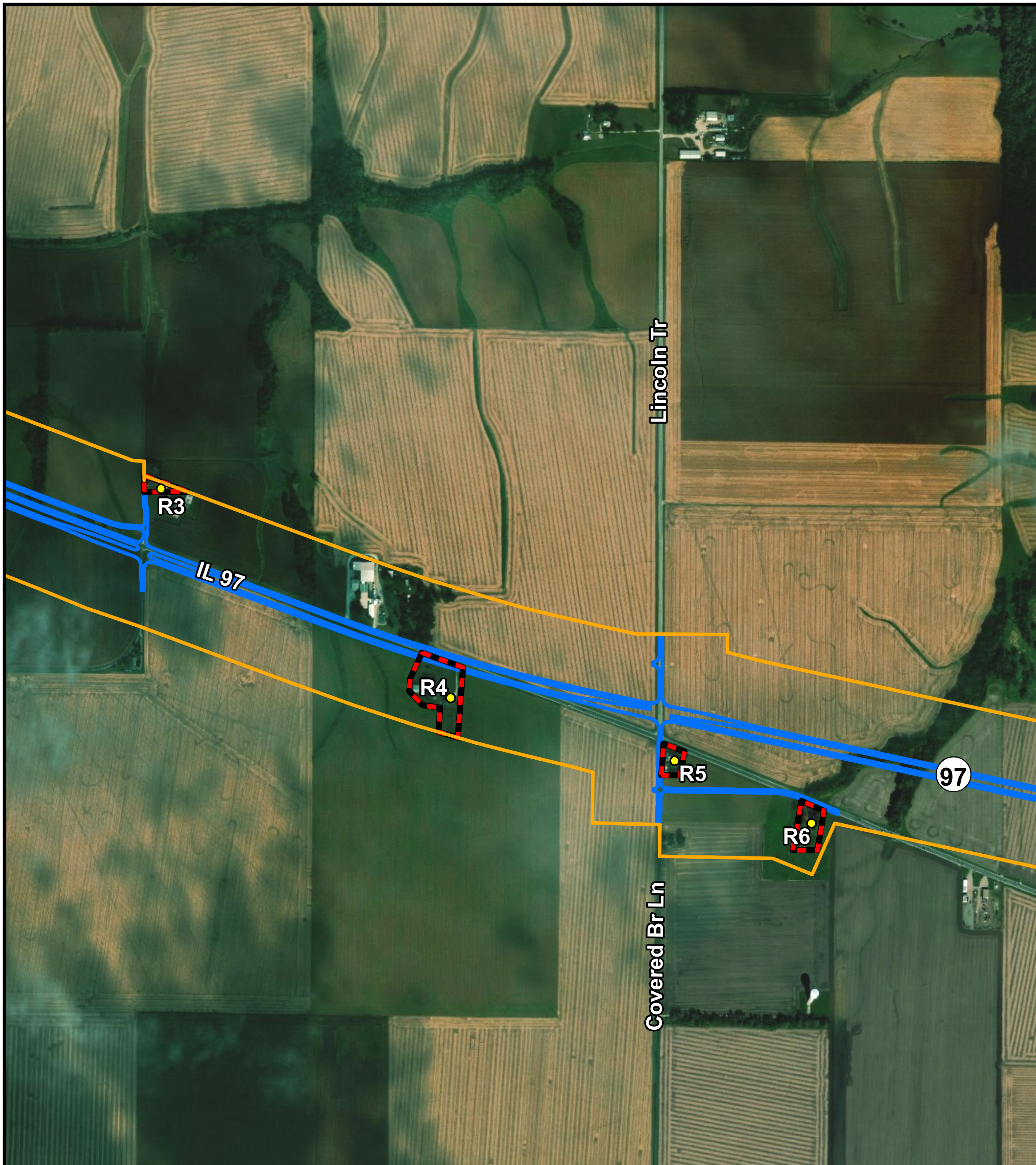

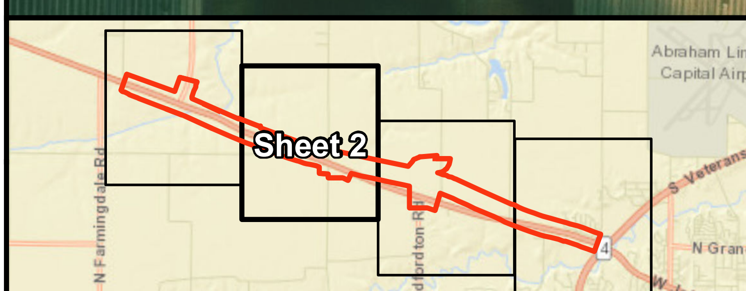

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Aerial Source: ESRI Online World Imagery

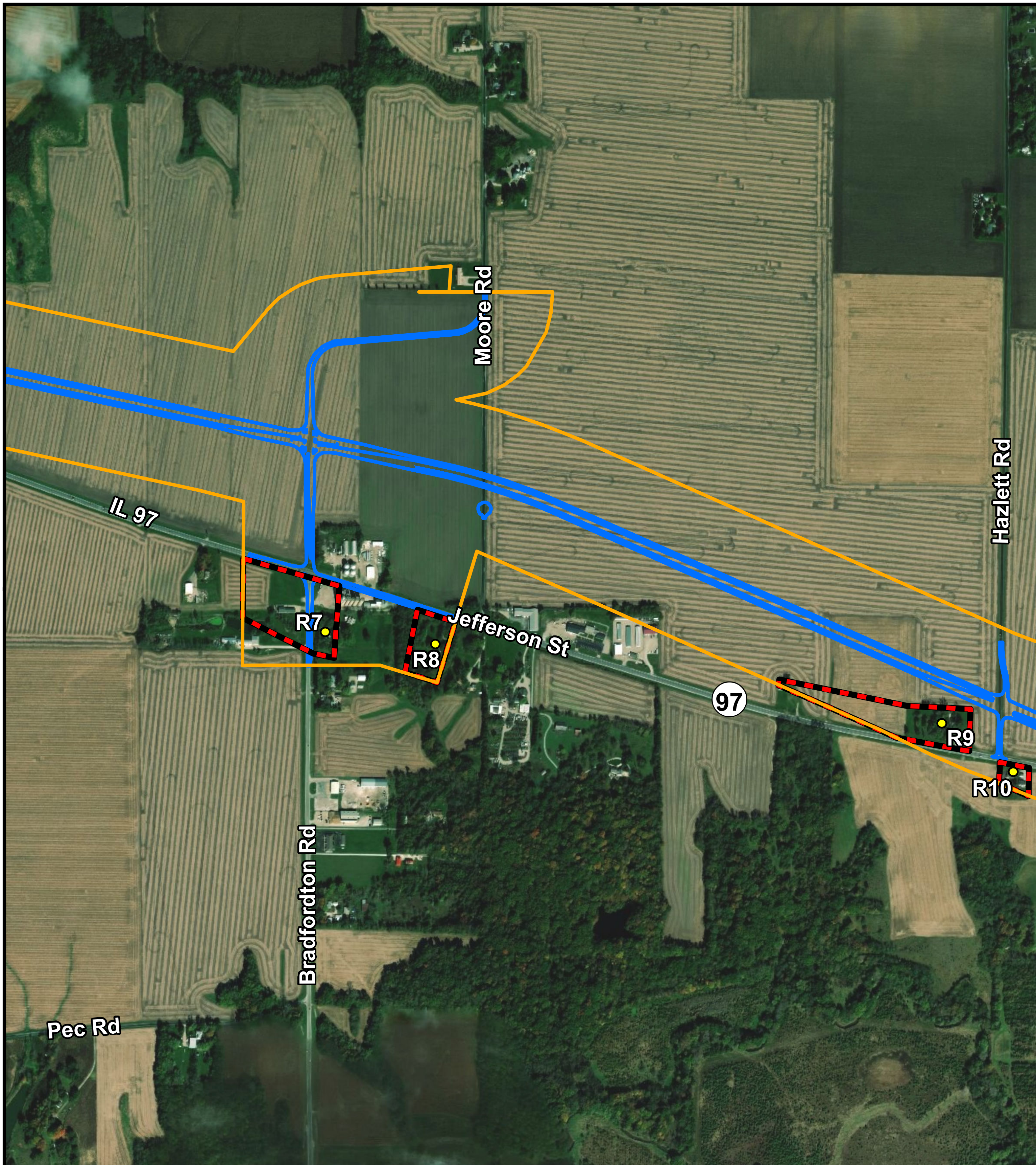
Legend

- Common Noise Environment
- Receptors
- Noise Study Area
- Proposed Improvement

Huff & Huff, Inc.

Figure 3
Noise Receptor Location Map
IL 97 Highway Improvements in
Sangamon County, IL
Sheet 2 of 4

J:\81.0220490.06 IDOT FY19-6 IL 97 Noise\Figures\IDOT_IL97_NRLM.mxd



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Aerial Source: ESRI Online World Imagery

Legend

- Common Noise Environment
- Receptors
- Noise Study Area
- Proposed Improvement

Huff & Huff, Inc.

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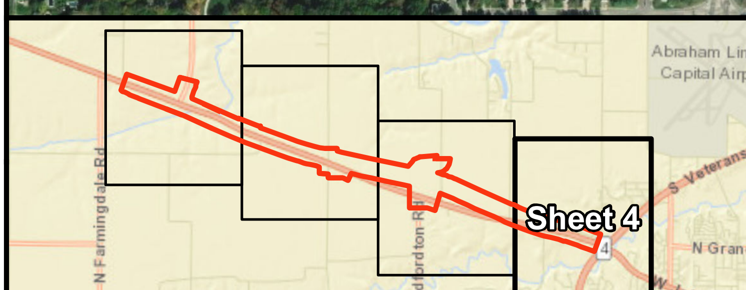

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Aerial Source: ESRI Online World Imagery

N W E S

Legend

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- Receptors
- Noise Study Area
- Proposed Improvement

Huff & Huff, Inc.

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Sheet 4 of 4

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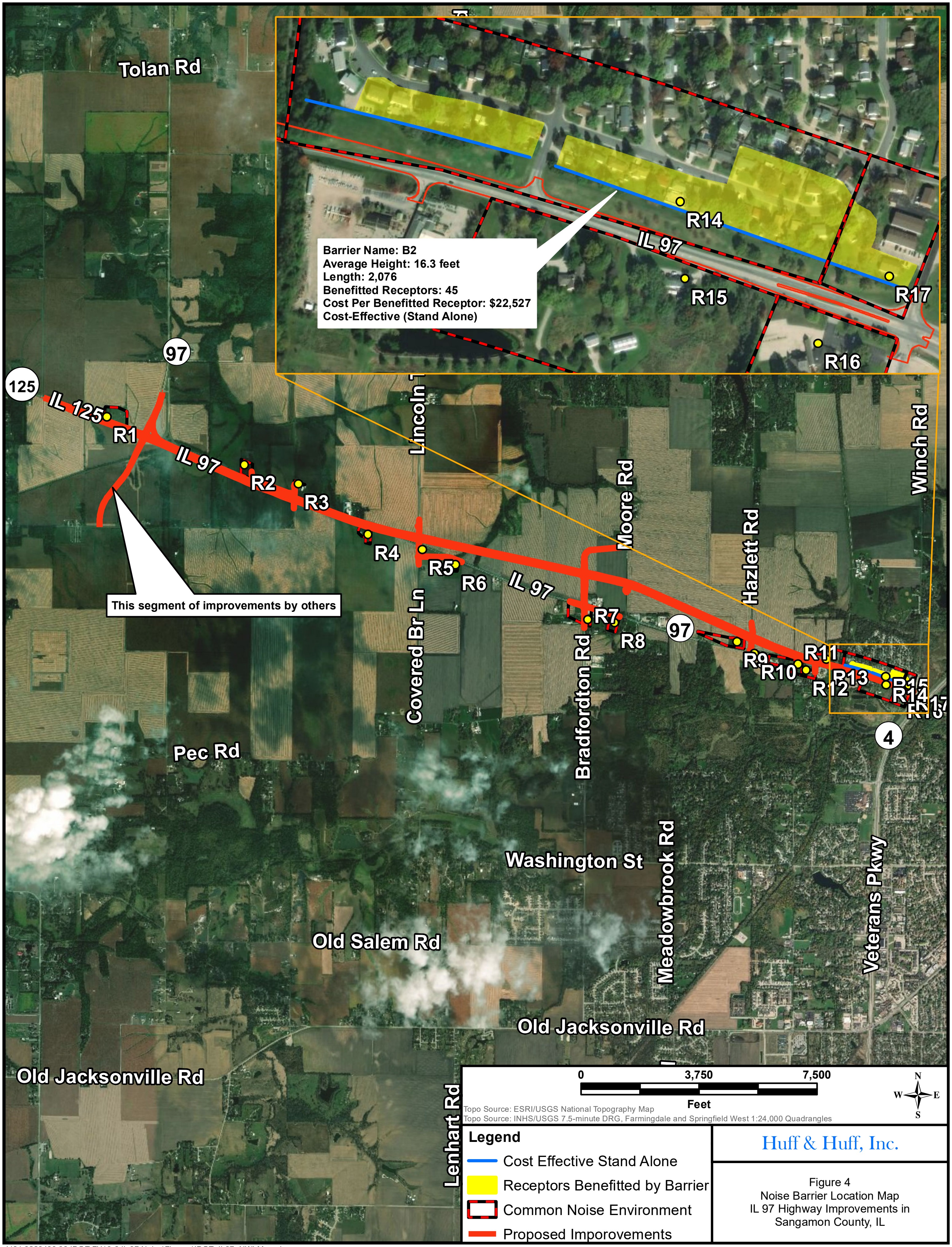

Figure 4
Noise Barrier Location Map
IL 97 Highway Improvements in
Sangamon County, IL

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Appendix A – Local Agency Noise Coordination

[DATE]

Springfield-Sangamon County
Regional Planning Commission
Room 212
200 South 9th Street
Springfield, Illinois 62701-1629

Re: Traffic Noise Information for Undeveloped Lands
Illinois Route 97 (Smith Road to Veterans Parkway)

The Illinois Department of Transportation is currently conducting environmental (Phase I) preliminary engineering studies for proposed improvements to Illinois Route 97 (IL 97) from Smith Road to Veterans Parkway in Sangamon County, Illinois.

As part of the Phase I Environmental Study for this proposed project, projected future traffic noise levels were evaluated for lands (either currently under your jurisdiction or land that may come under your jurisdiction) near the proposed roadway improvement. For your information, this study area includes land that may be planned for future development in a comprehensive land use plan.

This letter includes an exhibit showing the predicted design year (2040) build traffic noise levels for the undeveloped lands along the project corridor within your jurisdiction. This information is for your use in planning and permitting future development. We recommend that you carefully consider the future predicted noise levels to avoid potential issues of public concern over incompatible noise levels.

The figure shows currently vacant/future development areas in red, and also shows the distance from the center of the nearest outside IL 97 travel lane (based on the proposed improvement) to both the 66- and 71-dB(A) noise level contours.

- A 66-dB(A) noise contour represents noise levels that would be a noise impact for residential areas, schools, places of worship, medical offices, recreational areas, and institutional uses.
- A 71-dB(A) noise contour represents noise levels that would be a noise impact for hotels, restaurants, and offices.

To help with your future planning and discernment regarding permitting decisions, we encourage you to obtain the Federal Highway Administration (FHWA) publication titled *Entering the Quiet Zone: Noise Compatible Land Use Planning.* This publication can be obtained from the FHWA website:

www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/land_use/quitezon.pdf

For additional information regarding traffic noise, regulations and policy, noise analyses or noise abatement, we encourage you to visit the Department’s web site at: http://www.dot.il.gov/. Click on the “Environment” link and then the “Traffic Noise” link to access this information.
Sincerely

[DATE]

Valera Yazell
Director, Planning & Economic Development
City of Springfield
800 East Monroe, Suite 107,
Springfield, IL 6270

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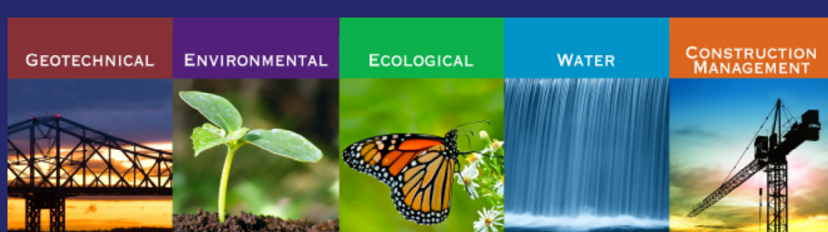

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