

APPENDIX I

Noise Analysis Reports

NOISE ANALYSIS REPORT

US 31 AT 276TH STREET INTERCHANGE

DES. NO. 1901797
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HAMILTON COUNTY, INDIANA

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION



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PROJECT INFORMATION

The US Route 31 (US 31) and 276th Street Interchange project is located at the intersection of 276th Street with US 31 at the border of Adams and Jackson Townships in Hamilton County, Indiana. It is located on the Sheridan and Arcadia, Indiana USGS 2.5-minute topographic quadrangles. Figures showing the project location are included in Appendix A.

The project extends along US 31 approximately 2,112 feet south and 2,326 feet north of 276th Street, and along 276th Street approximately 2,000 feet to the east and west 2,685 feet to Dunbar Road. The project area also includes the proposed locations of two access roads for existing uses in the southwest and northeast quadrants of the interchange.

In the project area, US 31 is a four-lane divided rural principal arterial with two twelve-foot lanes in each direction separated by a 43-foot grass median. 276th Street is a rural major collector with one eleven-foot travel lane in each direction. The existing US 31 and 276th Street intersection is four-legged with signal control. US 31 has two through lanes and a left turn lane on the northbound and southbound approaches. 276th Street has a single lane for all movements on the eastbound and westbound approaches.

The proposed project will include the construction of an interchange at US 31 and 276th Street. The proposed project will grade-separate 276th Street over US 31 in a partial clover (ParClo-A) two-quadrant configuration with ramps in the northwest and southeast quadrants. The ramp terminals will be one-way stop-controlled intersections. Other alternatives considered included a teardrop roundabout interchange, a traditional diamond interchange and a diamond interchange with roundabout ramp terminals.

In the proposed design, US 31 will remain on the existing alignment and retain the existing travel lane configuration. A new ten-foot outside shoulder will be added north and south of the interchange ramp gores through the ends of the project. Ramps will have one sixteen-foot lane, an eight-foot outside shoulder and a four-foot inside shoulder.

276th Street will have one twelve-foot lane in each direction, six-foot shoulders in each direction, a painted median on the overpass bridge and twelve-foot left turn lanes at the ramp terminals. The overpass bridge will have a minimum 16'-9½" vertical clearance and 276th Street will reach a peak elevation of approximately 920 feet, approximately 210 feet to the east of the overpass bridge. This will result in a vertical grade change of approximately 25 feet for 276th Street from existing to proposed along the new alignment of 276th Street.

The two access roads will be constructed on new alignment and will have one twelve-foot lane and a two-foot shoulder in each direction. One of these roads extends south from 276th Street on the west side of US 31; it will provide access to Reynolds Farm Equipment, which currently has access to 276th Street and a gravel drive to US 31. The other access road extends north from 276th Street on the east side of US 31 to serve several residences that currently have direct access to 276th Street.

Development at the project intersection is primarily residential and agricultural. An abandoned restaurant occupies the northwest corner of the intersection. The Reynolds Farm Equipment retail site is located on the west side of US 31 approximately 600 feet south of the intersection. One

residential relocation and acquisition of the abandoned restaurant are anticipated as part of the project.

The project is a Type 1 project under 23 CFR 772.5 because it involves the physical alteration of 276th Street causing substantial vertical alteration, removing shielding and exposing the line-of-sight between 276th Street and surrounding receptors.

The purpose of the project is to provide a grade separation between US 31 and 276th Street while maintaining access, in the context of INDOT's long term goal of full access control along US 31 between State Route 38 and the City of Kokomo, Indiana.

TRAFFIC NOISE ANALYSIS BACKGROUND INFORMATION AND REGULATIONS

Noise is generally defined as unwanted sound. Its loudness is measured in terms of sound pressure levels expressed in decibels (dB) and is composed of a wide range of frequencies. The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level. Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. Frequencies are measured in hertz (Hz), which is the number of cycles per second. The human ear is typically capable of hearing frequencies from approximately 20 to 20,000 Hz, and is less sensitive to higher and lower frequencies than mid-range frequencies. To compensate for low-end and high-end frequency insensitivity and to render noise levels readings more relevant to human experience, an "A-weighting" scale is used to approximate the response of the human ear. The A-weighted decibel (dB(A)) unit emphasizes measurement of perceptible sound energy and factors out the frequencies not perceptible to humans.

The dB(A) unit may indicate the level of environmental noise at an instant in time, but community noise levels vary continuously. Most environmental noise includes a composite of noise from different sources, creating a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of traffic noise, the equivalent hourly sound level $Leq(h)$, is commonly used. $Leq(h)$ is defined as the equivalent steady-state sound level over a one-hour period which contains the same acoustic energy as the time-varying sound level during the same period. Noise levels referred to in this report are stated as hourly-equivalent sound pressure levels $Leq(h)$ expressed in units of dB(A).

As decibels are logarithmic units, sound levels cannot be added by ordinary arithmetic means. The following general relationships provide a basic understanding of sound generation and propagation:

- The noise level from a line source, such as moving traffic on a road, will decrease approximately 3 dB(A) with every doubling of distance from the source.
- Research has indicated that a difference of 10 dB(A) is perceived as twice as loud (or half as loud) to the human ear.
- Typically, the human ear can barely perceive a 3 dB(A) change in loudness.

FEDERAL REGULATIONS

The Federal Aid Highway Act of 1970 required the Federal Highway Administration (FHWA) to develop noise standards and abatement requirements for highway traffic noise. These standards are contained in Title 23, Code of Federal Regulations (CFR), Part 772, Procedures for Abatement of

Highway Traffic Noise and Construction Noise. This regulation applies to highway construction projects where a state department of transportation has requested Federal funding for participation in the project. 23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. The regulations do not mandate that the abatement criteria be met in all situations, but rather require that reasonable and feasible efforts be made to provide noise mitigation when the abatement criteria are approached or exceeded. Per 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with FHWA noise standards.

FHWA has developed three “project types” to assess noise analysis applicability. Federal regulations only apply to Type I and Type II projects. Type III projects are ones that do not meet the definition of a Type I or Type II project and do not require a noise analysis. The project is a Type 1 project under 23 CFR 772.5 because it involves the physical alteration of 276th Street causing substantial vertical alteration, removing shielding and exposing the line-of-sight between 276th Street and surrounding receptors. Therefore, a traffic noise analysis is required for the full project limits. The FHWA regulations establish Noise Abatement Criteria (NAC) activity categories based on land use to assess potential traffic noise impacts as defined in 23 CFR 772. The FHWA NAC and description of activity categories are shown in Table 1. Traffic noise impacts occur when predicted design year noise levels under the build scenario approach, meet or exceed the NAC, or if there are substantial increases in traffic noise over existing conditions, independent of the NAC.

TABLE 1: FHWA NOISE ABATEMENT CRITERIA (NAC) ACTIVITY CATEGORIES

Activity Category	Leq (1 hour)	Description of Activity Category
A	57 dB(A) (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 dB(A) (exterior)	Residential.
C	67 dB(A) (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 dB(A) (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 dB(A) (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: 23 CFR 772, Table 1

If one or both of these conditions (noise level approaching the NAC or substantial increase in noise level) are met as a result of the proposed project, 23 CFR 772 requires that noise abatement measures must be considered. Noise abatement measures may include the following:

- Noise barrier construction: Noise barriers reduce noise by blocking the path of sound between the source of the noise and the receiver. To be effective, a noise barrier should be located adjacent to either the noise source or the receiver. There must be a long, continuous break of the line-of-sight from the highway to the receiver.
- Traffic management measures: These may include restrictions on speed, restrictions on traffic volumes, restricted access for certain motor vehicle types, and restricted times of travel.
- Alteration of horizontal and vertical alignments: Alignment of the road refers to the physical layout and location of the highway. A highway's noise impacts may be altered by shifting it in the horizontal or vertical direction.
- Noise insulation of public use or non-profit institution structures: For buildings listed under Category D in Table 1, insulation may be considered as a noise mitigation strategy; this strategy is not available to other types of noise-sensitive development.
- Acquisition of real property: In this case, the DOT acquires, or acquires interest in, primarily undeveloped property near the roadway that is the noise source, to preempt its future development with noise-sensitive uses.

STATE POLICY

FHWA requires that all states have an approved policy to identify and address highway traffic noise impacts. The Indiana Department of Transportation (INDOT) Traffic Noise Policy, effective July 1, 2017, was developed to implement the requirements of 23 CFR Part 772 and the noise-related requirements of the National Environmental Policy Act (NEPA) of 1969. The structure of the policy focuses on the following principal elements:

- Identification of noise sensitive areas and receptors.
- Determination of existing noise levels.
- Prediction of future noise levels.
- Identification of traffic noise impacts.
- Identification and consideration of noise abatement measures.
- Coordination with local government officials.
- Consideration of construction noise.

FHWA requires use of FHWA Traffic Noise Model (TNM) to determine current and future traffic noise levels created by a proposed project, and has deferred to the State agencies to define the noise level that “approaches” the NAC and to define a substantial increase in traffic noise levels.

INDOT defines noise impacts as modeled traffic-generated noise levels that are predicted to come within 1 dB(A) of, meet, or exceed the NAC for the appropriate activity category or that increase by 15 dB(A) or more over the existing traffic-generated noise levels. If modeling identifies noise impacts, noise abatement is considered. Abatement usually takes the form of noise barriers, which must be both feasible and reasonable to be constructed.

Feasibility includes two factors: engineering feasibility and acoustic feasibility. Engineering feasibility requires that noise abatement measures are based on sound engineering practices and standards and requires that any measures be evaluated at the optimum location. INDOT defines acoustic feasibility as noise barriers that achieve a 5 dB(A) reduction at a majority (greater than 50%) of the impacted receptors. In situations where engineering or acoustic considerations make noise barriers not feasible, the noise analysis will explicitly state the reasons.

To be considered reasonable, noise abatement measures must meet INDOT's noise reduction design goal, must not exceed INDOT's reasonable cost and must be desired by the benefited receptors.

INDOT's goal for substantial noise reduction is to provide at least a 7.0 dB(A) reduction for benefited first row receptors in the design year. However, conflicts with adjacent lands may make it impossible to achieve substantial noise reduction at all benefited first row receptors. Therefore, the noise reduction design goal for Indiana is 7dB(A) for a majority (greater than 50%) of the benefited first row receptors.

To determine cost effectiveness, the estimated cost of constructing a noise barrier (including installation and additional necessary construction such as foundations or guardrails) will be divided by the number of benefited receptors (those who would receive a reduction of at least 5 dB(A)). INDOT currently considers a base material and design cost of \$25,000 or less per benefited receptor to be cost-effective. Development in which the majority (more than 50%) of the receptors were in place prior to the initial construction of the roadway in its current state (functional classification) will receive additional consideration for noise abatement. The cost-effectiveness criteria used for these cases will be 20% greater (currently \$30,000 per benefited receptor).

If a noise barrier is determined to be feasible and to meet the noise reduction design goal within a reasonable cost, then the receptors benefiting from the noise barrier will be surveyed. If greater than 50% of the surveyed receptors respond that they desire the noise barrier, then it will be recommended for construction. If less than 50% of the surveyed receptors respond after two survey attempts, INDOT and FHWA will consult to determine whether the abatement will be recommended for construction.

The objectives of this noise study are to:

- Identify noise sensitive land uses within the traffic noise analysis area.
- Characterize the existing noise environment through field noise measurement at representative noise receptor sites.
- Validate the computer model using traffic data collected during the field measurement period.
- Use TNM to predict the existing year and design year traffic noise levels at noise receptor sites using INDOT certified traffic volumes.
- Identify impacted receptor sites and use TNM to determine if noise abatement measures are reasonable and feasible.

EXISTING CONDITIONS AND MODELED NOISE ENVIRONMENT

Centered on the existing signal-controlled intersection of US 31 and 276th Street, the US 31 at 276th Street Interchange project extends along US 31 approximately 2,112 feet south and 2,326 feet north of 276th Street, and along 276th Street approximately 2,000 feet to the east and west 2,685 feet to Dunbar Road. The project area also includes the proposed locations of two access roads for existing uses in the southwest and northeast quadrants of the interchange.

The existing project area terrain is relatively level, with the exception of the area immediately surrounding Little Cicero Creek. Because the creek areas do not intervene between the area roadways and the adjacent noise-sensitive uses, it was not necessary to model this change in elevation. The proposed changes will grade-separate 276th Street over US 31, using a ParClo-A (Two Quadrant) configuration with ramps in the northwest and southeast quadrants and stop-controlled offramps.

The noise study area was drawn to incorporate all areas within 500 feet perpendicular to the proposed project alignment. Land uses in the noise study area include primarily residential and agricultural properties, with limited commercial properties. The NAC Land Use Activity Categories figure in Appendix A shows the classification of properties in the noise study area with respect to the FHWA NAC Activity Categories. Whole-parcel acquisitions were not classified; they are identified on this figure. Noise sensitive receptor locations are shown on the 2043 Build Traffic Noise Model Results figure in Appendix A.

TNM MODELED OBJECTS

The 2023 Existing model includes sensitive receivers and applicable roadways and served as the base for the Validation models. The No Build model for design year 2043 retain the same features, while the 2043 Build model incorporates roadway and surface contour changes proposed for the project. The 2043 Contour model contains the same roadway and terrain features as the Build model and evaluates an array of receivers to develop noise level contours for the primarily agricultural area along US 31. Specific features of models for each area are as follows:

Validation, 2023 Existing and 2043 No Build models

- US 31, two lanes in each direction. Signal-controlled departure lanes at 276th Street. Traffic data indicate queues are less than one vehicle length on average and therefore the controlled lanes begin at the intersection.
- 276th Street, one lane in each direction. Signal-controlled departure lanes from US 31. Because there are no noise-sensitive receptors west of the intersection, the lanes were truncated approximately 1,300 feet west of the intersection rather than extending through Dunbar Road. Modeling has confirmed that the noise level outside of road right of way would not be expected to exceed 66 dBA in the existing, no build and build cases.
- Both US 31 and 276th Street on structure where they cross Little Cicero Creek
- Four individual receivers in Existing and No Build models
- Three GIS-located field receivers in Validation models; a separate Validation model was prepared for each field measurement and its corresponding traffic count

2043 Build model

- US 31 travel lanes on same location, segmented to reflect new on- and off-ramps
- All four ramps, segmented to model acceleration and deceleration as appropriate
- 276th Street east of the project area on same location
- Within project area, 276th Street new alignment and profile, which includes a slight shift north on the west leg. 276th Street overpass is on structure where appropriate.
- 276th Street is segmented at ramp intersections to allow modeling of vehicles accelerating from ramps. Normally, a one-way stop-controlled intersection would not require modeling of acceleration on the main road. In this case, the DHV traffic for 276th Street originating from the surrounding area is approximately equal to the DHV traffic originating from the ramps, and therefore acceleration was modeled by adding flow control segments in both directions from each ramp. The flow control consisted of a constraint of 20 miles per hour (mph) to represent the speed vehicles would attain when exiting the intersection and a percentage of vehicles affected equal to the percentage of vehicles departing the intersection that originate from the ramp, calculated from the DHV traffic.
- The new private drives were not modeled because traffic projections indicated the number of vehicles traveling these roadways will be very low and unlikely to contribute to a noise impact.
- The same receivers found in the Existing and No Build models
- Terrain representing bottom of slope for new ramps and at the overpass

2043 Contour model

- The same roadways and terrain lines as the 2043 Build model
- On the east and west sides of US 31 and the proposed ramps, an array of receivers spaced at 50 feet east-west and 200 feet north-south on center. Based on results observed in the 2043 Build model, three rows of receivers were used in most locations and were found adequate to define the 66 dBA contour.

TRAFFIC VOLUMES AND SPEED

For the Validation models, traffic volumes were counted simultaneously with the field noise measurements. For the Existing, No Build, Build and Contour models, 2017 INDOT traffic counts at the US 31 and 276th Street intersection were projected forward to 2023 and 2043 using annual growth figures developed from HCS results presented in the Alternatives Evaluation Report (The Corradino Group, July 26, 2019). Design hour volumes were calculated from the resulting projected ADT values.

Traffic speeds on US 31 were measured with a radar gun during the field noise measurements and the average of the measured speeds in each direction was used for the Validation, Existing and No Build models. Because these speeds were just under the posted speed and the project would be expected to create more consistent traffic flow along US 31, the posted speed of 60 mph was used in the Build and Contour models. The posted speed of 55 mph was used on 276th Street in all models.

NOISE MEASUREMENTS AND MODEL VALIDATION

FIELD NOISE MEASUREMENTS

CMT collected field noise measurements on October 8, 2020. Based on correspondence with INDOT ESD, one location was chosen as representative of the limited noise-sensitive uses in the area, and two additional locations were selected to ensure that the model accurately represents noise along US 31 north and south of the intersection. Noise measurement locations are shown on the Noise Sensitive Areas and Field Measurement Points figure in Appendix A.

Field data collection sheets are included in Appendix B and show measurement times, weather conditions and details of each measurement location. The field team consisted of a field noise analyst and a traffic count person. For all measurement points, traffic was counted at the intersection of US 31 and 276th Street simultaneously with the measurement.

All noise measurements were collected with a Quest SoundPro DL-2 sound level meter that was calibrated with a Quest QC-10 acoustical calibrator. The meter was mounted on a tripod to establish a sampling height of five feet. The meter was set to Leq mode with slow response and 3 dB exchange rate, and the frequency response was set to the A-weighted scale as required by FHWA. All measurements were collected over 15-minute periods with simultaneous traffic counts on the applicable roadway(s). The sound level meter reports and calibration information for the meter and calibrator are also included in Appendix B.

TRAFFIC NOISE MODEL VALIDATION

A model is considered validated when the modeled and measured noise levels are within 3 dB(A). To create the validation models for each field noise measurement point, the TNM model of the 2023 existing condition was adjusted to reflect atmospheric conditions observed during the noise measurements. The traffic data collected during noise measurements were used to validate the 2023 Existing model by setting up Validation models for each measurement point, multiplying the traffic counts from each 15-minute measurement period by four to obtain hourly traffic counts and entering the resulting counts into that measurement point's model. All Validation models validated for their respective measurement locations. Model validation results are provided in Table 2.

TABLE 2: MODEL VALIDATION RESULTS

Model Measurement Location	Address	Field Measurement (dB(A))	TNM Model Result (dB(A))	Difference
NMP-1	2000 E 276 th Street	59.9	58.4	-1.5
NMP-2	27915 US Highway 31 N	65.9	66.7	0.8
NMP-3	27498 US Highway 31 N	67.6	65.0	-2.6

TRAFFIC NOISE MODEL RESULTS AND IMPACT ASSESSMENT

Once the model was determined valid, TNM was used to predict existing and future traffic noise impacts at noise sensitive land uses throughout the analysis area. Due to required right of way, the project will result in property acquisition that is shown on the 2043 Build Traffic Noise Model Results figure in Appendix A. All receptors in the project area are single-family residential properties with a NAC criterion of 67 dB(A), and an INDOT approach criterion of 66 dB(A).

The 2023 Existing TNM model predicted traffic noise levels for the current roadway configuration and the 2043 Build TNM model predicted traffic noise levels for the proposed roadway configuration in the design year. The model results were evaluated to assess whether the proposed project results in noise levels that meet one or both of the traffic noise impact criteria described in the “Traffic Noise Analysis Overview” section on page 4.

Table 3 provides the TNM results for the project area receptors, which are depicted on the 2043 Build Traffic Noise Model Results figure in Appendix A. No receptors are predicted to experience traffic noise levels that approach, meet or exceed the Noise Abatement Criterion (NAC) or to experience design year “build” traffic noise levels of at least 15 dB(A) over the existing condition, the substantial increase criterion. Therefore, no evaluation of noise mitigation measures is required.

TABLE 3: NOISE MODEL RESULTS AND IMPACT ASSESSMENT

Receptor Number	Location	Number of Dwelling Units (DUs)	NAC with INDOT Approach Criterion (dB(A))	2023 Existing Traffic Noise (dB(A))	2043 Predicted Traffic Noise (dB(A))	Increase/Decrease (dB(A))	# DUs Impacted
1	2000 E 276 th St	1	66	57.1	57.3	0.2	0
2	2240 E 276 th St	1	66	54.2	52.2	-2.0	0
3	2248 E 276 th St	1	66	51.4	51.3	-0.1	0
4	2417 E 276 th St	1	66	59.0	59.3	0.3	0

CONSIDERATION OF ABATEMENT

Because no traffic noise impacts were identified, no abatement measures were considered.

CONSTRUCTION NOISE

Construction phasing remains under development. Based on information in the Alternatives Evaluation Report, the interchange ramps and local connector streets are likely to be constructed before the overpass to provide continued access during closure of 276th Street. Construction is expected to require approximately 14 months.

Noise from construction activities will add to the average noise level during the construction phase of the project. However, construction activities will be temporary. INDOT will be sensitive to local needs and may make adjustments to work practices in order to reduce inconvenience to the public.

COORDINATION WITH LOCAL GOVERNMENT OFFICIALS

To evaluate the distance from US 31 at which the Noise Abatement Criteria (NAC) approach criterion for various types of land uses would be exceeded, “dummy” receivers were placed in the TNM in a regularly-spaced array along both sides of the roadway to a distance of 200 feet from the edge of planned pavement. The 71 dBA NAC Category E approach criterion was not exceeded except at the planned roadway ditches. The 66 dBA NAC Categories B and C approach criterion noise contours are shown on the 2043 Noise Levels for Land Planning figure in Appendix A.

Upon completion of the environmental document for this project, INDOT will provide this noise study to the Hamilton County Plan Commission and to the Town of Arcadia Plan Commission. INDOT understands that it is in a unique position to provide outreach to local government and county planning units. INDOT also understands that it is the local or county government that has the power to regulate land development. INDOT is willing to help the local government by providing expert guidance on noise-related issues. This can include recommendations on setbacks, how to interpret noise studies that have been provided for FHWA projects, and other general noise concerns so that noise impacts are minimized for areas that are being developed.

CONCLUSIONS AND RECOMMENDATIONS

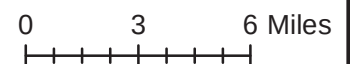
The proposed US 31 at 276th Street Interchange project is centered on the intersection of US 31 with 276th Street in Hamilton County, Indiana. The project will replace the existing signal-controlled intersection of US 31 and 276th Street with an interchange that grade-separates 276th Street in a ParClo-A (Two Quadrant) configuration with ramps in the northwest and southeast quadrants and one-way stop-controlled intersections at the ramp terminals. New local access roads will be provided in the northeast and southwest quadrants. The project is a Type 1 project under 23 CFR 772.5 because it involves the physical alteration of 276th Street causing substantial vertical alteration, removing shielding and exposing the line-of-sight between 276th Street and surrounding receptors.

A total of four noise-sensitive receptors, all single-family residences, were evaluated for noise impacts as part of this study. Properties that will be relocated were not evaluated. Traffic noise impacts are not predicted for any receptor and therefore no noise abatement measures were evaluated.

US 31 at 276th Interchange

APPENDIX A: FIGURES

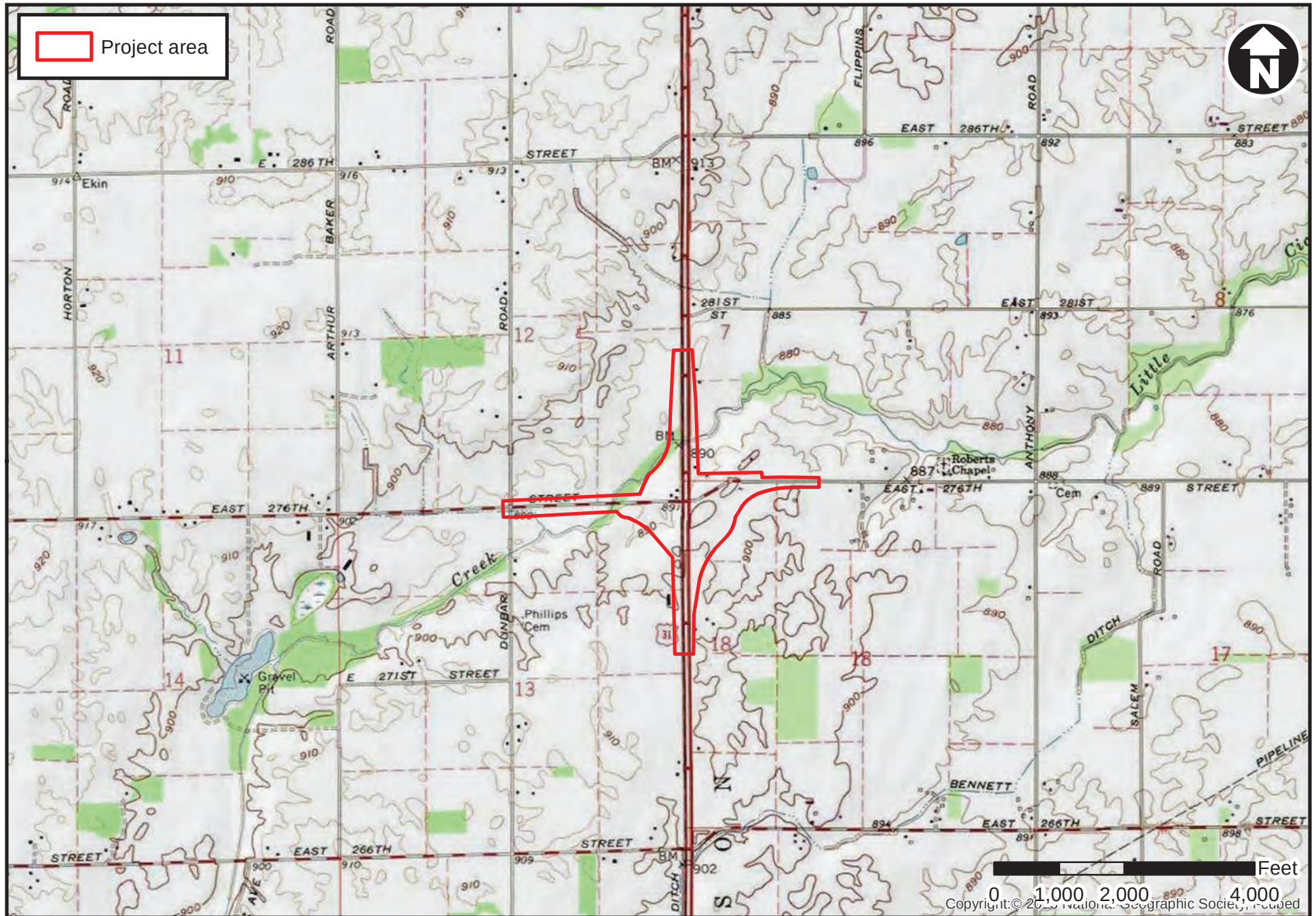




Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

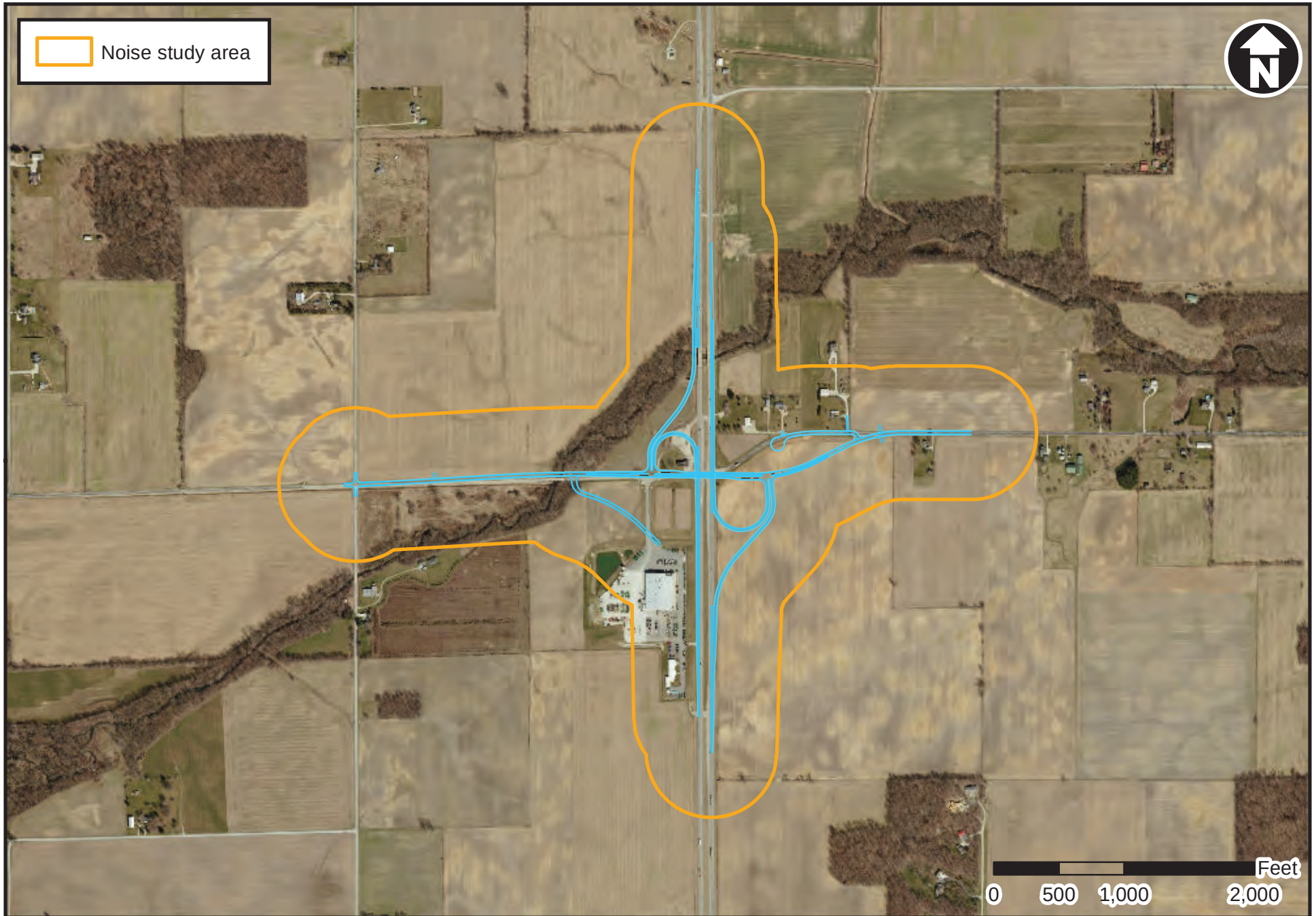
US 31/276th St New Interchange (Des. No. 1901797)

Location Map - Hamilton County, Indiana

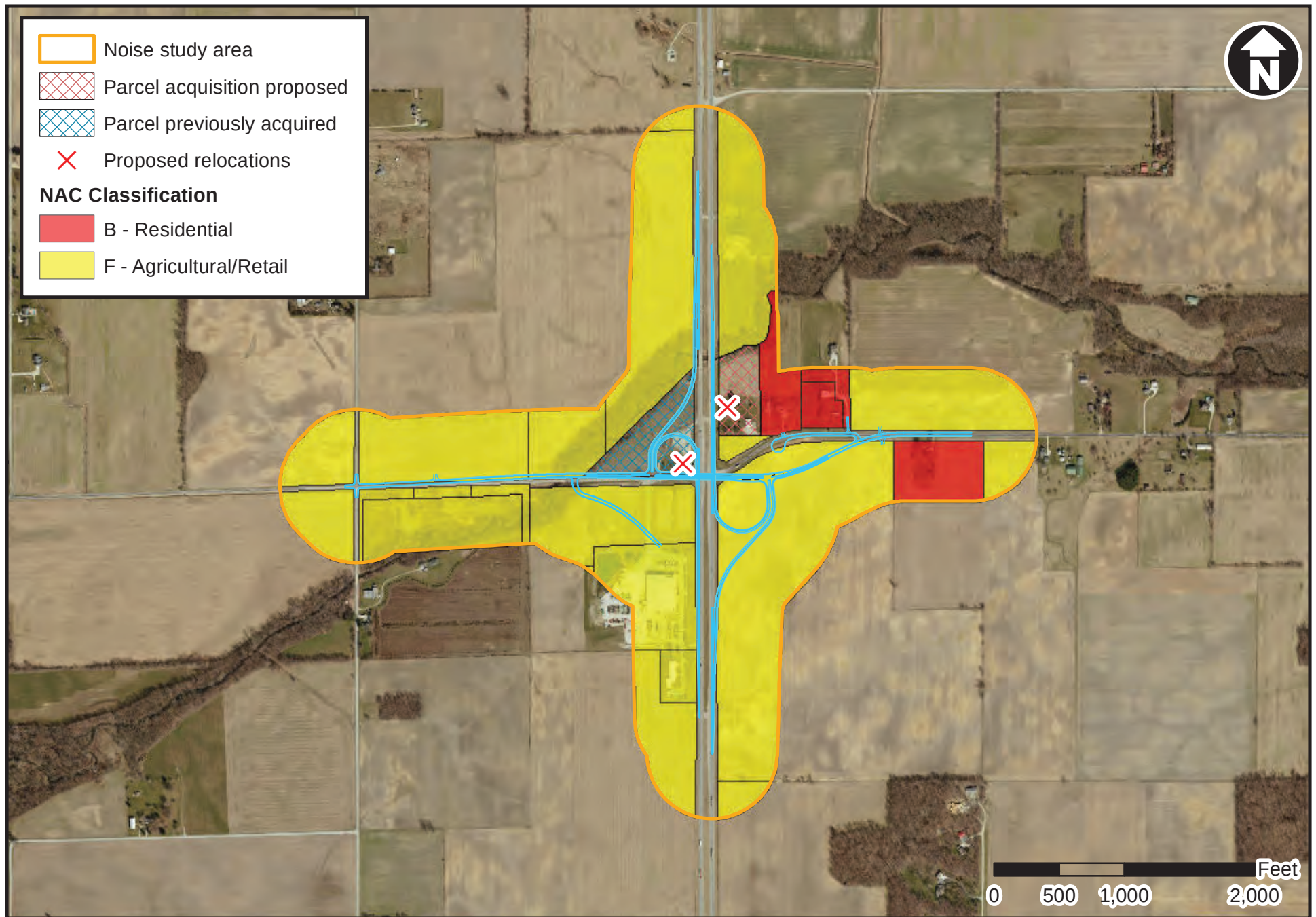


US 31 & 276th Street New Interchange (Des No 1901797)

USGS TOPOGRAPHIC MAP - Sheridan & Arcadia, IN Quadrangles



US 31 & 276th Street New Interchange (Des No 1901797)
AERIAL MAP SHOWING PROPOSED DESIGN



US 31 & 276th Street New Interchange (Des No 1901797)

NAC LAND USE ACTIVITY CATEGORIES

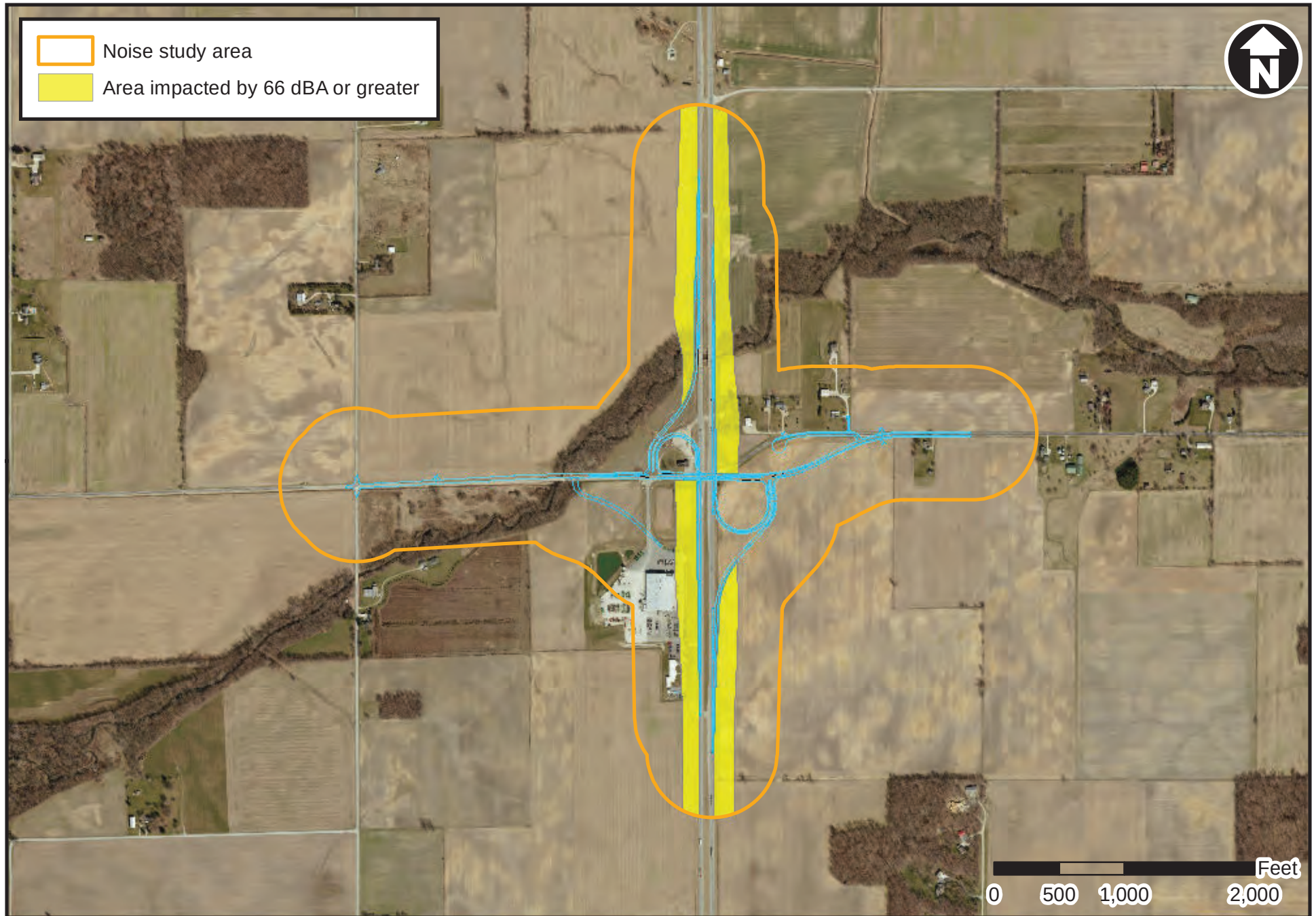


US 31 & 276th Street New Interchange (Des No 1901797)

NOISE SENSITIVE AREAS AND FIELD MEASUREMENT POINTS



US 31 & 276th Street New Interchange (Des No 1901797) 2043 BUILD TRAFFIC NOISE MODEL RESULTS



US 31 & 276th Street New Interchange (Des No 1901797)
2043 NOISE LEVELS FOR LAND PLANNING

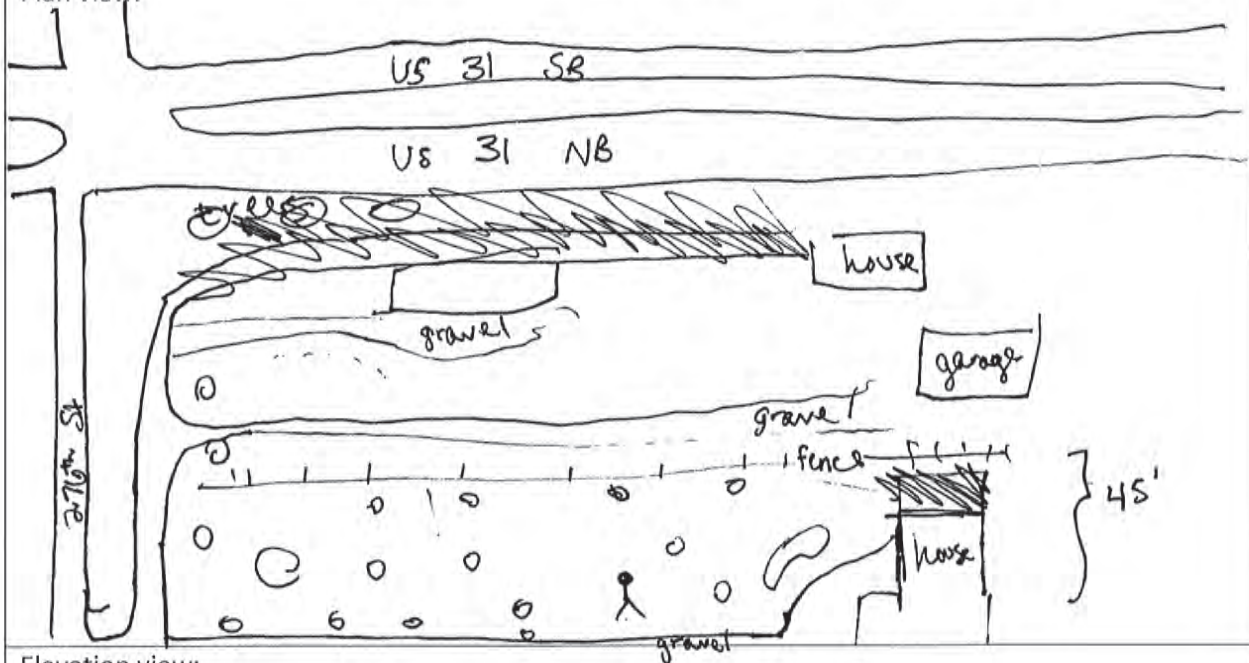
US 31 at 276th Interchange

APPENDIX B: FIELD DATA

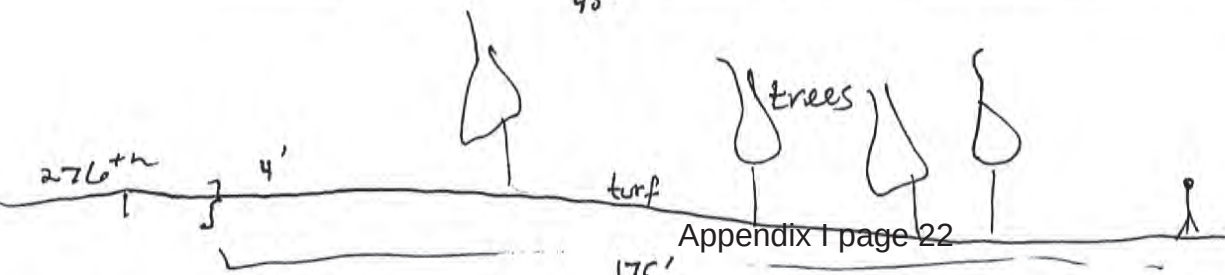
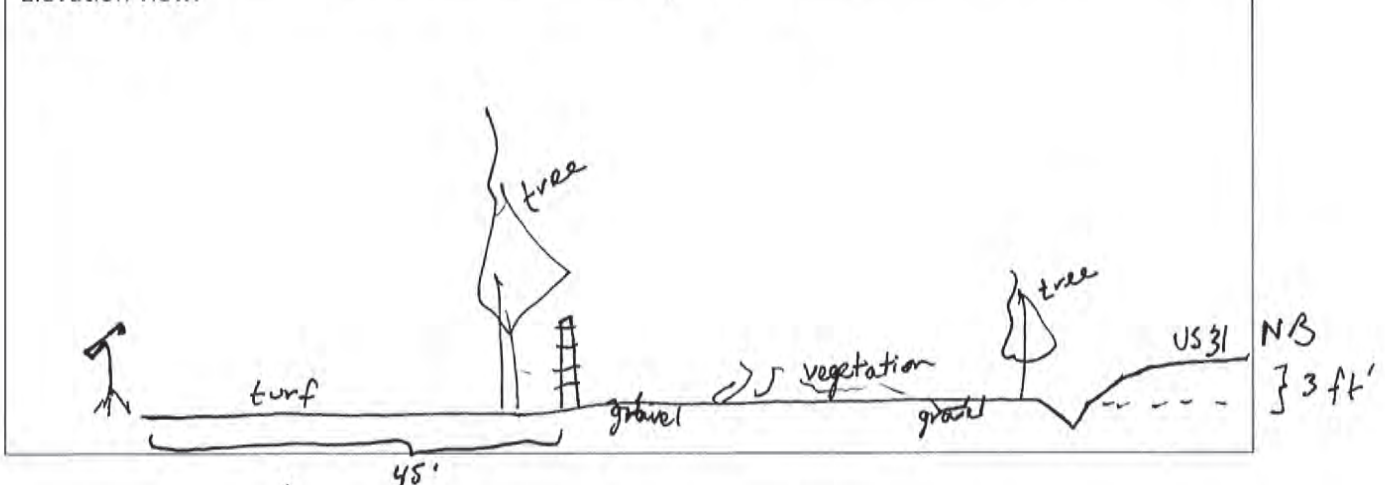


Site ID:	US 31/276 th St		Location		
Observer	CMP	Date	10/8/20	Count location	NMP 1
Temperature	83°F	Cloud cover	0 %	Humidity	30 %
Wind direction	NE	Wind speed, avg	1.5 mph	Wind speed, max	4.6 mph
Start time	4:07	Stop time	4:22	Leq/avg and Lmax	59.9 ; 66.6

Plan view:



Elevation view:



402

Traffic Count

Start Time: 4:07

End Time: 4:22

Primary roadway/direction: US 31 NB

Cars ⑨

Med Trucks

Heavy Trucks

⑭

⑬

⑮

⑯

⑰

⑱

⑲

Primary roadway/2nd direction: US 31 SB

Cars ⑩

Med Trucks

Heavy Trucks

⑪

⑫

⑬

⑭

⑮

⑯

⑰

Secondary roadway/direction: West 276th Street

Cars

Med Trucks

Heavy Trucks

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Secondary roadway/2nd direction: East 276th Street

Cars

Med Trucks

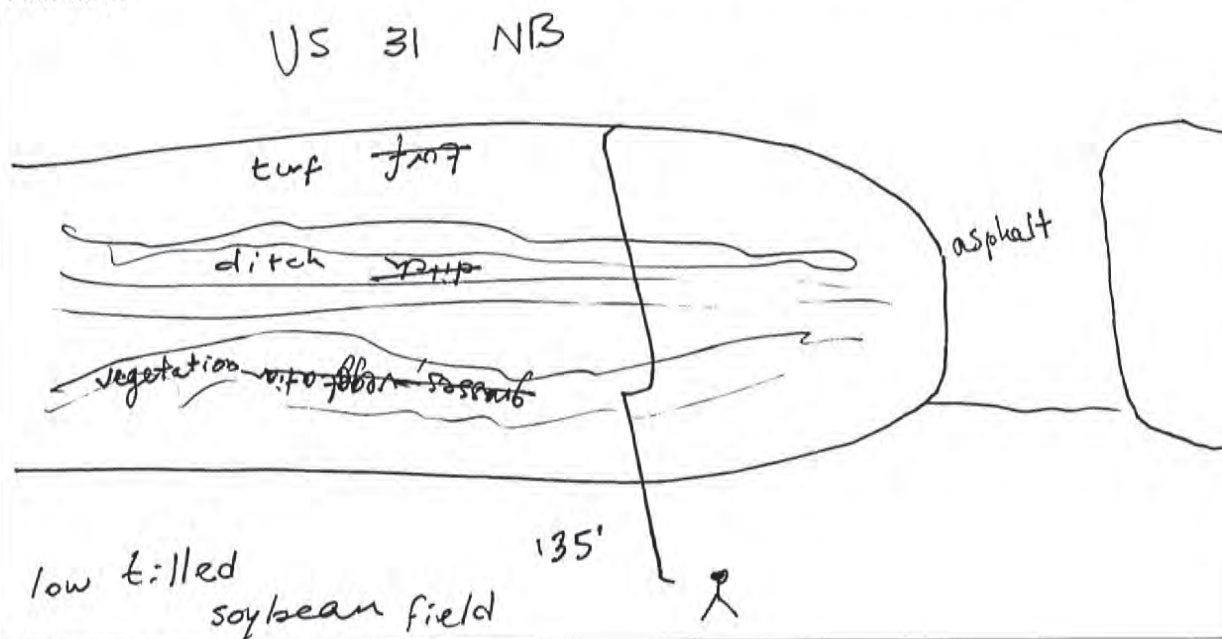
Heavy Trucks

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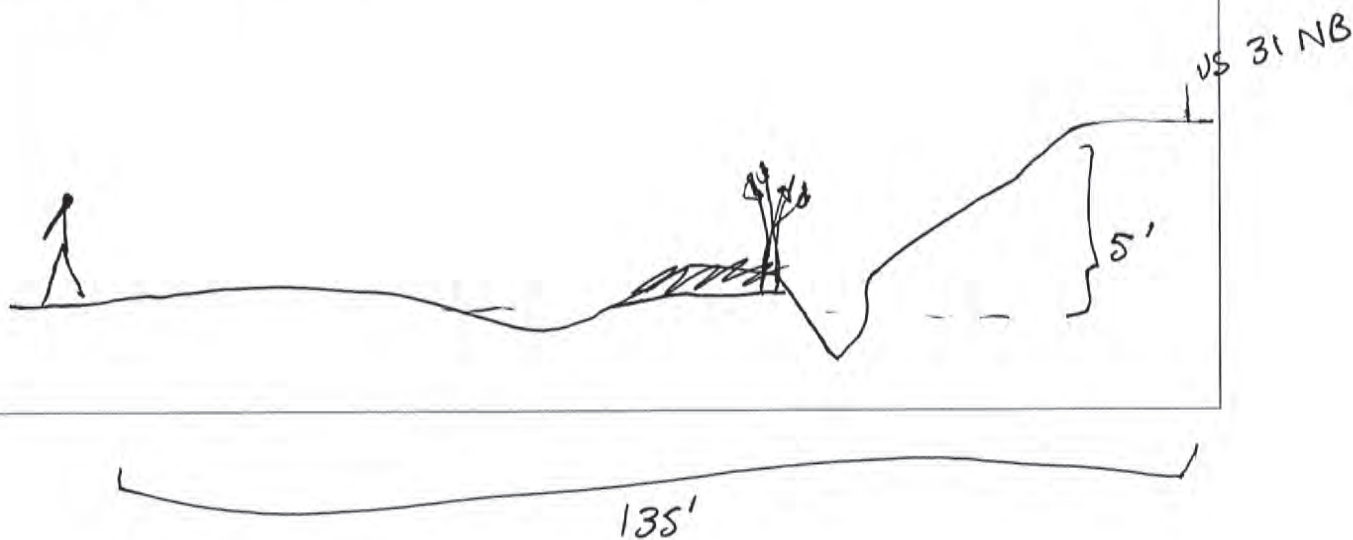
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Site ID:	US 31 / 276 th		Location		
Observer	CMP	Date	10/8/20	Count location	NMP 2
Temperature	83°F	Cloud cover	0%.	Humidity	30%
Wind direction	~~S~~ E	Wind speed, avg	2.2 mph	Wind speed, max	4.3 mph
Start time	4:37	Stop time	4:52	Leq/avg and Lmax	66.3; 74.2

Plan view:

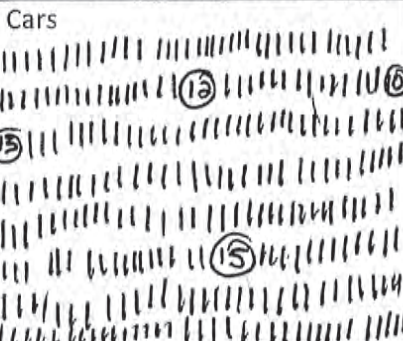
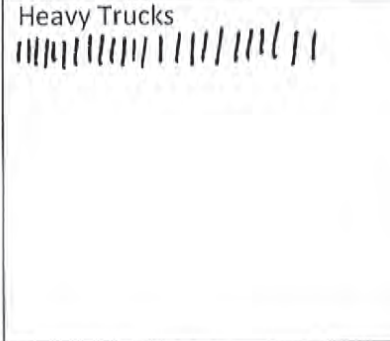
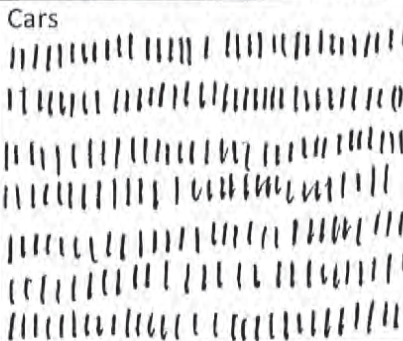
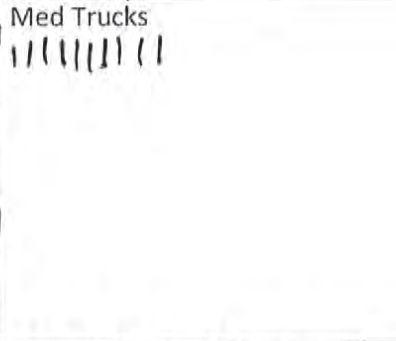
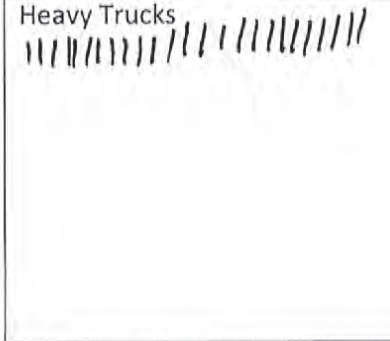
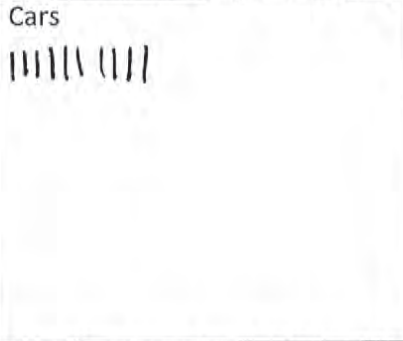
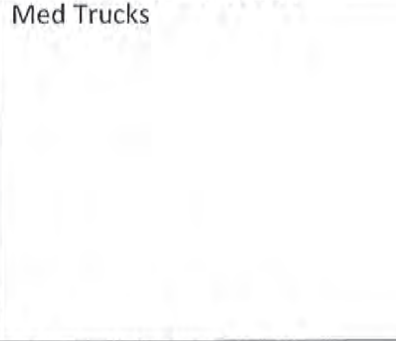
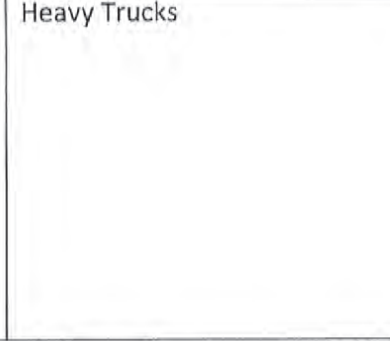


Elevation view:



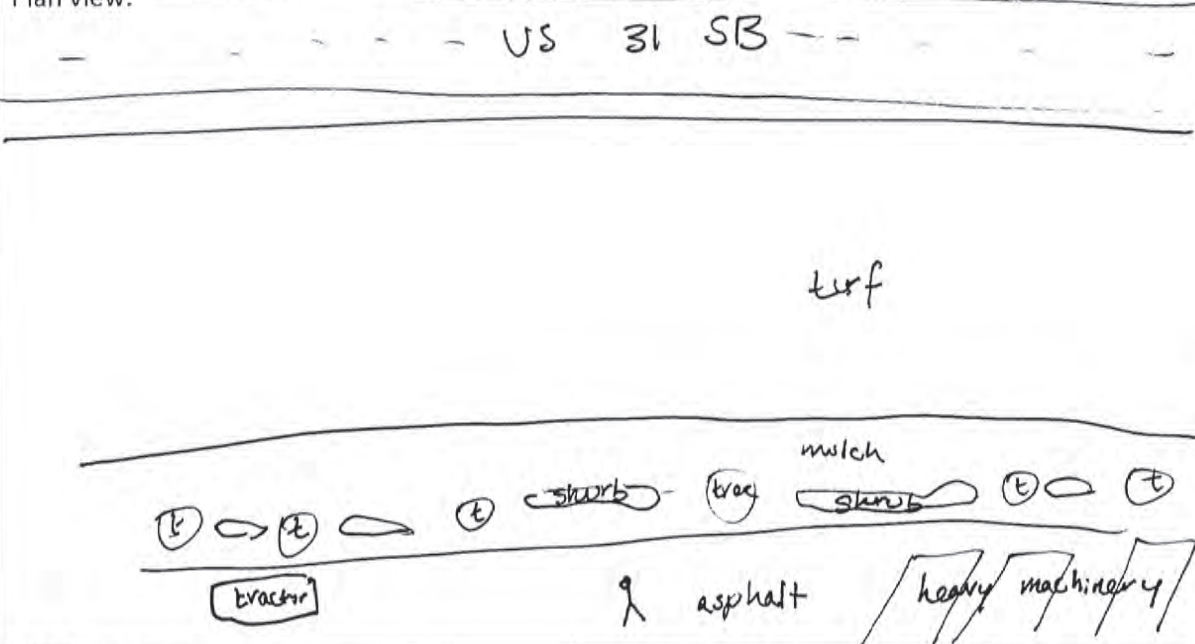
Traffic Count Start Time: 4136

End Time: 4:51

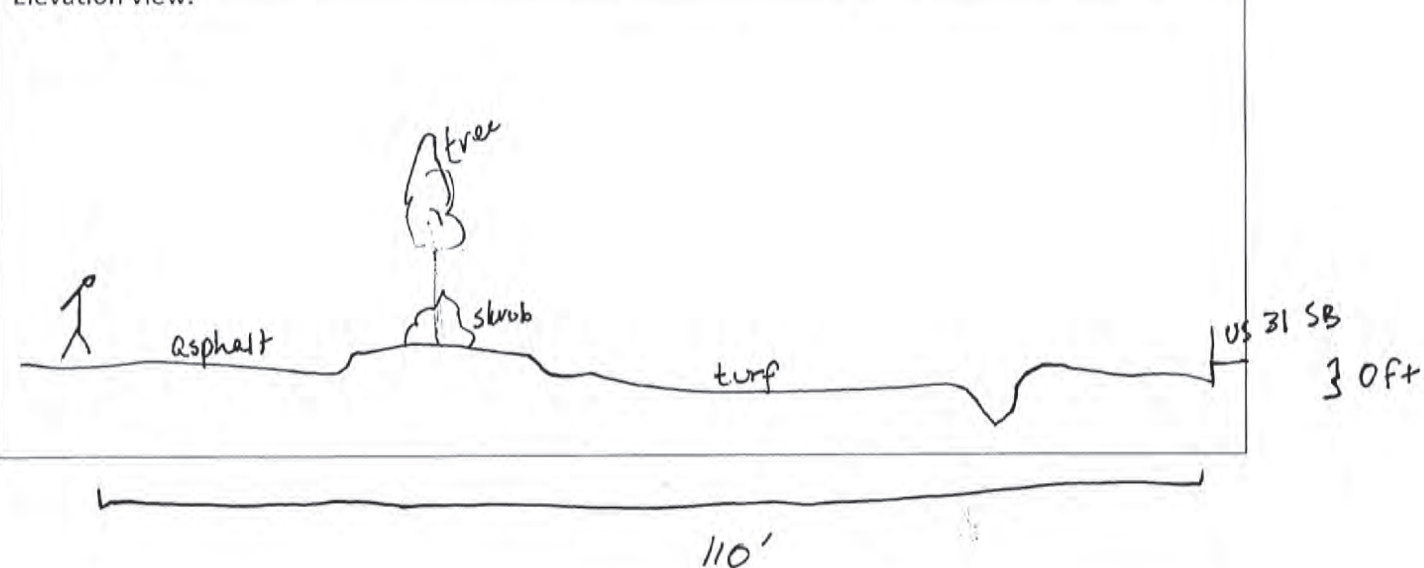
Primary roadway/direction: <u>US 31 NB</u>		
Cars 	Med Trucks 	Heavy Trucks 
Primary roadway/2 nd direction: <u>US 31 SB</u>		
Cars 	Med Trucks 	Heavy Trucks 
Secondary roadway/direction: <u>West 276th Street</u>		
Cars 	Med Trucks 	Heavy Trucks 
Secondary roadway/2 nd direction: <u>East 276th Street</u>		
Cars 	Med Trucks 	Heavy Trucks 

Site ID:	US 31/276 th		Location		
Observer	CMP	Date	10/8/20	Count location	NMP 3
Temperature	81°	Cloud cover	0	Humidity	30%.
Wind direction	SE	Wind speed, avg	2.7 mph	Wind speed, max	5.1 mph
Start time	5:05	Stop time	5:20	Leq/avg and Lmax	67.8; 83.3

Plan view:

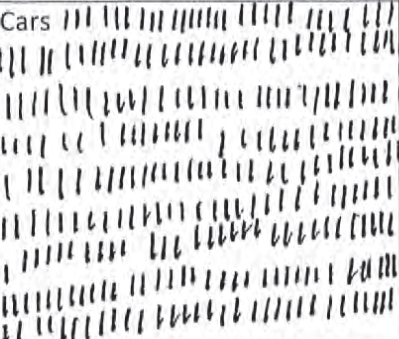
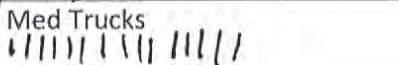
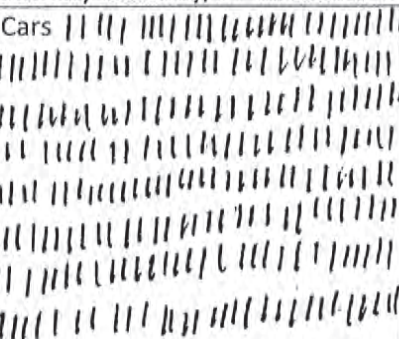
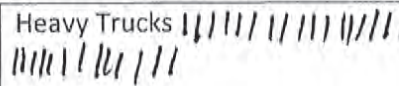
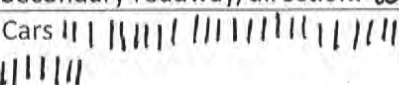
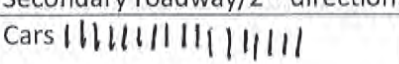


Elevation view:



Traffic Count Start Time: 5:05

End Time: 5:20

Primary roadway/direction: <u>US 31 NB</u>		
Cars 	Med Trucks 	Heavy Trucks 
Primary roadway/2 nd direction: <u>US 31 SB</u>		
Cars 	Med Trucks 	Heavy Trucks 
Secondary roadway/direction: <u>West 276th Street</u>		
Cars 	Med Trucks	Heavy Trucks
Secondary roadway/2 nd direction: <u>East 276th Street</u>		
Cars 	Med Trucks	Heavy Trucks

58mph

61mph

Session Report

10/8/2020

Information Panel

Name S063_BIJ080007_08102020_192739
Start Time 10/8/2020 4:07:22 PM
Stop Time 10/8/2020 4:22:29 PM
Device Name BIJ080007
Model Type SoundPro DL
Device Firmware Rev R.13H
Comments

Calibration History

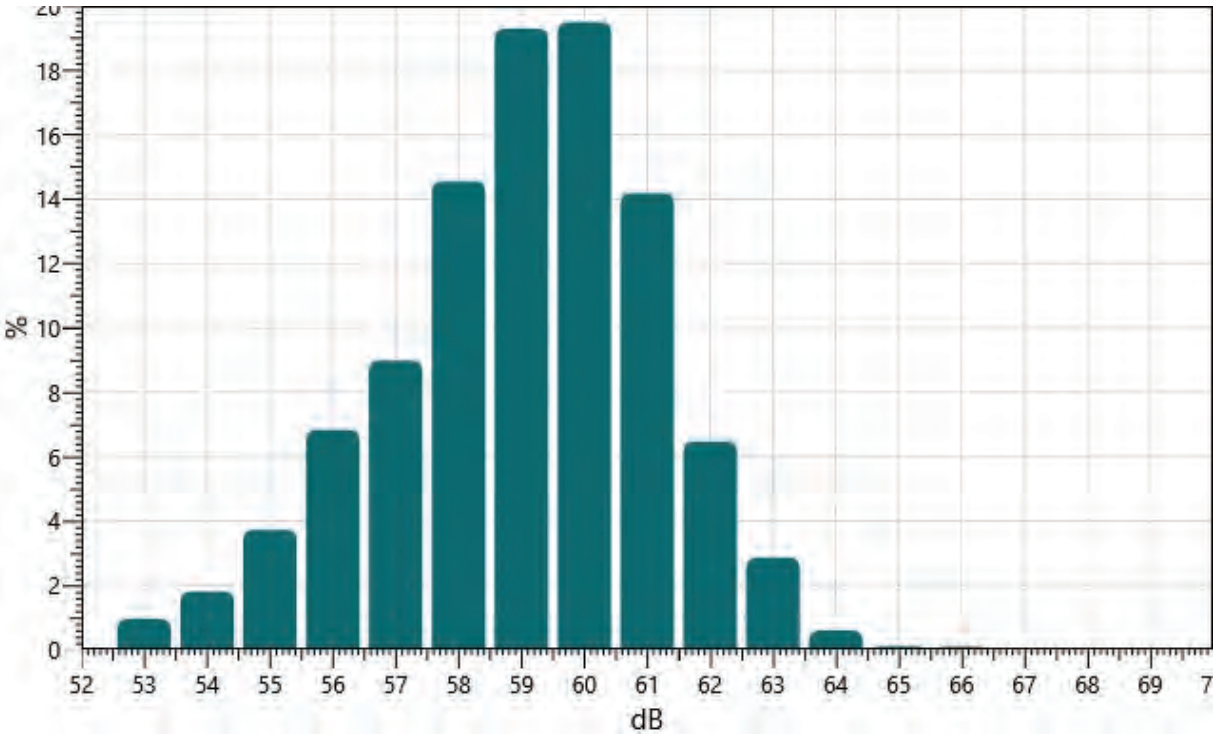
<u>Date</u>	<u>Calibration Action</u>	<u>Level</u>	<u>Cal. Model Type</u>	<u>Serial Number</u>	<u>Cert. Due Date</u>
10/8/2020 3:48:51 PM	Calibration	114.0			

Summary Data Panel

<u>Description</u>	<u>Meter</u>	<u>Value</u>	<u>Description</u>	<u>Meter</u>	<u>Value</u>
Leq	1	59.9 dB	Lmax	1	66.6 dB
L90	1	56.4 dB	L50	1	59.5 dB
L10	1	61.9 dB			
Exchange Rate	1	3 dB	Weighting	1	A
Response	1	SLOW	Bandwidth	1	OFF
Leq	2	59.8 dB	Lmax	2	69.1 dB
Exchange Rate	2	3 dB	Weighting	2	A
Response	2	FAST			

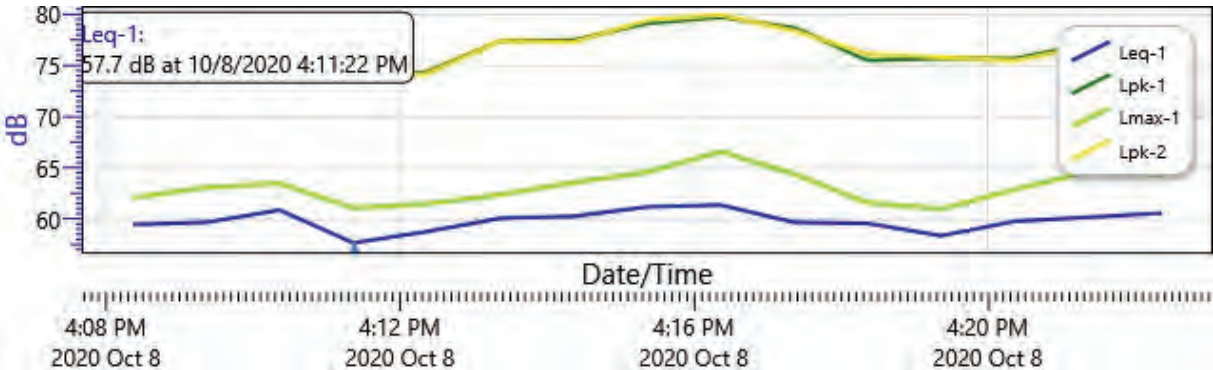
Statistics Chart

S063_BIJ080007_08102020_192739: Statistics Chart



Logged Data Chart

S063_BIJ080007_08102020_192739: Logged Data Chart



Logged Data Table

Date/Time	Leq-1
10/8/2020 4:08:22 PM	59.5
4:09:22 PM	59.7
4:10:22 PM	60.9
4:11:22 PM	57.7
4:12:22 PM	58.8



Date/Time	Leq-1
4:13:22 PM	60.1
4:14:22 PM	60.3
4:15:22 PM	61.2
4:16:22 PM	61.4
4:17:22 PM	59.7
4:18:22 PM	59.6
4:19:22 PM	58.4
4:20:22 PM	59.8
4:21:22 PM	60.2
4:22:22 PM	60.6

Session Report

10/8/2020

Information Panel

Name S064_BIJ080007_08102020_192739
Start Time 10/8/2020 4:36:52 PM
Stop Time 10/8/2020 4:52:11 PM
Device Name BIJ080007
Model Type SoundPro DL
Device Firmware Rev R.13H
Comments

Calibration History

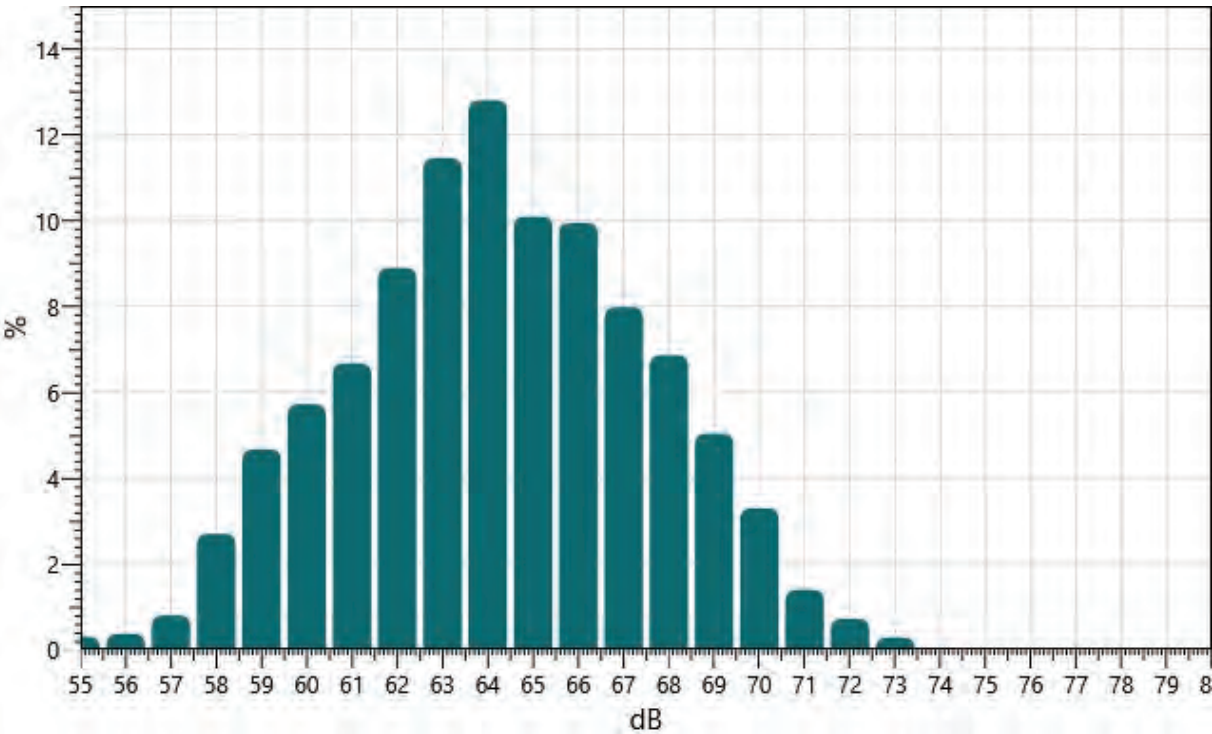
<u>Date</u>	<u>Calibration Action</u>	<u>Level</u>	<u>Cal. Model Type</u>	<u>Serial Number</u>	<u>Cert. Due Date</u>
10/8/2020 3:48:51 PM	Calibration	114.0			

Summary Data Panel

<u>Description</u>	<u>Meter</u>	<u>Value</u>	<u>Description</u>	<u>Meter</u>	<u>Value</u>
Leq	1	65.9 dB	Lmax	1	74.2 dB
L90	1	60 dB	L50	1	64.5 dB
L10	1	69 dB			
Exchange Rate	1	3 dB	Weighting	1	A
Response	1	SLOW	Bandwidth	1	OFF
Leq	2	65.8 dB	Lmax	2	76.4 dB
Exchange Rate	2	3 dB	Weighting	2	A
Response	2	FAST			

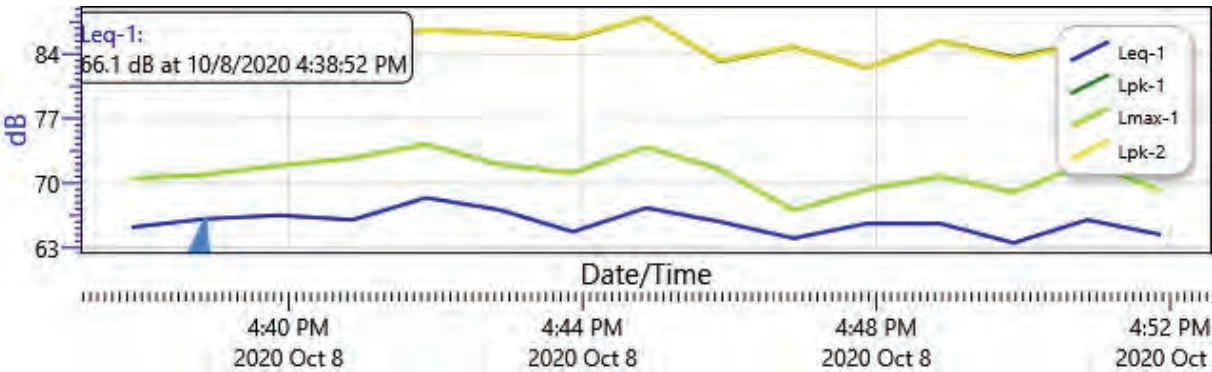
Statistics Chart

S064_BIJ080007_08102020_192739: Statistics Chart



Logged Data Chart

S064_BIJ080007_08102020_192739: Logged Data Chart



Logged Data Table

Date/Time	Leq-1
10/8/2020 4:37:52 PM	65.2
4:38:52 PM	66.1
4:39:52 PM	66.5
4:40:52 PM	66
4:41:52 PM	68.4



Date/Time	Leq-1
4:42:52 PM	67.1
4:43:52 PM	64.7
4:44:52 PM	67.3
4:45:52 PM	65.8
4:46:52 PM	64
4:47:52 PM	65.6
4:48:52 PM	65.6
4:49:52 PM	63.5
4:50:52 PM	66
4:51:52 PM	64.4

Session Report

10/8/2020

Information Panel

Name S065_BIJ080007_08102020_192740
Start Time 10/8/2020 5:04:51 PM
Stop Time 10/8/2020 5:19:54 PM
Device Name BIJ080007
Model Type SoundPro DL
Device Firmware Rev R.13H
Comments

Calibration History

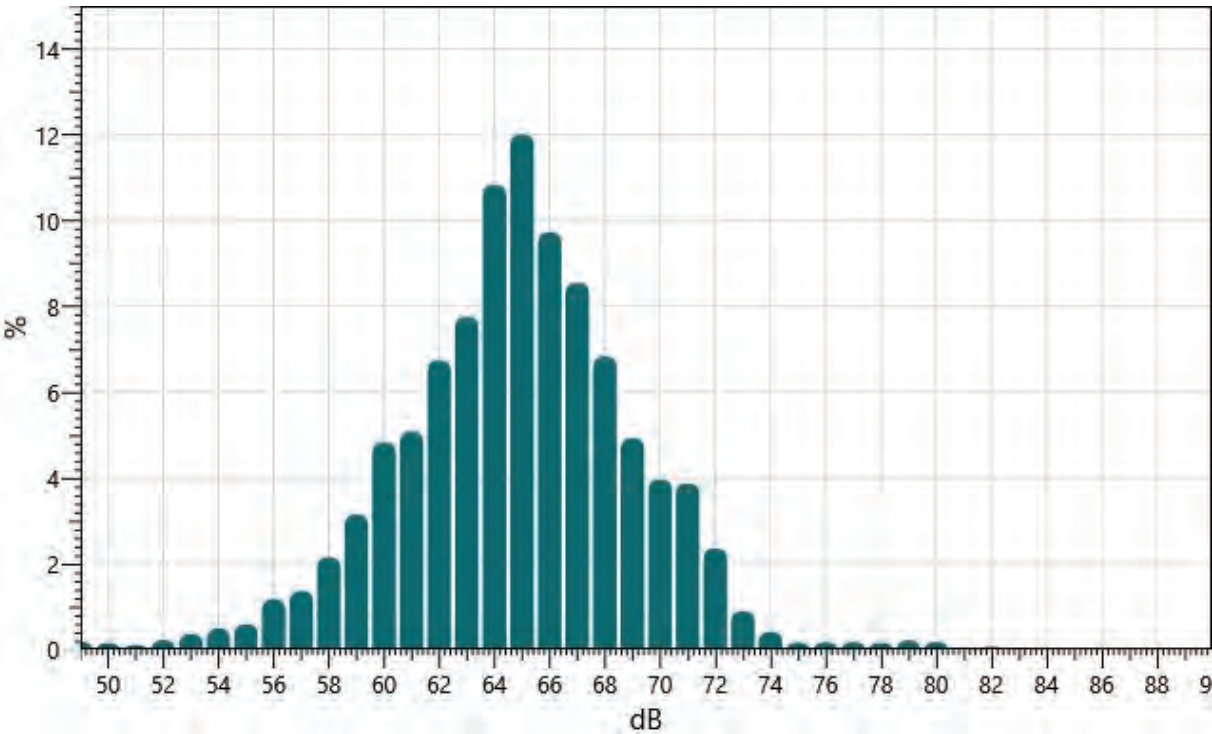
<u>Date</u>	<u>Calibration Action</u>	<u>Level</u>	<u>Cal. Model Type</u>	<u>Serial Number</u>	<u>Cert. Due Date</u>
10/8/2020 3:48:51 PM	Calibration	114.0			
10/8/2020 5:22:39 PM	Verification	114.0			

Summary Data Panel

<u>Description</u>	<u>Meter</u>	<u>Value</u>	<u>Description</u>	<u>Meter</u>	<u>Value</u>
Leq	1	67.6 dB	Lmax	1	83.3 dB
L90	1	59.9 dB	L50	1	65.2 dB
L10	1	70.5 dB			
Exchange Rate	1	3 dB	Weighting	1	A
Response	1	SLOW	Bandwidth	1	OFF
Leq	2	67.5 dB	Lmax	2	85.7 dB
Exchange Rate	2	3 dB	Weighting	2	A
Response	2	FAST			

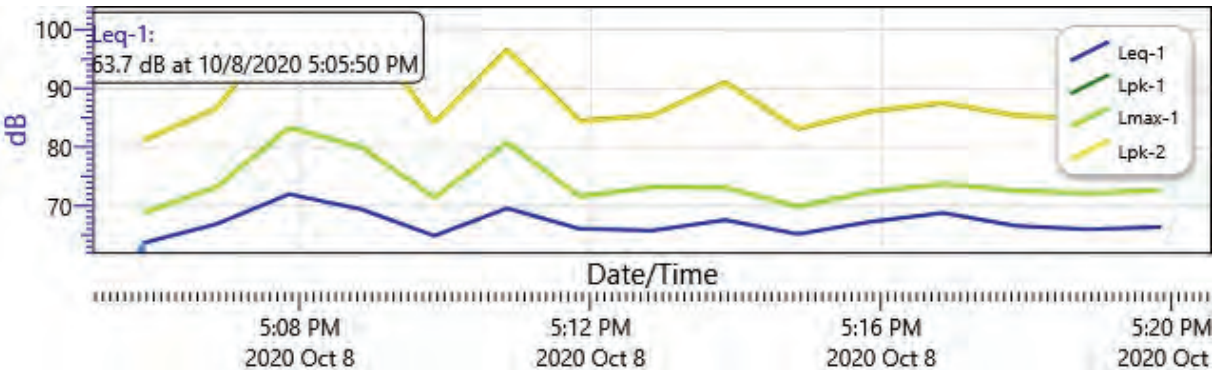
Statistics Chart

S065_BIJ080007_08102020_192740: Statistics Chart



Logged Data Chart

S065_BIJ080007_08102020_192740: Logged Data Chart



Logged Data Table

Date/Time	Leq-1
10/8/2020 5:05:51 PM	63.7
5:06:51 PM	66.9
5:07:51 PM	72
5:08:51 PM	69.4
5:09:51 PM	64.9



Date/Time	Leq-1
5:10:51 PM	69.6
5:11:51 PM	66.1
5:12:51 PM	65.8
5:13:51 PM	67.6
5:14:51 PM	65.2
5:15:51 PM	67.3
5:16:51 PM	68.8
5:17:51 PM	66.6
5:18:51 PM	66
5:19:51 PM	66.4



TSI INCORPORATED – OCONOMOWOC

1060 Corporate Center Drive, Oconomowoc, WI 53066 USA
tel 651 490 2811 + toll free 800 245 0779 + web www.tsi.com

Page 1 of 1

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Registered Company

Certificate of Calibration

Certificate No: 861374 BIJ080007

Submitted By: PREMIER SAFETY
46400 CONTINENTAL DR
CHESTERFIELD MI 48047-5206

Serial Number: BIJ080007
Customer ID: 1115453
Model: SOUNDPRO DL-2-1/3 SLM

Date Received: 4/2/2020
Date Issued: 4/2/2020
Valid Until: 4/2/2021

Test Conditions:

Temperature: 18°C to 29°C
Humidity: 20% to 80%
Barometric Pressure: 890 mbar to 1050 mbar

Model Conditions:

As Found: DAMAGED
As Left: IN TOLERANCE

SubAssemblies:

Description:

MICROPHONE QE 7052 1/2 IN. ELECTRET
TYPE 2 PREAMP

Serial Number:

41369
05193817

Calibrated per Procedure: 53V899

Reference Standard(s):

I.D. Number	Device
EF000138	QUEST-CAL
ET0000556	B&K ENSEMBLE

Last Calibration	Date Calibration Due
12/11/2019	12/11/2020
11/9/2019	6/18/2020

Measurement Uncertainty:

+/- 2.2% ACOUSTIC (0.19DB)
Estimated at 95% Confidence Level (k=2)

Calibrated By:


BRYAN RASMUSSEN Service Technician

4/2/2020

This report certifies that all calibration equipment used in the test is traceable to NIST, and applies only to the unit identified under equipment above. This report must not be reproduced except in its entirety without the written approval of TSI Incorporated. For each calibration measurement within the stated tolerance or "Pass", there is at least 95% confidence in the decision that the error meets specification. Otherwise report as "Fail".



Calibration Certificate

0040294

Instrument: **Acoustical Calibrator**
Model: **QC-10**
Manufacturer: **Quest**
Serial number: **QE2120254**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **4/3/2020** *Cal Due:* **4-03-2021**
Status:

Received	Sent
X	X

In tolerance:
Out of tolerance:
See comments:
Contains non-accredited tests: **___Yes X No**

Customer: **PREMIER SAFETY**
Tel/Fax: **586-840-3200 /**

Address: **46400 CONTINENTAL DR
CHESTERFIELD, MI 48047**

Tested in accordance with the following procedures and standards:

Calibration of Noise Dosimeters, Sound Meters, and Calibrators., Rev. Chf 04

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence	Cal. Due
				Cal. Lab / Accreditation	
483B-Norsonic	SME Cal Unit	31079	May 09, 2019	Norsonic SA	May 09, 2021
DS-360-SRS	Function Generator	123268	May 10, 2019	SRS	May 10, 2020
34401A-Agilent Technologies	Digital Voltmeter	MY53003818	May 15, 2018	Agilent Provider #93107	May 15, 2021
SD700-Extech	Meteo Station	Q769118	May 06, 2019	INNOCAL	May 06, 2021
140-Norsonic	Real Time Analyzer	1405966	May 09, 2019	Norsonic SA	May 09, 2021
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
40AG-GRAS	Microphone	173539	May 16, 2019	Scantek, Inc. / NVLAP	May 16, 2020
NN1203-Norsonic	Preamplifier	138531	May 16, 2019	Norsonic SA	May 16, 2020

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Steven Boertmann	Authorized signatory:	Eric Ford
Signature	Steven Boertmann	Signature	Eric Ford
Date	0040294	Date	0040294

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
Document stored as: C:\Nor1504\Cal\2014\Questc10-old_QE2120254_M7.doc

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES ¹ FROM STANDARDS REFERENCED IN PROCEDURES:	MET ²	NOT MET	COMMENTS
Manufacturer specifications			
Manufacturer specifications: Sound pressure level	X		
Manufacturer specifications: Frequency	X		
Manufacturer specifications: Total harmonic distortion	X		
Current standards			
ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection	X		Unit older than the standard
ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level	X		Unit older than the standard
ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability	-	-	Unit older than the standard
ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency	X		Unit older than the standard
ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion	X		Unit older than the standard
Older standards (obsolete)			
IEC 60942: 1997 B.2 - Preliminary inspection	X		
IEC 60942: 1997 B.3.3 - Sound pressure level	X		
IEC 60942: 1997 B.3.4 - Sound pressure level stability	X		
IEC 60942: 1997 B.3.5 - Frequency	X		
IEC 60942: 1997 B.3.6 - Total harmonic distortion	X		
ANSI S1.40: 1984 (R1997) 4.4.2 Sound pressure level in the coupler	X		Not applicable
ANSI S1.40: 1984 (R1997) 4.4 Frequency sound in the coupler	X		Not applicable
ANSI S1.40: 1984 (R1997) 4.10 Total harmonic distortion	X		Not applicable

¹ The results of this calibration apply only to the instrument type with serial number identified in this report.

²

Main measured parameters ³:

Measured ⁴ /Acceptable ⁵ Tone frequency (Hz):	Measured ⁴ /Acceptable ⁵ Total Harmonic Distortion (%):	Measured ⁴ /Acceptable Level ⁵ (dB):
1014.80 ± 1.0/1000.0 ± 10.0	0.40 ± 0.10/ < 3	114.08 ± 0.02/114.0 ± 0.4

³ The stated level is valid at reference conditions.

⁴ The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=4.53

⁵ Acceptable parameters values are from the current standards

Barometer indication	Nominal indication

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.0 ± 1.0	100.00 ± 0.001	31.0 ± 2.0

Tests made with following attachments to instrument:

Calibrator ½" Adaptor Type:
Other:

Adjustments: Unit was not adjusted.

Comments: C:\Nor1504\Cal\2014\Questc10-old_QE2120254_M7.doc

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger. Compliance with any standard cannot be claimed based solely on the periodic tests.

Place of Calibration: Premier Safety

46410 Continental Dr.
Chesterfield, MI 48047

Ph/Fax: 586-840-3220/ -3221
www.premier safety.com

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.

This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

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Page 2 of 2

US 31 at 276th Interchange

APPENDIX C: TRAFFIC DATA



Traffic for validation model						Field count				Model count		
Route	Segment	Lane	Corresponding NMP	Posted Speed, mph	Measured Speed, mph	Measurement period length, minutes	P&A	B	C	P&A	B	C
US 31 NB	N of 276th	Inside	NMP-1	60	65	15	402	18	35	660	11	27
		Outside								948	61	113
	N of 276th	Inside	NMP-2	60	55	15	374	8	24	614	5	19
		Outside								882	27	77
	S of 276th	Inside	NMP-3	60	58	15	386	15	15	634	9	12
		Outside								910	51	48
US 31 SB	N of 276th	Inside	NMP-1	60	53	15	375	13	35	615	8	27
		Outside								885	44	113
	N of 276th	Inside	NMP-2	60	60	15	275	10	25	451	6	19
		Outside								649	34	81
	S of 276th	Inside	NMP-3	60	61	15	274	1	30	450	1	23
		Outside								646	3	97
276th St WB	E of US 31		NMP-1	55		15	5	2	1	20	8	4
	E of US 31		NMP-2	55		15	10	0	0	40	0	0
	W of US 31		NMP-3	55		15	31	0	0	124	0	0
276th St EB	E of US 31		NMP-1	55		15	8	1	0	32	4	0
	E of US 31		NMP-2	55		15	22	1	0	88	4	0
	W of US 31		NMP-3	55		15	17	0	0	68	0	0

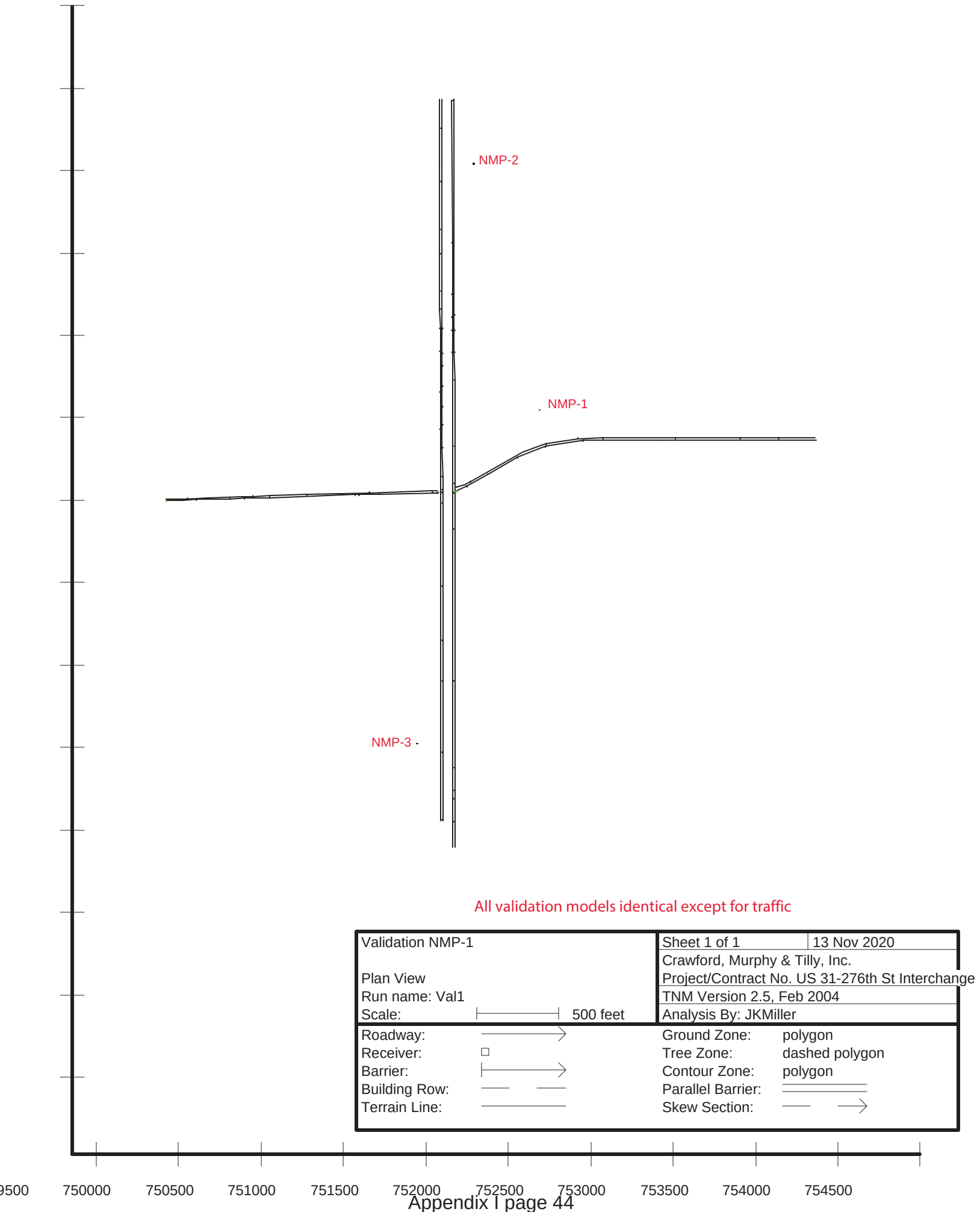
Traffic for existing and future models												2023 Existing			2043 No Build			2043 Build						
												[Columns for DHV]			Model counts			Model counts			Model counts			
Route	Segment	Lane if applic.	Lane P&A fraction	Lane B fraction	Lane C fraction	Classification	Constraint	Posted speed	Calculated speed	Modeled speed*		Pk hr vol	B percent	C percent	P&A	B	C	Pk hr vol	B percent	C percent	P&A	B	C	
US 31 NB	S of 276th	Inside	0.41	0.15	0.19	Principal Arterial	None	60	59	59		1680	0.016752	0.053248	668	4	17	1914	0.016752	0.053248	761	5	19	
		Outside	0.59	0.85	0.81										895	24	72				1019	27	83	
US 31 NB	N of 276th	Inside	0.41	0.15	0.19	Principal Arterial	Signal/0/50%	60	59	59		1671	0.016752	0.053248	664	4	17	1903	0.016752	0.053248	756	5	19	
		Outside	0.59	0.85	0.81										890	24	72				1014	27	82	
US 31 NB	S of ramps	Inside	0.41	0.15	0.19	Principal Arterial	None	60	NA	60											1914	0.016752	0.053248	
		Outside	0.59	0.85	0.81																	1019	27	83
US 31 NB	Between ramps	Inside	0.41	0.15	0.19	Principal Arterial	None	60	NA	60											1914	0.016752	0.053248	
		Outside	0.59	0.85	0.81																	1019	27	83
US 31 NB	N of ramps	Inside	0.41	0.15	0.19	Principal Arterial	None	60	NA	60											1903	0.016752	0.053248	
		Outside	0.59	0.85	0.81																	1014	27	82
US 31 NB offramp	Cruise					None				60											51	0.011549	0.008451	
	ZOI 1					None				50/40/35											51	0.011549	0.008451	
	ZOI 2					None				20/20/20											51	0.011549	0.008451	
US 31 NB onramp	Entry					Onramp/10/100%				45											15	0.023099	0.016901	
	Loop					None				45											15	0.023099	0.016901	
	Acceleration					Onramp/45/100%				60											15	0.023099	0.016901	
US 31 SB	N of 276th	Inside	0.41	0.15	0.19	Principal Arterial	None	60	59	58		1542	0.016752	0.053248	612	4	16	1756	0.016752	0.053248	698	4	18	
		Outside	0.59	0.85	0.81										821	22	67				935	25	76	
US 31 SB	S of 276th	Inside	0.41	0.15	0.19	Principal Arterial	Signal/0/50%	60	59	58		1551	0.016752	0.053248	616	4	16	1766	0.016752	0.053248	702	4	18	
		Outside	0.59	0.85	0.81										826	22	67				941	25	76	
US 31 SB	N of ramps	Inside	0.41	0.15	0.19	Principal Arterial	None	60	NA	60											1756	0.016752	0.053248	
		Outside	0.59	0.85	0.81																	935	25	76
US 31 SB	Between ramps	Inside	0.41	0.15	0.19	Principal Arterial	None	60	NA	60											1766	0.016752	0.053248	
		Outside	0.59	0.85	0.81																	941	25	76
US 31 SB	S of ramps	Inside	0.41	0.15	0.19	Principal Arterial	None	60	NA	60											1766	0.016752	0.053248	
		Outside	0.59	0.85	0.81																	941	25	76
US 31 SB offramp	Cruise					None				60											23	0.023099	0.016901	
	ZOI 1					None				50/40/35											23	0.023099	0.016901	
	ZOI 2					None				20/20/20											23	0.023099	0.016901	
US 31 SB onramp	Entry					Onramp/10/100%				45											43	0.017324	0.012676	
	Loop					None				45											43	0.017324	0.012676	
	Acceleration					Onramp/45/100%				60											43	0.017324	0.012676	
276th St WB	E of US 31					Major Collector	None	NP		55		40	0.023099	0.016901	38	1	1	45	0.023099	0.016901	43	1	1	
	W of US 31					Major Collector	Signal/20/50%	NP		55		57	0.023099	0.016901	55	1	1	65	0.023099	0.016901	62	2	1	
276th St WB	E of interchange					Major Collector	None			55											42	0.023099	0.016901	
	Between ramps					Major Collector	Stop/20/48%			55											63	0.023099	0.016901	
	W of interchange					Major Collector	Stop/20/20%			55											60	0.023099	0.016901	
276th St EB	W of US 31					Major Collector	None	NP		55		47	0.023099	0.016901	45	1	1	53	0.023099	0.016901	51	1	1	
	E of US 31					Major Collector	Signal/20/50%	NP		55		48	0.023099	0.016901	46	1	1	55	0.023099	0.016901	53	1	1	
276th St EB	E of interchange					Major Collector	Stop/20/38%			55											56	0.023099	0.016901	
	Between ramps					Major Collector	Stop/20/37%			55											41	0.023099	0.016901	
	W of interchange					Major Collector	None			55											58	0.023099	0.016901	

*Posted US 31 speed used as modeled speed in future build model because new limited access is expected to encourage higher steady speed

US 31 at 276th Interchange

APPENDIX D: TNM MODEL OUTPUT





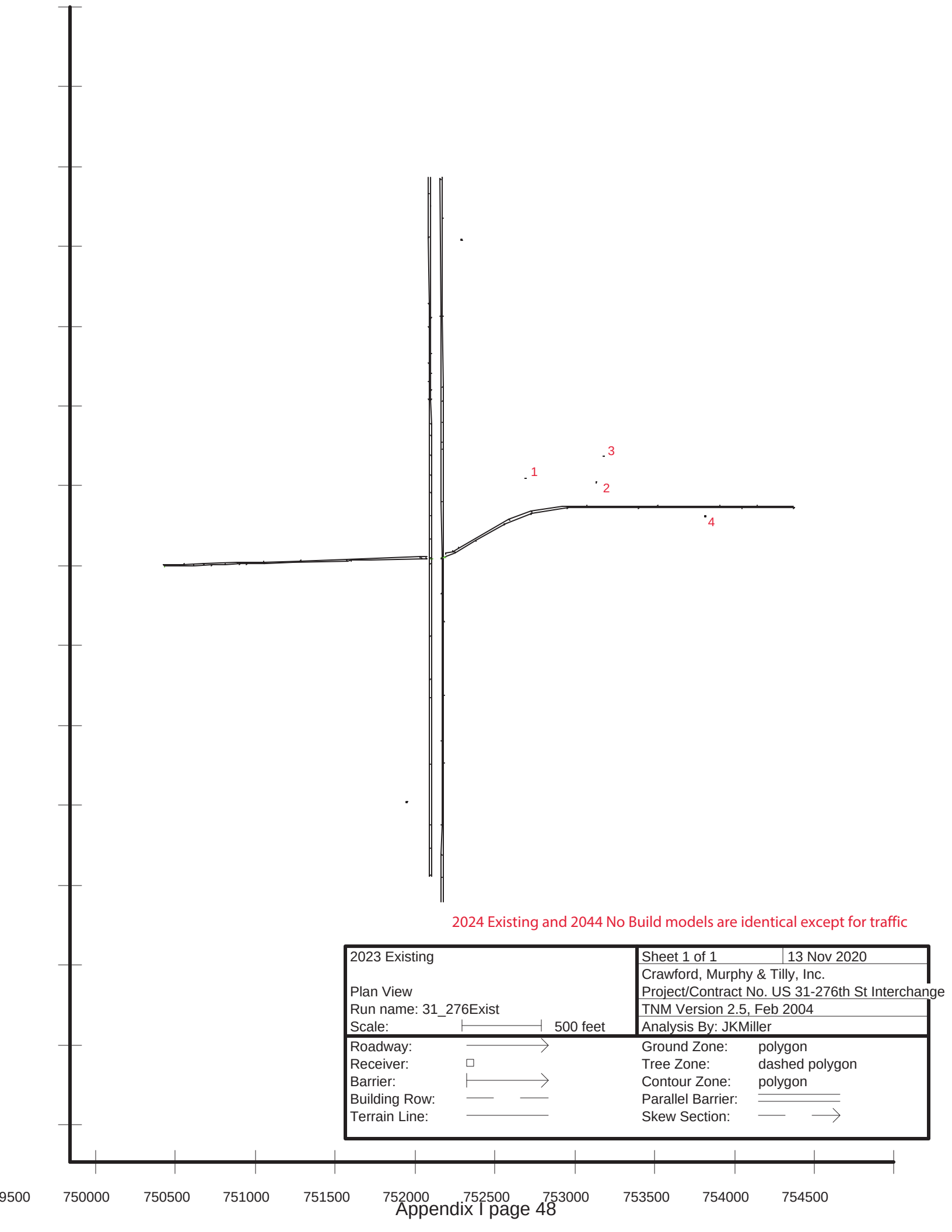
US 31-276th St Interchange

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Crawford, Murphy & Tilly, Inc.								13 November 2020				
JKMiller								TNM 2.5				
								Calculated with TNM 2.5				
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT:		US 31-276th St Interchange										
RUN:		Validation NMP-2										
BARRIER DESIGN:		INPUT HEIGHTS							Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.			
ATMOSPHERICS:		30 deg F, 83% RH										
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dB	dB	dB	dB	dB		dB	dB	dB	dB
NMP-1	1	1	0.0	56.9	66	56.9	15	----	56.9	0.0	8	-8.0
NMP-2	2	1	0.0	66.7	66	66.7	15	Snd Lvl	66.7	0.0	8	-8.0
NMP-3	3	1	0.0	65.1	66	65.1	15	----	65.1	0.0	8	-8.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		3	0.0	0.0	0.0							
All Impacted		1	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Crawford, Murphy & Tilly, Inc.													
JKMiller													
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:		US 31-276th St Interchange											
RUN:		Validation NMP-3											
BARRIER DESIGN:		INPUT HEIGHTS							Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.				
ATMOSPHERICS:		81 deg F, 30% RH											
Receiver													
Name	No.	#DUs	Existing	No Barrier					With Barrier				
			LAeq1h	LAeq1h									
				Calculated	Crit'n	Increase over	existing	Type	Calculated	Noise Reduction			
						Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal		Calculated
							Sub'l Inc						minus
													Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB		dB
NMP-1	1	1	0.0	56.8	66	56.8	15	----	56.8	0.0	8		-8.0
NMP-2	2	1	0.0	66.4	66	66.4	15	Snd Lvl	66.4	0.0	8		-8.0
NMP-3	3	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8		-8.0
Dwelling Units		# DUs	Noise Reduction										
			Min	Avg	Max								
			dB	dB	dB								
All Selected		3	0.0	0.0	0.0								
All Impacted		1	0.0	0.0	0.0								
All that meet NR Goal		0	0.0	0.0	0.0								



2024 Existing and 2044 No Build models are identical except for traffic

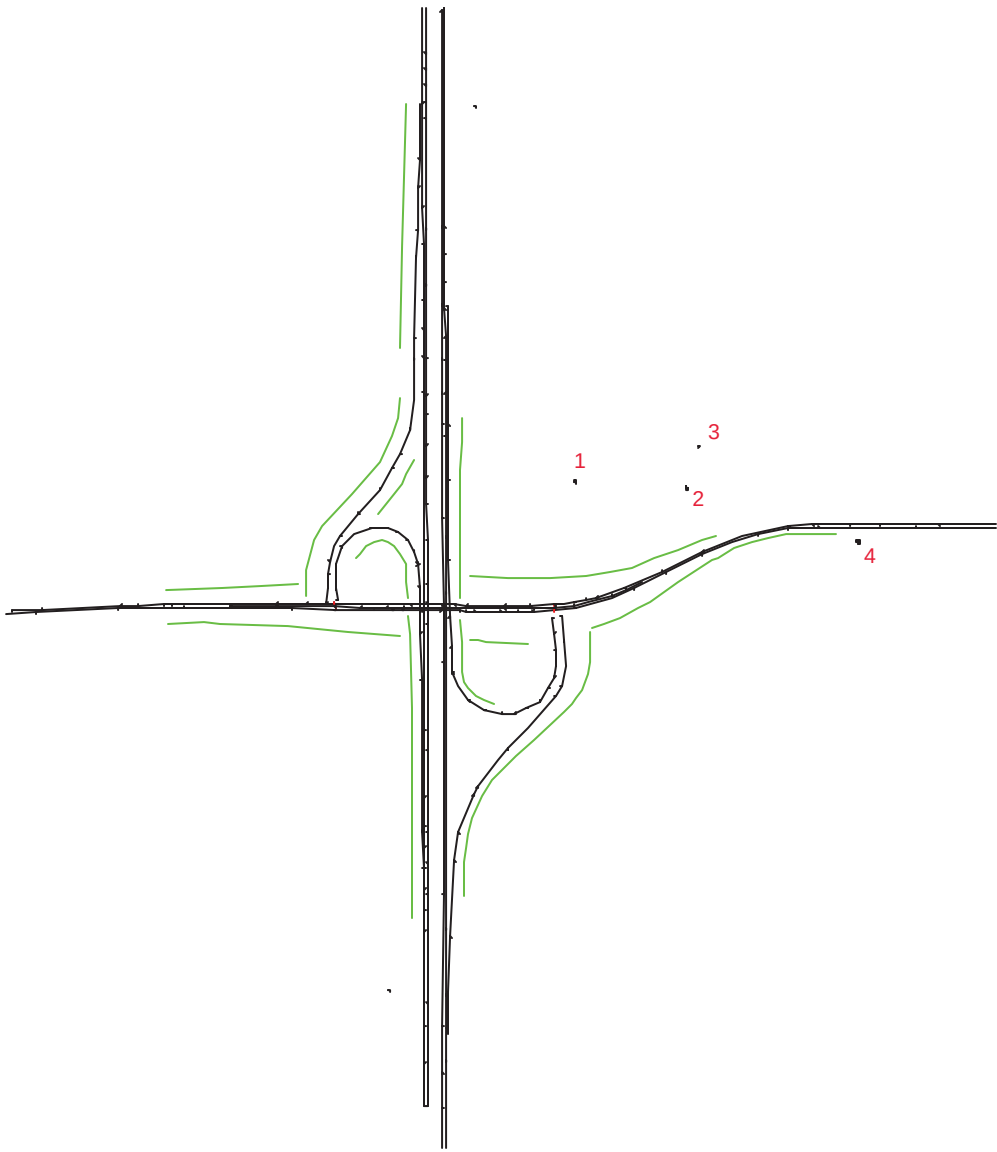
2023 Existing		Sheet 1 of 1	13 Nov 2020
Plan View		Crawford, Murphy & Tilly, Inc.	
Run name: 31_276Exist		Project/Contract No. US 31-276th St Interchange	
Scale: 		TNM Version 2.5, Feb 2004	
		Analysis By: JKMiller	
Roadway:		Ground Zone:	polygon
Receiver:		Tree Zone:	dashed polygon
Barrier:		Contour Zone:	polygon
Building Row:		Parallel Barrier:	
Terrain Line:		Skew Section:	

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Crawford, Murphy & Tilly, Inc.												
JKMiller												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31-276th St Interchange												
RUN: 2023 Existing												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing	No Barrier	With Barrier							
			LAeq1h	LAeq1h								
				Calculated	Crit'n	Increase over existing		Type	Calculated	Noise Reduction		
						Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1/ NMP-1 - 2000 E 276th St	1	1	0.0	57.1	66	57.1	15	----	57.1	0.0	8	-8.0
NMP-2 - Agricultural field	2	1	0.0	66.8	66	66.8	15	Snd Lvl	66.8	0.0	8	-8.0
NMP-3 - Retail Category F	3	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
2 - 2240 E 276th St	6	1	0.0	54.2	66	54.2	15	----	54.2	0.0	8	-8.0
3 - 2248 E 276th St	7	1	0.0	51.4	66	51.4	15	----	51.4	0.0	8	-8.0
4 - 2417 E 276th St	8	1	0.0	59.0	66	59.0	15	----	59.0	0.0	8	-8.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		6	0.0	0.0	0.0							
All Impacted		1	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Crawford, Murphy & Tilly, Inc.												
JKMiller												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31-276th St Interchange												
RUN: 2043 No Build												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	With Barrier				
								Type Impact	Calculated LAeq1h	Noise Reduction		
										Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1/ NMP-1 - 2000 E 276th St	1	1	57.1	57.6	66	0.5	15	----	57.6	0.0	8	-8.0
NMP-2 - Agricultural field	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
NMP-3 - Retail Category F	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
2 - 2240 E 276th St	6	1	54.2	54.7	66	0.5	15	----	54.7	0.0	8	-8.0
3 - 2248 E 276th St	7	1	51.4	51.9	66	0.5	15	----	51.9	0.0	8	-8.0
4 - 2417 E 276th St	8	1	59.0	59.5	66	0.5	15	----	59.5	0.0	8	-8.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		6	0.0	0.0	0.0							
All Impacted		0	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							



2043 Build		Sheet 1 of 1	13 Nov 2020
Plan View		Crawford, Murphy & Tilly, Inc.	
Run name: Build2		Project/Contract No. US 31-276th St Interchange	
Scale: 		TNM Version 2.5, Feb 2004	
		Analysis By: JKMiller	
Roadway:		Ground Zone:	polygon
Receiver:		Tree Zone:	dashed polygon
Barrier:		Contour Zone:	polygon
Building Row:		Parallel Barrier:	
Terrain Line:		Skew Section:	

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Crawford, Murphy & Tilly, Inc.												
JKMiller												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31-276th St Interchange												
RUN: 2043 Build												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	With Barrier				
								Type Impact	Calculated LAeq1h	Noise Reduction		
										Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 / NMP-1 - 2000 E 276th St	1	1	57.1	57.3	66	0.2	15	----	57.3	0.0	8	-8.0
NMP-2 - Agricultural field	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
NMP-3 - Retail Category F	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
2 - 2240 E 276th St	6	1	54.2	52.2	66	-2.0	15	----	52.2	0.0	8	-8.0
3 - 2248 E 276th St	7	1	51.4	51.3	66	-0.1	15	----	51.3	0.0	8	-8.0
4 - 2417 E 276th St	8	1	59.0	59.3	66	0.3	15	----	59.3	0.0	8	-8.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		6	0.0	0.0	0.0							
All Impacted		0	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

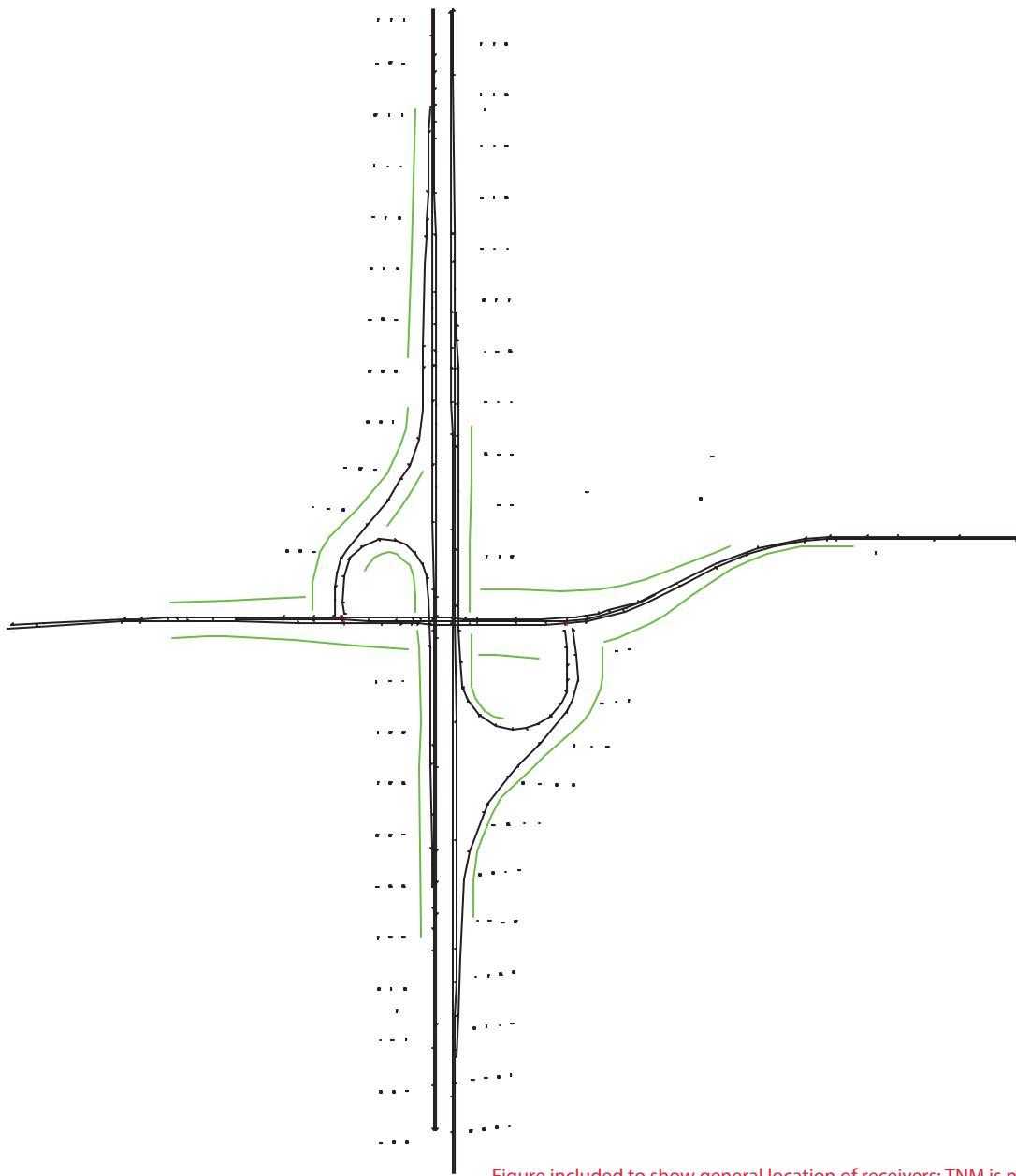


Figure included to show general location of receivers; TNM is not capable of displaying legible receiver numbers at this scale

2043 Build - Contours for Planning		Sheet 1 of 1	13 Nov 2020
Plan View		Crawford, Murphy & Tilly, Inc.	
Run name: Contours		Project/Contract No. US 31-276th St Interchange	
Scale: 		TNM Version 2.5, Feb 2004	
		Analysis By: JKMiller	
Roadway:		Ground Zone:	polygon
Receiver:		Tree Zone:	dashed polygon
Barrier:		Contour Zone:	polygon
Building Row:		Parallel Barrier:	
Terrain Line:		Skew Section:	

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Crawford, Murphy & Tilly, Inc.												
JKMiller												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31-276th St Interchange												
RUN: 2043 Build - Contours for Planning												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	With Barrier				
								Type Impact	Calculated LAeq1h	Noise Reduction		
										Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
NMP-1 - 2000 E 276th St	1	1	57.1	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
NMP-2 - Agricultural field	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
NMP-3 - Retail Category F	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
2240 E 276th St	6	1	54.2	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
2248 E 276th St	7	1	51.4	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
2417 E 276th St	8	1	59.0	0.0	66	0.0	15	inactive	0.0	0.0	8	0.0
Receiver10	10	1	0.0	66.9	66	66.9	15	Snd Lvl	66.9	0.0	8	-8.0
Receiver11	11	1	0.0	68.4	66	68.4	15	Snd Lvl	68.4	0.0	8	-8.0
Receiver12	12	1	0.0	67.8	66	67.8	15	Snd Lvl	67.8	0.0	8	-8.0
Receiver13	13	1	0.0	66.6	66	66.6	15	Snd Lvl	66.6	0.0	8	-8.0
Receiver14	14	1	0.0	66.3	66	66.3	15	Snd Lvl	66.3	0.0	8	-8.0
Receiver15	15	1	0.0	68.7	66	68.7	15	Snd Lvl	68.7	0.0	8	-8.0
Receiver16	16	1	0.0	68.2	66	68.2	15	Snd Lvl	68.2	0.0	8	-8.0
Receiver17	17	1	0.0	65.8	66	65.8	15	----	65.8	0.0	8	-8.0
Receiver18	18	1	0.0	65.5	66	65.5	15	----	65.5	0.0	8	-8.0
Receiver19	19	1	0.0	61.7	66	61.7	15	----	61.7	0.0	8	-8.0
Receiver20	20	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
Receiver21	21	1	0.0	55.1	66	55.1	15	----	55.1	0.0	8	-8.0
Receiver22	22	1	0.0	63.8	66	63.8	15	----	63.8	0.0	8	-8.0
Receiver23	23	1	0.0	66.2	66	66.2	15	Snd Lvl	66.2	0.0	8	-8.0
Receiver24	24	1	0.0	66.5	66	66.5	15	Snd Lvl	66.5	0.0	8	-8.0
Receiver26	26	1	0.0	65.3	66	65.3	15	----	65.3	0.0	8	-8.0
Receiver27	27	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
Receiver28	28	1	0.0	67.2	66	67.2	15	Snd Lvl	67.2	0.0	8	-8.0

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Receiver30	30	1	0.0	66.9	66	66.9	15	Snd Lvl	66.9	0.0	8	-8.0
Receiver31	31	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8	-8.0
Receiver32	32	1	0.0	63.6	66	63.6	15	----	63.6	0.0	8	-8.0
Receiver33	33	1	0.0	61.5	66	61.5	15	----	61.5	0.0	8	-8.0
Receiver34	34	1	0.0	57.4	66	57.4	15	----	57.4	0.0	8	-8.0
Receiver35	35	1	0.0	54.9	66	54.9	15	----	54.9	0.0	8	-8.0
Receiver37	37	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
Receiver38	38	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
Receiver39	39	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8	-8.0
Receiver40	40	1	0.0	64.9	66	64.9	15	----	64.9	0.0	8	-8.0
Receiver41	41	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8	-8.0
Receiver42	42	1	0.0	64.5	66	64.5	15	----	64.5	0.0	8	-8.0
Receiver43	43	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
Receiver45	45	1	0.0	63.9	66	63.9	15	----	63.9	0.0	8	-8.0
Receiver46	46	1	0.0	63.5	66	63.5	15	----	63.5	0.0	8	-8.0
Receiver47	47	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
Receiver48	48	1	0.0	56.5	66	56.5	15	----	56.5	0.0	8	-8.0
Receiver49	49	1	0.0	54.8	66	54.8	15	----	54.8	0.0	8	-8.0
Receiver50	50	1	0.0	67.8	66	67.8	15	Snd Lvl	67.8	0.0	8	-8.0
Receiver51	51	1	0.0	68.4	66	68.4	15	Snd Lvl	68.4	0.0	8	-8.0
Receiver54	54	1	0.0	68.4	66	68.4	15	Snd Lvl	68.4	0.0	8	-8.0
Receiver55	55	1	0.0	68.3	66	68.3	15	Snd Lvl	68.3	0.0	8	-8.0
Receiver56	56	1	0.0	67.2	66	67.2	15	Snd Lvl	67.2	0.0	8	-8.0
Receiver57	57	1	0.0	67.1	66	67.1	15	Snd Lvl	67.1	0.0	8	-8.0
Receiver58	58	1	0.0	66.7	66	66.7	15	Snd Lvl	66.7	0.0	8	-8.0
Receiver59	59	1	0.0	67.4	66	67.4	15	Snd Lvl	67.4	0.0	8	-8.0
Receiver60	60	1	0.0	70.0	66	70.0	15	Snd Lvl	70.0	0.0	8	-8.0
Receiver61	61	1	0.0	69.8	66	69.8	15	Snd Lvl	69.8	0.0	8	-8.0
Receiver62	62	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
Receiver63	63	1	0.0	65.4	66	65.4	15	----	65.4	0.0	8	-8.0
Receiver64	64	1	0.0	65.6	66	65.6	15	----	65.6	0.0	8	-8.0
Receiver65	65	1	0.0	65.3	66	65.3	15	----	65.3	0.0	8	-8.0
Receiver66	66	1	0.0	65.4	66	65.4	15	----	65.4	0.0	8	-8.0
Receiver67	67	1	0.0	65.8	66	65.8	15	----	65.8	0.0	8	-8.0
Receiver69	69	1	0.0	66.0	66	66.0	15	Snd Lvl	66.0	0.0	8	-8.0
Receiver70	70	1	0.0	66.0	66	66.0	15	Snd Lvl	66.0	0.0	8	-8.0
Receiver72	72	1	0.0	67.7	66	67.7	15	Snd Lvl	67.7	0.0	8	-8.0
Receiver73	73	1	0.0	67.6	66	67.6	15	Snd Lvl	67.6	0.0	8	-8.0
Receiver74	74	1	0.0	67.6	66	67.6	15	Snd Lvl	67.6	0.0	8	-8.0
Receiver75	75	1	0.0	62.3	66	62.3	15	----	62.3	0.0	8	-8.0
Receiver76	76	1	0.0	63.2	66	63.2	15	----	63.2	0.0	8	-8.0

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Receiver77	77	1	0.0	63.7	66	63.7	15	----	63.7	0.0	8	-8.0
Receiver78	78	1	0.0	63.3	66	63.3	15	----	63.3	0.0	8	-8.0
Receiver79	79	1	0.0	63.6	66	63.6	15	----	63.6	0.0	8	-8.0
Receiver80	80	1	0.0	63.8	66	63.8	15	----	63.8	0.0	8	-8.0
Receiver81	81	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver82	82	1	0.0	65.1	66	65.1	15	----	65.1	0.0	8	-8.0
Receiver83	83	1	0.0	65.4	66	65.4	15	----	65.4	0.0	8	-8.0
Receiver85	85	1	0.0	65.3	66	65.3	15	----	65.3	0.0	8	-8.0
Receiver86	86	1	0.0	65.1	66	65.1	15	----	65.1	0.0	8	-8.0
Receiver87	87	1	0.0	69.5	66	69.5	15	Snd Lvl	69.5	0.0	8	-8.0
Receiver88	88	1	0.0	69.8	66	69.8	15	Snd Lvl	69.8	0.0	8	-8.0
Receiver89	89	1	0.0	70.5	66	70.5	15	Snd Lvl	70.5	0.0	8	-8.0
Receiver90	90	1	0.0	69.8	66	69.8	15	Snd Lvl	69.8	0.0	8	-8.0
Receiver91	91	1	0.0	69.2	66	69.2	15	Snd Lvl	69.2	0.0	8	-8.0
Receiver92	92	1	0.0	68.6	66	68.6	15	Snd Lvl	68.6	0.0	8	-8.0
Receiver93	93	1	0.0	68.2	66	68.2	15	Snd Lvl	68.2	0.0	8	-8.0
Receiver94	94	1	0.0	68.3	66	68.3	15	Snd Lvl	68.3	0.0	8	-8.0
Receiver95	95	1	0.0	67.7	66	67.7	15	Snd Lvl	67.7	0.0	8	-8.0
Receiver96	96	1	0.0	65.4	66	65.4	15	----	65.4	0.0	8	-8.0
Receiver97	97	1	0.0	67.2	66	67.2	15	Snd Lvl	67.2	0.0	8	-8.0
Receiver98	98	1	0.0	68.0	66	68.0	15	Snd Lvl	68.0	0.0	8	-8.0
Receiver99	99	1	0.0	67.3	66	67.3	15	Snd Lvl	67.3	0.0	8	-8.0
Receiver100	100	1	0.0	66.4	66	66.4	15	Snd Lvl	66.4	0.0	8	-8.0
Receiver101	101	1	0.0	65.9	66	65.9	15	----	65.9	0.0	8	-8.0
Receiver102	102	1	0.0	65.5	66	65.5	15	----	65.5	0.0	8	-8.0
Receiver103	103	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8	-8.0
Receiver104	104	1	0.0	64.9	66	64.9	15	----	64.9	0.0	8	-8.0
Receiver105	105	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
Receiver106	106	1	0.0	67.3	66	67.3	15	Snd Lvl	67.3	0.0	8	-8.0
Receiver108	108	1	0.0	64.5	66	64.5	15	----	64.5	0.0	8	-8.0
Receiver109	109	1	0.0	64.9	66	64.9	15	----	64.9	0.0	8	-8.0
Receiver110	110	1	0.0	65.5	66	65.5	15	----	65.5	0.0	8	-8.0
Receiver111	111	1	0.0	65.1	66	65.1	15	----	65.1	0.0	8	-8.0
Receiver112	112	1	0.0	64.2	66	64.2	15	----	64.2	0.0	8	-8.0
Receiver113	113	1	0.0	63.6	66	63.6	15	----	63.6	0.0	8	-8.0
Receiver114	114	1	0.0	63.2	66	63.2	15	----	63.2	0.0	8	-8.0
Receiver115	115	1	0.0	63.1	66	63.1	15	----	63.1	0.0	8	-8.0
Receiver116	116	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
Receiver117	117	1	0.0	60.6	66	60.6	15	----	60.6	0.0	8	-8.0
Receiver119	119	1	0.0	63.8	66	63.8	15	----	63.8	0.0	8	-8.0
Receiver120	120	1	0.0	68.4	66	68.4	15	Snd Lvl	68.4	0.0	8	-8.0

RESULTS: SOUND LEVELS
US 31-276th St Interchange

Receiver121	121	1	0.0	71.5	66	71.5	15	Snd Lvl	71.5	0.0	8	-8.0
Receiver122	122	1	0.0	71.6	66	71.6	15	Snd Lvl	71.6	0.0	8	-8.0
Receiver123	123	1	0.0	72.1	66	72.1	15	Snd Lvl	72.1	0.0	8	-8.0
Receiver124	124	1	0.0	72.5	66	72.5	15	Snd Lvl	72.5	0.0	8	-8.0
Receiver125	125	1	0.0	72.1	66	72.1	15	Snd Lvl	72.1	0.0	8	-8.0
Receiver126	126	1	0.0	72.6	66	72.6	15	Snd Lvl	72.6	0.0	8	-8.0
Receiver127	127	1	0.0	53.5	66	53.5	15	----	53.5	0.0	8	-8.0
Receiver128	128	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
Receiver129	129	1	0.0	61.6	66	61.6	15	----	61.6	0.0	8	-8.0
Receiver130	130	1	0.0	65.8	66	65.8	15	----	65.8	0.0	8	-8.0
Receiver131	131	1	0.0	68.3	66	68.3	15	Snd Lvl	68.3	0.0	8	-8.0
Receiver132	132	1	0.0	68.6	66	68.6	15	Snd Lvl	68.6	0.0	8	-8.0
Receiver133	133	1	0.0	68.8	66	68.8	15	Snd Lvl	68.8	0.0	8	-8.0
Receiver134	134	1	0.0	68.8	66	68.8	15	Snd Lvl	68.8	0.0	8	-8.0
Receiver135	135	1	0.0	67.9	66	67.9	15	Snd Lvl	67.9	0.0	8	-8.0
Receiver136	136	1	0.0	67.4	66	67.4	15	Snd Lvl	67.4	0.0	8	-8.0
Receiver137	137	1	0.0	51.6	66	51.6	15	----	51.6	0.0	8	-8.0
Receiver138	138	1	0.0	53.1	66	53.1	15	----	53.1	0.0	8	-8.0
Receiver139	139	1	0.0	57.5	66	57.5	15	----	57.5	0.0	8	-8.0
Receiver140	140	1	0.0	60.1	66	60.1	15	----	60.1	0.0	8	-8.0
Receiver141	141	1	0.0	63.6	66	63.6	15	----	63.6	0.0	8	-8.0
Receiver142	142	1	0.0	66.2	66	66.2	15	Snd Lvl	66.2	0.0	8	-8.0
Receiver143	143	1	0.0	66.5	66	66.5	15	Snd Lvl	66.5	0.0	8	-8.0
Receiver144	144	1	0.0	66.4	66	66.4	15	Snd Lvl	66.4	0.0	8	-8.0
Receiver145	145	1	0.0	65.9	66	65.9	15	----	65.9	0.0	8	-8.0
Receiver146	146	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
Receiver147	147	1	0.0	64.5	66	64.5	15	----	64.5	0.0	8	-8.0
Receiver148	148	1	0.0	51.7	66	51.7	15	----	51.7	0.0	8	-8.0
Receiver149	149	1	0.0	52.7	66	52.7	15	----	52.7	0.0	8	-8.0
Receiver150	150	1	0.0	56.3	66	56.3	15	----	56.3	0.0	8	-8.0
Receiver151	151	1	0.0	59.3	66	59.3	15	----	59.3	0.0	8	-8.0
Receiver152	152	1	0.0	61.7	66	61.7	15	----	61.7	0.0	8	-8.0
Receiver153	153	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver154	154	1	0.0	64.8	66	64.8	15	----	64.8	0.0	8	-8.0
Receiver155	155	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
Receiver156	156	1	0.0	63.7	66	63.7	15	----	63.7	0.0	8	-8.0
Receiver157	157	1	0.0	63.3	66	63.3	15	----	63.3	0.0	8	-8.0
Receiver158	158	1	0.0	62.3	66	62.3	15	----	62.3	0.0	8	-8.0
Dwelling Units			# DUs Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							

RESULTS: SOUND LEVELS**US 31-276th St Interchange**

All Selected		144	0.0	0.0	0.0							
All Impacted		56	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

From: [Bales, Ronald](#)
To: [Adam Burns](#); [Beck, Jennifer](#)
Cc: [Andrea Langille](#); [Kia Gillette](#); [Jennifer Miller](#); [Neal Bennett](#)
Subject: RE: 1901797 - US 31 and 276th Street - Noise Analysis
Date: Tuesday, May 25, 2021 8:53:34 AM
Attachments: [image001.png](#)
[image002.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.png](#)
[image009.png](#)
[image010.png](#)

A traffic noise analysis report was completed CMT in March 2021 to evaluate potential traffic noise impacts for the US 31 and 276th Street interchange that is part of the US 31 Limited Access Project in Hamilton County, Indiana. Traffic noise was evaluated at all receptors within 500 feet of edge of pavement. Traffic noise levels were evaluated for the existing (2023) and projected (2043) traffic volumes for the build alternative.

This report evaluated potential noise impacts for the proposed improvements in compliance with the Federal Highway Administration's (FHWA) Procedures for Abatement of Highway Traffic Noise and Construction Noise as presented in the Code of Federal Regulations, Title 23 Part 772 (23 CFR 772) and the INDOT *Traffic Noise Analysis Procedure* (2017).

Existing modeled (2023) peak hour noise levels ranged from 51.4 to 66.8 dBA. Predicted design year (2043) noise levels would not approach or exceed the Noise Abatement Criteria (NAC) at any of the noise sensitive receptors.

Based on the studies thus far accomplished, the State of Indiana has not identified any locations where noise abatement is likely. 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 feasible and reasonable, the abatement measures might 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 process.

This email will serve as INDOT's approval of this traffic noise analysis report.

Ron Bales

INDOT-Environmental Services Division

Office: (317) 515-7908

Email: rbales@indot.in.gov

From: Adam Burns <aburns@cmtengr.com>
Sent: Wednesday, March 24, 2021 8:56 AM
To: INDOT Coordinator 3 <indotcoordinator3@indot.IN.gov>; Beck, Jennifer <JBeck@indot.IN.gov>
Cc: Andrea Langille <ALangille@bfsengr.com>; Kia Gillette <kgillette@HNTB.com>; Bales, Ronald <rbales@indot.IN.gov>; Adam Burns <aburns@cmtengr.com>; Jennifer Miller <jkmillier@cmtengr.com>
Subject: RE: 1901797 - US 31 and 276th Street - Noise Analysis

**** This is an EXTERNAL email. Exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email. ****

Jenn

CMT has uploaded the revise Noise Analysis report and Response to Comments Letter for transition to INDOT review. Since the requested revisions were to the text only, we did not reupload the TNM files. (Ron – if you would like me to email those direct, just say the word).

Please let me know if you have any questions or need any additional information. Thank you.

ADAM BURNS, PE, MBA | Crawford, Murphy & Tilly | w 317.492.9159 | m 317.281.4514
Senior Project Manager

From: INDOT Coordinator 3 <indotcoordinator3@indot.IN.gov>
Sent: Thursday, February 4, 2021 4:10 PM
To: Adam Burns <aburns@cmtengr.com>
Cc: Beck, Jennifer <JBeck@indot.IN.gov>; Andrea Langille <alangille@bfsengr.com>; Kia Gillette <kgillette@HNTB.com>; INDOT Coordinator 3 <indotcoordinator3@indot.IN.gov>
Subject: FW: 1901797 - US 31 and 276th Street - Noise Analysis

External Message: This email was sent from someone outside of CMT. Please use caution with links and attachments from unknown

NOISE ANALYSIS

U.S. 31 LIMITED ACCESS CORRIDOR STUDY

HAMILTON COUNTY, INDIANA

DES. NO. 1900096, 1900097, 1901797, AND 2002313

PREPARED FOR:

INDIANA DEPARTMENT OF TRANSPORTATION

JULY 8, 2021

Prepared by:



Complex Environment. Creative Solutions.

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Appendices

Appendix A – Receptor Addresses

Appendix B – Exhibits

Exhibit 1 - Receptor and Sampling Location Exhibit

Exhibit 2 – Sound Level Contour Exhibit

Appendix C – Noise Level Modeling Data

Table 5 – Predicted Noise Level Distributions

FHWA-TNM 2.5 Modeling Data

Validation Model Sound Levels

Existing Conditions Model Sound Levels

Future No-Build Model Sound Levels

Future Build Model Sound Levels

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Agency Correspondence Records

Indiana Department of Natural Resources - 2018/2019 Estimated Fiscal Year Visits for Indiana State Parks
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Town of Cicero/ Jackson Township Comprehensive Plan - Future Land Use Map

Hamilton County Comprehensive Plan - Future Land Use Map

Appendix E – Calibration Logs/ Field Logs & Sound Level Meter Outputs

Appendix F – Traffic Analysis Reports

ENVIRONMENTAL PROFESSIONALS CERTIFICATIONS

**NOISE ANALYSIS
U.S. 31 LIMITED ACCESS CORRIDOR STUDY
HAMILTON COUNTY, INDIANA
DES. NO. 1900096, 1900097, 1901797, AND 2002313**

This Noise Analysis was prepared by Mr. Samir Raman, P.E., Environmental Engineer, under direction of Mr. Kenneth Beache, P.E., Senior Engineer, of Metric Environmental, LLC (Metric) who reviewed this report for the Indiana Department of Transportation.

EXECUTIVE SUMMARY

The Indiana Department of Transportation proposes to convert all existing cross streets along the Corridor of U.S. 31 (from State Road 38 to 286th Street, Hamilton County, Indiana) to one of the following operations:

1. cul-de-sacs
2. new overpasses

The project area is primarily comprised of farmland with interspersed areas of industrial and residential land uses. The Corridor was divided into three (3) separate segments associated with each interchange and each segment was then independently modeled and assessed for noise impacts. The three (3) segments along U.S. 31 are described as follows:

- **Segment 1:**
~500 feet South of Sheridan Road to ~500 feet North of East 236th Street
(including an access road connecting 226th Street and 236th Street)
- **Segment 2:**
~500 feet North of East 236th Street to ~1,000 feet South of East 276th Street
- **Segment 3:**
~300 feet North of East 276th Street to ~500 feet North of East 286th Street

The areas of separation between the three (3) segments are due to two (2) additional areas being assessed under separate NEPA review. Those two (2) areas along the alignment are not being analyzed as part of this noise study and are identified as:

- 236th Street Proposed Interchange
- 276th Street Proposed Interchange

The project scope in this noise analysis represents the following improvements:

- **Conversion to cul-de-sacs:**
 - 216th Street, 241st Street, 246th Street, 256th Street, and 281st Street
- **Conversion to overpasses:**
 - 226th Street and 266th Street

Based on criteria of the Federal Highway Administration (FHWA) and Indiana Department of Transportation (INDOT), the proposed project is a Type I Project because the above improvements consist of a roadway on a new alignment, significant changes in vertical alignment, and interchange construction. A noise analysis is therefore required.

In accordance with 23 CFR Part 772-*Procedures for Abatement of Highway Noise* and the INDOT Traffic Noise Analysis Procedures approved by the Federal Highway Administration effective July

1, 2017, existing and future noise levels were determined using the Federal Highway Administration *Traffic Noise Model Program Version 2.5* (FHWA-TNM 2.5).

Seventy-three (73) noise sensitive receptors were identified in the project area, all of which are Category “B” or “C” receptors. Twenty-two (22) non-noise sensitive commercial/industrial receptors (Category F) were also identified along the project corridor.

The results of this noise analysis show that predicted noise levels did not have a substantial increase of at least 15 dBA at any of the receptors. However, sixteen (16) Category “B” residential receptors and one (1) Category “C” receptor within the project study area will be impacted in the Future Build condition based on exceedance of the 66 dBA NAC; therefore, noise abatement measures were investigated.

Due to engineering feasibility restrictions, such as the impact of multiple long access drives off U.S. 31 and safety and line of sight considerations, adversely impacted the ability to install abatement measures that can effectively provide noise abatement to the impacted receptors. Therefore, abatement measures for the impacted receptors within the project area were found to not be feasible. A re-evaluation 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 feasible and reasonable, then abatement measures may 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 process.

1.0 INTRODUCTION

1.1 Purpose of the Analysis

The purpose of this investigation is to analyze potential noise impacts that would be generated by the U.S. 31 Limited Access Corridor in Hamilton County, Indiana, in accordance with the 2017 Indiana Department of Transportation (INDOT) Traffic Noise Analysis Procedures. Based on the criteria of 23 CFR 772, the proposed project is a Type I Project, because it involves a roadway on a new alignment, significant changes in vertical alignment, and interchange construction.

Noise (unwanted sound) as perceived by the human ear, is the result of the sound pressure exerted on the eardrum. Sound pressure is the sensory mechanism by which the human ear perceives loudness. As sound pressure reduces, loudness (as perceived by the ear) decreases. The purpose of the noise analysis is to predict future noise levels, identify potential impacted receptors and, if necessary, evaluate noise abatement measures in areas that show potential noise impacts resulting from the proposed project.

In accordance with 23 CFR Part 772-*Procedures for Abatement of Highway Noise* and the INDOT Traffic Noise Analysis Procedures, the objectives of the study were achieved by performing the following tasks:

1. Measurement of existing traffic noise levels at representative locations using a Larson Davis SoundTrack LxT Type 1 Sound Level Meter,
2. Validation of the project model created with Federal Highway Administration (FHWA) *Traffic Noise Model version 2.5* (FHWA-TNM 2.5) using measured traffic noise levels and volumes,
3. Modeling of existing and future noise levels using FHWA-TNM 2.5 to identify impacted receptors, if any, based on FHWA Noise Abatement Criteria (NAC) and/or a substantial increase in noise level of 15 dBA,
4. If impacts are identified, assessment of traffic noise mitigation measures, and
5. If impacts are identified, evaluation of whether proposed abatement measures are both feasible and reasonable.

1.2 Project Purpose and Need

The purpose of this project is to reduce traffic accidents along U.S. 31 between State Road 38 and 286th Street while maintaining local access by providing interchanges and overpasses at select locations.

Aerial imagery of the Project Area is included in Exhibit 1 – Receptor and Sampling Exhibit, located in Appendix B.

1.3 Existing Conditions

The typical section of U.S. 31 northbound and southbound consists of two (2) 12 ft travel lanes, an 11 ft outside shoulder, and a 6 ft inside shoulder. An approximately 40 ft wide grass median separates the northbound and southbound directions of U.S. 31. The vertical alignment is relatively flat and does not appear to contain any substandard vertical curves.

The project noise study area, within 500 feet of the outer reach of proposed improvements, is comprised primarily of farmland interspersed with industrial and residential land uses.

The speed limit on the existing highway is 60 miles per hour (mph) throughout the project alignment and no changes to the speed limit are planned.

1.4 Proposed Improvements

The project scope includes the conversion of all existing cross streets along the Corridor of U.S. 31 (from State Road 38 to E 286th Street, Hamilton County, Indiana) to one of the following operations:

1. cul-de-sacs
2. new overpasses

The project scope in this noise analysis represents the following improvements:

- **Conversion to cul-de-sacs:**
 - o 216th Street, 241st Street, 246th Street, 256th Street, 281st Street
- **Conversion to overpasses:**
 - o 226th Street, 266th Street

2.0 NOISE ANALYSIS METHODOLOGY

The FHWA *Traffic Noise Model version 2.5* (FHWA-TNM 2.5) is used to assist in conducting the noise analysis. Numerical noise models are a simplification of actual physical conditions. All model results are affected by numerical approximation used within the best fit algorithms of FHWA-TNM 2.5. The modeled area, and the availability and the accuracy of data used to define receptors, traffic, etc. on the noise model for this project, was limited by the availability and reliability of traffic data, the roadway characteristics, and receptor locations.

FHWA-TNM 2.5 was used to develop noise models for:

- The existing conditions (including a validation model) for the design year 2020
- Future “no-build” condition for the design year 2040
- Future “build” conditions for the design year 2040

“No-build” and “Build” conditions connote the traffic patterns and volumes of the project area if the project is either not built or is built, respectively.

2.1 Data Collection Site

Metric selected representative monitoring locations along the project alignment to measure existing noise levels at representative receptors within 500 feet of the existing alignment. The criteria for selecting monitoring locations included, but were not limited to, existing land use, accessibility for purposes of conducting field measurements and estimated distance from the edge of the roadway. The number of in-field measurement locations was determined through consultation with INDOT.

Metric measured existing noise levels at three (3) representative locations along the project length based upon best judgment, the criteria discussed above and approval from INDOT. Noise levels were measured utilizing a Larson Davis SoundTrack LxT Type 1 sound level meter. The noise level meter was checked for calibration at the beginning of field measurements, between each measurement, and at the end of the series of measurements.

On September 29, 2020, between approximately 9:00 a.m. and 10:30 a.m. data was gathered at the three (3) measurement locations. The pavement was dry at all the measurement locations. The average weather conditions were 75 degrees Fahrenheit, sunny, and less than 15 mph wind speed.

The locations of the field measurements are depicted in Exhibit 1 – Receptor and Sampling Exhibit, located in Appendix B. One 15-minute recording period was performed at each monitoring location. During these 15-minute recording periods, traffic volume data was recorded along U.S. 31, E 216th Street, E 256th Street, and E 276th Street to allow for validation of the FHWA-TNM 2.5 model of the existing conditions.

2.2 Traffic Volumes

Traffic counts for U.S. 31, E 216th Street, E 256th Street, and E 276th Street were concurrently performed during data collection (September 29, 2020). Traffic was free flowing during data collection. Each 15-minute traffic count interval was multiplied by four to simulate an hourly volume for input into the validation FHWA-TNM 2.5 model.

The existing and future traffic volumes for impacted streets were provided by the design engineer for the existing conditions (Year 2020), future no-build conditions (Year 2040), and future build conditions (Year 2040). Additional existing traffic volumes inputted into the FHWA-TNM 2.5 models were gathered through the INDOT Traffic Count Database System (TCDS). For rural roadways with no available traffic information, in-field traffic counts or estimations based on the congestion of properties that the roadway provides access to were inputted to the FHWA-TNM 2.5 models.

Following are the impacted streets for which future traffic volumes were provided:

- U.S. 31
- E 216th Street,
- E 226th Street,
- E 236th Street,
- E 241st Street,
- E 246th Street,
- E 256th Street,
- E 266th Street,
- E 276th Street,
- E 281st Street,
- E 286th Street

Future traffic volumes for other roadways within the project area for the period 2020 to 2040 were estimated using 1.0% annual linear growth for all roadways. The traffic volumes provided by Butler, Fairman & Seufert, Inc. (BF&S) were used for input into the future FHWA-TNM 2.5 models. This traffic data provided by BF&S is included in the Traffic Analysis Reports, located in Appendix F.

2.3 Model Assumptions

The following assumptions were made when handling traffic data:

- Intersection traffic data was not available; therefore, estimations for intersection roadways and turns were used in the models based on the traffic conditions of the connecting streets.
- Traffic volumes used in the models were assumed to be uniformly distributed amongst multiple lanes when applied to a single movement within multiple lanes.

- Truck percentages applied to a traffic volume were all assumed to be heavy trucks reflecting a worst-case scenario for noise generation.

2.4 Model Validation

To validate the existing conditions noise model, noise levels were calculated within an equivalent validation FHWA-TNM 2.5 model and compared to in-field noise measurements. This validation model is identical to the existing conditions model with the exception of:

- receptors being placed in the approximate locations of the field noise measurements;
- traffic data being replaced with the in-field traffic counts taken in concurrence with the field noise measurements; and
- default TNM weather conditions being replaced with weather conditions at the time of the field measurements.

The noise measurements and traffic counts were conducted during the COVID-19 pandemic, which could have potentially affected the traffic during the data gathering; however, traffic was free flowing throughout the in-field measurements and traffic counts. Additionally, in-field traffic counts were comparable to traffic data provided by the design engineer.

Data presented in Table 1 shows field measured noise levels as well as modeled noise levels predicted using the validation FHWA-TNM 2.5 model.

Table 1: Noise Level Validation Modeled

Measurement #	Noise Level Measured (dBA)	Noise Level Modeled (dBA)	Difference (+/-) (dBA)	Result
1	54.1	56.7	+2.6	Valid
2	57.1	59.9	+2.8	Valid
3	57.3	58.8	-1.5	Valid

The noise model is considered to be accurate if the modeled noise level is within 3.0 dBA of the level measured in the field. All three (3) noise measurements taken in the field are within 3.0 dBA of the noise levels modeled at those locations; therefore, the TNM model as developed for the project is validated. See Appendix E for field measurement worksheets, Sound Level Meter outputs, and sound meter Calibration Certificate.

2.5 Identification of Impacted Receptors

In accordance with the INDOT Traffic Noise Analysis Procedures, the determination of noise impacts is determined by the Noise Abatement Criteria (NAC) Activity Category criterion level and/or substantial increases to the noise level. FHWA-TNM 2.5 generated noise levels for each identified receptor are compared to the appropriate NAC level (found in Table 2). Further discussion on NAC Criteria follow in Section 3 of this report.

FHWA-TNM 2.5 modeling software also evaluates the increase in the noise level at each receptor resulting from the future design alternatives. An affected receptor is classified as “impacted” if either of the two following conditions is met:

- Predicted noise level approaches (within 1 dBA) or exceeds the applicable NAC, or
- Predicted noise level substantially exceeds the existing noise level by 15 dBA.

2.6 Abatement Considerations

Once noise impacts are identified, noise abatement measures are considered in areas where receptors experienced noise impacts. Due to limitations on INDOT’s ability to acquire property for mitigation or to mitigate sites off State right-of-ways, the most common form of abatement is the construction of noise barriers.

To be considered, noise abatement incorporated in Type 1 Projects must be both feasible and reasonable. The feasibility analysis looks at both engineering feasibility and acoustic feasibility. The engineering assessment determines whether abatement measures can be built. This assessment is based on engineering considerations such as topography, drainage, safety and access/maintenance needs. Acoustic feasibility considers how many impacted receptors receive

a 5 dBA reduction in noise levels after abatement. To be considered acoustically feasible, a majority (greater than 50%) of impacted receptors must reach the 5 dBA reduction goal.

Abatement reasonableness considers noise abatement cost, public opinion, and a noise reduction design goal. Noise barrier cost effectiveness is determined based on the estimated construction cost and the total number of benefited receptors.

Per INDOT's 2017 Traffic Noise Analysis Procedure:

- When the majority of receptors were not in place prior to the existence of the roadway, a construction cost of \$25,000 or less per benefited receptor is considered cost effective. The definition of a benefited receptor is a receptor that experiences at least a 5 dBA noise reduction.
- When a majority of the receptors were in place before the existence of the roadway the allowable cost per receptor is \$30,000. The reasonableness design goal says selected noise abatement options must substantially reduce (at least 7 dBA) noise impacts for the majority (greater than 50%) of impacted first row receptors in the design year, compared to the average non-abatement levels. First row receptors are receptors that do not have other receptors between them and the roadway.

If abatement designs are found to be reasonable and feasible, surveys describing the project and barrier locations under consideration will be mailed to each benefited receptor for public opinion. Responses to the public surveys will be considered by the FHWA and INDOT Project Management to determine the appropriate course of action. Please see the 2017 INDOT Traffic Noise Analysis Procedures for further details regarding the noise abatement public opinion process.

3.0 IMPACT ANALYSIS

FHWA identifies seven (7) Noise Abatement Criteria (NAC) categories. Five (5) of these criteria are considered noise sensitive. Four (4) are considered noise-sensitive based on existing exterior land use activities and one (1) criterion is considered sensitive based on the existing interior uses of any structure located on the site. Each noise-sensitive land use category is assigned a noise level above which abatement is required to be evaluated. See Table 2 for a description of NAC Activity Categories and criteria abatement action levels.

Table 2: FHWA Noise Abatement Criteria in dBA

Activity Category	NAC	Activity Description
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where 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, 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 stations, recording studios, schools, and television studios
E*	72 (Exterior)	Hotels, motels, offices, restaurant/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

*Includes undeveloped lands permitted for this activity category

Based on the FHWA NAC, land uses in the project area are designated as Activity Categories B, C, and F.

3.1 Location and Description of Receivers

Noise levels were modeled in FHWA-TNM 2.5 for all receptors identified in Section 2 of this report. The total number of receptors identified within 500 feet of the outside travel lane along the proposed U.S. 31 Limited Access Corridor Study are listed below in Table 3 and identified with their appropriate NAC categorical classification.

Table 3: Receptors per FHWA Activity Category

Activity Category	Number of Receptors	Receptor Numbers
A	0	
B	65	10, 15-17, 23, 25-27, 30, 32-43, 45-65, 67-72, 75-84, 86-87, 91-95
C	8	1-8
D	0	
E	0	
F	22	9, 11-14, 18-22, 24, 28-29, 31, 44, 66, 73-74, 85, 88-90
G	0	
Total	95	

Seventy-three (73) Category B or C noise sensitive receptors were identified in the project area. Twenty-two (22) non-noise sensitive commercial/industrial receptors (Category F) were identified spread out along the project corridor. Noise impact at the Category F receptors were not modeled in FHWA-TNM 2.5.

The Corridor was divided into three (3) separate segments and each segment was then independently modeled and assessed for noise impacts. The three (3) segments along U.S. 31 are described as follows:

- **Segment 1:**
~500 feet South of Sheridan Road to ~500 feet North of East 236th Street
(including an access road connecting 226th Street and 236th Street)
- **Segment 2:**
~500 feet North of East 236th Street to ~1,000 feet South of East 276th Street
- **Segment 3:**
~300 feet North of East 276th Street to ~500 feet North of East 286th Street

Receptor identification within each of the four (4) segments of the alignment are as follows:

- Segment 1: Receptor #s 1-48
- Segment 2: Receptor #s 49-89
- Segment 3: Receptor #s 90-95

Thirty-three (33) Receptors (physical structures) including Receptor #s 15-18, 27, 49-59, 65-71, 75-79, 81, 87, 91-92, 94 will be relocated as part of the project and therefore are not being assessed for impact analysis. Noise impacts to these receptors were not considered when determining overall impacts as part of this noise analysis.

The segment limits and receptor locations are depicted in Exhibit 1 – Receptor and Sampling Location Exhibit, located in Appendix B.

Metric contacted several local agencies/representatives to discuss any permitted, planned development along the proposed U.S. 31 Limited Access Corridor Study to account for future impacts to anticipated land use. See Section 6.0 for further details regarding agency correspondence.

3.2 Pedestrian Receptors

A count of pedestrian traffic is required to evaluate the noise impacts to users of parks, trails, and other similar outdoor public spaces. The project alignment has a resource impact and requires evaluation.

MacGregor Park

MacGregor Park is located east and adjacent to U.S. 31 between Sheridan Road and E. 216th Street. No pedestrians were witnessed at MacGregor Park during the time of field data collection, (September 29, 2020). Metric contacted Mr. Christopher McConnell, Superintendent of the City of Westfield Parks and Recreation Department, to get pedestrian count information for MacGregor Park; however, no park pedestrian traffic data was available from the Westfield Parks and Recreation Department to assist with this determination. A copy of the correspondence with Mr. McConnell is included in Appendix D.

To determine this necessary data, park visitation count information for several Indiana parks was obtained from the 2018/2019 Estimated Fiscal Year Visits for Indiana State Parks Table provided by the Indiana Department of Natural Resources (IDNR). The trails study includes estimated annual visits for Indiana State Parks in 2018/2019. Nine (9) cities with comparable populations to Westfield and containing State Parks were used to determine an average park visitation count scaled for the population of Westfield. Westfield has a population of approximately 40,000 residents and these comparable populations ranged from 16,000 to 85,000 residents. A copy of the IDNR 2018/2019 Estimated Fiscal Year Visits Table is included in Appendix D.

The estimated average daily park visits scaled to the population of Westfield for each of the nine (9) cities with similar populations was determined through the following equations:

$$\begin{aligned}
 & \frac{\text{Estimated Annual Park Visits}}{365 \text{ days/year}} \\
 &= \frac{\text{Estimated Daily Park Visits} \times \text{Population of Westfield } (\sim 41,500 \text{ people})}{\text{Population of Park's City}} \\
 &= \text{Estimated Daily MacGregor Park Visits (scaled for Westfield)}
 \end{aligned}$$

The estimated daily MacGregor Park visits as compared to the nine (9) comparable cities was averaged to determine a final estimation of 557 daily visits to MacGregor Park. See Table 4 below for the park visitation and population information for each City.

Table 4: MacGregor Park Estimated Daily Park Visitation

Park	Estimated Annual Visits	City	Estimated Population	Estimated Daily MacGregor Park Visits (scaled for Westfield)
Whitewater	240,651	Richmond	35,353	774
McCormick's	641,437	Bloomington	84,981	859
Shades	86,862	Crawfordsville	16,114	613
Mounds	394,815	Anderson	55,037	816
Falls of the Ohio	158,680	Clarksville	21,622	835
Ritchey Woods	106,600	Fishers	90,127	135
Praire Duneland	153,982	Portage	36,806	476
Cardinal Greenway	111,300	Muncie	68,529	185
Pennsy	62,616	Greenfield	22,564	316

Average: 557

The area of MacGregor Park is approximately ninety-six (96) acres, approximately 3.125 miles of which is within the project area. As per the 2017 INDOT Traffic Noise Policy, the average household size in Indiana is 2.52 people per household, which is used to convert the number of park users to equivalent household receptors as defined by FHWA-TNM 2.5. The following equation was used to determine the number of receptors to represent MacGregor Park, as per the 2017 INDOT Traffic Noise Policy:

$$\begin{aligned}
 & \frac{\text{Daily Number of Users}}{2.52 \text{ People per Average Household}} \times \text{Percentage of Park Within Project Area} \\
 &= \text{Number of Receptors (rounded up)}
 \end{aligned}$$

$$\frac{557}{2.52} \frac{\text{Users}}{\text{People/Household}} \times \frac{3.125 \text{ acres}}{96 \text{ acres}} = 7.2 \text{ Receptors} \approx 8 \text{ Receptors}$$

3.3 Description of Noise Levels

FHWA-TNM 2.5 was used to estimate future noise levels for identified receptors. Future noise levels were generated based on traffic volumes for design year 2040 and the preferred alternatives for the proposed project. Table 5, located in Appendix C due to its size and for visual clarity, presents a summary of the existing and proposed noise levels for all analyzed receptors.

3.4 Determination of Noise Levels for Future Conditions

The model indicates that no receptors were impacted by a substantial noise level increase of 15 dBA or more in the existing condition. However, of the seventeen (17) impacted receptors that were identified, all were impacted by reaching or exceeding their NAC sound criteria levels. thirteen (13) of these impacted receptors were found to be impacted in both the existing model as well as the proposed model, indicating that the receptors are already experiencing high noise levels before the proposed limited access corridor project. On average, noise levels decreased across all noise sensitive receptors by approximately 0.5 dB from the existing (2020) to proposed (2040) conditions. Table 8 below presents the observed high and low predictions by the model.

Table 8: Predicted Noise Level Distributions

Model	Predicted Noise Level (dBA)	
	Low	High
Existing	50.6	73.1
Future No-Build	51.5	74.8
Future Build	50.8	74.8

First row receptors typically have higher noise levels than second row receptors and therefore, as can be expected, noise levels fell as the distance from US 31 increased. Receptors adjacent to proposed cul-de-sacs in the proposed conditions showed a decrease in noise levels from the existing conditions.

Receptor locations are depicted in the Exhibit 1 - Receptor Exhibit, located in Appendix B. Modeled noise level results for each receptor are included Table 5, located in Appendix C.

4.0 NOISE ABATEMENT CONSIDERATIONS

According to guidelines provided by the INDOT and FHWA, receptors that are found to be impacted in the design year require abatement measures to be analyzed. In total there are seventy-three (73) noise sensitive receptors (Categories B and C) and twenty-two (22) non-noise sensitive receptors (Category F) within 500 feet of the U.S. 31 Limited Access Corridor Study alignment:

- Sixty-five (65) receptors fall into Category “B”,
- Eight (8) receptors fall into Category “C”,
- Twenty-two (22) receptors fall into Category “F”.

Of these receptors, thirty-three (33) will be relocated as part of the project and were not considered when determining impacts as part of this noise analysis.

As discussed in Section 3 of this report, no receptors were impacted by a substantial noise level increase of 15 dBA or more from the model of the existing conditions. However, seventeen (17) were impacted by reaching or exceeding their NAC sound criteria levels including thirteen (13) of these impacted receptors that are already experiencing high noise levels before the proposed limited access corridor project. All seventeen (17) impacted receptors fall into Categories “B” or “C”. In total there are sixteen (16) Category “B” and one (1) Category “C” impacted receptors.

Table 8 below presents the seventeen (17) impacted receptors:

Table 8: Impacted Receptors

Category	#	Receptor ID
Segment 1		
B	11	30, 32, 35-38, 43, 45-48
C	1	7
Segment 2		
B	4	60, 62, 72, 80
C	0	
Segment 3		
B	1	95
C	0	

These receptors are listed in Appendix A and graphically presented in Appendix B of this report.

To recommend noise abatement alternatives to impacted receptor, such alternatives must be, amongst other factors, feasible and reasonable.

Assessment of the practicality of a noise barrier wall between the proposed roadway and the seventeen (17) impacted Category B and C receptors in the area was conducted. The impacted receptors are spread out uniformly along the alignment. All impacted receptors identified within the study area are isolated receptors with multiple access drives that branch off U.S. 31 that provide access to residences and businesses.

For noise barriers to effectively mitigate noise impacts from the U.S. 31, they would have to be constructed either at the edge of pavement or within the right-of-way between U.S. 31 and the impacted receptors. The multiple access drives that provide access to the impacted receptors limit the continuity and subsequently the effectiveness of noise barriers at these locations due to frequent openings in the barrier. Additionally, the construction of barriers at these locations may cause safety issues due to sight limitations while entering or exiting the drives.

Due to the restrictions from drives off U.S. 31 and safety and line of sight considerations, noise barrier(s) or other land disturbing abatement measures lack the engineering feasibility to effectively benefit the impacted receptors.

Assessment for reasonable noise abatement measures were not evaluated since the number of benefited receptors and the high cost required to construct a noise barrier wall would make the cost per benefited receptor quotient far exceed the allowable limits, and therefore not reasonable.

5.0 CONSTRUCTION NOISE

Construction noise is unwanted sound from an active construction site and includes but is not limited to backing trucks, heavy equipment, and saws. No adverse noise impacts from construction are anticipated because construction noise would be short-term and intermittent. Measures to minimize the temporary impacts could include requiring equipment to have sound-control devices that are no less effective than those provided on the original equipment, requiring all equipment to be muffled and restricting the hours of active construction activity.

6.0 AGENCY CORRESPONDENCE

Metric contacted the following agencies/representatives to discuss any permitted planned development along the proposed U.S. 31 Limited Access Corridor Study:

- Mr. David Lucas, Hamilton County Engineering Department – Staff Engineer
- Mr. C.J. Taylor, Town of Cicero/ Jackson Township Plan Commission - Director
- Mr. Kai Chuck, City of Westfield – Economic Development Director

Mr. Lucas, Staff Engineer for the Hamilton County Engineering Department, was contacted via telephone on December 18, 2020 and stated that there is no development currently planned for this area, except for few houses within individual lots, and no permits are filed for any parcels within the project area.

Mr. Taylor, Director of the Town of Cicero/ Jackson Township Plan Commission, was contacted via email on December 16, 2020 and stated that he is not aware of any proposed development within his jurisdictional area. Additionally, Mr. Taylor provided a Future Land Use Map from the Town of Cicero/ Jackson Township Comprehensive Plan. The Future Land Use Map from the Town of Cicero/ Jackson Township Comprehensive Plan indicated the following potential future uses along the Corridor:

- Commercial development is planned for the properties adjoining the intersection of U.S. 31 and E 236th Street.
- Heavy Commercial/ Light Industrial development is planned for parcels adjoining U.S. 31 to the east between E 241st Street and E 276th Street
- Commercial development is planned for the properties adjoining the intersection of U.S. 31 and E 276th Street.

The City of Westfield Economic Development Director was contacted via email and/or telephone by Metric regarding knowledge of any permitted planned development along the proposed U.S. 31 Limited Access Corridor Study. To date, a response has not been received. If a response is received in the future that alters the findings of this investigation, Metric will issue an addendum to this report.

In addition, the Future Land Use Map from the Hamilton County Comprehensive Plan was reviewed for future land use planning within the project noise study area. The Hamilton County Future Land Use Map indicates the following potential future land use within the project area:

- Priority Mixed-Use and Highway Oriented Business Enterprises are planned for the areas west adjacent to U.S. 31 between 216th Street and 296th Street.

Logs containing pertinent information regarding the correspondence with the various agency representatives and the Town of Cicero/ Jackson Township and Hamilton County Comprehensive Plan Future Use Land Maps are located in Appendix D.

Setback distances at which noise contributions are 66 dBA (NAC for Category “B” and “C” receptors) from the proposed project area have been estimated using the FHWA-TNM 2.5 model for the proposed conditions. Any new noise sensitive developments within the 66 dBA Sound Level Contour will likely experience noise levels within their respective impacted range. Receptors placed in the future build FHWA-TNM 2.5 model at varying distances from the roadway were used to determine appropriate a 66 dBA Sound Level contour for the project area. The 66 dBA Sound Level contour from edge of pavement in the design year (2040) for consideration in planning future development for each segment is described in the Table 9 below:

Table 9: 66 dBA Sound Level Contour

Segment #	Distance From Edge of Pavement (ft)
1	260
2	220
3	200

The 66 dBA Sound Level Contour is depicted in Exhibit 2 – Setback Distances Exhibit, located in Appendix B.

7.0 CONCLUSION

Metric conducted the Noise Analysis for the proposed U.S. 31 Limited Access Corridor Study. The results of this noise analysis show that predicted noise levels did not have a substantial increase of at least 15 dBA at any of the receptors. However, sixteen (16) Category “B” residential receptors and one (1) Category “C” receptors within the project study area will be impacted in the Future Build condition based on exceedance of the 66 dBA NAC; therefore, noise abatement measures were investigated.

Engineering feasibility restrictions such as the impact of multiple long access drives off U.S. 31, safety and line of sight considerations adversely impact the ability to install abatement measures that can effectively provide noise abatement to the impacted receptors. Therefore, abatement measures for the impacted receptors within the project area were found to be not feasible.

Based on the studies thus far accomplished, the State of Indiana has not identified any locations where noise abatement is likely. Noise abatement measures that were studied for the impacted receptors were based upon preliminary design costs and design criteria. Noise abatement has not been found to be feasible due to the impact of multiple long access drives off U.S. 31 to safety and line of sight considerations. Noise barrier(s) or other land disturbing abatement measures lack the engineering feasibility to effectively benefit the impacted receptors.

A re-evaluation 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 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 process.

8.0 REFERENCES

Indiana Department of Transportation. (2017). *Traffic Noise Analysis Procedure*.
(<https://www.in.gov/indot/files/2017%20INDOT%20Noise%20Policy.pdf>)

APPENDIX A
RECEPTOR ADDRESSES

Noise Analysis
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Hamilton County, Indiana
Receptor Addresses

Noise Sensitive Receptors								
Receptor No	Street Number	Street	City, State, Zip	Owner Name	Parcel No.	Elevations (ft)	Land Use Category	Impact Level (dBA)
1	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	875.00	C	66
2	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	877.00	C	66
3	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	877.00	C	66
4	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	880.00	C	66
5	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	887.00	C	66
6	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	898.00	C	66
7	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	917.00	C	66
8	21105	Macgregor Park Rd	Westfield, In, 46074	Washington Township of Hamilton County	08-06-18-00-00-003.000	914.00	C	66
9	1701	E 216th St	Westfield, In, 46074	McClure Store #65 LLC	08-06-18-00-00-001.000	916.00	F	
10	22175	US Highway 31 N	Cicero, In, 46034	Collins, Douglas Deem	03-06-07-00-00-022.000	922.00	B	66
11	22179	US Highway 31 N	Cicero, In, 46034	Bullseye Fence Design Inc	03-06-07-00-00-022.001	923.00	F	
12	22265	US Highway 31 N	Cicero, In, 46034	Case Real Estate Group LLC	03-06-07-00-00-023.001	919.00	F	
13	0	E 226th St	Cicero, In, 46034	G W Pierce Enterprises LLC	03-06-07-00-00-023.101	920.00	F	
14	0	E 226th St	Cicero, In, 46034	G W Pierce Enterprises LLC	03-06-07-00-00-023.000	923.00	F	
15	22278	US Highway 31 N	Cicero, In, 46034	Thompson, Vernon R & Sharon J	01-05-12-00-00-016.001	922.00	B	66
16	22298	US Highway 31 N	Cicero, In, 46034	Elbrecht, April M	01-05-12-00-00-017.002	923.00	B	66
17	22310	US Highway 31 N	Cicero, In, 46034	Blaine, Wilson L	01-05-12-00-00-014.000	922.00	B	66
18	1637	E 226th St	Cicero, In, 46034	JEDKM Enterprises LLC	01-05-12-00-00-013.000	926.00	F	
19	1461	E 226th St	Cicero, In, 46034	Copart of Connecticut Inc	01-05-12-00-00-013.002	928.00	F	
20	1461	E 226th St	Cicero, In, 46034	Copart of Connecticut Inc	01-05-12-00-00-013.002	923	F	
21	1405	E 226th St	Cicero, In, 46034	Copart of Connecticut Inc	01-05-12-00-00-013.001	927	F	
22	1715	E 226th St	Cicero, In, 46034	G W Pierce Enterprises LLC	03-06-07-00-00-001.000	918	F	
23	1965	E 226th St	Cicero, In, 46034	Pierce, Benny Howard & Susan K	03-06-07-00-00-001.001	913	B	66
24	2133	E 226th St	Cicero, In, 46034	Five Star Real Estate Development LLC	03-06-06-00-00-025.003	918	F	
25	2130	E 226th St	Cicero, In, 46034	Goodbold, Gerard A Sr Trustee of Gerard A Goodbold Sr Living Trust	03-06-06-00-00-025.002	914	B	66
26	1820	E 226th St	Cicero, In, 46034	Orahood, Douglas R & Susan D	03-06-06-00-00-024.001	916	B	66
27	22730	US Highway 31 N	Cicero, In, 46034	Walloon Group LLC	01-05-01-00-00-026.000	921	B	66
28	22925	US Highway 31 N	Cicero, In, 46034	Pickett, Dale A	03-06-06-00-00-027.000	916	F	
29	23465	US Highway 31 N	Cicero, In, 46034	Waltz, Alan K	03-06-06-00-00-028.000	915	B	66
30	23468	US Highway 31 N	Cicero, In, 46034	State of Indiana	01-05-01-00-00-022.000	914	B	66
31	23478	US Highway 31 N	Cicero, In, 46034	Riley Real Estate Holdings LLC	01-05-01-00-00-020.000	911	F	
32	23502	US Highway 31 N	Sheridan, In, 46069	Riley Real Estate Holdings LLC	01-05-01-00-00-019.000	913	B	66
33	1641	E 236th St	Arcadia, In, 46030	Schiedel, Darrell R & Michelle L	01-05-01-00-00-017.102	907.00	B	66
34	1631	E 236th St	Arcadia, In, 46030	Ceiling Pro Inc	01-05-01-00-00-017.702	908.00	B	66
35	1695	E 236th St	Arcadia, In, 46030	Irwin, Robert H and Jennifer L	01-05-01-00-00-017.000	909.00	B	66
36	1695	E 236th St	Arcadia, In, 46030	Irwin, Robert H and Jennifer L	01-05-01-00-00-017.000	911.00	B	66
37	1695	E 236th St	Arcadia, In, 46030	Irwin, Robert H and Jennifer L	01-05-01-00-00-017.000	912.00	B	66
38	1611	E 236th St	Arcadia, In, 46030	State of Indiana	01-05-01-00-00-017.602	909.00	B	66
39	1671	E 236th St	Arcadia, In, 46030	Blue Doors Real Estate LLC S Series 236th	01-05-01-00-00-017.302	909.00	B	66
40	1563	E 236th St	Arcadia, In, 46030	Bender, Anissa J	01-05-01-00-00-015.000	907.00	B	66
41	1561	E 236th St	Sheridan, In, 46069	Parkhurst, Marinell	01-05-01-00-00-014.000	906.00	B	66
42	1551	E 236th St	Sheridan, In, 46069	Hunt, Sheree L	01-05-01-00-00-012.001	904.00	B	66
43	1552	E 236th St	Arcadia, In, 46030	Boyd, Judith A	01-01-36-00-00-017.002	904.00	B	66
44	1650	E 236th St	Arcadia, In, 46030	Speedway LLC	01-01-36-00-00-016.101	906.00	F	
45	1715	E 236th St	Cicero, In, 46034	McBryant, James W II & Eunice E	03-06-06-00-00-001.001	909.00	B	66
46	1716	E 236th St	Cicero, In, 46034	McBryant, James W II & Eunice E	03-06-06-00-00-001.001	912.00	B	66
47	1756	E 236th St	Cicero, In, 46034	Keeker, Jim C & Kristi Sue Gaugler Keeker	03-02-31-00-00-030.002	903.00	B	66
48	1798	E 236th St	Cicero, In, 46034	State of Indiana	03-02-31-00-00-030.001	906.00	B	66
49	23689	US Highway 31 N	Arcadia, In, 46030	State of Indiana	03-02-31-00-00-031.000	906.00	B	66
50	23725	US Highway 31 N	Arcadia, In, 46030	Teegarden, Dorothy Dianne & Laura Beth McCommon Trustees HerbertK Strough Trust	03-02-31-00-00-033.000	910.00	B	66
51	23725	US Highway 31 N	Arcadia, In, 46030	Teegarden, Dorothy Dianne & Laura Beth McCommon Trustees HerbertK Strough Trust	03-02-31-00-00-033.000	912.00	B	66
52	23711	US Highway 31 N	Arcadia, In, 46030	State of Indiana	03-02-31-00-00-034.000	913.00	B	66
53	23737	US Highway 31 N	Arcadia, In, 46030	State of Indiana	03-02-31-00-00-035.000	907.00	B	66
54	23841	US Highway 31 N	Arcadia, In, 46030	State of Indiana	03-02-31-00-00-036.000	903.00	B	66
55	23871	US Highway 31 N	Arcadia, In, 46030	State of Indiana	03-02-31-00-00-038.000	899.00	B	66

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US 31 Limited Access Corridor Study
Hamilton County, Indiana
Receptor Addresses

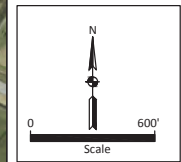
Noise Sensitive Receptors								
Receptor No	Street Number	Street	City, State, Zip	Owner Name	Parcel No.	Elevations (ft)	Land Use Category	Impact Level (dBA)
56	23871	US Highway 31 N	Arcadia, In, 46030	State of Indiana	03-02-31-00-00-038.000	906.00	B	66
57	23950	US Highway 31 N	Arcadia, In, 46030	State of Indiana	01-01-36-00-00-015.000	904.00	B	66
58	23980	US Highway 31 N	Arcadia, In, 46030	State of Indiana	01-01-36-00-00-014.000	903.00	B	66
59	24010	US Highway 31 N	Arcadia, In, 46030	State of Indiana	01-01-36-00-00-013.000	899.00	B	66
60	24097	US Highway 31 N	Cicero, In, 46034	Stumpf, Clinton and Mary Elizabeth	03-02-31-00-00-052.000	908.00	B	66
61	24097	US Highway 31 N	Cicero, In, 46034	Stumpf, Clinton and Mary Elizabeth	03-02-31-00-00-052.000	910.00	B	66
62	24121	US Highway 31 N	Arcadia, In, 46030	Dorsey, Donna J	03-02-31-00-00-053.000	909.00	B	66
63	24121	US Highway 31 N	Arcadia, In, 46030	Dorsey, Donna J	03-02-31-00-00-053.000	911.00	B	66
64	1802	US Highway 31 N	Cicero, In, 46034	Meier, Tim William & Cheryl Ann	03-02-31-00-00-054.001	911.00	B	66
65	24130	US Highway 31 N	Arcadia, In, 46030	Gerth, Carolyn H Trustee Carolyn H Gerth Rev Trust	01-01-36-00-00-012.000	906.00	B	66
66	24220	US Highway 31 N	Cicero, In, 46034	Waitt Companies Inc	01-01-36-00-00-010.000	910.00	F	
67	24259	US Highway 31 N	Arcadia, In, 46030	Harmon, Rush J Jr & Ruth M Kitron h&w te	03-02-31-00-00-054.000	913.00	B	66
68	24510	US Highway 31 N	Cicero, In, 46034	Harsin, Donald D Jr	01-01-36-00-00-008.000	912.00	B	66
69	24910	US Highway 31 N	Arcadia, In, 46030	Hartley, Sylvia K	01-01-25-00-00-009.000	907.00	B	66
70	24949	US Highway 31 N	Arcadia, In, 46030	Hartley, Sylvia Kay	03-02-30-00-00-014.004	909.00	B	66
71	25120	US Highway 31 N	Arcadia, In, 46030	Woodcock, J R & Marilyn K	01-01-25-00-00-008.001	908.00	B	66
72	1698	E 256th St	Arcadia, In, 46030	Barrantes, Niko Juan Carlos	01-01-24-00-00-014.000	905.00	B	66
73	1720	E 256th St	Arcadia, In, 46030	Wilson Farm Market LLC	03-02-30-00-00-001.001	906.00	F	
74	1955	E 256th St	Arcadia, In, 46030	Hammond, Stephen & Patsy L	03-02-30-00-00-004.004	906.00	F	
75	0	US Highway 31 N	Arcadia, In, 46030	Wang, David	01-01-24-00-00-015.000	906.00	B	66
76	25720	US Highway 31 N	Arcadia, In, 46030	Mohler, Nitha & Todd Chandler Clark Jr/rs	01-01-24-00-00-013.000	907.00	B	66
77	25810	US Highway 31 N	Arcadia, In, 46030	McNeely, Glenn E Jr & Mary Sue	01-01-24-00-00-011.000	907.00	B	66
78	25810	US Highway 31 N	Arcadia, In, 46030	McNeely, Glenn E Jr & Mary Sue	01-01-24-00-00-010.001	907.00	B	66
79	25860	US Highway 31 N	Arcadia, In, 46030	Whitmore, Dickie Lee	01-01-24-00-00-010.000	907.00	B	66
80	25911	US Highway 31 N	Arcadia, In, 46030	Hammond Farm Inc	03-02-19-00-00-012.000	905.00	B	66
81	26491	US Highway 31 N	Arcadia, In, 46030	Becks Superior Hybrids Inc	03-02-19-00-00-001.000	906.00	B	66
82	1511	E 266th St	Arcadia, In, 46030	Yutzy, Ryan A & Kristen E h&w	01-01-24-00-00-005.000	908.00	B	66
83	1620	E 266th St	Sheridan, In, 46069	Armfield, Steve L	01-01-13-00-00-014.000	905.00	B	66
84	2161	E 266th St	Arcadia, In, 46030	Baker, Nancy J	03-02-19-00-00-002.001	903.00	B	66
85	1770	E 266th St	Arcadia, In, 46030	Patterson, Markus E & Ruth A	03-02-19-00-00-001.001	903.00	F	
86	2170	E 266th St	Arcadia, In, 46030	Stern, Duane M & Nancy J Waltz Stern	03-02-18-00-00-011.003	901.00	B	66
87	26910	US Highway 31 N	Sheridan, In, 46069	McMillen, Michael P	01-01-13-00-00-013.000	904.00	B	66
88	27498	US Highway 31 N	Sheridan, In, 46069	Springdale Properties LLC	01-01-13-00-00-005.000	905.00	F	
89	1451	E 276th St	Atlanta, In, 46031	Springdale Properties LLC	01-01-13-00-00-004.001	899.00	F	
90	0	US Highway 31 N	Atlanta, In, 46031	Beck Family LP	03-02-07-00-00-004.000	895.00	F	
91	28230	US Highway 31 N	Atlanta, In, 46031	Farmhouse Property LLC	01-01-12-00-00-008.000	900.00	B	66
92	28210	US Highway 31 N	Atlanta, In, 46031	Farmland Property LLC	01-01-12-00-00-009.000	901.00	B	66
93	1333	286th St	Atlanta, In, 46031	Daulton, Scott & Chrystal h&w	01-01-12-00-00-006.001	911.00	B	66
94	28511	US Highway 31 N	Atlanta, In, 46031	Scott, Shannon S	03-02-07-00-00-002.001	910.00	B	66
95	1709	E 286th St	Atlanta, In, 46031	Becks Superior Hybrids Inc	03-02-07-00-00-001.000	912.00	B	66

APPENDIX B

EXHIBITS

EXHIBIT 1 - RECEPTOR AND SAMPLING LOCATIONS EXHIBIT

EXHIBIT 2 – SOUND LEVEL CONTOUR EXHIBIT



**SEGMENT 1
1 OF 2**

P:\2020\20-0109 - 818LS\US31 Limited Access Corridor Study\5 - Deliverables\Report\Appendix B - Exhibit\Exhibit 1 Noise Receptors - 07082021.dwg

Source: <http://maps.indiana.edu/>

Exhibit 1 - Receptor and Sampling Location Exhibit
US 31 Limited Access Corridor Study
~500 Feet South of Sheridan Road to 236th Street
Hamilton County, Indiana
Metric Project # P20-0109

Note: All locations are approximate

— Alignment
--- 500 foot buffer area

● Category B Receptors

● Category C Receptors

● Category F Receptors
(No noise analysis)

● Two colors indicate Impacted Receptors

■ Receptors to be relocated

● Measurement Locations



Drawn by: ILJ

Checked by: SR

Approved by: PL

Date: July, 2021



P:\2020\20-0109 - 8185 US 31 Limited Access Corridor Study\5 - Deliverables\Report\Appendix B - Exhibit\Exhibit 1 Noise Receptors - 07082021.dwg

Source: <http://maps.indiana.edu/>

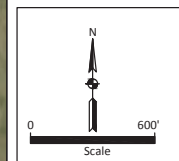
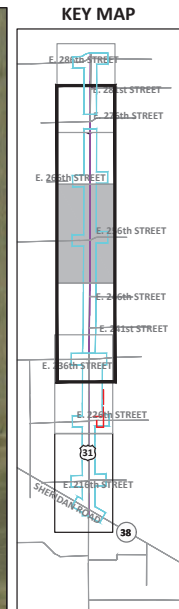
Exhibit 1 - Receptor and Sampling Location Exhibit
 US 31 Limited Access Corridor Study
 ~500 Feet North of East 236th Street to
 ~1,000 Feet South of East 276th Street
 Hamilton County, Indiana
 Metric Project # P20-0109

Note: All locations are approximate
 — Alignment
 --- 500 foot buffer area

- Category B Receptors
- Category C Receptors
- Category F Receptors (No noise analysis)
- Two colors indicate Impacted Receptors
- Receptors to be relocated
- Measurement Locations

METRIC
 ENVIRONMENTAL

Drawn by: ILJ
 Checked by: SR
 Approved by: PL
 Date: July, 2021



SEGMENT 2
2 OF 3

P:\2020\20-0109 - 818.S.US31 Limited Access Noise Study\5 - Deliverables\Report\Appendix\Appendix B - Exhibit\Exhibit 1 Noise Receptors - 07082021.dwg

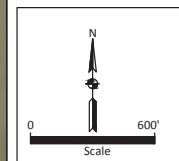
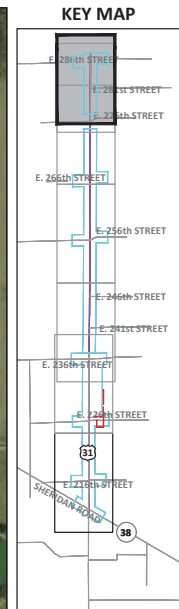
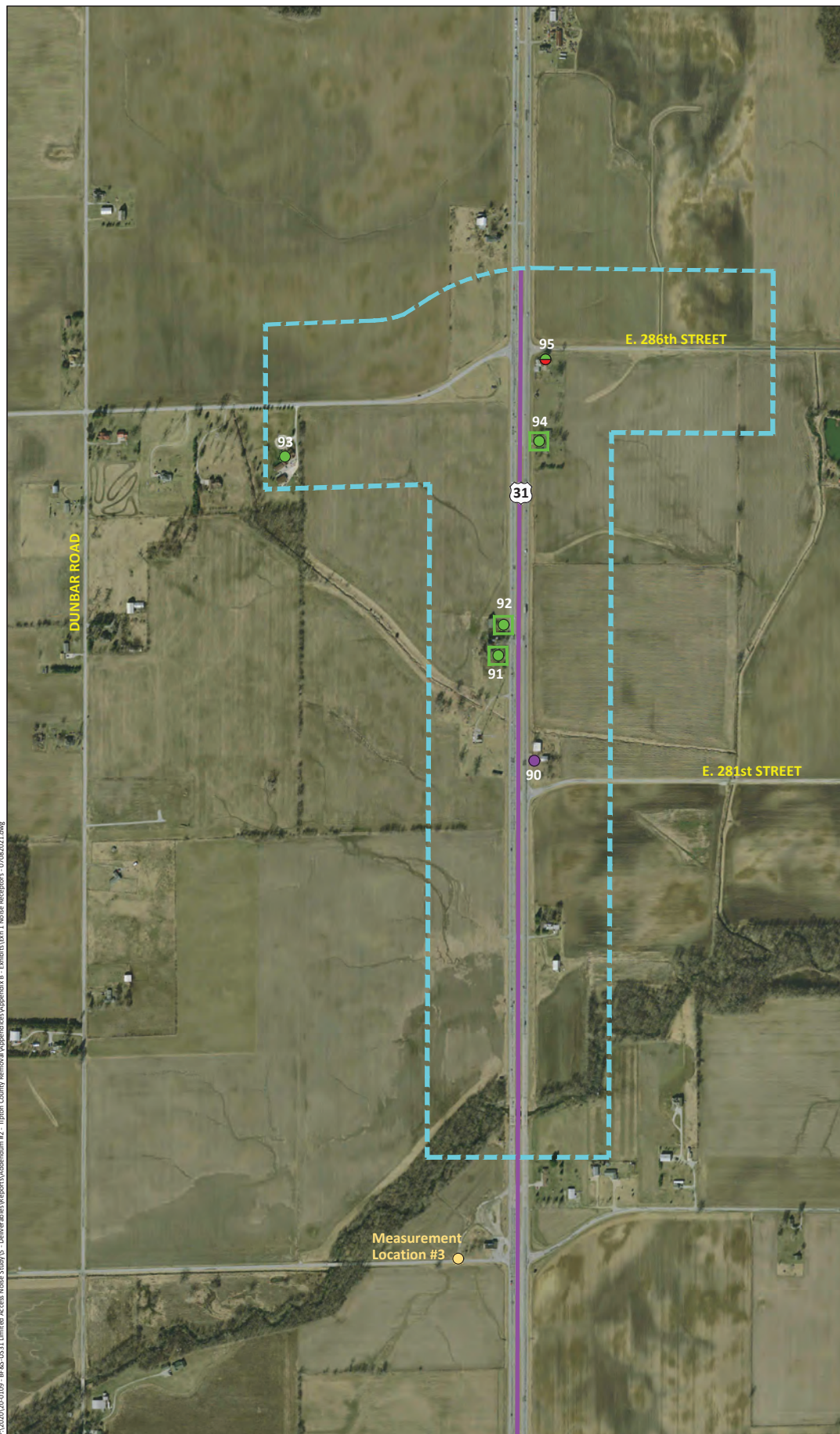
Source: <http://maps.indiana.edu/>

Exhibit 1 - Receptor and Sampling Location Exhibit
US 31 Limited Access Corridor Study
~500 Feet North of East 236th Street to
~1,000 Feet South of East 276th Street
Hamilton County, Indiana
Metric Project # P20-0109

Note: All locations are approximate
— Alignment
--- 500 foot buffer area

- Category B Receptors
- Category C Receptors
- Category F Receptors (No noise analysis)
- Two colors indicate Impacted Receptors
- Receptors to be relocated
- Measurement Locations

METRIC
ENVIRONMENTAL
Drawn by: ILJ
Checked by: SR
Approved by: PL
Date: July, 2021



**SEGMENT 3
1 OF 1**

P:\2020\20-0109 - 8F&S-US31 Limited Access Corridor Study\5 - Deliverables\Report\Appendix B - Exhibit 1 Noise Receptors - 07082021.dwg

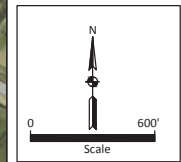
Source: <http://maps.indiana.edu/>

Exhibit 1 - Receptor and Sampling Location Exhibit
US 31 Limited Access Corridor Study
~500 Feet North of East 286th Street
to ~1,000 Feet South of State Road 28
Hamilton County, Indiana
Metric Project # P20-0109

Note: All locations are approximate
— Alignment
--- 500 foot buffer area

- Category B Receptors
- Category C Receptors
- Category F Receptors (No noise analysis)
- Two colors indicate Impacted Receptors
- Receptors to be relocated
- Measurement Locations

METRIC ENVIRONMENTAL
Drawn by: ILJ
Checked by: SR
Approved by: PL
Date: July, 2021



**SEGMENT 1
1 OF 2**

P:\2020\20-0109 - 818.5 US 31 Limited Access Noise Study\5 - Deliverables\Report\Appendix B - Exhibit\Exhibit 2 Setback Distances - 07082021.dwg

Source: <http://maps.indiana.edu/>

Exhibit 2 - Setback Distances
US 31 Limited Access Corridor Study
Segment 1 - 1 of 2
~500 Feet South of Sheridan Road to 236th Street
Hamilton County, Indiana
Metric Project # 20-0109

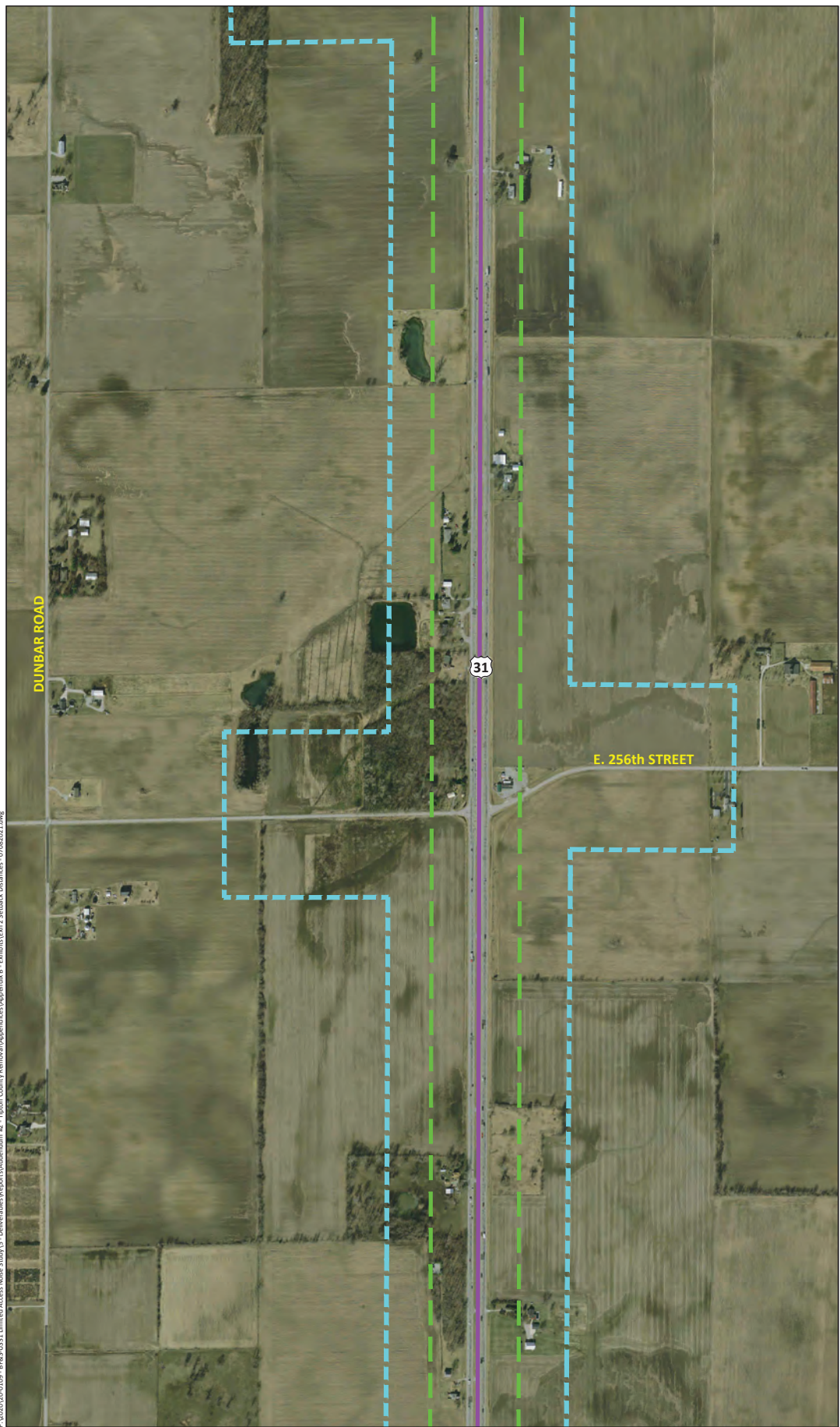
Note: All locations are approximate

- Proposed Road Alignment
- Setback Distance - 260 feet
- 500 foot buffer area

METRIC
ENVIRONMENTAL

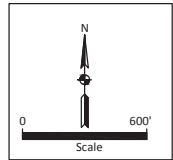
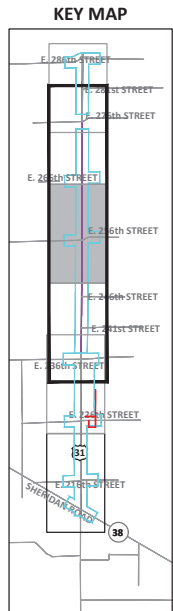
Drawn by: ILJ
Checked by: SR
Approved by: PL
Date: July, 2021





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Source: <http://maps.indiana.edu/>



**SEGMENT 2
2 OF 3**

Exhibit 2 - Setback Distances
US 31 Limited Access Corridor Study
Segment 2 - 2 of 3
~500 Feet North of East 236th Street to
~1,000 Feet South of East 276th Street
Hamilton County, Indiana
Metric Project # 20-0109

Note: All locations are approximate

- Proposed Road Alignment
- Setback Distance - 220 feet
- 500 foot buffer area

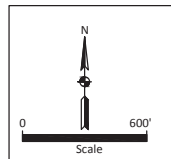
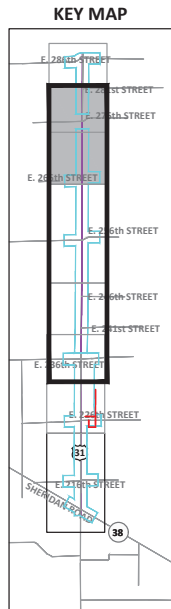
METRIC
ENVIRONMENTAL

Drawn by: ILJ
Checked by: SR
Approved by: PL
Date: July, 2021



P:\2020\20-0109 - H&S\US31 Limited Access Corridor Study\5 - Deliverables\Report\Appendix B - Exhibit 2 Setback Distances - 07082021.dwg

Source: <http://maps.indiana.edu/>

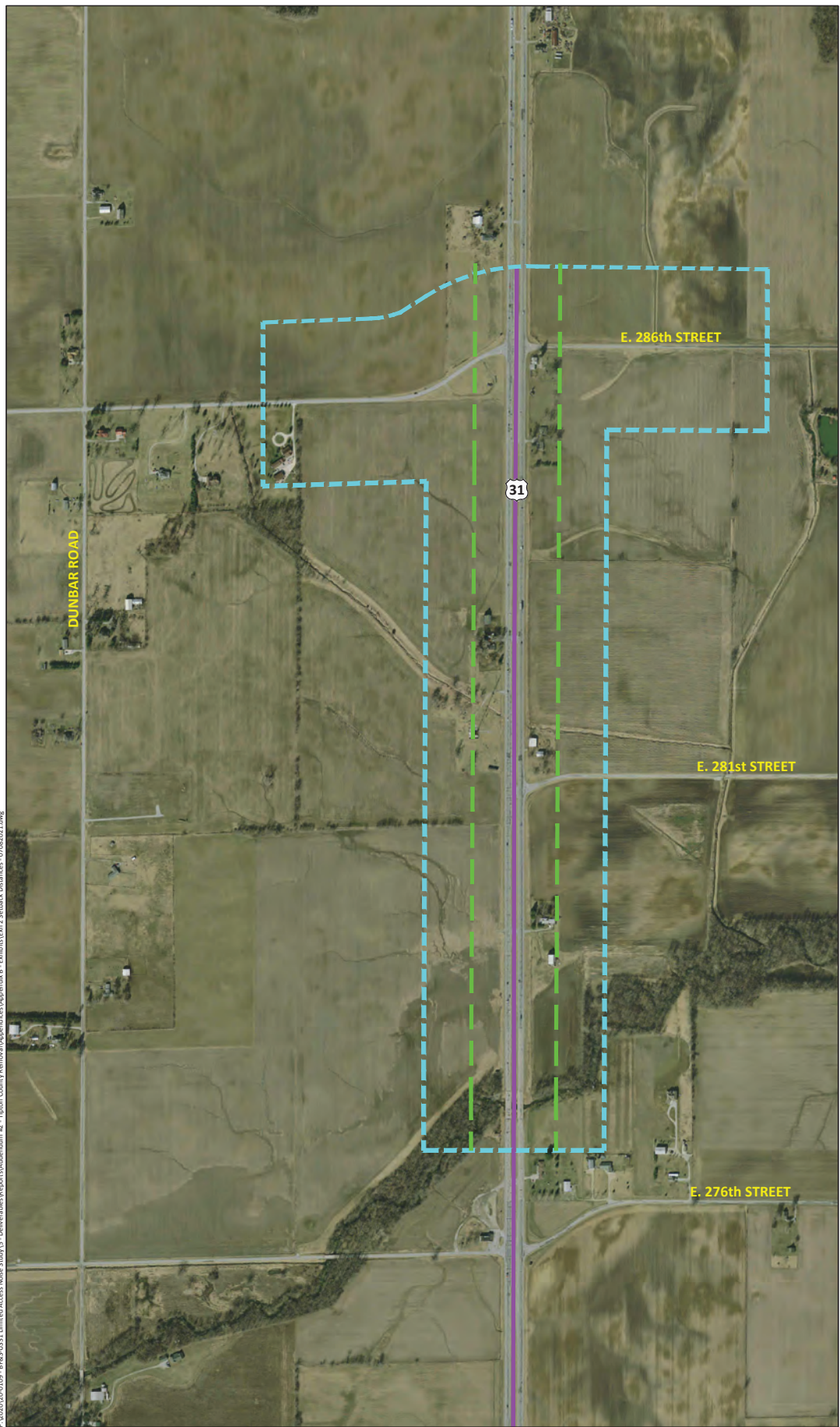


**SEGMENT 2
3 OF 3**

Exhibit 2 - Setback Distances
US 31 Limited Access Corridor Study
Segment 2 - 3 of 3
~500 Feet North of East 236th Street to
~1,000 Feet South of East 276th Street
Hamilton County, Indiana
Metric Project # 20-0109

Note: All locations are approximate
— Proposed Road Alignment
— Setback Distance - 200 feet
— 500 foot buffer area

METRIC
ENVIRONMENTAL
Drawn by: ILJ
Checked by: SR
Approved by: PL
Date: July, 2021



P:\2020\20-0109 - 818LS US 31 Limited Access Noise Study\5 - Deliverables\Report\Appendix B - Exhibit 3 (Setback Distances - 07082021).png

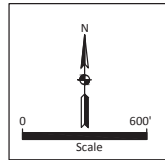
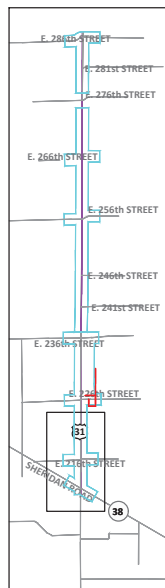
Source: <http://maps.indiana.edu/>

Exhibit 2 - Setback Distances
US 31 Limited Access Corridor Study
Segment 3 - 1 of 1
~500 feet north of East 276th Street
to ~1,000 feet south of State Road 28
Hamilton County, Indiana
Metric Project # 20-0109

Note: All locations are approximate

- Proposed Road Alignment
- Setback Distance - 200 feet
- 500 foot buffer area

KEY MAP



SEGMENT 3
1 OF 1



Drawn by: ILJ
Checked by: SR
Approved by: PL
Date: July, 2021

APPENDIX C

NOISE LEVEL MODELING DATA AND CALCULATIONS

TABLE 5 – PREDICTED NOISE LEVEL DISTRIBUTIONS
FHWA-TNM 2.5 MODELING DATA

Receptor #	NAC Category	Predicted Noise Level			Difference (+/-) (dBA)	Relocated? (Yes/No)	Impacted? (Yes/No)
		Existing	Future No Build	Future Build			
1	C	60.4	61.2	61.2	0.8	No	No
2	C	65.1	65.9	65.9	0.8	No	No
3	C	62.4	63.3	63.3	0.9	No	No
4	C	58.5	59.4	59.4	0.9	No	No
5	C	60.3	61.2	61.2	0.9	No	No
6	C	63.2	64.1	64.1	0.9	No	No
7	C	68.9	69.8	69.8	0.9	No	Yes
8	C	62.0	62.9	62.9	0.9	No	No
9	F	NA	NA	NA	NA	No	NA
10	B	62.2	63.0	63.0	0.8	No	No
11	F	NA	NA	NA	NA	No	NA
12	F	NA	NA	NA	NA	No	NA
13	F	NA	NA	NA	NA	No	NA
14	F	NA	NA	NA	NA	No	NA
15	B	NA	NA	NA	NA	Yes	NA
16	B	NA	NA	NA	NA	Yes	NA
17	B	NA	NA	NA	NA	Yes	NA
18	F	NA	NA	NA	NA	Yes	NA
19	F	NA	NA	NA	NA	No	NA
20	F	NA	NA	NA	NA	No	NA
21	F	NA	NA	NA	NA	No	NA
22	F	NA	NA	NA	NA	No	NA
23	B	55.1	56.0	55.9	0.8	No	No
24	F	NA	NA	NA	NA	No	NA
25	B	57.9	58.8	58.0	0.1	No	No
26	B	52.7	53.6	55.3	2.6	No	No
27	B	NA	NA	NA	NA	Yes	NA
28	F	NA	NA	NA	NA	No	NA
29	F	NA	NA	NA	NA	No	NA
30	B	66.1	67.0	67.0	0.9	No	Yes
31	F	NA	NA	NA	NA	No	NA
32	B	70.8	71.6	71.6	0.8	No	Yes
33	B	60.9	61.8	61.8	0.9	No	No
34	B	60.6	61.4	61.4	0.8	No	No
35	B	65.5	66.3	66.3	0.8	No	Yes
36	B	69.0	69.9	69.9	0.9	No	Yes
37	B	65.1	66.0	66.0	0.9	No	Yes
38	B	65.6	66.5	66.5	0.9	No	Yes
39	B	60.2	61.1	61.1	0.9	No	No
40	B	61.7	62.6	62.6	0.9	No	No
41	B	60.8	61.7	61.7	0.9	No	No
42	B	61.6	62.5	62.5	0.9	No	No

Receptor #	NAC Category	Predicted Noise Level			Difference (+/-) (dBA)	Relocated? (Yes/No)	Impacted? (Yes/No)
		Existing	Future No Build	Future Build			
43	B	66.1	67.0	67.0	0.9	No	Yes
44	F	NA	NA	NA	NA	No	NA
45	B	70.1	71.0	71.0	0.9	No	Yes
46	B	65.8	66.7	66.7	0.9	No	Yes
47	B	68.2	69.0	69.0	0.8	No	Yes
48	B	70.8	71.6	71.6	0.8	No	Yes
49	B	NA	NA	NA	NA	Yes	NA
50	B	NA	NA	NA	NA	Yes	NA
51	B	NA	NA	NA	NA	Yes	NA
52	B	NA	NA	NA	NA	Yes	NA
53	B	NA	NA	NA	NA	Yes	NA
54	B	NA	NA	NA	NA	Yes	NA
55	B	NA	NA	NA	NA	Yes	NA
56	B	NA	NA	NA	NA	Yes	NA
57	B	NA	NA	NA	NA	Yes	NA
58	B	NA	NA	NA	NA	Yes	NA
59	B	NA	NA	NA	NA	Yes	NA
60	B	66.5	67.4	67.5	1.0	No	Yes
61	B	63.2	64.1	64.0	0.8	No	No
62	B	67.5	68.3	68.4	0.9	No	Yes
63	B	64.6	65.5	65.4	0.8	No	No
64	B	60.2	61.1	61.4	1.2	No	No
65	B	NA	NA	NA	NA	Yes	NA
66	F	NA	NA	NA	NA	Yes	NA
67	B	NA	NA	NA	NA	Yes	NA
68	B	NA	NA	NA	NA	Yes	NA
69	B	NA	NA	NA	NA	Yes	NA
70	B	NA	NA	NA	NA	Yes	NA
71	B	NA	NA	NA	NA	Yes	NA
72	B	69.2	70.8	70.6	1.4	No	Yes
73	F	NA	NA	NA	NA	No	NA
74	F	NA	NA	NA	NA	No	NA
75	B	NA	NA	NA	NA	Yes	NA
76	B	NA	NA	NA	NA	Yes	NA
77	B	NA	NA	NA	NA	Yes	NA
78	B	NA	NA	NA	NA	Yes	NA
79	B	NA	NA	NA	NA	Yes	NA
80	B	73.1	74.8	74.8	1.7	No	Yes
81	B	NA	NA	NA	NA	Yes	NA
82	B	54.9	56.3	60.5	5.6	No	No
83	B	61.8	62.8	62.5	0.7	No	No
84	B	58.1	59.1	57.7	-0.4	No	No

Receptor #	NAC Category	Predicted Noise Level			Difference (+/-) (dBA)	Relocated? (Yes/No)	Impacted? (Yes/No)
		Existing	Future No Build	Future Build			
85	F	NA	NA	NA	NA	No	NA
86	B	58.4	59.3	57.9	-0.5	No	No
87	B	NA	NA	NA	NA	Yes	NA
88	F	NA	NA	NA	NA	No	NA
89	F	NA	NA	NA	NA	No	NA
90	F	NA	NA	NA	NA	No	NA
91	B	NA	NA	NA	NA	Yes	NA
92	B	NA	NA	NA	NA	Yes	NA
93	B	50.6	51.5	50.8	0.2	No	No
94	B	NA	NA	NA	NA	Yes	NA
95	B	73.0	73.9	73.8	0.8	No	Yes

* Shaded Receptor rows indicate impacted receptors

** Receptors are only within the study area for the E 296th Street bypass with cul-de-sacs option

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC												
S. Raman												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31 Limited Access Study												
RUN: Segment 1 - Validation												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	With Barrier				
								Type Impact	Calculated LAeq1h	Noise Reduction		
										Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Measurement #1	52	1	0.0	56.7	54	56.7	15	Snd Lvl	56.7	0.0	7	-7.0
Dwelling Units		# DUs	Noise Reduction									
			Min dB	Avg dB	Max dB							
All Selected		1	0.0	0.0	0.0							
All Impacted		1	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

US 31 Limited Access Study

US 31 Limited Access Study

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC							18 January 2021						
S. Raman							TNM 2.5						
							Calculated with TNM 2.5						
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:	US 31 Limited Access Study												
RUN:	Existing - Segment 1												
BARRIER DESIGN:	INPUT HEIGHTS						Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.						
ATMOSPHERICS:	68 deg F, 50% RH												
Receiver													
Name	No.	#DUS	Existing	No Barrier				With Barrier					
			LAeq1h	LAeq1h		Increase over	existing	Type	Calculated	Noise Reduction			
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated	
							Sub'l Inc					minus	
												Goal	
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB	
Receiver #1	1	1	0.0	60.4	66	60.4	15	----	60.4	0.0	7	-7.0	
Receiver #2	2	1	0.0	65.1	66	65.1	15	----	65.1	0.0	7	-7.0	
Receiver #3	3	1	0.0	62.4	66	62.4	15	----	62.4	0.0	7	-7.0	
Receiver #4	4	1	0.0	58.5	66	58.5	15	----	58.5	0.0	7	-7.0	
Receiver #5	5	1	0.0	60.3	66	60.3	15	----	60.3	0.0	7	-7.0	
Receiver #6	6	1	0.0	63.2	66	63.2	15	----	63.2	0.0	7	-7.0	
Receiver #7	7	1	0.0	68.9	66	68.9	15	Snd Lvl	68.9	0.0	7	-7.0	
Receiver #8	8	1	0.0	62.0	66	62.0	15	----	62.0	0.0	7	-7.0	
Receiver #9	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #10	12	1	0.0	62.2	66	62.2	15	----	62.2	0.0	7	-7.0	
Receiver #11	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #12	14	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #13	15	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #14	16	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #15	17	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #16	18	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #17	19	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #18	20	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #19	21	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #20	22	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #21	23	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #22	24	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #23	25	1	0.0	55.1	66	55.1	15	----	55.1	0.0	7	-7.0	
Receiver #24	26	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Receiver #25	27	1	0.0	57.9	66	57.9	15	----	57.9	0.0	7	-7.0
Receiver #26	28	1	0.0	52.7	66	52.7	15	----	52.7	0.0	7	-7.0
Receiver #27	29	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #28	30	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #29	31	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #30	32	1	0.0	66.1	66	66.1	15	Snd Lvl	66.1	0.0	7	-7.0
Receiver #31	33	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #32	34	1	0.0	70.8	66	70.8	15	Snd Lvl	70.8	0.0	7	-7.0
Receiver #33	35	1	0.0	60.9	66	60.9	15	----	60.9	0.0	7	-7.0
Receiver #34	36	1	0.0	60.6	66	60.6	15	----	60.6	0.0	7	-7.0
Receiver #35	37	1	0.0	65.5	66	65.5	15	----	65.5	0.0	7	-7.0
Receiver #36	38	1	0.0	69.0	66	69.0	15	Snd Lvl	69.0	0.0	7	-7.0
Receiver #37	39	1	0.0	65.1	66	65.1	15	----	65.1	0.0	7	-7.0
Receiver #38	40	1	0.0	65.6	66	65.6	15	----	65.6	0.0	7	-7.0
Receiver #39	41	1	0.0	60.2	66	60.2	15	----	60.2	0.0	7	-7.0
Receiver #40	42	1	0.0	61.7	66	61.7	15	----	61.7	0.0	7	-7.0
Receiver #41	43	1	0.0	60.8	66	60.8	15	----	60.8	0.0	7	-7.0
Receiver #42	45	1	0.0	61.6	66	61.6	15	----	61.6	0.0	7	-7.0
Receiver #43	46	1	0.0	66.1	66	66.1	15	Snd Lvl	66.1	0.0	7	-7.0
Receiver #44	47	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #45	48	1	0.0	70.1	66	70.1	15	Snd Lvl	70.1	0.0	7	-7.0
Receiver #46	49	1	0.0	65.8	66	65.8	15	----	65.8	0.0	7	-7.0
Receiver #47	50	1	0.0	68.2	66	68.2	15	Snd Lvl	68.2	0.0	7	-7.0
Receiver #48	52	1	0.0	70.8	66	70.8	15	Snd Lvl	70.8	0.0	7	-7.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		48	0.0	0.0	0.0							
All Impacted		8	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC							18 January 2021						
S. Raman							TNM 2.5						
							Calculated with TNM 2.5						
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:		US 31 Limited Access Study											
RUN:		Existing - Segment 2											
BARRIER DESIGN:		INPUT HEIGHTS						Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.					
ATMOSPHERICS:		68 deg F, 50% RH											
Receiver													
Name	No.	#DUS	Existing	No Barrier				With Barrier					
			LAeq1h	LAeq1h		Increase over	existing	Type	Calculated	Noise Reduction			
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated	
							Sub'l Inc					minus	
												Goal	
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB	
Receiver #49	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #50	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #51	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #52	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #53	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #54	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #55	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #56	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #57	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #58	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #59	11	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #60	12	1	0.0	66.5	66	66.5	15	Snd Lvl	66.5	0.0	7	-7.0	
Receiver #61	13	1	0.0	63.2	66	63.2	15	----	63.2	0.0	7	-7.0	
Receiver #62	14	1	0.0	67.5	66	67.5	15	Snd Lvl	67.5	0.0	7	-7.0	
Receiver #63	15	1	0.0	64.6	66	64.6	15	----	64.6	0.0	7	-7.0	
Receiver #64	16	1	0.0	60.2	66	60.2	15	----	60.2	0.0	7	-7.0	
Receiver #65	17	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #66	18	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #67	19	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #68	20	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #69	22	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #70	23	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #71	24	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #72	25	1	0.0	69.2	66	69.2	15	Snd Lvl	69.2	0.0	7	-7.0	

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Receiver #73	26	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #74	27	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #75	28	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #76	29	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #77	30	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #78	31	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #79	32	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #80	33	1	0.0	73.1	66	73.1	15	Snd Lvl	73.1	0.0	7	-7.0
Receiver #81	34	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #82	35	1	0.0	54.9	66	54.9	15	----	54.9	0.0	7	-7.0
Receiver #83	36	1	0.0	61.8	66	61.8	15	----	61.8	0.0	7	-7.0
Receiver #84	37	1	0.0	58.1	66	58.1	15	----	58.1	0.0	7	-7.0
Receiver #85	38	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #86	39	1	0.0	58.4	66	58.4	15	----	58.4	0.0	7	-7.0
Receiver #87	40	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #88	42	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #89	43	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		41	0.0	0.0	0.0							
All Impacted		4	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC												
S. Raman												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31 Limited Access Study												
RUN: Existing - Segment 3												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	With Barrier				
								Type Impact	Calculated LAeq1h	Noise Reduction		
										Calculated	Goal	Calculated minus Goal
			dB	dB	dB	dB	dB		dB	dB	dB	dB
Receiver #90	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #91	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #92	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #93	4	1	0.0	50.6	66	50.6	15	----	50.6	0.0	7	-7.0
Receiver #94	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #95	6	1	0.0	73.0	66	73.0	15	Snd Lvl	73.0	0.0	7	-7.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		6	0.0	0.0	0.0							
All Impacted		1	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC								18 January 2021					
S. Raman								TNM 2.5					
								Calculated with TNM 2.5					
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:					US 31 Limited Access Study								
RUN:					Future No Build - Segment 1								
BARRIER DESIGN:					INPUT HEIGHTS			Average pavement type shall be used unless					
								a State highway agency substantiates the use					
ATMOSPHERICS:					68 deg F, 50% RH			of a different type with approval of FHWA.					
Receiver													
Name		No.	#DUS	Existing	No Barrier			With Barrier					
				LAeq1h	LAeq1h		Increase over existing	Type	Calculated	Noise Reduction			
					Calculated	Crit'n	Calculated	Crit'n			Calculated	Goal	
								Sub'l Inc					Calculated
													minus
													Goal
				dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver #1	1	1	60.4	61.2	66	0.8	15	----	61.2	0.0	7	-7.0	
Receiver #2	2	1	65.1	65.9	66	0.8	15	----	65.9	0.0	7	-7.0	
Receiver #3	3	1	62.4	63.3	66	0.9	15	----	63.3	0.0	7	-7.0	
Receiver #4	4	1	58.5	59.4	66	0.9	15	----	59.4	0.0	7	-7.0	
Receiver #5	5	1	60.3	61.2	66	0.9	15	----	61.2	0.0	7	-7.0	
Receiver #6	6	1	63.2	64.1	66	0.9	15	----	64.1	0.0	7	-7.0	
Receiver #7	7	1	68.9	69.8	66	0.9	15	Snd Lvl	69.8	0.0	7	-7.0	
Receiver #8	8	1	62.0	62.9	66	0.9	15	----	62.9	0.0	7	-7.0	
Receiver #9	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #10	12	1	62.2	63.0	66	0.8	15	----	63.0	0.0	7	-7.0	
Receiver #11	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #12	14	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #13	15	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #14	16	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #15	17	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #16	18	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #17	19	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #18	20	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #19	21	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #20	22	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #21	23	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #22	24	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #23	25	1	55.1	56.0	66	0.9	15	----	56.0	0.0	7	-7.0	
Receiver #24	26	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Receiver #25	27	1	57.9	58.8	66	0.9	15	----	58.8	0.0	7	-7.0
Receiver #26	28	1	52.7	53.6	66	0.9	15	----	53.6	0.0	7	-7.0
Receiver #27	29	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #28	30	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #29	31	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #30	32	1	66.1	67.0	66	0.9	15	Snd Lvl	67.0	0.0	7	-7.0
Receiver #31	33	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #32	34	1	70.8	71.6	66	0.8	15	Snd Lvl	71.6	0.0	7	-7.0
Receiver #33	35	1	60.9	61.8	66	0.9	15	----	61.8	0.0	7	-7.0
Receiver #34	36	1	60.6	61.4	66	0.8	15	----	61.4	0.0	7	-7.0
Receiver #35	37	1	65.5	66.3	66	0.8	15	Snd Lvl	66.3	0.0	7	-7.0
Receiver #36	38	1	69.0	69.9	66	0.9	15	Snd Lvl	69.9	0.0	7	-7.0
Receiver #37	39	1	65.1	66.0	66	0.9	15	Snd Lvl	66.0	0.0	7	-7.0
Receiver #38	40	1	65.6	66.5	66	0.9	15	Snd Lvl	66.5	0.0	7	-7.0
Receiver #39	41	1	60.2	61.1	66	0.9	15	----	61.1	0.0	7	-7.0
Receiver #40	42	1	61.7	62.6	66	0.9	15	----	62.6	0.0	7	-7.0
Receiver #41	43	1	60.8	61.7	66	0.9	15	----	61.7	0.0	7	-7.0
Receiver #42	45	1	61.6	62.5	66	0.9	15	----	62.5	0.0	7	-7.0
Receiver #43	46	1	66.1	67.0	66	0.9	15	Snd Lvl	67.0	0.0	7	-7.0
Receiver #44	47	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #45	48	1	70.1	71.0	66	0.9	15	Snd Lvl	71.0	0.0	7	-7.0
Receiver #46	49	1	65.8	66.7	66	0.9	15	Snd Lvl	66.7	0.0	7	-7.0
Receiver #47	50	1	68.2	69.0	66	0.8	15	Snd Lvl	69.0	0.0	7	-7.0
Receiver #48	52	1	70.8	71.6	66	0.8	15	Snd Lvl	71.6	0.0	7	-7.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		48	0.0	0.0	0.0							
All Impacted		12	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC								18 January 2021					
S. Raman								TNM 2.5					
								Calculated with TNM 2.5					
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:		US 31 Limited Access Study											
RUN:		Future No Build - Segment 2											
BARRIER DESIGN:		INPUT HEIGHTS							Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.				
ATMOSPHERICS:		68 deg F, 50% RH											
Receiver													
Name	No.	#DUS	Existing	No Barrier				With Barrier					
			LAeq1h	LAeq1h		Increase over	existing	Type Impact	Calculated LAeq1h	Noise Reduction			
				Calculated	Crit'n	Calculated	Crit'n			Calculated	Calculated	Goal	Calculated minus Goal
							Sub'l Inc						
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB	
Receiver #49	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #50	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #51	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #52	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #53	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #54	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #55	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #56	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #57	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #58	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #59	11	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #60	12	1	66.5	67.4	66	0.9	15	Snd Lvl	67.4	0.0	7	-7.0	
Receiver #61	13	1	63.2	64.1	66	0.9	15	----	64.1	0.0	7	-7.0	
Receiver #62	14	1	67.5	68.3	66	0.8	15	Snd Lvl	68.3	0.0	7	-7.0	
Receiver #63	15	1	64.6	65.5	66	0.9	15	----	65.5	0.0	7	-7.0	
Receiver #64	16	1	60.2	61.1	66	0.9	15	----	61.1	0.0	7	-7.0	
Receiver #65	17	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #66	18	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #67	19	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #68	20	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #69	22	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #70	23	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #71	24	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #72	25	1	69.2	70.8	66	1.6	15	Snd Lvl	70.8	0.0	7	-7.0	

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Receiver #73	26	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #74	27	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #75	28	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #76	29	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #77	30	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #78	31	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #79	32	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #80	33	1	73.1	74.8	66	1.7	15	Snd Lvl	74.8	0.0	7	-7.0
Receiver #81	34	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #82	35	1	54.9	56.3	66	1.4	15	----	56.3	0.0	7	-7.0
Receiver #83	36	1	61.8	62.8	66	1.0	15	----	62.8	0.0	7	-7.0
Receiver #84	37	1	58.1	59.1	66	1.0	15	----	59.1	0.0	7	-7.0
Receiver #85	38	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #86	39	1	58.4	59.3	66	0.9	15	----	59.3	0.0	7	-7.0
Receiver #87	40	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #88	42	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #89	43	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		41	0.0	0.0	0.0							
All Impacted		4	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC						6 July 2021							
S. Raman						TNM 2.5							
						Calculated with TNM 2.5							
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:		US 31 Limited Access Study											
RUN:		Future No Build - Segment 3											
BARRIER DESIGN:		INPUT HEIGHTS						Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.					
ATMOSPHERICS:		68 deg F, 50% RH											
Receiver													
Name		No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
				dB	dB	dB	dB	dB		dB	dB	dB	dB
Receiver #90		1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #91		2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #92		3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #93		4	1	50.6	51.5	66	0.9	15	----	51.5	0.0	7	-7.0
Receiver #94		5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #95		6	1	73.0	73.9	66	0.9	15	Snd Lvl	73.9	0.0	7	-7.0
Dwelling Units			# DUs	Noise Reduction									
				Min	Avg	Max							
				dB	dB	dB							
All Selected			6	0.0	0.0	0.0							
All Impacted			1	0.0	0.0	0.0							
All that meet NR Goal			0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC							18 January 2021							
S. Raman							TNM 2.5							
							Calculated with TNM 2.5							
RESULTS: SOUND LEVELS														
PROJECT/CONTRACT:		US 31 Limited Access Study												
RUN:		Future Build - Segment 1												
BARRIER DESIGN:		INPUT HEIGHTS						Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.						
ATMOSPHERICS:		68 deg F, 50% RH												
Receiver														
Name	No.	#DUs	Existing	No Barrier				With Barrier						
			LAeq1h	LAeq1h		Increase over	existing	Type Impact	Calculated LAeq1h	Noise Reduction			Calculated minus Goal	
				Calculated	Crit'n	Calculated	Crit'n			Calculated	Calculated	Goal		
							Sub'l Inc							
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB		
Receiver #1	1	1	60.4	61.2	66	0.8	15	----	61.2	0.0	7	-7.0		
Receiver #2	2	1	65.1	65.9	66	0.8	15	----	65.9	0.0	7	-7.0		
Receiver #3	3	1	62.4	63.3	66	0.9	15	----	63.3	0.0	7	-7.0		
Receiver #4	4	1	58.5	59.4	66	0.9	15	----	59.4	0.0	7	-7.0		
Receiver #5	5	1	60.3	61.2	66	0.9	15	----	61.2	0.0	7	-7.0		
Receiver #6	6	1	63.2	64.1	66	0.9	15	----	64.1	0.0	7	-7.0		
Receiver #7	7	1	68.9	69.8	66	0.9	15	Snd Lvl	69.8	0.0	7	-7.0		
Receiver #8	8	1	62.0	62.9	66	0.9	15	----	62.9	0.0	7	-7.0		
Receiver #9	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #10	12	1	62.2	63.0	66	0.8	15	----	63.0	0.0	7	-7.0		
Receiver #11	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #12	14	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #13	15	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #14	16	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #15	17	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #16	18	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #17	19	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #18	20	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #19	21	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #20	22	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #21	23	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #22	24	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		
Receiver #23	25	1	55.1	55.9	66	0.8	15	----	55.9	0.0	7	-7.0		
Receiver #24	26	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0		

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Receiver #25	27	1	57.9	58.0	66	0.1	15	----	58.0	0.0	7	-7.0
Receiver #26	28	1	52.7	55.3	66	2.6	15	----	55.3	0.0	7	-7.0
Receiver #27	29	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #28	30	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #29	31	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #30	32	1	66.1	67.0	66	0.9	15	Snd Lvl	67.0	0.0	7	-7.0
Receiver #31	33	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #32	34	1	70.8	71.6	66	0.8	15	Snd Lvl	71.6	0.0	7	-7.0
Receiver #33	35	1	60.9	61.8	66	0.9	15	----	61.8	0.0	7	-7.0
Receiver #34	36	1	60.6	61.4	66	0.8	15	----	61.4	0.0	7	-7.0
Receiver #35	37	1	65.5	66.3	66	0.8	15	Snd Lvl	66.3	0.0	7	-7.0
Receiver #36	38	1	69.0	69.9	66	0.9	15	Snd Lvl	69.9	0.0	7	-7.0
Receiver #37	39	1	65.1	66.0	66	0.9	15	Snd Lvl	66.0	0.0	7	-7.0
Receiver #38	40	1	65.6	66.5	66	0.9	15	Snd Lvl	66.5	0.0	7	-7.0
Receiver #39	41	1	60.2	61.1	66	0.9	15	----	61.1	0.0	7	-7.0
Receiver #40	42	1	61.7	62.6	66	0.9	15	----	62.6	0.0	7	-7.0
Receiver #41	43	1	60.8	61.7	66	0.9	15	----	61.7	0.0	7	-7.0
Receiver #42	45	1	61.6	62.5	66	0.9	15	----	62.5	0.0	7	-7.0
Receiver #43	46	1	66.1	67.0	66	0.9	15	Snd Lvl	67.0	0.0	7	-7.0
Receiver #44	47	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #45	48	1	70.1	71.0	66	0.9	15	Snd Lvl	71.0	0.0	7	-7.0
Receiver #46	49	1	65.8	66.7	66	0.9	15	Snd Lvl	66.7	0.0	7	-7.0
Receiver #47	50	1	68.2	69.0	66	0.8	15	Snd Lvl	69.0	0.0	7	-7.0
Receiver #48	52	1	70.8	71.6	66	0.8	15	Snd Lvl	71.6	0.0	7	-7.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		48	0.0	0.0	0.0							
All Impacted		12	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC							18 January 2021						
S. Raman							TNM 2.5						
							Calculated with TNM 2.5						
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:		US 31 Limited Access Study											
RUN:		Future Build - Segment 2											
BARRIER DESIGN:		INPUT HEIGHTS						Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.					
ATMOSPHERICS:		68 deg F, 50% RH											
Receiver													
Name	No.	#DUs	Existing	No Barrier				With Barrier					
			LAeq1h	LAeq1h		Increase over	existing	Type Impact	Calculated LAeq1h	Noise Reduction			
				Calculated	Crit'n	Calculated	Crit'n			Calculated	Calculated	Goal	Calculated minus Goal
							Sub'l Inc						
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB	
Receiver #49	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #50	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #51	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #52	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #53	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #54	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #55	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #56	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #57	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #58	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #59	11	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #60	12	1	66.5	67.5	66	1.0	15	Snd Lvl	67.5	0.0	7	-7.0	
Receiver #61	13	1	63.2	64.0	66	0.8	15	----	64.0	0.0	7	-7.0	
Receiver #62	14	1	67.5	68.4	66	0.9	15	Snd Lvl	68.4	0.0	7	-7.0	
Receiver #63	15	1	64.6	65.4	66	0.8	15	----	65.4	0.0	7	-7.0	
Receiver #64	16	1	60.2	61.4	66	1.2	15	----	61.4	0.0	7	-7.0	
Receiver #65	17	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #66	18	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #67	19	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #68	20	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #69	22	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #70	23	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #71	24	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0	
Receiver #72	25	1	69.2	70.6	66	1.4	15	Snd Lvl	70.6	0.0	7	-7.0	

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Receiver #73	26	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #74	27	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #75	28	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #76	29	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #77	30	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #78	31	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #79	32	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #80	33	1	73.1	74.8	66	1.7	15	Snd Lvl	74.8	0.0	7	-7.0
Receiver #81	34	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #82	35	1	54.9	60.5	66	5.6	15	----	60.5	0.0	7	-7.0
Receiver #83	36	1	61.8	62.5	66	0.7	15	----	62.5	0.0	7	-7.0
Receiver #84	37	1	58.1	57.7	66	-0.4	15	----	57.7	0.0	7	-7.0
Receiver #85	38	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #86	39	1	58.4	57.9	66	-0.5	15	----	57.9	0.0	7	-7.0
Receiver #87	40	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #88	42	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #89	43	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		41	0.0	0.0	0.0							
All Impacted		4	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

RESULTS: SOUND LEVELS
US 31 Limited Access Study

Metric Environmental, LLC												
S. Raman												
RESULTS: SOUND LEVELS												
PROJECT/CONTRACT: US 31 Limited Access Study												
RUN: Future Build - Segment 3												
BARRIER DESIGN: INPUT HEIGHTS												
ATMOSPHERICS: 68 deg F, 50% RH												
Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	With Barrier				
								Type Impact	Calculated LAeq1h	Noise Reduction		
										Calculated	Goal	Calculated minus Goal
			dB	dB	dB	dB	dB		dB	dB	dB	dB
Receiver #90	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #91	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #92	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #93	4	1	50.6	50.8	66	0.2	15	----	50.8	0.0	7	-7.0
Receiver #94	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
Receiver #95	6	1	73.0	73.8	66	0.8	15	Snd Lvl	73.8	0.0	7	-7.0
Dwelling Units		# DUs	Noise Reduction									
			Min	Avg	Max							
			dB	dB	dB							
All Selected		6	0.0	0.0	0.0							
All Impacted		1	0.0	0.0	0.0							
All that meet NR Goal		0	0.0	0.0	0.0							

APPENDIX D

AGENCY CORRESPONDENCE

AGENCY CORRESPONDENCE RECORDS

IDNR - 2018/2019 ESTIMATED FISCAL YEAR VISITS FOR INDIANA STATE PARKS TABLE
TOWN OF CICERO/ JACKSON TOWNSHIP COMPREHENSIVE PLAN – FUTURE LAND USE MAP
HAMILTON COUNTY COMPREHENSIVE PLAN – FUTURE LAND USE MAP



Phone Memo

Topic:	US-31 Roadway Redevelopment - Development
Date & Time:	December 18, 2020; 9:00 AM
Attendees:	Patrick Ollier, Metric Environmental David Lucas, Hamilton County Staff Engineer - Road

Patrick contacted Mr. Lucas to discuss any permitted planned development along the proposed US-31 Roadway Redevelopment project. Mr. Lucas indicated that there is no development currently planned for this area, except for few houses within individual lots, and no permits are filed for any parcels within the project area.

From: [C.J. Taylor](#)
To: [Patrick Ollier](#)
Subject: RE: Planned Development Information Request – US-31
Date: Thursday, December 17, 2020 3:15:51 PM
Attachments: [image008.png](#)
[image009.png](#)
[image010.png](#)
[image011.png](#)
[image012.png](#)
[image001.png](#)
[Future Land Use Map.pdf](#)

Mr. Oliver,

Please find attached the Future Land Use map that is included in the Cicero/Jackson Township Comprehensive Plan. I am unaware of any proposed development in my jurisdictional area of the inquiry.

Blessings!

C.J. Taylor, Director



From: Kenton C. Ward <Kenton.Ward@hamiltoncounty.in.gov>
Sent: Thursday, December 17, 2020 11:38 AM
To: patricko@metricenv.com
Cc: Kevin M. Todd, AICP <ktodd@westfield.in.gov>; C.J. Taylor <ctaylor@townofcicero.in.gov>; Chuck E. Kiphart <Chuck.Kiphart@hamiltoncounty.in.gov>; emmaw@metricenv.com; Andy D. Conover <Andy.Conover@hamiltoncounty.in.gov>
Subject: RE: Planned Development Information Request – US-31

Mr. Oliver,

I am forwarding this request with this email to the three planning jurisdictions involved in the study area. The area south of 216th Street is under the Westfield Plan Commission; the area north of 216th Street and east of US 31 is under the Cicero Plan Commission; and the area north of 216th Street

west of US 31 is under the Hamilton County Plan Commission.

Kenton C. Ward
Hamilton County Surveyor

From: Surveyor <surveyor@hamiltoncounty.in.gov>
Sent: Wednesday, December 16, 2020 3:14 PM
To: Kenton C. Ward <Kenton.Ward@hamiltoncounty.in.gov>
Subject: FW: Planned Development Information Request – US-31

Pam Louks
Receptionist
Hamilton County Surveyor's Office
317-776-8495

From: Patrick Ollier <patricko@metricenv.com>
Sent: Wednesday, December 16, 2020 3:11 PM
To: Surveyor <surveyor@hamiltoncounty.in.gov>
Cc: Emma Winkeljohn <emmaw@metricenv.com>
Subject: Planned Development Information Request – US-31

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hamilton County Surveyor

**US-31,
Hamilton County, Indiana**

For the purposes of a Noise Study we are requesting the following information along the project limits of US-31:

1. Are you aware of any planned development within the project limits?
2. Are you aware of any comprehensive Land Use plans/maps that contain information about future development use?
3. If so, can you provide these plans/maps?

Project Limits are within 500 feet of the following (also see attached exhibit):

- Segment 1: Sheridan Road to East 236th Street (including access road connecting 226th Street and 236th Street)
- Segment 2: ~500 feet north of East 236th Street to ~1,000 feet south of East 276th Street
- Segment 3: ~300 feet north of East 276th Street to ~1,000 feet south of State Road 28
- Segment 4: ~500 feet north of West 100 South to ~200 feet south of West 600 North

Any assistance that you could provide would be greatly appreciated.

Thank You.

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~~~~~  
Patrick Ollier

Environmental Staff Geologist



Phone: 317-400-1633

Mobile: 317-981-3093

Email: [patricko@metricenv.com](mailto:patricko@metricenv.com)

6971 Hillside Court, Indianapolis, IN 46250

[www.metricenv.com](http://www.metricenv.com)



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**From:** [Danielle Carey Tolan](#)  
**To:** [Christopher McConnell](#)  
**Cc:** [Patrick Ollier](#)  
**Subject:** Re: MacGregor Park - Average Daily Number Request  
**Date:** Wednesday, September 30, 2020 3:36:49 PM  
**Attachments:** [image001.png](#)  
[image002.png](#)  
[image003.png](#)  
[image004.png](#)  
[image005.png](#)

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Patrick

We have not done a daily count on our traffic at MacGregor Park

On Thu, Sep 24, 2020 12:23 PM, Christopher McConnell [cmcconnell@westfield.in.gov](mailto:cmcconnell@westfield.in.gov) wrote:

Patrick,

MacGregor Park is operated by Washington Township Parks Department, If you reach out to Danielle Carey Tolan, Washington Township Trustee, I am sure she can assist in providing you the information you are looking for. I have copied Danielle on this email for you.

**Christopher McConnell | Parks and Recreation  
Superintendent**

Public Works | 2728 East 171st Street | Westfield, IN 46074  
[cmcconnell@westfield.in.gov](mailto:cmcconnell@westfield.in.gov) | 317-372-1192

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**From:** Patrick Ollier <[patricko@metricenv.com](mailto:patricko@metricenv.com)>  
**Sent:** Monday, September 21, 2020 11:21 AM  
**To:** Parks Info <[parksinfo@westfield.in.gov](mailto:parksinfo@westfield.in.gov)>  
**Subject:** MacGregor Park - Average Daily Number Request

**Warning: This external email is from [patricko@metricenv.com](mailto:patricko@metricenv.com). Do not click on unexpected or untrusted links and attachments.**

Hello,

My name is Patrick Ollier with Metric Environmental. I am searching for any information regarding the average daily number of people that visit MacGregor Park which is located at 21105 MacGregor Park Rd in Westfield Indiana. Any information would be greatly appreciated.

Thank you,

~~~~~

Patrick Ollier

Environmental Staff Geologist



Phone: 317-400-1633

Mobile: 317-981-3093

Email: patricko@metricenv.com

6971 Hillsdale Court, Indianapolis, IN 46250

www.metricenv.com



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With Abundance,



danielle@wwtownship.us

w: 317-574-9490

m: 317-966-5523

1549 E Greyhound Pass, Carmel, IN 46032

www.westfieldwashingtontwp.us

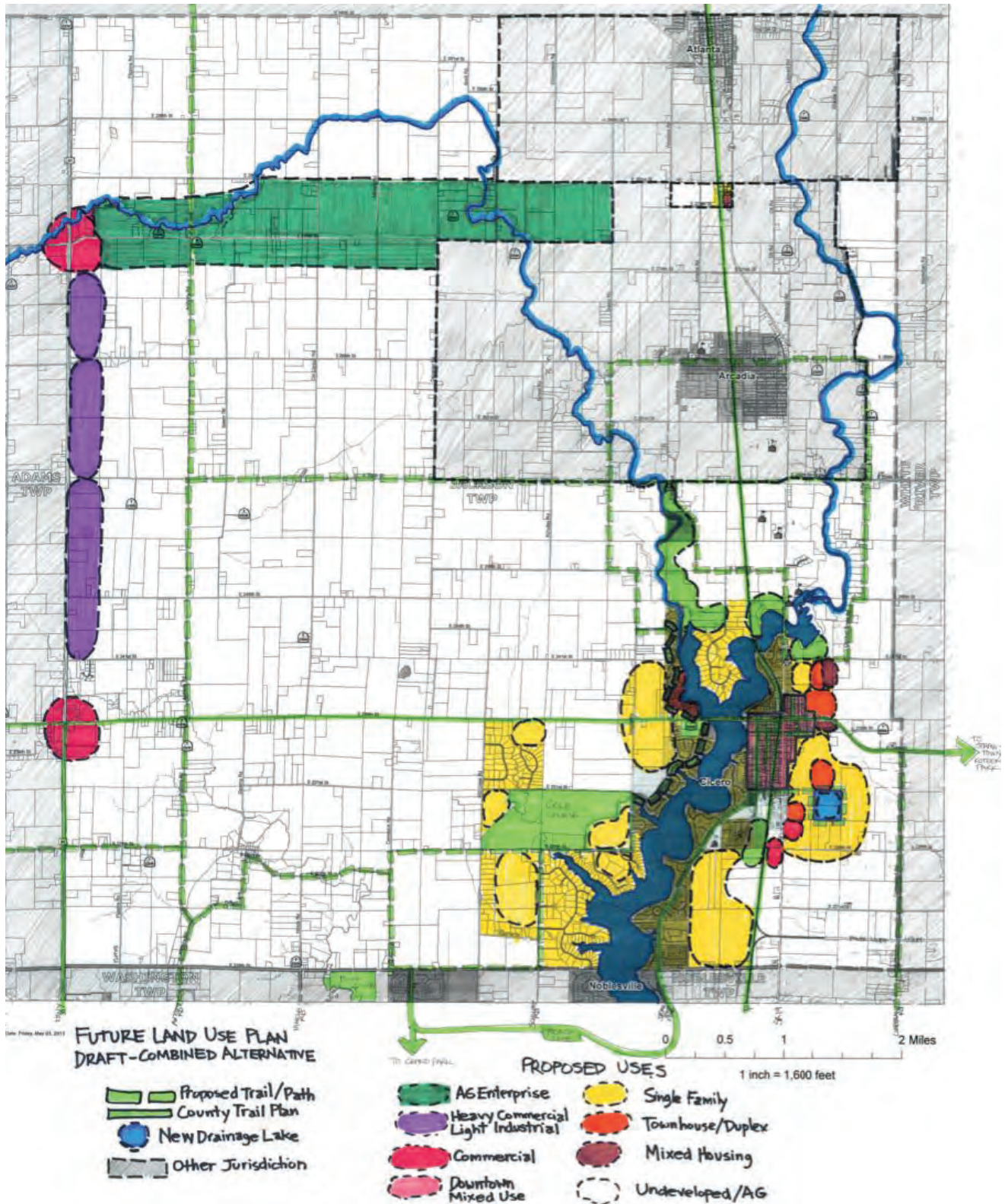
2018 / 2019 Estimated Fiscal Year Visits for Indiana State Parks ~ Alphabetical

Property	Est. Annual Visits
Brookville Lake*	1,228,967
Brown County	1,222,235
Chain O' Lakes	336,392
Charlestown	198,808
Clifty Falls	372,925
Falls of the Ohio	158,680
Ft. Harrison	889,232
Hardy Lake	205,987
Harmonie	131,785
Indiana Dunes	1,367,194
Lieber SRA*	450,000
Lincoln	234,226
McCormick's	641,437
Mississinewa Lake*	486,802
Monroe Lake*	830,000
Mounds	394,815
O'Bannon Woods	121,880
Ouabache	199,822
Patoka Lake*	625,000
Pokagon	638,087
Potato Creek	572,183
Prophetstown	334,375
Raccoon Lake*	900,000
Salamonie Lake*	394,611
Shades	86,862
Shakamak	232,660
Spring Mill	675,880
Summit Lake	235,825
Tippecanoe River	127,495
Trine SRA	5,673
Turkey Run	706,323
Versailles	224,526
Whitewater	240,651

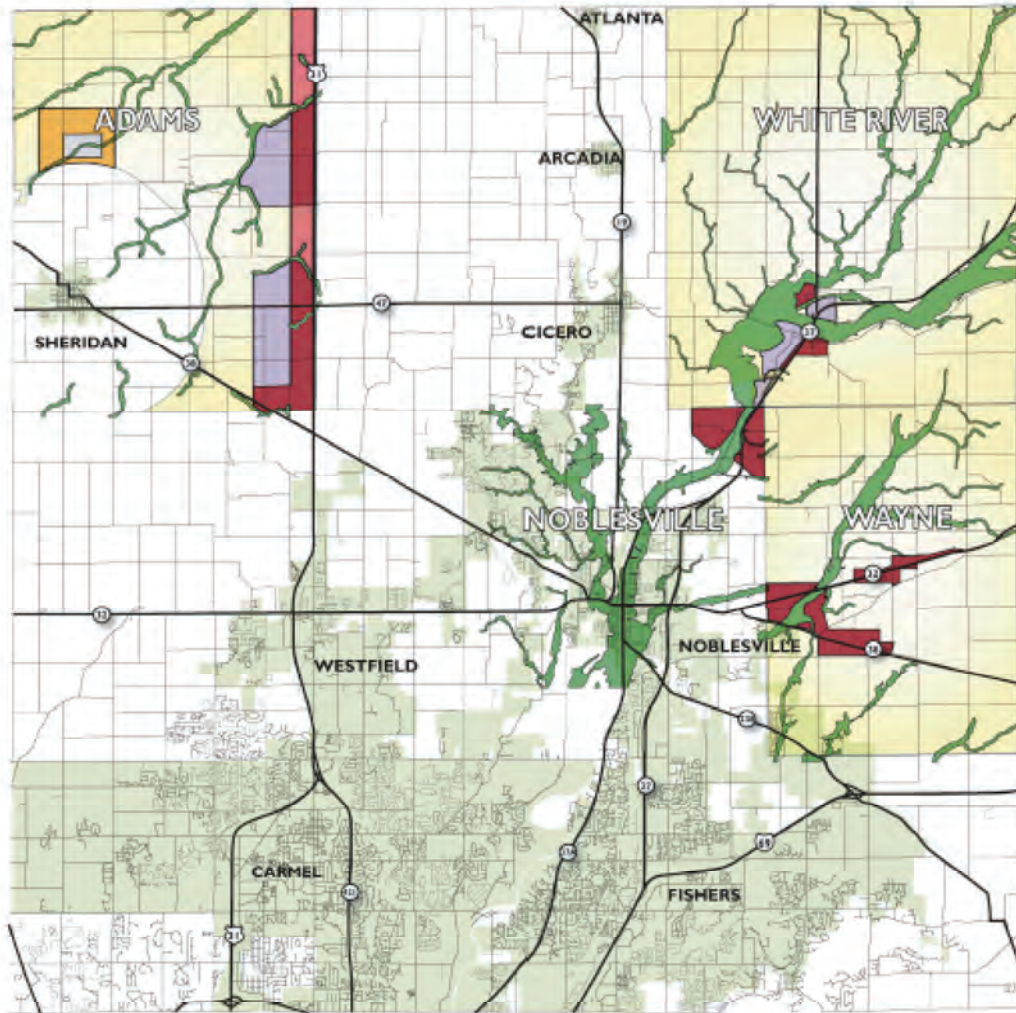
TOTAL 15,471,338

* denotes reservoir properties that are owned by United States Army Corps of Engineers (USACE)

FUTURE LAND USE MAP



Hamilton County Comprehensive Plan



LEGEND

- Municipal Boundaries
 Rural Areas
 Priority Growth - Residential
 Priority Growth - Mixed-Use
 Highway Oriented Business Enterprise
 Airport Business Enterprise
 Airport
 Conservation/Recreation
 Major Road

RETROGRADATION

This map is part of the Hamilton County Comprehensive Plan Update, which was originally drafted and adopted in 1992. The Comprehensive Plan covers all portions of Hamilton County that are not within municipalities or their planning districts. The purpose of a Comprehensive Plan is to guide future development and growth. It provides the framework for the planning and implementation of public improvements, decision-making regarding land use and zoning issues, and encouraging private investment in desirable but less profitable areas.

The Comprehensive Plan Update is grounded in an ecologically-based planning approach and it represents the optimum and desires of current residents through an ongoing public participation process. Specific goals identified as priorities in Harford County include national land conservation, farmland preservation, reduced automobile dependence, preservation of public lands, achieving improved air and water quality, improved housing, and the provision of more viable, sustainable, restoring recreation for people of all income levels.

HISBOM'S STATEMENT

¹⁰ The *Message Statement* summarizes the inspiration for the plan and reflects the direction given by the participants in the comprehensive planning process, Hamilton County's leadership, and ecological land planning and transportation principles.

*This plan is based upon a common vision for Hamilton County that reflects a healthy balance between ecology, community, culture, and economy.

² Rapid growth and development must be moderated with sound, long-range planning for natural resources, transportation, homes, businesses, and other community infrastructure.

The land use categories indicated on the land use map are as follows:

1. **Rural Areas:** These areas are inhabited by those marginalised farmers, herds, and other infrastructures. They are primarily agricultural in nature currently, and are situated to grow up agriculture, or be developed with non-agricultural growth, ruralised tourism, and fisheries.
2. **Growing Growth-Resilient:** These areas are accessible to transport infrastructure and/or existing roads, non-agricultural growth, and other infrastructures. They are likely to be developed to accommodate the anticipated growth in population, namely the existing municipalities. This development should follow sustainable practices to minimise environmental impacts and provide a high quality of life for residents.
3. **Priority Growth-Phase:** These areas are adjacent to high-speed transport channels where small-scale development includes homes and other small-scale shops, schools, clinics, churches, and other uses that benefit from the mobility and access these locations provide.
4. **Highway-Related Business:** These areas are suitable and accessible from main roads. It will provide the support services for business and other other agencies. These areas should be designed in a way that supports the movement of these persons of the country through tourism, landscape agriculture, design, and building industries.
5. **Algebraic Business:** Enterprise These areas are adjacent to and provide the unique opportunity of accessibility to tourism, transport, and other uses that would benefit from being served by small aircraft should be developed here.
6. **Conservation/Development:** These are large, unpopulated areas where natural resources and water resources should be preserved and managed to perpetuity as an ecological system. They are represented as all of the areas that should be identified as parts and open spaces. They should be parts and open spaces associated with each neighborhood for additional sustainable development.

LAND USE PLAN UPDATE



Labella Engineering Inc.
University of Maryland
College Park, MD 20742
Tel: 301/405-1100
Fax: 301/405-1101

LAND STRATEGIES
PLANNING • TRANSPORTATION • UTILITIES • DEVELOPMENT

[illegible]

CONSERVATION DESIGN FUTURE

APPENDIX E

CALIBRATION LOGS/ FIELD LOGS AND SOUND LEVEL METER OUTPUTS

Calibration Certificate

Certificate Number 2020003650

Customer:

The Modal Shop

3149 East Kemper Road

Cincinnati, OH 45241, United States

Model Number LxT1

Serial Number 0006169

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.402

Procedure Number D0001.8378

Technician Ron Harris

Calibration Date 18 Mar 2020

Calibration Due

Temperature 23.56 °C ± 0.25 °C

Humidity 52.8 %RH ± 2.0 %RH

Static Pressure 85.43 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1L S/N 069940 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 23.6 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1

IEC 60804:2000 Type 1

IEC 61252:2002

IEC 61672:2013 Class 1

IEC 61260:2001 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 1

ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



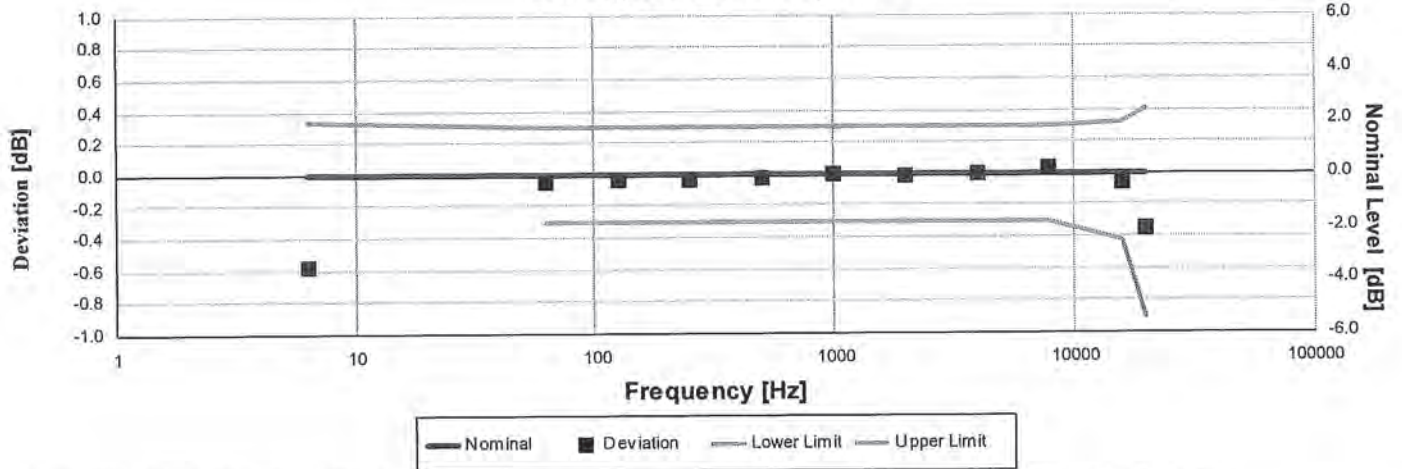
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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2019-07-18	2020-07-18	006946
SRS DS360 Ultra Low Distortion Generator	2020-01-17	2021-01-17	007118

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 Provo, UT 84601, United States
 716-684-0001



Z-weight Filter Response

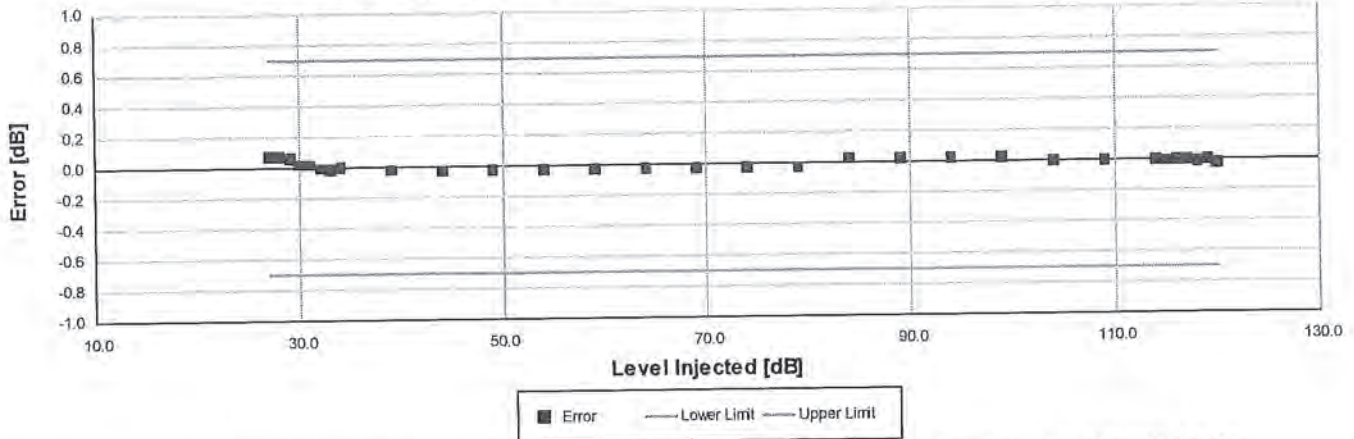


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.58	-0.59	-1.11	0.33	0.15	Pass
63.10	-0.04	-0.04	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results--

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
27.00	0.07	-0.70	0.70	0.16	Pass
28.00	0.07	-0.70	0.70	0.17	Pass
29.00	0.06	-0.70	0.70	0.16	Pass
30.00	0.02	-0.70	0.70	0.35	Pass
31.00	0.02	-0.70	0.70	0.16	Pass
32.00	-0.01	-0.70	0.70	0.16	Pass
33.00	-0.01	-0.70	0.70	0.16	Pass
34.00	-0.01	-0.70	0.70	0.16	Pass
39.00	-0.02	-0.70	0.70	0.16	Pass
44.00	-0.03	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.03	-0.70	0.70	0.16	Pass
64.00	-0.03	-0.70	0.70	0.16	Pass
69.00	-0.03	-0.70	0.70	0.16	Pass
74.00	-0.03	-0.70	0.70	0.16	Pass
79.00	-0.03	-0.70	0.70	0.16	Pass
84.00	0.03	-0.70	0.70	0.16	Pass
89.00	0.03	-0.70	0.70	0.16	Pass
94.00	0.02	-0.70	0.70	0.16	Pass
99.00	0.02	-0.70	0.70	0.16	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.00	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
115.00	-0.01	-0.70	0.70	0.15	Pass
116.00	-0.01	-0.70	0.70	0.15	Pass
117.00	0.00	-0.70	0.70	0.15	Pass
118.00	-0.01	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
120.00	-0.03	-0.70	0.70	0.15	Pass

-- End of measurement results--

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1985 (R2000) 6.4.4							
Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
116.15	40	Negative Pulse	117.57	116.09	118.09	0.15	Pass
		Positive Pulse	117.49	116.01	118.01	0.15	Pass
	30	Negative Pulse	116.63	116.09	118.09	0.15	Pass
		Positive Pulse	116.53	116.01	118.01	0.15	Pass
-- End of measurement results--							

Positive Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
114.15	3	OVLD	± 0.50	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
104.15	3	-0.17	± 0.50	0.15 ‡	Pass
	5	-0.18	± 1.00	0.16 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
94.15	3	-0.13	± 0.50	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
	10	-0.28	± 1.50	0.15 ‡	Pass
84.15	3	-0.14	± 0.50	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
	10	-0.18	± 1.50	0.15 ‡	Pass
-- End of measurement results--					

Negative Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
114.15	3	OVLD	± 0.50	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
104.15	3	-0.14	± 0.50	0.15 ‡	Pass
	5	-0.11	± 1.00	0.15 ‡	Pass
	10	OVLD	± 1.50	0.15 ‡	Pass
94.15	3	-0.13	± 0.50	0.15 ‡	Pass
	5	-0.11	± 1.00	0.15 ‡	Pass
	10	-0.23	± 1.50	0.15 ‡	Pass
84.15	3	-0.13	± 0.50	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
	10	-0.08	± 1.50	0.15 ‡	Pass
-- End of measurement results--					

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	84.02	83.90	84.10	0.15	Pass
0 dB Gain, Linearity	21.14	20.30	21.70	0.16	Pass
OBA Low Range	84.00	83.90	84.10	0.15	Pass
OBA Normal Range	84.00	83.20	84.80	0.15	Pass

-- End of measurement results--

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	7.50	16.00	Pass
C-weight Noise Floor	11.90	18.00	Pass
Z-weight Noise Floor	19.77	25.00	Pass

-- End of measurement results--

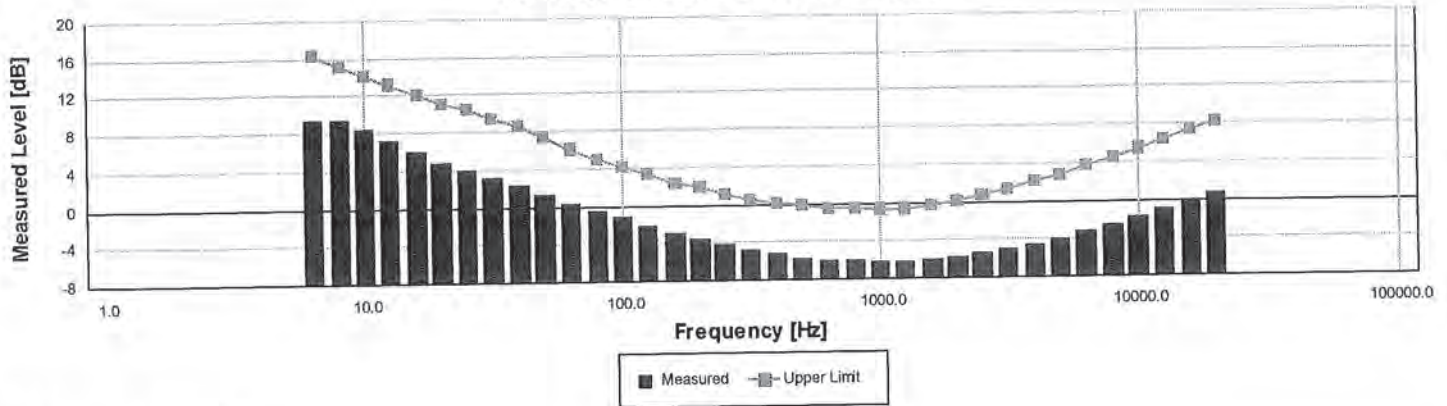
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	113.11	112.35	113.95	0.15	Pass
THD	-53.25		-50.00	0.01 ‡	Pass
THD+N	-52.14		-50.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	9.51	16.30	Pass
8.00	9.51	15.20	Pass
10.00	8.53	14.20	Pass
12.50	7.31	13.20	Pass
16.00	6.07	12.10	Pass
20.00	4.83	11.10	Pass
25.00	3.95	10.40	Pass
31.50	3.24	9.40	Pass
40.00	2.35	8.60	Pass
50.00	1.37	7.40	Pass
63.00	0.34	6.10	Pass
80.00	-0.48	5.00	Pass
100.00	-1.14	4.20	Pass
125.00	-2.11	3.30	Pass
160.00	-2.85	2.40	Pass
200.00	-3.53	1.90	Pass
250.00	-4.17	1.20	Pass
315.00	-4.76	0.60	Pass
400.00	-5.19	0.20	Pass
500.00	-5.69	-0.10	Pass
630.00	-5.90	-0.50	Pass
800.00	-6.03	-0.50	Pass
1,000.00	-6.16	-0.60	Pass
1,250.00	-6.21	-0.60	Pass
1,600.00	-6.01	-0.20	Pass
2,000.00	-5.76	0.20	Pass
2,500.00	-5.37	0.70	Pass
3,150.00	-5.02	1.40	Pass
4,000.00	-4.55	2.10	Pass
5,000.00	-3.93	2.80	Pass
6,300.00	-3.20	3.70	Pass
8,000.00	-2.48	4.60	Pass
10,000.00	-1.67	5.50	Pass
12,500.00	-0.88	6.40	Pass
16,000.00	-0.02	7.40	Pass
20,000.00	0.84	8.30	Pass

-- End of measurement results--

-- End of Report--

Signatory: Ron Harris

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



 **LARSON DAVIS**
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2020003718

Customer:

The Modal Shop

3149 East Kemper Road

Cincinnati, OH 45241, United States

Model Number LxT1

Serial Number 0006169

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.402

Procedure Number D0001.8384

Technician Ron Harris

Calibration Date 19 Mar 2020

Calibration Due

Temperature 22.99 °C ± 0.25 °C

Humidity 52.4 %RH ± 2.0 %RH

Static Pressure 85.04 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis PRMLxT1L S/N 069940

PCB 377B02 S/N 319673

Larson Davis CAL200 S/N 9079

Larson Davis CAL291 S/N 0108

Data reported in dB re 20 µPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1

IEC 60804:2000 Type 1

IEC 61252:2002

IEC 61260:2001 Class 1

IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.11 (R2009) Class 1

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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1681 West 820 North

Provo, UT 84601, United States

716-684-0001



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Certificate Number 2020003718

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2019-09-18	2020-09-18	001250
SRS DS360 Ultra Low Distortion Generator	2019-06-14	2020-06-14	006311
Hart Scientific 2626-S Humidity/Temperature Sensor	2019-07-18	2020-07-18	006946
Larson Davis CAL200 Acoustic Calibrator	2019-07-22	2020-07-22	007027
Larson Davis Model 831	2020-03-02	2021-03-02	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2020-03-05	2021-03-05	007185

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.18	-0.20	-1.20	0.80	0.23	Pass
1000	0.16	0.00	-0.70	0.70	0.23	Pass
8000	-3.47	-3.00	-5.50	-1.50	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.25

-- End of measurement results--

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-- End of Report--

Signatory: Ron Harris

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~ Certificate of Calibration and Compliance ~

Microphone Model: 377B02

Serial Number: 323917

Manufacturer: PCB

Calibration Environmental Conditions

Environmental test conditions as printed on microphone calibration chart.

Reference Equipment

Manufacturer	Model #	Serial #	PCB Control #	Cal Date	Due Date
National Instruments	PCle-6351	1896F08	CA1918	10/18/19	10/16/20
Larson Davis	PRM915	134	CA2114	11/11/19	11/11/20
Larson Davis	PRM902	5352	CA1247	11/12/19	11/12/20
Larson Davis	PRM916	140	CA2129	11/25/19	11/25/20
Larson Davis	CAL250	4118	TA463	1/31/20	1/29/21
Larson Davis	2201	143	CA1206	2/13/20	2/12/21
Bruel & Kjaer	4192	2764626	CA1636	8/20/19	8/21/20
Larson Davis	GPRM902	5281	CA1595	11/20/19	11/20/20
Newport	iTHX-SD/N	1080002	CA1511	2/6/20	2/5/21
Larson Davis	PRA951-4	234	CA1154	11/8/19	11/6/20
Larson Davis	PRM915	123	CA866	11/20/19	11/20/20
PCB	68510-02	N/A	CA2672	2/13/20	2/12/21
0	0	0	0	not required	not required
0	0	0	0	not required	not required
0	0	0	0	not required	not required

Frequency sweep performed with B&K UA0033 electrostatic actuator.

Condition of Unit

As Found: n/a

As Left: New Unit, In Tolerance

Notes

1. Calibration of reference equipment is traceable to one or more of the following National Labs; NIST, PTB or DFM.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 10012-1, ANSI/NC SL Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Open Circuit Sensitivity is measured using the insertion voltage method following procedure AT603-5.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for sensitivity is +/-0.20 dB.
7. Unit calibrated per ACS-20.

Technician: Leonard Lukasik

Date: July 29, 2020



3425 Walden Avenue, Depew, New York, 14043

TEL: 888-684-0013

FAX: 716-685-3886

www.pcb.com

ID: CAL112:3678890992 034+0

~ Calibration Report ~

Microphone Model: 377B02

Serial Number: 323917

Description: 1/2" Free-Field Microphone

Calibration Data

Open Circuit Sensitivity @ 251.2 Hz: 45.37 mV/Pa
-26.86 dB re 1V/Pa

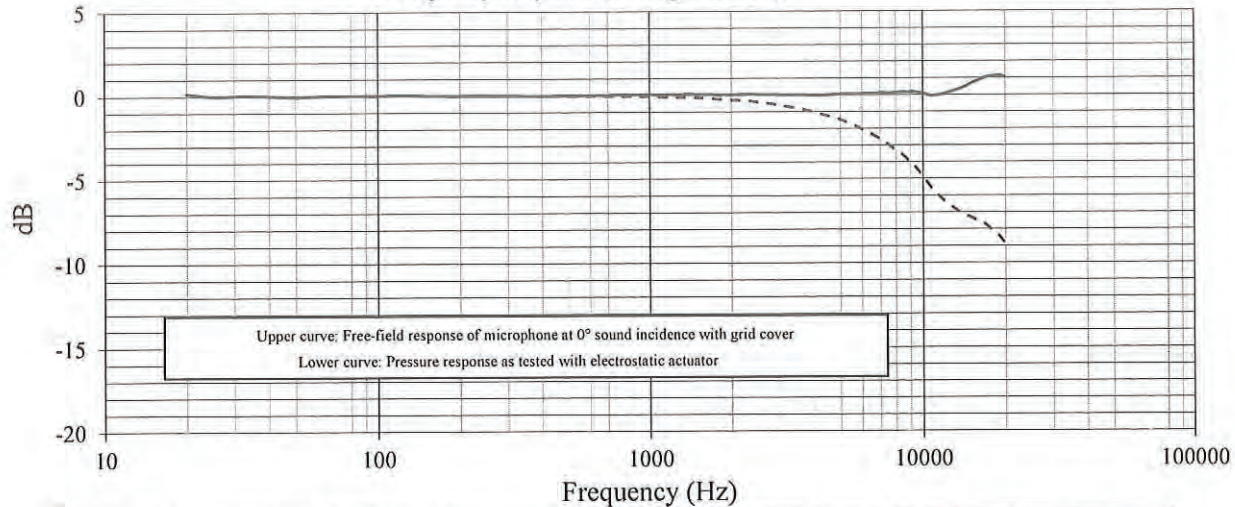
Polarization Voltage, External: 0 V
Capacitance: 13.5 pF

Temperature: 71 °F (22°C)

Ambient Pressure: 985 mbar

Relative Humidity: 50 %

Frequency Response (0 dB @ 251.2 Hz)



Freq (Hz)	Lower (dB)	Upper (dB)	Freq (Hz)	Lower (dB)	Upper (dB)	Freq (Hz)	Lower (dB)	Upper (dB)	Freq (Hz)	Lower (dB)	Upper (dB)
20.0	0.17	0.17	1679	-0.18	0.05	7499	-2.97	0.10	-	-	-
25.1	0.00	0.00	1778	-0.23	0.02	7943	-3.26	0.13	-	-	-
31.6	0.05	0.05	1884	-0.25	0.03	8414	-3.56	0.17	-	-	-
39.8	0.02	0.02	1995	-0.29	0.02	8913	-3.94	0.17	-	-	-
50.1	-0.04	-0.04	2114	-0.30	0.04	9441	-4.36	0.17	-	-	-
63.1	0.02	0.02	2239	-0.33	0.04	10000	-4.86	0.09	-	-	-
79.4	0.03	0.03	2371	-0.36	0.05	10593	-5.44	-0.04	-	-	-
100.0	0.02	0.02	2512	-0.43	0.03	11220	-5.89	-0.03	-	-	-
125.9	0.05	0.05	2661	-0.47	0.04	11885	-6.27	0.05	-	-	-
158.5	0.01	0.01	2818	-0.53	0.03	12589	-6.59	0.18	-	-	-
199.5	0.00	0.00	2985	-0.60	0.02	13335	-6.89	0.30	-	-	-
251.2	0.00	0.00	3162	-0.67	0.01	14125	-7.14	0.45	-	-	-
316.2	-0.01	0.00	3350	-0.74	0.00	14962	-7.31	0.66	-	-	-
398.1	-0.02	-0.02	3548	-0.81	0.01	15849	-7.51	0.84	-	-	-
501.2	-0.02	0.02	3758	-0.90	0.00	16788	-7.70	1.02	-	-	-
631.0	-0.04	0.00	3981	-1.01	-0.01	17783	-8.03	1.08	-	-	-
794.3	-0.05	0.04	4217	-1.13	-0.02	18837	-8.37	1.14	-	-	-
1000.0	-0.07	0.05	4467	-1.23	0.00	19953	-8.87	1.06	-	-	-
1059.3	-0.10	0.04	4732	-1.35	0.02	-	-	-	-	-	-
1122.0	-0.10	0.04	5012	-1.48	0.05	-	-	-	-	-	-
1188.5	-0.10	0.05	5309	-1.63	0.07	-	-	-	-	-	-
1258.9	-0.13	0.03	5623	-1.81	0.07	-	-	-	-	-	-
1333.5	-0.12	0.06	5957	-2.00	0.07	-	-	-	-	-	-
1412.5	-0.13	0.06	6310	-2.20	0.09	-	-	-	-	-	-
1496.2	-0.15	0.05	6683	-2.43	0.09	-	-	-	-	-	-
1584.9	-0.16	0.05	7080	-2.66	0.12	-	-	-	-	-	-

Technician: Leonard Lukasik

Date: July 29, 2020



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TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

ID CAL112-3678890992.034+0

Calibration Certificate

Certificate Number 2020009394

Customer:

The Modal Shop
10310 AeroHub Boulevard
Cincinnati, OH 45215, United States

Model Number CAL200
Serial Number 18146
Test Results Pass
Initial Condition As Manufactured
Description Larson Davis CAL200 Acoustic Calibrator

Procedure Number D0001.8386
Technician Scott Montgomery
Calibration Date 26 Aug 2020
Calibration Due
Temperature 24 °C ± 0.3 °C
Humidity 36 %RH ± 3 %RH
Static Pressure 101.4 kPa ± 1 kPa

Evaluation Method The data is acquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 µPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2017 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Agilent 34401A DMM	08/04/2020	08/04/2021	001021
Larson Davis Model 2900 Real Time Analyzer	04/02/2020	04/02/2021	001051
Microphone Calibration System	03/03/2020	03/03/2021	005446
1/2" Preamplifier	09/17/2019	09/17/2020	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/06/2020	08/06/2021	006507
1/2 inch Microphone - RI - 200V	12/06/2019	12/06/2020	006511
Pressure Transducer	10/18/2019	10/18/2020	007204

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Output Level

Nominal Level [dB]	Pressure [kPa]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
114	101.4	113.99	113.80	114.20	0.14	Pass
94	101.4	93.99	93.80	94.20	0.14	Pass

-- End of measurement results--

Frequency

Nominal Level [dB]	Pressure [kPa]	Test Result [Hz]	Lower limit [Hz]	Upper limit [Hz]	Expanded Uncertainty [Hz]	Result
114	101.4	999.96	990.00	1,010.00	0.20	Pass
94	101.4	999.97	990.00	1,010.00	0.20	Pass

-- End of measurement results--

Total Harmonic Distortion + Noise (THD+N)

Nominal Level [dB]	Pressure [kPa]	Test Result [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
114	101.4	0.53	0.00	2.00	0.25 ‡	Pass
94	101.4	0.52	0.00	2.00	0.25 ‡	Pass

-- End of measurement results--

Level Change Over Pressure

Tested at: 114 dB, 24 °C, 35 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
108.0	108.0	-0.03	-0.30	0.30	0.04 ‡	Pass
101.3	101.2	0.00	-0.30	0.30	0.04 ‡	Pass
92.0	92.1	0.03	-0.30	0.30	0.04 ‡	Pass
83.0	83.0	0.04	-0.30	0.30	0.04 ‡	Pass
74.0	73.9	0.04	-0.30	0.30	0.04 ‡	Pass
65.0	65.0	0.01	-0.30	0.30	0.04 ‡	Pass

-- End of measurement results--

Frequency Change Over Pressure

Tested at: 114 dB, 24 °C, 35 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [Hz]	Lower limit [Hz]	Upper limit [Hz]	Expanded Uncertainty [Hz]	Result
108.0	108.0	0.00	-10.00	10.00	0.20 ‡	Pass
101.3	101.2	0.00	-10.00	10.00	0.20 ‡	Pass
92.0	92.1	0.00	-10.00	10.00	0.20 ‡	Pass
83.0	83.0	0.00	-10.00	10.00	0.20 ‡	Pass
74.0	73.9	-0.01	-10.00	10.00	0.20 ‡	Pass
65.0	65.0	-0.01	-10.00	10.00	0.20 ‡	Pass

-- End of measurement results--

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Total Harmonic Distortion + Noise (THD+N) Over Pressure

Tested at: 114 dB, 24 °C, 35 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
108.0	108.0	0.55	0.00	2.00	0.25 ‡	Pass
101.3	101.2	0.52	0.00	2.00	0.25 ‡	Pass
92.0	92.1	0.48	0.00	2.00	0.25 ‡	Pass
83.0	83.0	0.44	0.00	2.00	0.25 ‡	Pass
74.0	73.9	0.40	0.00	2.00	0.25 ‡	Pass
65.0	65.0	0.37	0.00	2.00	0.25 ‡	Pass

-- End of measurement results--

Signatory: Scott Montgomery

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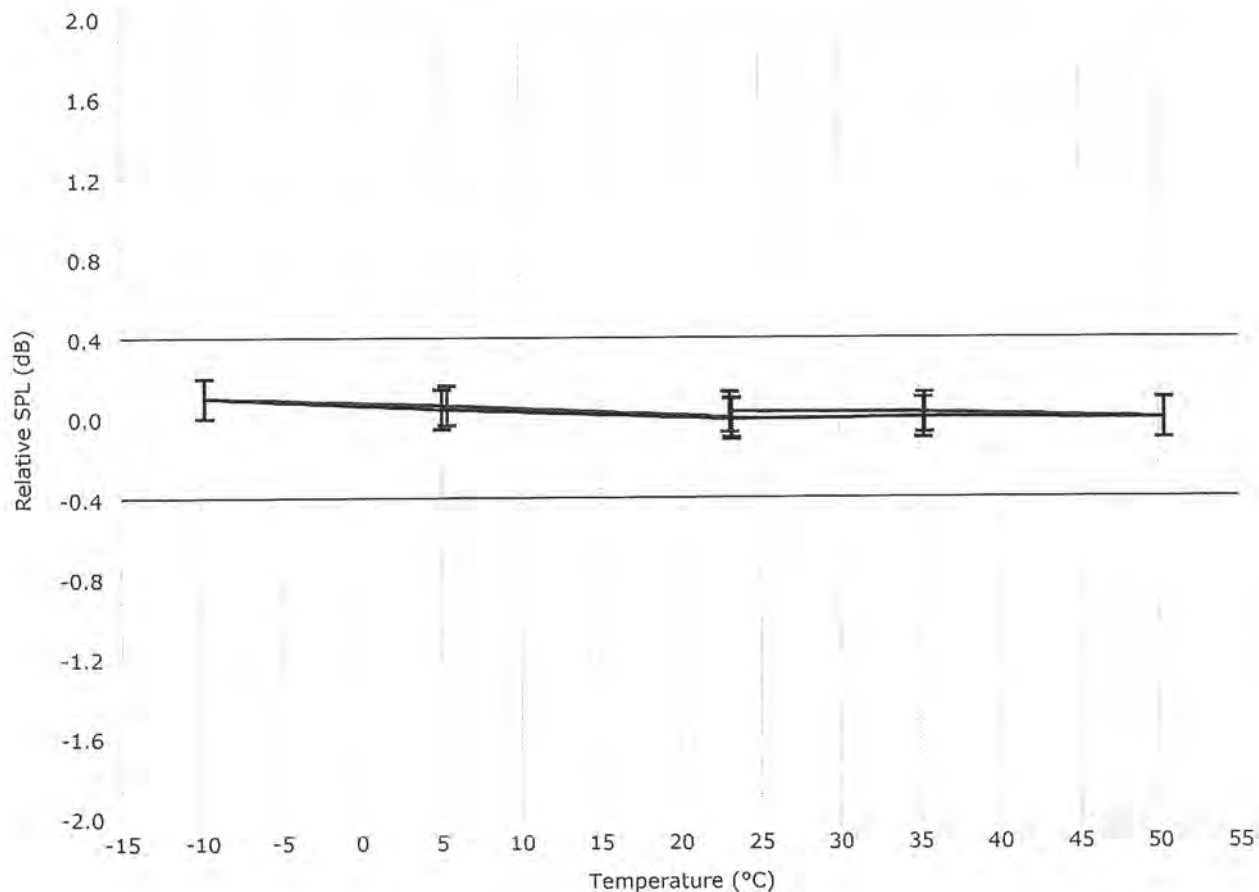
Model CAL200 Relative SPL vs. Temperature

Larson Davis Model CAL200 Serial Number: 18146

Model CAL200 Relative SPL vs. Temperature at 50% RH.

A 2559 Mic (SN: 2912) with a PRM902 Preamp (SN: 5719), station 7 was used to check the levels.

Test Date: 05 Jun 2020 8:32:56 AM



0.1dB expanded uncertainty at ~95% confidence level (k=2)

Sequence File: CAL200.SEQ

Test Location: Larson Davis, a division of PCB Piezotronics, Inc.
1681 West 820 North, Provo, Utah 84601
Tel: 716 684-0001 www.LarsonDavis.com

Page 1 of 2



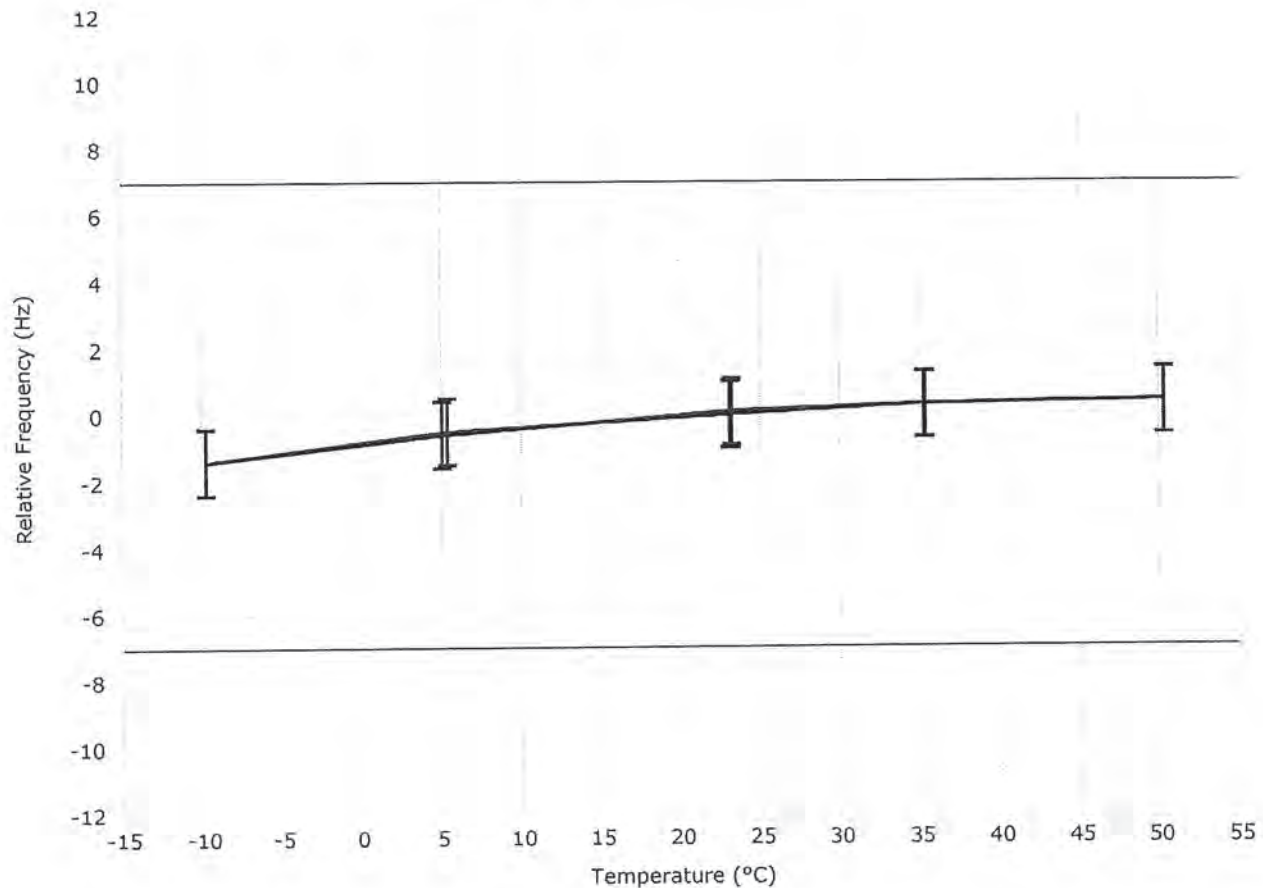
Model CAL200 Relative Frequency vs. Temperature

Larson Davis Model CAL200 Serial Number: 18146

Model CAL200 Relative Frequency vs. Temperature at 50% RH.

A 2559 Mic (SN: 2912) with a PRM902 Preamp (SN: 5719), station 7 was used to check the levels.

Test Date: 05 Jun 2020 8:32:56 AM



1.0 Hz expanded uncertainty at ~95% confidence level ($k=2$)

Sequence File: CAL200.SEQ

Test Location: Larson Davis, a division of PCB Piezotronics, Inc.
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Tel: 716 684-0001 www.LarsonDavis.com

Page 2 of 2

NOISE ANALYSIS
US-31 LIMITED ACCESS CORRIDOR STUDY
HAMILTON AND TIPTON COUNTIES, IN

Location #1

Receptor Description: NW quadrant of corner of US-31 and E 216 St

Major Noise Source: Traffic on US-31 and E 216 St

Land Use Category: Rural / Agricultural

Field Engineers: Samir Raman, Patrick Ollier, and Emma Winkeljohn

Date: September 29, 2020

Start Time: 9:16

End Time: 9:31

Weather: overcast, 60 degrees F, ~9 mph winds

Decibel Reading: 54.1 dBA

US-31

Ambient Speed: 60

Posted Speed: 60

Number of Lanes: 4

Lane Width: 12'

Traffic Count:

	NB	SB
Cars	167	163
Heavy Trucks	47	38

E 216 St

Ambient Speed: 45

Posted Speed: 45

Number of Lanes: 2

Lane Width: 12'

Traffic Count:

	SB 31 to EB 216	NB 31 to EB 216	WB 216 to NB 31	WB 216 through US 31	WB 216 to SB 31
Cars	3	16	8	1	16
Heavy Trucks	0	1	4	0	0

Site Photos:

Facing North



Facing East



Facing West



Facing South



Measurement Report

Report Summary

Meter's File Name	LxT_Data.002.s	Computer's File Name	LxT_0006169-20200929 091608-LxT_Data.002.ldbin
Meter	LxT1		
Firmware	2.403		
User		Location	
Job Description			
Note			
Start Time	2020-09-29 09:16:08	Duration	0:15:00.8
End Time	2020-09-29 09:31:09	Run Time	0:15:00.8
		Pause Time	0:00:00.0

Results

Overall Metrics

LA _{eq}	54.1 dB		
LAE	83.6 dB	SEA	--- dB
EA	25.7 µPa²h		
EA8	820.6 µPa²h		
EA40	4.1 mPa²h		
LZS _{peak}	98.4 dB	2020-09-29 09:22:13	
LAS _{max}	66.8 dB	2020-09-29 09:22:13	
LAS _{min}	46.6 dB	2020-09-29 09:27:43	
LA _{eq}	54.1 dB		
LC _{eq}	68.3 dB	LC _{eq} - LA _{eq}	14.2 dB
LAI _{eq}	56.0 dB	LAI _{eq} - LA _{eq}	1.9 dB

Exceedances

Count	Duration
LAS > 85.0 dB	0
LAS > 115.0 dB	0
LZSpeak > 135.0 dB	0
LZSpeak > 137.0 dB	0
LZSpeak > 140.0 dB	0

Community Noise

54.1 dB	54.1 dB	0.0 dB	
LDEN	LDay	LEve	LNight
54.1 dB	54.1 dB	--- dB	--- dB

Any Data

A	C	Z
Level	Level	Level
Time Stamp	Time Stamp	Time Stamp
L _{eq}	54.1 dB	--- dB
LS _(max)	66.8 dB	2020-09-29 09:22:13
LS _(min)	46.6 dB	2020-09-29 09:27:43
L _{Peak(max)}	--- dB	98.4 dB

Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	0	0:00:00.0

Statistics

LAS 5.0	57.4 dB
LAS 10.0	56.5 dB
LAS 33.3	54.2 dB
LAS 50.0	53.0 dB
LAS 66.6	51.9 dB
LAS 90.0	49.8 dB

NOISE ANALYSIS
US-31 LIMITED ACCESS CORRIDOR STUDY
HAMILTON AND TIPTON COUNTIES, IN

Location #2

Receptor Description: SE quadrant of corner of US-31 and E 256 St

Major Noise Source: Traffic on US-31 and E 256 St

Land Use Category: Rural / Agricultural

Field Engineers: Samir Raman, Patrick Ollier, and Emma Winkeljohn

Date: September 29, 2020

Start Time: 9:45

End Time: 10:00

Weather: overcast, 60 degrees F, ~9 mph winds

Decibel Reading: 57.1 dBA

US-31

Ambient Speed: 60

Posted Speed: 60

Number of Lanes: 4

Lane Width: 12'

Traffic Count:

	NB	SB
Cars	162	158
Heavy Trucks	45	37

E 256 St

Ambient Speed: 45

Posted Speed: 45

Number of Lanes: 2

Lane Width: 12'

Traffic Count:

	E 256 through US 31	W 256 through US 31	E 256 to N 31	N 31 to W 256	S 31 to W 256	S 31 to E 256	N 31 to E 256	W 256 to S 31	W 256 to N 31
Cars	1	6	1	3	3	1	9	6	4
Heavy Trucks	2	0	0	0	1	2	0	0	0

Site Photos:

Facing North



Facing East



Facing West



Facing South



Measurement Report

Report Summary

Meter's File Name	LxT_Data.004.s	Computer's File Name	LxT_0006169-20200929 094550-LxT_Data.004.ldbin
Meter	LxT1		
Firmware	2.403		
User		Location	
Job Description			
Note			
Start Time	2020-09-29 09:45:50	Duration	0:15:00.7
End Time	2020-09-29 10:00:50	Run Time	0:15:00.7
		Pause Time	0:00:00.0

Results

Overall Metrics

L _{Aeq}	57.1 dB		
L _{AE}	86.7 dB	SEA	--- dB
EA	51.6 $\mu\text{Pa}^2\text{h}$		
EA ₈	1.6 mPa^2h		
EA ₄₀	8.2 mPa^2h		
LZS _{peak}	95.3 dB	2020-09-29 09:49:46	
LAS _{max}	74.2 dB	2020-09-29 09:45:50	
LAS _{min}	48.9 dB	2020-09-29 09:58:30	
L _{Aeq}	57.1 dB		
LC _{eq}	69.9 dB	LC _{eq} - L _{Aeq}	12.8 dB
LAI _{eq}	59.0 dB	LAI _{eq} - L _{Aeq}	1.8 dB

Exceedances

Count	Duration
LAS > 85.0 dB	0
LAS > 115.0 dB	0
LZSpeak > 135.0 dB	0
LZSpeak > 137.0 dB	0
LZSpeak > 140.0 dB	0

Community Noise

57.1 dB	57.1 dB	0.0 dB	
LDEN	LDay	LEve	LNight
57.1 dB	57.1 dB	--- dB	--- dB

Any Data

Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L _{eq}	57.1 dB		--- dB		--- dB	
L _{S(max)}	74.2 dB	2020-09-29 09:45:50	--- dB		--- dB	
L _{S(min)}	48.9 dB	2020-09-29 09:58:30	--- dB		--- dB	
L _{Peak(max)}	--- dB		--- dB		95.3 dB	2020-09-29 09:49:46

Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	0	0:00:00.0

Statistics

LAS 5.0	61.5 dB
LAS 10.0	60.2 dB
LAS 33.3	56.7 dB
LAS 50.0	54.9 dB
LAS 66.6	53.5 dB
LAS 90.0	51.6 dB

NOISE ANALYSIS
US-31 LIMITED ACCESS CORRIDOR STUDY
HAMILTON AND TIPTON COUNTIES, IN

Location #3

Receptor Description: NW quadrant of corner of US-31 and E 276 St

Major Noise Source: Traffic on US-31 and E 276 St

Land Use Category: Rural / Agricultural

Field Engineers: Samir Raman, Patrick Ollier, and Emma Winkeljohn

Date: September 29, 2020

Start Time: 10:14

End Time: 10:29

Weather: overcast, 60 degrees F, ~9 mph winds

Decibel Reading: 57.3 dBA

US-31

Ambient Speed: 60

Posted Speed: 60

Number of Lanes: 4

Lane Width: 12'

Traffic Count:

	NB	SB
Cars	136	167
Heavy Trucks	41	29

E 276 St

Ambient Speed: 45

Posted Speed: 45

Number of Lanes: 2

Lane Width: 12'

Traffic Count:

	E 276 to N 31	E 276 to S 31	N 31 to W 276	S 31 to E 276	W 276 to N 31	W 276 to S 31	N 31 to E 276	W 276 through US 31
Cars	0	2	2	1	0	5	5	0
Heavy Trucks	2	4	1	1	1	0	0	1

Site Photos:

Facing North



Facing East



Facing West



Facing South



Measurement Report

Report Summary

Meter's File Name	LxT_Data.006.s	Computer's File Name	LxT_0006169-20200929 101457-LxT_Data.006.ldbin
Meter	LxT1		
Firmware	2.403		
User		Location	
Job Description			
Note			
Start Time	2020-09-29 10:14:57	Duration	0:15:00.6
End Time	2020-09-29 10:29:57	Run Time	0:15:00.6
		Pause Time	0:00:00.0

Results

Overall Metrics

L _{Aeq}	57.3 dB		
L _{AE}	86.8 dB	SEA	--- dB
EA	53.6 $\mu\text{Pa}^2\text{h}$		
EA8	1.7 mPa^2h		
EA40	8.6 mPa^2h		
LZS _{peak}	98.1 dB	2020-09-29 10:15:21	
LAS _{max}	73.8 dB	2020-09-29 10:19:27	
LAS _{min}	47.7 dB	2020-09-29 10:18:53	
L _{Aeq}	57.3 dB		
LC _{eq}	68.8 dB	LC _{eq} - L _{Aeq}	11.5 dB
LAI _{eq}	59.2 dB	LAI _{eq} - L _{Aeq}	1.9 dB

Exceedances

Count	Duration
LAS > 85.0 dB	0
LAS > 115.0 dB	0
LZSpeak > 135.0 dB	0
LZSpeak > 137.0 dB	0
LZSpeak > 140.0 dB	0

Community Noise

57.3 dB	57.3 dB	0.0 dB	
LDEN	LDay	LEve	LNight
57.3 dB	57.3 dB	--- dB	--- dB

Any Data

Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L _{eq}	57.3 dB		--- dB		--- dB	
L _{S(max)}	73.8 dB	2020-09-29 10:19:27	--- dB		--- dB	
L _{S(min)}	47.7 dB	2020-09-29 10:18:53	--- dB		--- dB	
L _{Peak(max)}	--- dB		--- dB		98.1 dB	2020-09-29 10:15:21

Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	0	0:00:00.0

Statistics

LAS 5.0	61.8 dB
LAS 10.0	59.2 dB
LAS 33.3	55.1 dB
LAS 50.0	53.6 dB
LAS 66.6	52.4 dB
LAS 90.0	50.7 dB

APPENDIX F

TRAFFIC ANALYSIS REPORTS

US 31 Limited Access from SR 38 to 286th St Preliminary Intersection Treatments

END PROJECT

BEGIN PROJECT

FY2022

FY2024

FY2021

FY2023

286th St

286th St
ADT 177 (50)

276th St

281st St

276th St
ADT 664

266th St

266th St AADT 1340 (526)
Truck Percentage 5.0%

256th St

256th St
ADT 815 (50)

246th St

246th St
ADT 156 (50)

241st St

241st St
ADT 131 (50)

236th St

236th St
AADT 3928
Truck Percentage 1.5%

226th St

226th St
ADT 357 (587)

216th St

216th St
ADT 2049 (50)



38

Existing Condition (Future Volume)

Sources:
Hamilton County
INDOT TCDS

From: [Bales, Ronald](#)
To: [Samir Raman](#); [Miller, Brandon](#)
Cc: [Andrea Langille](#); [Neal Bennett](#); [Mark James](#); [Beck, Jennifer](#)
Subject: US 31 Limited Access Project, Hamilton County - Noise Analysis Report 1900096
Date: Monday, July 12, 2021 4:08:01 PM

A traffic noise analysis report was completed CMT in July 2021 to evaluate potential traffic noise impacts for the US 31 Limited Access Project in Hamilton County, Indiana. Traffic noise was evaluated at all receptors within 500 feet of edge of pavement. Traffic noise levels were evaluated for the existing (2020) and projected (2040) traffic volumes for the build alternative.

This report evaluated potential noise impacts for the proposed improvements in compliance with the Federal Highway Administration's (FHWA) Procedures for Abatement of Highway Traffic Noise and Construction Noise as presented in the Code of Federal Regulations, Title 23 Part 772 (23 CFR 772) and the INDOT *Traffic Noise Analysis Procedure* (2017).

Existing modeled (2020) peak hour noise levels ranged from 50.6 to 73.1 dBA. Predicted design year (2040) noise levels would approach or exceed the Noise Abatement Criteria (NAC) at 17 receptors. Impacted receptors identified within the study area are isolated receptors with multiple access drives that branch off U.S. 31 that provide access to residences and businesses. For noise barriers to effectively mitigate noise impacts from the U.S. 31, they would have to be constructed either at the edge of pavement or within the right-of-way between U.S. 31 and the impacted receptors. The multiple access drives that provide access to the impacted receptors limit the continuity and subsequently the effectiveness of noise barriers at these locations due to frequent openings in the barrier.

Based on the studies thus far accomplished, the State of Indiana has not identified any locations where noise abatement is likely. 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 feasible and reasonable, the abatement measures might 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 process.

This email will serve as INDOT's approval of this traffic noise analysis report.

Ron Bales

INDOT-Environmental Services Division

Office: (317) 515-7908

Email: rbales@indot.in.gov

APPENDIX J

Additional Documentation

**Environmental Justice (EJ) Analysis
US 31 Limited Access Highway Study
from SR 38 to 286th Street in Hamilton County
Des. Nos. 1900096, 1900097, 1901797 and 2002313**

Under FHWA Order 6640.23A, FHWA and the project sponsor, as a recipient of funding from FHWA, are responsible to ensure that their programs, policies, and activities do not have a disproportionately high and adverse effect on minority or low-income populations. The impacts for the proposed US 31 Limited Access Highway Study are being reviewed under an National Environmental Policy Act (NEPA) document. Therefore, an EJ Analysis is required.

Hamilton County, Indiana

Potential EJ impacts are detected by locating minority and low-income populations relative to a reference population to determine if populations of EJ concern exists and whether there could be disproportionately high and adverse impacts to them. The reference population may be a county, city or town and is called the community of comparison (COC). Within the Hamilton County portion of this project, the COC is Hamilton County, Indiana. The community that overlaps the project area is called the affected community (AC). Within the Hamilton County portion of this project the ACs are Census Tract 1103 (AC1), Census Tract 1102.01 (AC2), Census Tract 1104.01 (AC3), and 1105.07 (AC4). An AC has a population of concern for EJ if the population is more than 50% minority or low-income or if the low-income or minority population is 125% of the COC. Data from the 2019 American Community Survey (ACS) 5-year estimate data for Hamilton County, Indiana was obtained from the US Census Bureau Website data.census.gov/cedsci/ on February 18, 2021 by BF&S, Inc. The data collected for minority and low-income populations within the AC are summarized in the following table.

Environmental Justice Data Analysis
Des. Nos. 1900096, 1900097, 1901797 and 2002313
Source: U.S. Census Bureau 2019 ACS 5-year Estimates

	COC1	AC1	AC2	AC3	AC4
	Hamilton County, Indiana	Census Tract 1103, Hamilton County, Indiana	Census Tract 1102.01, Hamilton County, Indiana	Census Tract 1104.01, Hamilton County, Indiana	Census Tract 1105.07, Hamilton County, Indiana
LOW-INCOME					
Population for whom poverty status is determined: Total	335,217	17,122	4,543	4,144	15,151
Income in the past 12 months below poverty level	15,563	1,381	462	424	201
Percent Low-income	4.6%	8.1%	10.2%	10.2%	1.3%
125 Percent of COC	5.8%	AC > 125% COC	AC > 125% COC	AC > 125% COC	AC < 125% COC
Potential Population of EJ Concern?		Yes	Yes	Yes	No

MINORITY					
Total population: Total	323,117	17,135	4,571	4,318	15,169
Total population: Not Hispanic or Latino	310,189	16,635	4,527	3,480	14,679
Total population: Not Hispanic or Latino; White alone	270,351	15,211	4,483	3,395	13,801
Total population: Not Hispanic or Latino; Black or African American alone	12,585	854	19	35	363
Total population: Not Hispanic or Latino; American Indian and Alaska Native alone	603	0	0	7	0
Total population: Not Hispanic or Latino; Asian alone	19,155	115	11	43	449
Total population: Not Hispanic or Latino; Native Hawaiian and Other Pacific Islander alone	69	0	0	0	0
Total population: Not Hispanic or Latino; Some other race alone	503	54	0	0	0
Total population: Not Hispanic or Latino; Two or more races	6,496	401	14	0	66
Total population: Hispanic or Latino	12,928	500	44	838	490
Total population: Hispanic or Latino; White alone	10,012	321	39	759	337
Total population: Hispanic or Latino; Black or African American alone	179	0	0	0	0
Total population: Hispanic or Latino; American Indian and Alaska Native alone	16	0	0	0	0
Total population: Hispanic or Latino; Asian alone	181	0	0	0	0
Total population: Hispanic or Latino; Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0
Total population: Hispanic or Latino; Some other race alone	1,551	55	5	79	0
Total population: Hispanic or Latino; Two or more races	989	124	0	0	153
Number Non-white/minority	52,766	1,924	88	923	1,368
Percent Non-white/Minority	16.3%	11.2%	1.9%	21.4%	9.0%
125 Percent of COC	20.4%	AC < 125% COC	AC < 125% COC	AC > 125% COC	AC < 125% COC
Potential Population of EJ Concern?		No	No	Yes	No

Please refer to the INDOT EJ guidance for calculating percentages.

AC1, Census Tract 1103, Hamilton County, Indiana has a percent minority of 11.2% which is below 50% and is below the 125% COC threshold. Therefore, the AC1 does not contain minority populations of EJ concern.

AC1, Census Tract 1103, Hamilton County, Indiana has a percent low-income of 8.1% which is below 50% and above the 125% COC threshold. Therefore, AC1 contains low income populations of EJ concern.

AC2, Census Tract 1102.01, Hamilton County, Indiana has a percent minority of 1.9% which is below 50% and is below the 125% COC threshold. Therefore, the AC2 does not contain minority populations of EJ concern.

AC2, Census Tract 1102.01, Hamilton County, Indiana has a percent low-income of 10.2% which is below 50% and above the 125% COC threshold. Therefore, AC2 contains low income populations of EJ concern.

AC3, Census Tract 1104.01, Hamilton County, Indiana has a percent minority of 21.4% which is below 50% and above the 125% COC threshold. Therefore, the AC3 contains minority populations of EJ concern.

AC3, Census Tract 1104.01, Hamilton County, Indiana has a percent low-income of 10.2% which is below 50% and above the 125% COC threshold. Therefore, AC3 contains low income populations of EJ concern.

AC4, Census Tract 1105.07, Hamilton County, Indiana has a percent minority of 9.0% which is below 50% and is below the 125% COC threshold. Therefore, the AC3 does not contain minority populations of EJ concern.

AC4, Census Tract 1105.07, Hamilton County, Indiana has a percent low-income of 1.3% which is below 50% and above the 125% COC threshold. Therefore, AC4 does not contain low income populations of EJ concern.

Benefits of the proposed project include increased safety by removing potential vehicle conflicts at intersections related to traffic crossing US 31, as well as reduced rear-end accidents for turning movements from US 31 to intersecting roads. Another benefit would reducing the amount of time cars are idling at intersections.

Efforts to date to engage the public, and other identified stakeholders in Hamilton County, include a Community Advisory Committee (CAC) meeting that was held on July 1, 2020, and a Public Information Meeting that was held on September 1, 2020. As a result of feedback received at these meetings, potential adverse impacts to low-income populations have been identified, which include: relocation of some residences and businesses, increased travel time and difficulty for farmers who manage agricultural lands both east and west of US 31, complicated access to larger communities that exist both east and west of US 31, accelerated degradation of county roads surrounding US 31 due to increased use resulting from limited access implementation, potential wage loss to workers when snow/ice on county roads prevents them from traveling to work, and potential delays for emergency response – especially for properties located on a current intersecting road to US 31 that will receive cul-de-sac treatment as part of the project.

At this point in project planning, the proposed right-of-way acquisition for the project, within the limits of Hamilton County, would consist of the following:



See note on next page regarding relocations.

Intersecting Roadway	Right-of-way Acquisition Estimates	Relocations	Changes in Access	Community Cohesion Impacts
216 th Street	Partial agricultural parcel take west of US 31; full commercial parcel take east of US 31	1 commercial	Removes direct access to US 31 via cul-de-sac	No direct route impacts to surrounding towns; relocation of only gas station within a 3-mile radius of intersection
226 th Street	Partial commercial and agricultural parcel takes from multiple parcels east and west of US 31	2 commercial in SW quadrant	Removes direct access to US 31 via overpass; maintains access to commercial properties east of US 31 via new access roads	No direct route impacts to surrounding towns; minimizes impacts to surrounding businesses.
246 th Street	Partial agricultural parcel take east of US 31	None	Removes direct access to US 31 via cul-de-sac	No direct route impacts to surrounding towns

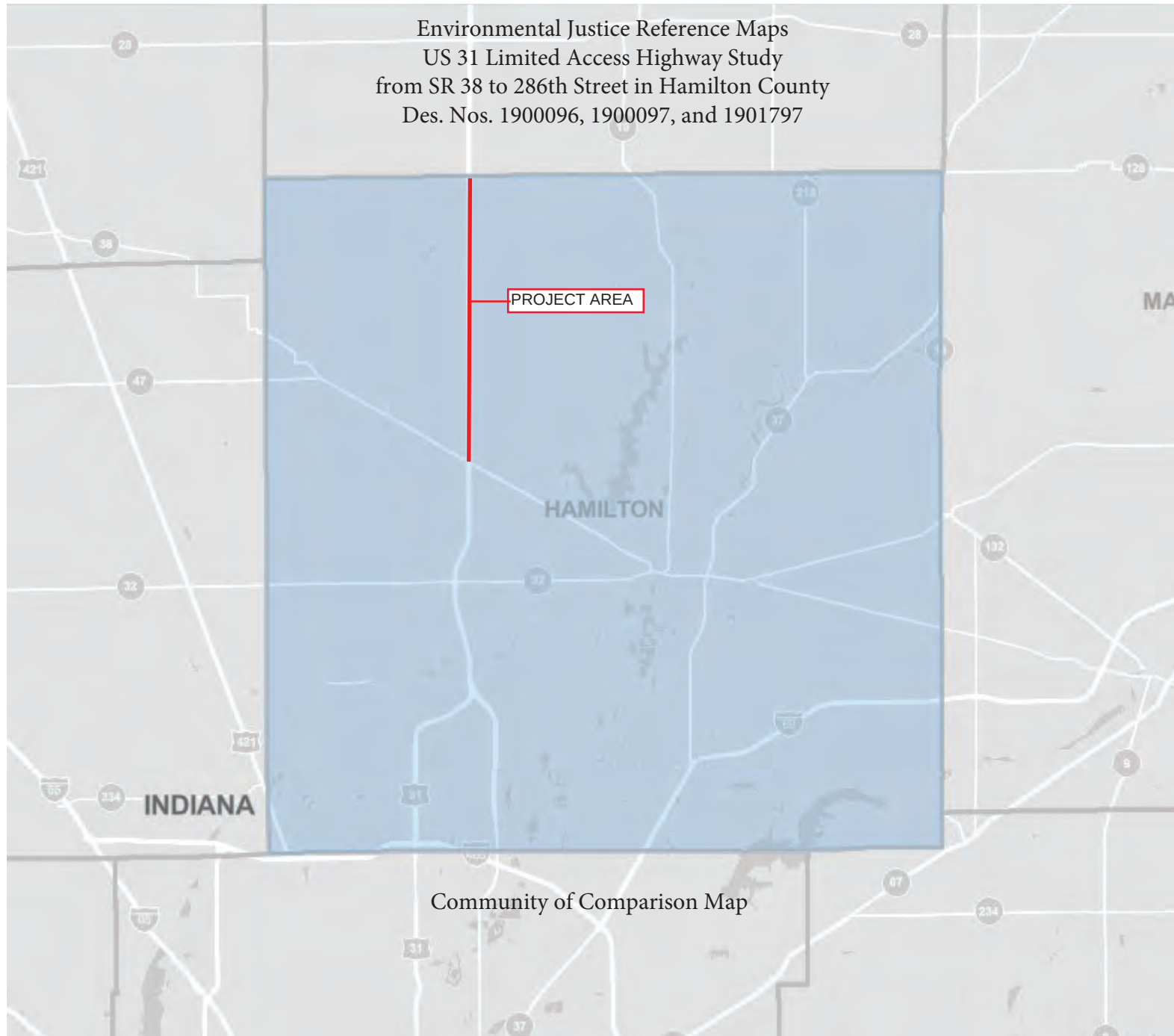
256 th Street	Partial agricultural parcel takes east and west of US 31	None	Removes direct access to US 31 via cul-de-sac	Restricts access to existing commercial farm market east of US 31
266 th Street	Partial residential and agricultural parcel takes west of US 31; full commercial and partial agricultural parcel takes east of US 31	1 commercial	Removes direct access to US 31 via overpass	Removes direct access to/from US 31 and the Town of Arcadia (located approximately 5.5 miles east of US 31)
276 th Street	Parcel takes involving commercial, residential, and agricultural land and partial takes involving commercial, agricultural, and residential properties.	1 residential west of US 31, 1 residential east of US 31	Alters direct access to US 31 via full interchange	Maintains access to US 31
281 st Street	Partial agricultural parcel takes east and west of US 31	None	Removes direct access to US 31 via cul-de-sac	No direct route impacts to surrounding towns
286 th Street	Partial agricultural parcel takes east and west of US 31	None	Allows right-turns on and off US 31	No direct route impacts to surrounding towns

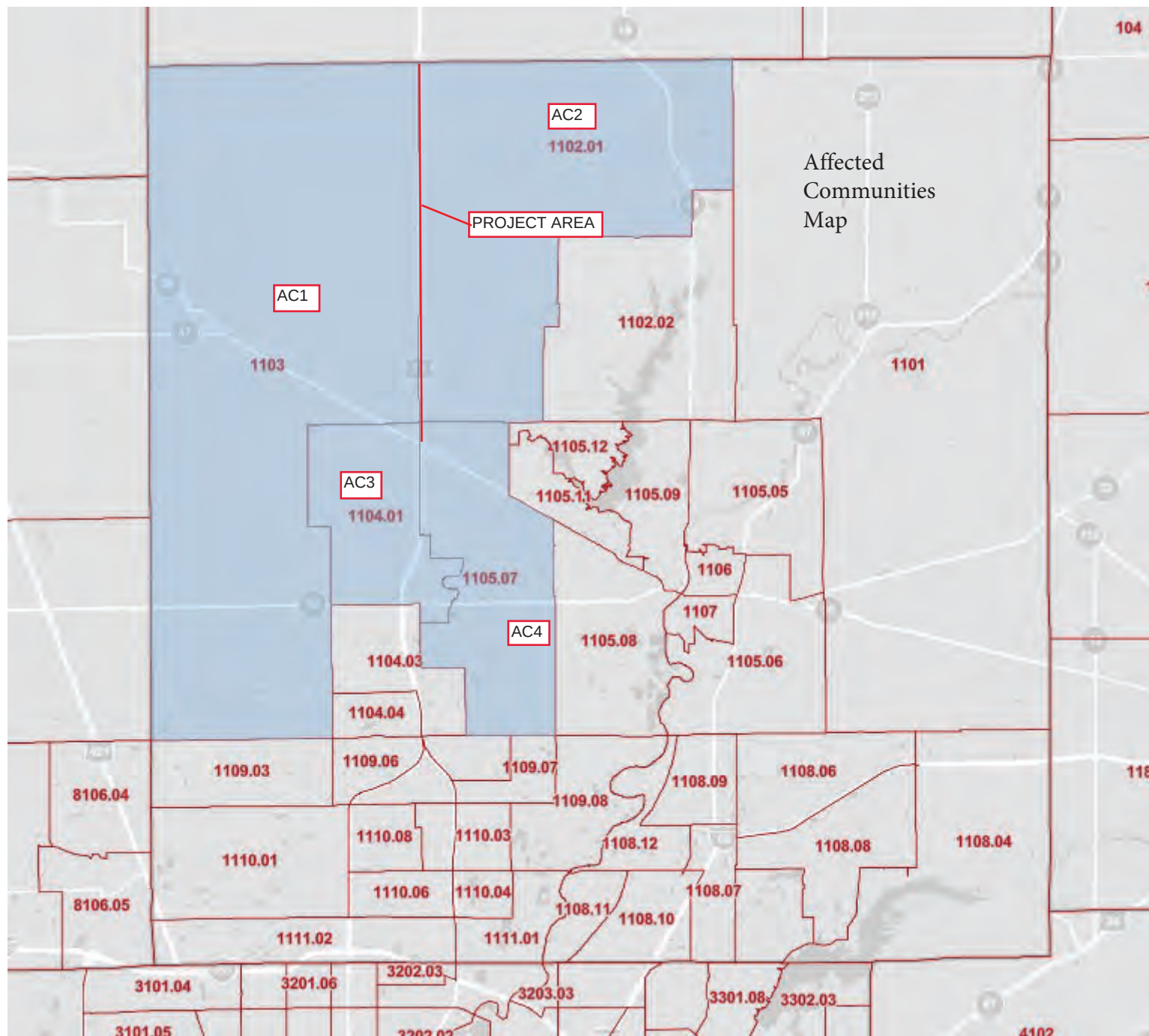
The project is a linear corridor type project that proposes limited access improvements for the entire length of Hamilton County from SR 38 to 286th Street. Therefore, all properties including EJ and non-EJ populations located along the project corridor are subject to the same considerations, including relocations of residences with driveway access to US 31, cul-de-sac or overpass treatment to all cross streets intersecting US 31, and interchange construction at previously identified locations (236th Street and 276th Street within Hamilton County). Therefore, at this time, the proposed project is not expected to result in disproportionately high and adverse impacts to the identified populations of environmental justice concern. Public involvement as a result of the proposed project will be ongoing, along with continuing efforts to engage the public.

Please note:

The relocations noted above are in reference to specific intersections, and do not account for the total relocations for the overall project. There are 19 residential and 5 commercial relocations anticipated for the overall project.

Environmental Justice Reference Maps
US 31 Limited Access Highway Study
from SR 38 to 286th Street in Hamilton County
Des. Nos. 1900096, 1900097, and 1901797





Structures Evaluated for the Presence of Bats

Structure Number/Name	Structure Location (Lat/Long)	Structure Size/Diameter	Date Inspected	Bats Observed
031-29-04572	40.191869, -86.127963	130-ft Length	2/3/2021	N
216-2	40.101347, -86.128388	12-36' diameter	3/24/2021	N
226-2	40.116206, -96.126822	12-36' diameter	2/3/2021	N
226-3	40.116183, -86.126351	12-36' diameter	2/3/2021	N
226-8	40.115790, -86.130012	12-36' diameter	2/3/2021	N
226-11	40.112587, -86.128383	12-36' diameter	2/3/2021	N
226-12	40.111878, -86.128338	12-36' diameter	2/3/2021	N
226-14	40.111423, -86.127776	12-36' diameter	3/24/2021	N
236-1	40.128074, -86.128456	12-36' diameter	2/3/2021	N
236-2	40.126930, -86.128407	12-36' diameter	2/3/2021	N
236-3	40.126708, -86.127800	12-36' diameter	2/3/2021	N
241-2	40.138817, -86.127433	12-36' diameter	2/3/2021	N
241-9	40.137256, -86.128222	12-36' diameter	2/3/2021	N
241-10	40.136752, -86.128268	12-36' diameter	2/3/2021	N
241-11	40.136201, -86.128340	12-36' diameter	2/3/2021	N
246-1	40.146430, -86.127614	12-36' diameter	2/3/2021	N
246-3	40.142142, -86.127719	12-36' diameter	2/3/2021	N
246-4	40.141090, -86.128262	12-36' diameter	2/3/2021	N
256-1	40.160276, -86.127754	12-36' diameter	2/3/2021	N
256-2	40.160251, -86.128335	12-36' diameter	2/3/2021	N
256-3	40.160462, -86.127194	12-36' diameter	2/3/2021	N
256-5	40.153976, -86.128276	12-36' diameter	2/3/2021	N
256-6	40.151779, -86.127710	12-36' diameter	2/3/2021	N
256-7	40.150592, -86.128272	12-36' diameter	2/3/2021	N
266-2	40.174786, -86.127497	12-36' diameter	2/3/2021	N
266-2b	40.189682, -86.128405	12-36' diameter	2/3/2021	N
266-6	40.171150, -86.127722	12-36' diameter	2/3/2021	N
266-7	40.165932, -86.127736	12-36' diameter	2/3/2021	N
266-8	40.165003, -86.128258	12-36' diameter	2/3/2021	N
266-9	40.163727, -86.128214	12-36' diameter	2/3/2021	N
281-2	40.198305, -86.127826	12-36' diameter	2/3/2021	N
286-2	40.204734, -86.127609	12-36' diameter	2/3/2021	N
286-3	40.204708, -86.128479	12-36' diameter	2/3/2021	N
286-4	40.203175, -86.127832	12-36' diameter	2/3/2021	N

286-8	40.198305, -86.127826	12-36' diameter	2/3/2021 N
296-7	40.217161, -86.126779	12-36' diameter	2/3/2021 N
296-14	40.210506, -86.127845	12-36' diameter	2/3/2021 N
296-15	40.209941, -86.127865	12-36' diameter	2/3/2021 N
296-15b	40.209941, -86.127865	12-36' diameter	2/3/2021 N
29-00011	40.129290, -86.132149	99-ft length	3/24/2021 N
CV 031-029-138.26	40.130516, -86.127847	12-36' diameter	2/3/2021 N
CV 031-029-138.78	40.137915, -86.127787	12-36' diameter	2/3/2021 N
CV 031-029-141.29	40.174177, -86.127995	12-36' diameter	2/3/2021 N
CV 031-029-142.59	40.194844, -86.127792	12-36' diameter	2/3/2021 N
JD-1	40.188013, -86.128370	12-36' diameter	2/3/2021 N
JD-2	40.185820, -86.128361	12-36' diameter	2/3/2021 N
JD-3	40.184329, -86.128349	12-36' diameter	2/3/2021 N
SL-01	40.105719, -86.127719	12-36' diameter	3/24/2021 N
SL-03	40.121359, -86.127833	12-36' diameter	3/24/2021 N
SL-04	40.120511, -86.128391	12-36' diameter	3/24/2021 N
SL-05	40.126650, -86.128432	12-36' diameter	3/24/2021 N
SL-06	40.127760, -86.128466	12-36' diameter	3/24/2021 N
SL-07	40.175533, -86.124906	12-36' diameter	3/24/2021 N
SL-07b	40.175533, -86.124906	12-36' diameter	3/24/2021 N
SL-09	40.189109, -86.129646	12-36' diameter	3/24/2021 N
SL-10	40.190257, -86.125958	12-36' diameter	3/24/2021 N
SL-11	40.190308, -86.124171	12-36' diameter	3/24/2021 N
SL-12	40.190224, -86.123226	12-36' diameter	3/24/2021 N
SL-13	40.190181, -86.121823	12-36' diameter	3/24/2021 N
SL-14	40.190163, -86.120485	12-36' diameter	3/24/2021 N
SL-15	40.189307, -86.127736	12-36' diameter	3/24/2021 N

1800017	1800017	Hamilton	Forest Park & Trail, White River Access Site
1800058	1800058	Hamilton	Forest Park & Trail, White River Access Site
1800128	1800128	Hamilton	Morse Park & Beach
1800198	1800198	Hamilton	Cicero Community Park
1800236	1800236	Hamilton	Forest Park & Trail, White River Access Site
1800493	1800493	Hamilton	Flowing Well Park
1800502	1800502	Hamilton	Cool Creek County Park
1800519	1800519	Hamilton	Taylor Property
1800551	1800551	Hamilton	MacGregor Park
1800581	1800581	Hamilton	MacGregor Park

Land and Water Conservation Fund (LWCF) Resources List for Hamilton County, IN

Taken from the list last Updated July 2020