TOWN OF KIRKWOOD NY
FIVE MILE POINT WAREHOUSE
COMMUNITY SOUND STUDY

October 24, 2023

Prepared for:

Five Mile Point Warehouse Investors, LLC

Submitted by:

Thornton Acoustics
521 Clay Run Rd.
Mill Run, PA 15464

CONTENTS

1 INTRODUCTION

Thornton Acoustics & Vibrations (TAV) performed a site sound study at the proposed Five Mile Point Warehouse location (currently the Five Mile Point Speedway) in Kirkwood NY on September 20-22, 2023. The purpose of the study was to measure and assess the current ambient noise levels across the site and on surrounding properties and to model and predict the community sound impact of the proposed development.

Thornton Acoustics & Vibrations is a Mechanical Engineering firm, founded in 1982, specializing in Physical Acoustics, Noise Control and Mechanical Vibrations. Our firm works extensively in the fields of environmental and community noise, including the development of modern/science-based noise ordinances, diagnostic/compliance noise testing and assessment, and noise control engineering. I have personally completed over 150 environmental and community noise projects working across the spectrum for developers, land owners, environmental/civic groups, and government/municipalities (my CV is attached as an Appendix to this report).

1.1 SITE DESCRIPTION

The site aerial views are shown in Figure 1 (as it currently exists) and Figure 2 (showing the footprint of the proposed development, yellow highlighting indicates building space and pink highlighting indicates loading dock/truck area). Note that the site is surrounded by industrial and commercial development, and multiple high-volume roads and Interstates as well as several residential neighborhoods.

Figure 1 Five Mile Point current site (Five Mile Point Speedway) and surrounding areas.

Figure 2 Proposed Five Mile Point Warehouse footprint.

The proposed site layout is shown in Figure 3. Note that the truck access, parking (truck) and docks for the site will be located on the eastern side of the building (nearest Interstate I-81) and that the buildings will attenuate potential truck sound incident on the residential properties surrounding the site (see Section 3.2 of this report). Note that although there will be car access and parking, due to the low volume and low speed of these vehicles the sound emitted will be significantly lower than the site ambient sound and as such will not contribute to the overall sound level. This report will focus primarily on site truck/dock activity.

Figure 3 Proposed Five Mile Point Warehouse site layout.

1.2 KIRKWOOD ZONING & NOISE ORDINANCE

The Town of Kirkwood NY has enacted a Zoning Noise Ordinance that will apply to sound emitted by the proposed site development. This Code limits noise emissions as incident on receiving properties as a function of Zoning District and time of day. Furthermore, the Code established noise emission limits on motor vehicles being operated off of a public right-of-way (as would occur on the proposed site and in loading/truck areas of the site).

The development site and the surrounding properties are shown in Figure 4, with Zoning Districts color coded according to the legend. Note that the site is currently zoned Business One and is seeking reclassification as to Industrial Development. However, this does not impact the sound analysis nor the sound impact as the Kirkwood Code regulates sound as a function of the receiving site Zoning District.

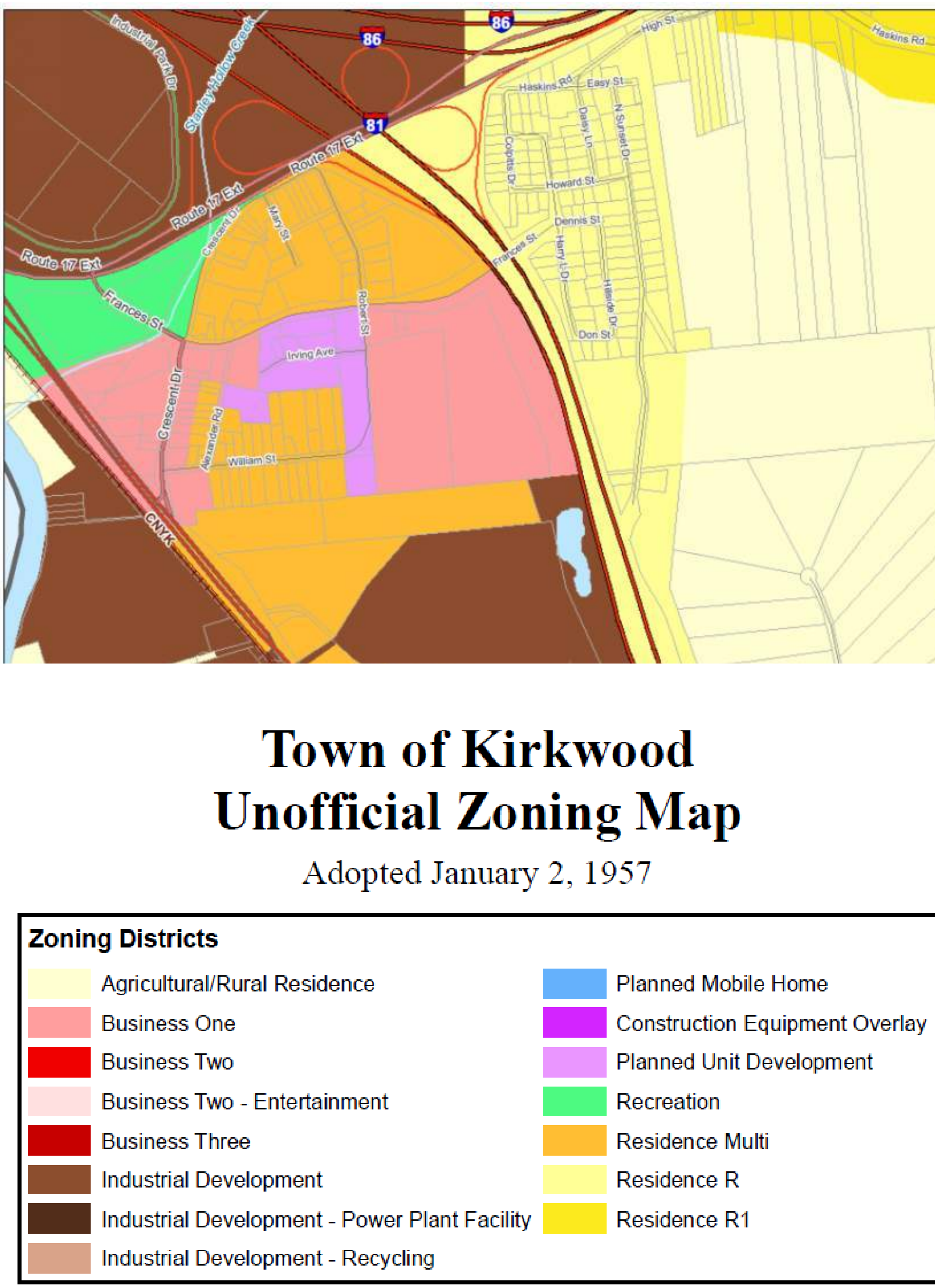

Figure 4 Town of Kirkwood Zoning Map excerpt

The Kirkwood Noise Code is excerpted in Figures 5 and 7 (Section 501.1 – B receiving land limits and Section 501.1 – D.3 motor vehicle limits respectively). Note that the Code, which references ANSI standards for measures, uses language that is also defined by ANSI standards. The Maximum Sound Level referenced in the Kirkwood Code is defined according to ANSI Standard *S1.1 – Acoustical Terminology* as shown in Figure 6. The sound emitted from the proposed site would be limited by the Code to not exceed an A-weighted, Slow response, Maximum sound level (L_{ASmax}) of 60 dB(A) during the day and 50 dB(A) at night as measured on the receiving residential properties. The motor vehicle operated on the site would be limited to A-weighted, Slow response, Maximum sound levels (L_{ASmax}) of between 82 and 88 dB(A) at a distance of 50 feet from the source depending on vehicle makeup and speed/operating state.

B. Maximum Permissible Sound Levels by Receiving Land Use

No person shall operate or cause to be operated on private property any source of sound in such a manner as to create a sound level which exceeds the limits set forth for the receiving land use category below when measured at or within the property boundary of the receiving land use.

Receiving Land Use District	Time of Day	Sound Level Limit dBA
Agricultural/Rural Residence (A/R-R) Residence (R) Residence (R-1) Residence Multi (R-M) Planned Unit Development	7:00a.m. -9:00p.m. 9:00p.m. -7:00a.m.	60 50
Business One (B-1) Business Two (B-2) Industrial Development	All Hours	60

7301

Figure 5 Zoning Local Law - Town of Kirkwood – Article V Supplementary Standards -Section 501.1 B Performance Standards Noise

3.13 maximum sound level. Greatest frequency-weighted and exponential-time-weighted sound level within a stated time interval. Unit, decibel (dB); abbreviation for F time weighting and A frequency weighting, for example, is MXFA; symbol L_{AFmx} (or C and S).

*Figure 6 ANSI S1.1 Acoustical Terminology – **Maximum Sound Level**, as referenced in the Kirkwood Zoning, defined.*

ZONING LOCAL LAW
TOWN OF KIRKWOOD

ARTICLE V – SUPPLEMENTARY STANDARDS

No person shall operate or cause to be operated a motor vehicle or motorcycle off a public right-of-way at any time and in such a manner that the sound level emitted by the motor vehicle or motorcycle exceeds the following levels measured at 50 feet or 15 meters:

Maximum Sound Level in dBA

Vehicle Class	Speed Limit 35 MPH or less	Speed Limit Over 35 MPH	Stationary Rumup
Motor Carrier Vehicle engaged in interstate commerce of GVWR or GCWR of 10,000 lbs. or more	86	90	88
All other motor vehicles of GVWR or GCWR of 10,000 lbs. or more	82	86	
Any motorcycle	82	86	
Any other motor vehicle of any combination of vehicles towed by any motor vehicle	76	80	

Figure 7 Zoning Local Law - Town of Kirkwood – Article V Supplementary Standards -Section 501.1 D.3 Performance Standards Noise

1.3 ENGINEERING NOISE CONTROL

The proposed building and tenant, regardless of use, will be effectively noise controlled according to well-developed engineering methodologies to limit sound emissions to meet the Kirkwood Code. Measurement, modelling, and prediction of sound emission as well as the development of engineering noise control designs to limit sound to meet an established target, goal or limit are well developed, accurate, and precise engineering disciplines. These methodologies can be applied to the development of this site to meet the required noise limits. The potential controls include:

- Building Shell – design/construct the building shell to achieve Noise Reduction (NR) sufficient to contain internal sound and to reduce emissions to meet code.
- Building Penetrations – control sound emissions from any building penetrations by installing Noise Attenuating Louvers and/or in-line Acoustical Silencer.
- External Mechanical/HVAC equipment – select OEM noise controlled/low-noise alternatives. Noise control equipment using appropriate silencers, enclosures/barriers, mufflers and other noise control appliances as needed.
- Location/ Placement - locate external sound emitting equipment and activities to take advantage of the noise shielding/barrier effects of the buildings.

1.4 NOISE PRIMER

In order to understand and interpret the noise data, analyses and discussions contained in this report it is essential to understand a number of the technical nuances related to sound, noise (unwanted sound) and the human perception of noise.

Sound is a pressure perturbation propagating through air (in this case) that can be described in terms of the level, the frequency content (tone/pitch) and temporal variation. These variables affect the perception and impact of the sound, which when unwanted is called noise by convention.

In measuring and characterizing noise, there exist numerous metrics and descriptors. The metrics/descriptors used must be carefully chosen such that they capture and accurately describe and characterize the sound or noise problem being addressed. For many of these metrics and descriptors, although they fundamentally differ in their computation, the final results are expressed in terms of decibels (dB, or when A-weighted as in the Kirkwood Code, dB(A)) and this can lead to confusion and misinterpretation. The use of the wrong metric will distort the measured results leading to erroneous conclusions.

As the human ear does not respond equally to all frequencies and levels, the human perception of loudness is a relatively complex phenomena and it can be challenging to use a simple single number noise descriptor to characterize noise.

There are many metrics that are used to measure sound in a manner that approximates the human perception of that sound. These include A, B and C weighting filters, Sones, Phons and Zwicker Loudness to name a few.

In order to characterize the typical ambient sound levels in a community, the sound level exceeded 90 percent of the time ($L_{90,}$ (dB)) metric is often used by convention (in the absence of a formal standard or specific guidance in an ordinance). Note that this metric is not used in the Kirkwood Code.

The decibel scale used to measure noise is a logarithmic scale rather than a simple linear scale and this leads to misunderstanding and misinterpretation of noise data and levels. Relatively small numerical changes or differences in sound level (expressed in decibels (dB)) are actually relatively large differences in acoustical energy. In order for the reader to interpret and understand the measured noise data, several simplified rules-of-thumb regarding the sound level/decibel scale are useful. First, every 3-dB increase (or decrease) is a doubling (or halving) of the amount of acoustical energy and is generally considered the smallest change perceptible to an average human listener. Secondly, every 10-dB increase (or decrease) is a doubling (or halving) of the perceived loudness of a sound. For example, if the ambient sound level is increased by 10 dB, the average person would perceive this is twice as loud. An increase by 20 dB, would be perceived as roughly 4-times as loud, 30 dB as 8-times as loud and so on.

Decibels are scaler numbers (having only a magnitude) and are defined at a point or location in space. A sound pressure level must have a specified location or distance form the source to be meaningful.

Sound propagates from a source in a predictable fashion. Several simplified rules of thumb are useful in understanding propagation. Sound from a discreet point source (an air conditioner unit, or industrial machine for example) will propagate through the atmosphere such that the level will decrease by approximately 6 dB per doubling of distance; i.e., if the noise source produces a sound level of 55 dB(A) at a distance of 100 feet from the source, the sound level will decrease to approximately 49 dB(A) at a distance of 200 feet from the source (-6 dB) and 43 dB(A) at a distance of 400 feet (-12 dB) and so on.

For a line noise source (such as a Highway or high-volume road), the sound will only decrease by approximately 3 dB per doubling of distance from the source. If a Highway such as I-81, produces a sound level of 75 dB(A) at a distance of 100 feet from the center of the lanes, the level will decrease to approximately 72 dB(A) (-3 dB) at a distance of 200 feet and 69 dB(A) (-6 dB) at 400 feet and so on.

The cumulative/aggregate effects of multiple noise sources are predictable and the levels can be added and subtracted. However, decibels are logarithmic numbers and thus cannot be manipulated arithmetically but rather must be converted to linear numbers (mean square pressure), arithmetic performed and converted back to decibels. Rather than digressing into the math, several rules are useful. If two independent noise sources each produce the same sound levels (individually) at a point in space, the two sources together will result in a 3 dB increase; i.e., 80 dB plus 80 dB is not 160 dB, it is 83 dB; 55 dB plus 55 dB is 58 dB etc. If a highway produces a noise level of 61 dB(A) at a specific residence, and an industrial machine produces a sound level of 61 dB(A) at that same residence; the two noise sources will add together to produce an overall level of 64 dB(A) (+ 3 dB) at that residence (a particular point in space).

When adding noise sources, if a specific source (individually) produces a sound level that is 10 dB (or greater) less than another source or cumulative sources, the lesser source does NOT contribute significant energy and thus does not increase the overall level. For example, if a

Highway produces a sound level of 65 dB(A) at a specific location and an individual piece of industrial equipment produces a level of 55 dB(A) (or less) at that same location; when the two sources are added together (the machine is turned on) the overall level will not increase and will remain 65 dB(A) (the Highway noise level; thus, the louder source controls the overall level when two sources differ by 10 dB or more).

2 METHODOLOGY

2.1 AMBIENT SITE NOISE TESTING

TAV performed a site noise study to measure and assess the existing ambient noise environment on the development site and on surrounding properties. An array of noise monitors was installed on the development site at locations shown in Figure 8.

Figure 8 Development site aerial view with Noise Monitoring sites indicates and labeled A, B, C, and D.

The noise monitors were Bruel & Kjaer (B&K) 2270 precision (IEEE Type 1) sound levels meters/monitors using B&K 4189 microphones. All equipment was traceably calibrated in February 2023 (annual calibration per industry standard practice) and field calibration checked prior to and at the completion of the study. All monitoring methodologies were in accordance with industry standards and best practices. The monitors were programmed to measure sound continuously over the study period, and to calculate and record noise metrics to describe and characterize the noise at selected intervals.

2.2 Sound Modelling

Computer sound modeling was performed to assess the sound impact of the proposed site buildings, layout and activities. This modelling was performed according to ISO 9613 Standards as is International industry best/standard practice.

3 RESULTS

3.1 AMBIENT NOISE LEVELS

The measured ambient sound levels over the study period and the four monitoring locations are plotted, overlaid with the Kirkwood Code limits, in Figures 9 and 10. These measured ambient noise levels are the aggregate of all noise emitted by the surrounding Interstates, highways, industrial noise sources, and the existing race track as well as other residential and community noise sources. The average (A-weighted, equivalent continuous sound levels, L_{Aeq}) for 30-minute intervals over the study period are shown in Figure 9.

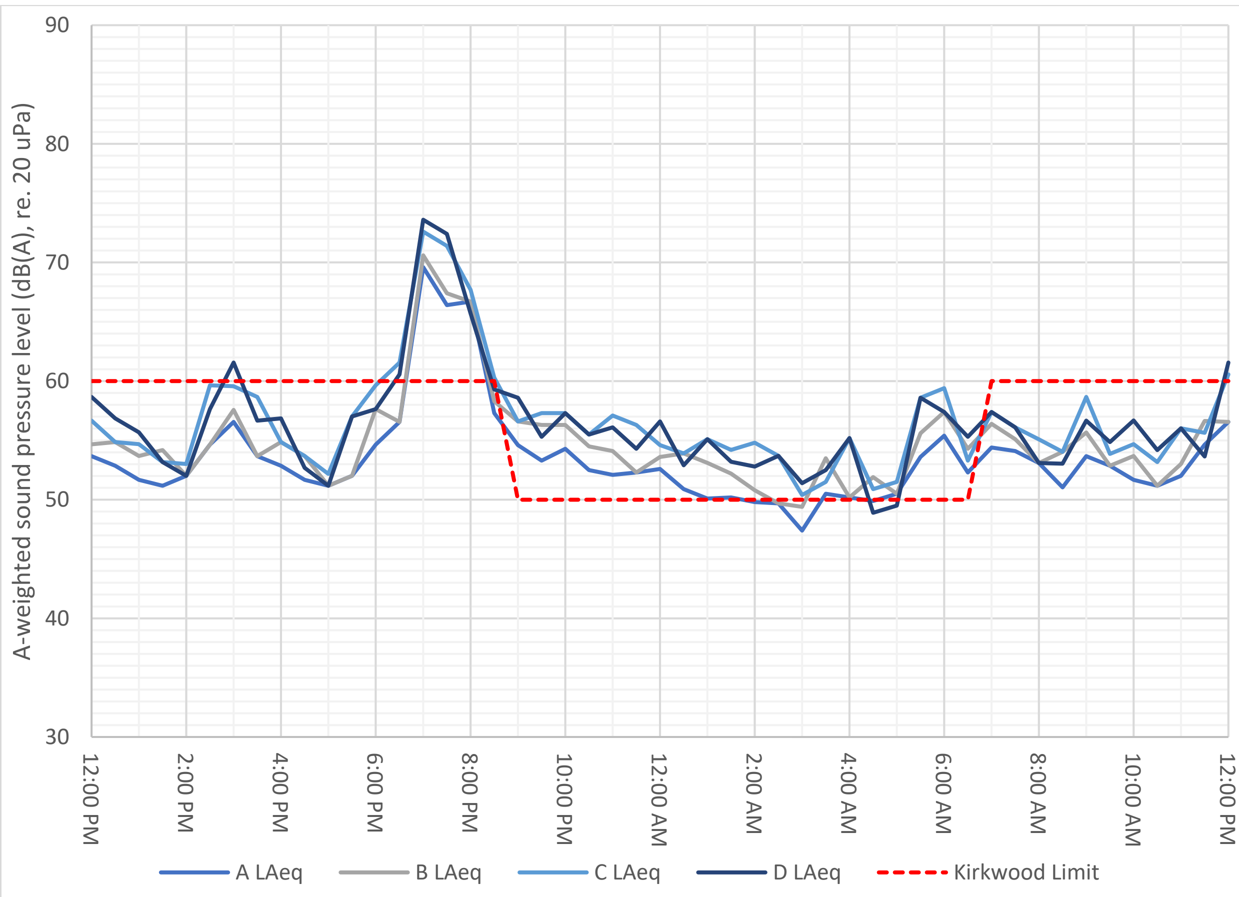

Figure 9 Average (A-weighted equivalent continuous sound levels, L_{Aeq}) 30-minute interval sound levels plotted for the four monitoring locations overlaid with the Kirkwood limit.

The maximum sound levels (maximum, A-weighted, Slow response sound levels, (L_{ASmax})) for each 30-minute interval over the study period are shown in Figure 10, overlaid with the Kirkwood limit. Note that the Maximum levels are used as the compliance metric in the Kirkwood Code.

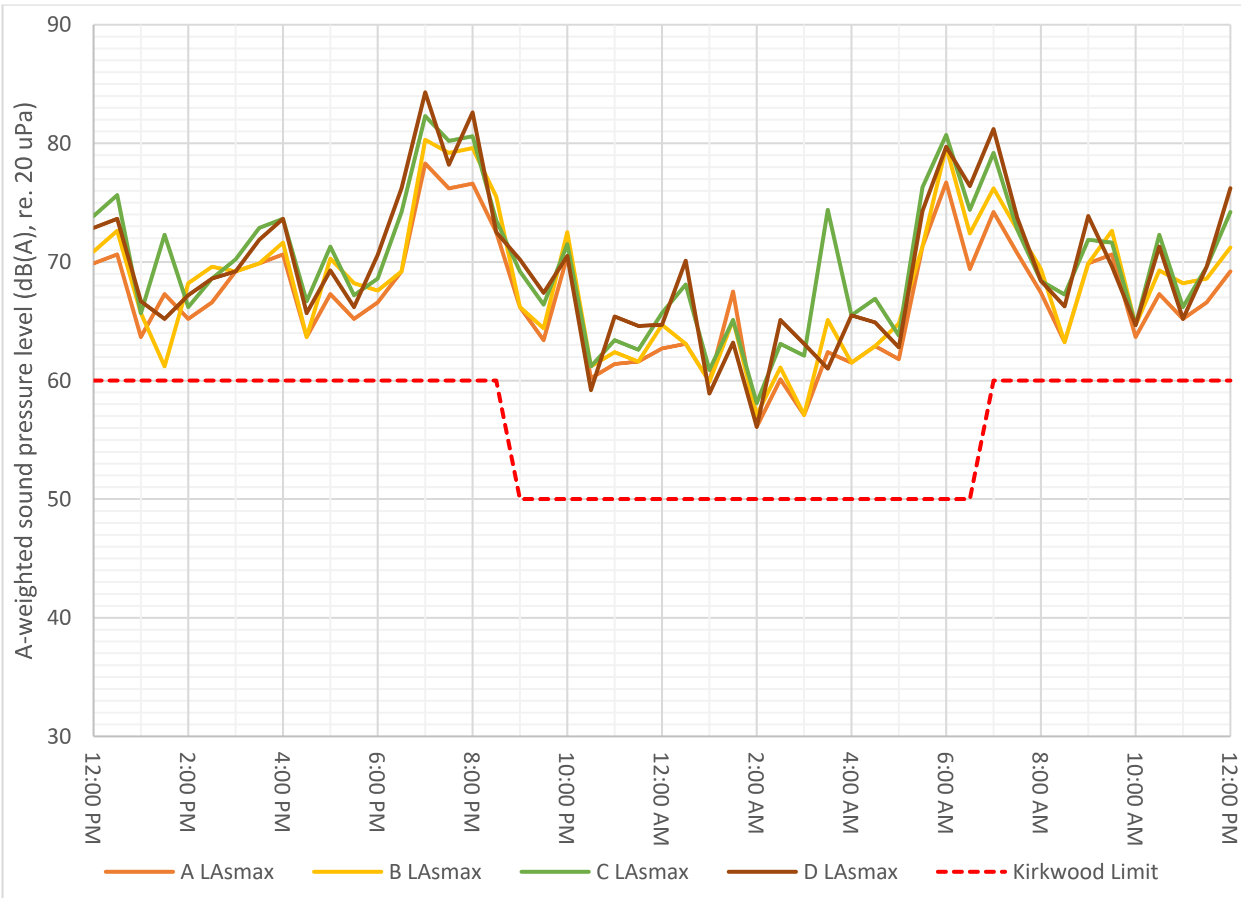

Figure 10 Maximum sound levels (maximum, A-weighted, Slow response sound levels, (L_{ASmax})) for each 30-minute interval plotted for the four monitoring locations overlaid with the Kirkwood limit.

The existing ambient sound levels, both average levels and the maximum levels (note that the maximum level is used as the Kirkwood compliance metric per Kirkwood Code) routinely and grossly exceed the Kirkwood Code limits by as much as 25 dB(A). Note that every 10-dB increase in noise is perceived as a doubling of loudness; accordingly, a 20 dB increase or exceedance is perceived as being four times as loud and 30 dB eight times as loud.

The Highway/road network throughout Kirkwood emits noise into the adjacent and surrounding communities, 24-hours a day. The road noise levels are typically the dominant and (level) controlling noise source(s) for neighborhoods located adjacent to , or near these roads. For the residential neighborhood located East/Northeast of the development site (located on the opposite side of I-81 from the development site) , the highway and transportation noise levels are tracked by the U.S. Department of Transportation (DOT). The transportation noise levels across Kirkwood are shown in Figure 11 (note that this map uses color contours to denote sound pressure levels according to the scale at the bottom left of the Figure).

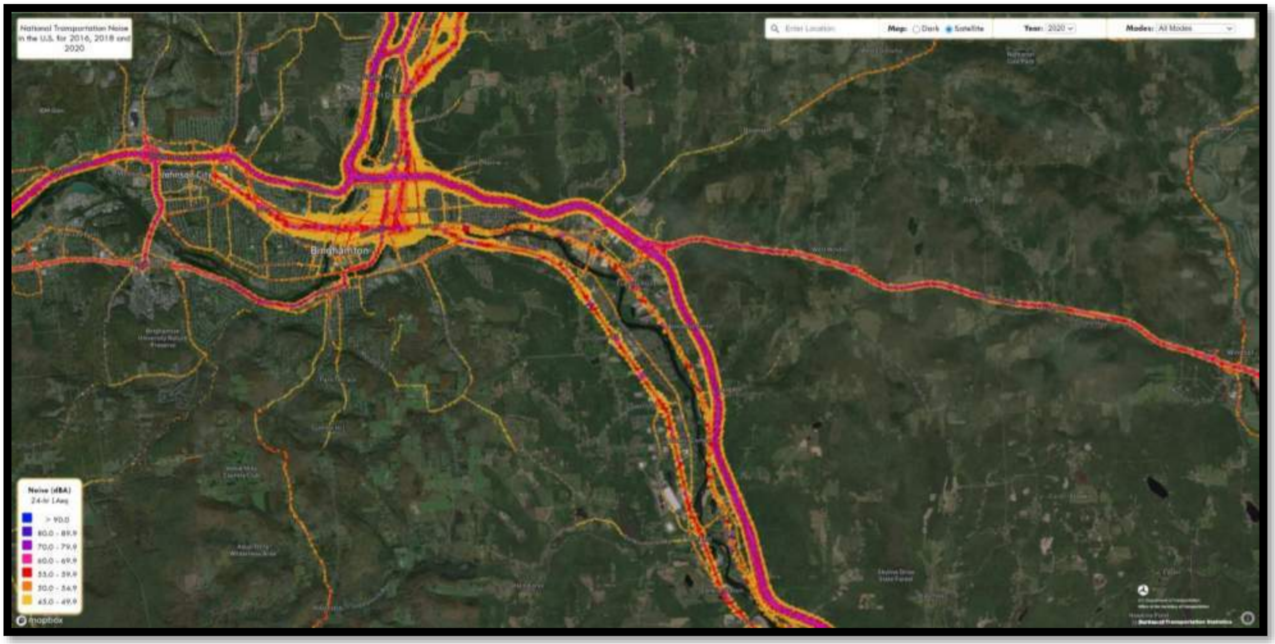

Figure 11 US DOT National Transportation (rail, air, and highway) highway noise overlay map.

A zoomed view of the transportation noise levels in the immediate vicinity of the development are shown in Figure 12 (color scale shown in Figure 13). Note that on the eastern side of I-81, the Interstate noise levels in the residential neighborhoods range from approximately 45-75 dB(A) depending on distance from the Highway.

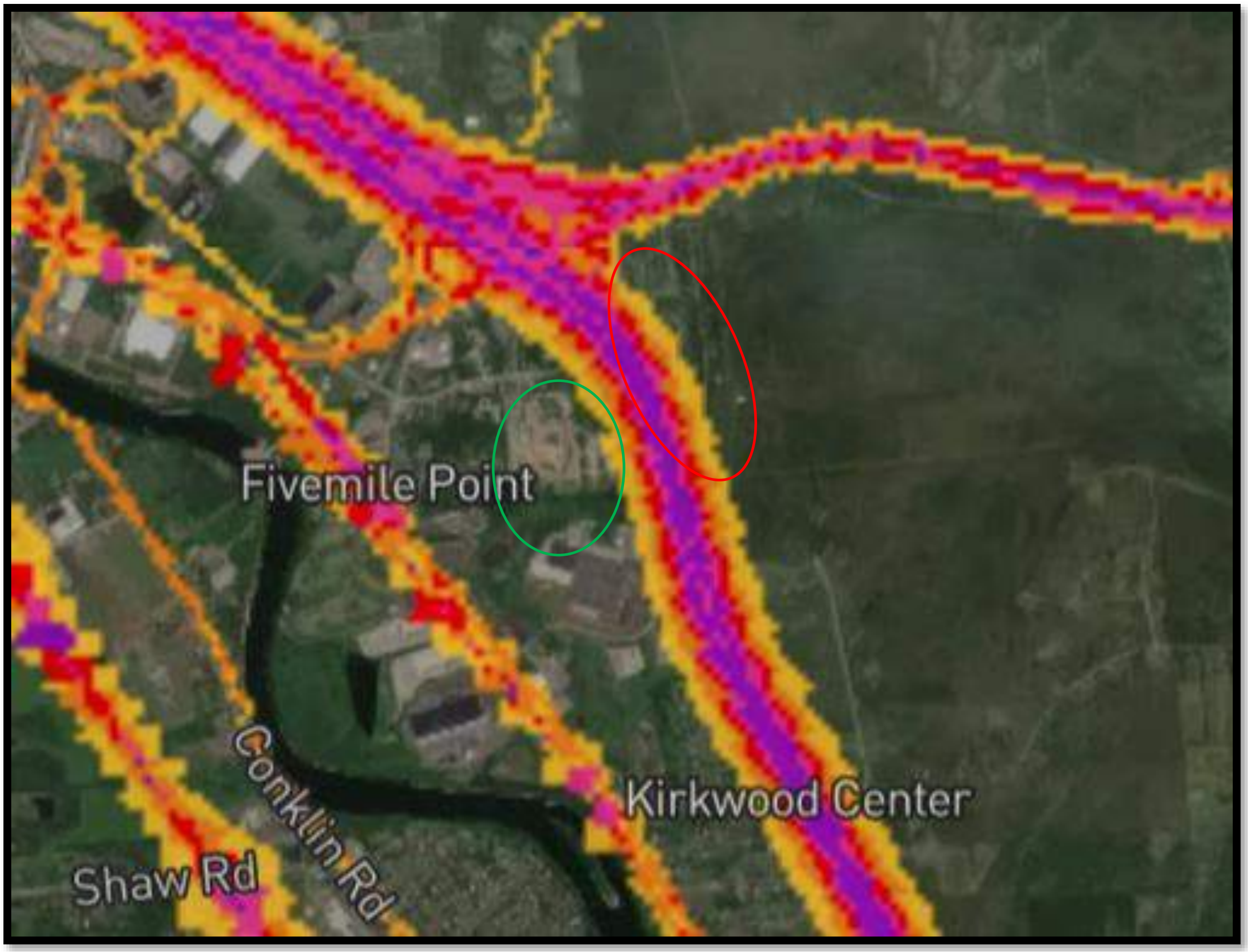

Figure 12 US DOT National Transportation (rail, air, and highway) highway noise overlay map – zoomed view of the development area and the surrounding community. The approximate development site is indicated by the green circle and the residential neighborhood on the opposite side of I-81 (the neighborhood that is most highly impacted by the Highway Noise due to proximity) by the red circle. Note that the residential neighborhoods North and West of the site are less Highway Noise imacted due to their distance but are analyzed and addressed separately in other sections of this report.

Figure 13 Transportation noise overlay map Sound Level scale.

3.2 Building Noise Barrier Effects

A rendering of one of the proposed buildings is shown in Figure 14. Note that due to the height and size of the buildings, they will behave as “noise barriers” for sound emitted in some locations as it propagates into the surrounding community.

Figure 14 proposed building rendering.

The noise barrier effects of the buildings were modeled and predicted according to US/International standards (ISO 9613). The predicted Insertion Loss (IL, the amount of noise reduction that will be provided when the building is “inserted” into the scenario). The buildings will act as noise barriers for both the pre-existing Highway Noise and for any new Truck sound that may occur onsite. Accordingly, the new buildings will actually reduce the Highway noise incident on the neighborhoods to the West of the site (the Neighborhood will have reduced highway noise and will be quieter as a result of this development.

The IL that the buildings will provide for any sound emitted in or near the dock areas (East of each building) is shown in Figure 15. The buildings will reduce any truck/dock sound emitted into the neighborhood located to the West of the buildings by as much as 25 dB(A) at the nearest locations. The IL is indicated both by the color scale and the white numbers overlaid in the Figures. Note that the IL numbers I the Figures are difficult to read due to the software and are shown in zoomed views in Figures 16 and 18 respectively.

Figure 15 Predicted Insertion Loss (IL) that will be provided by the development buildings for any sound emitted in the truck/dock areas.

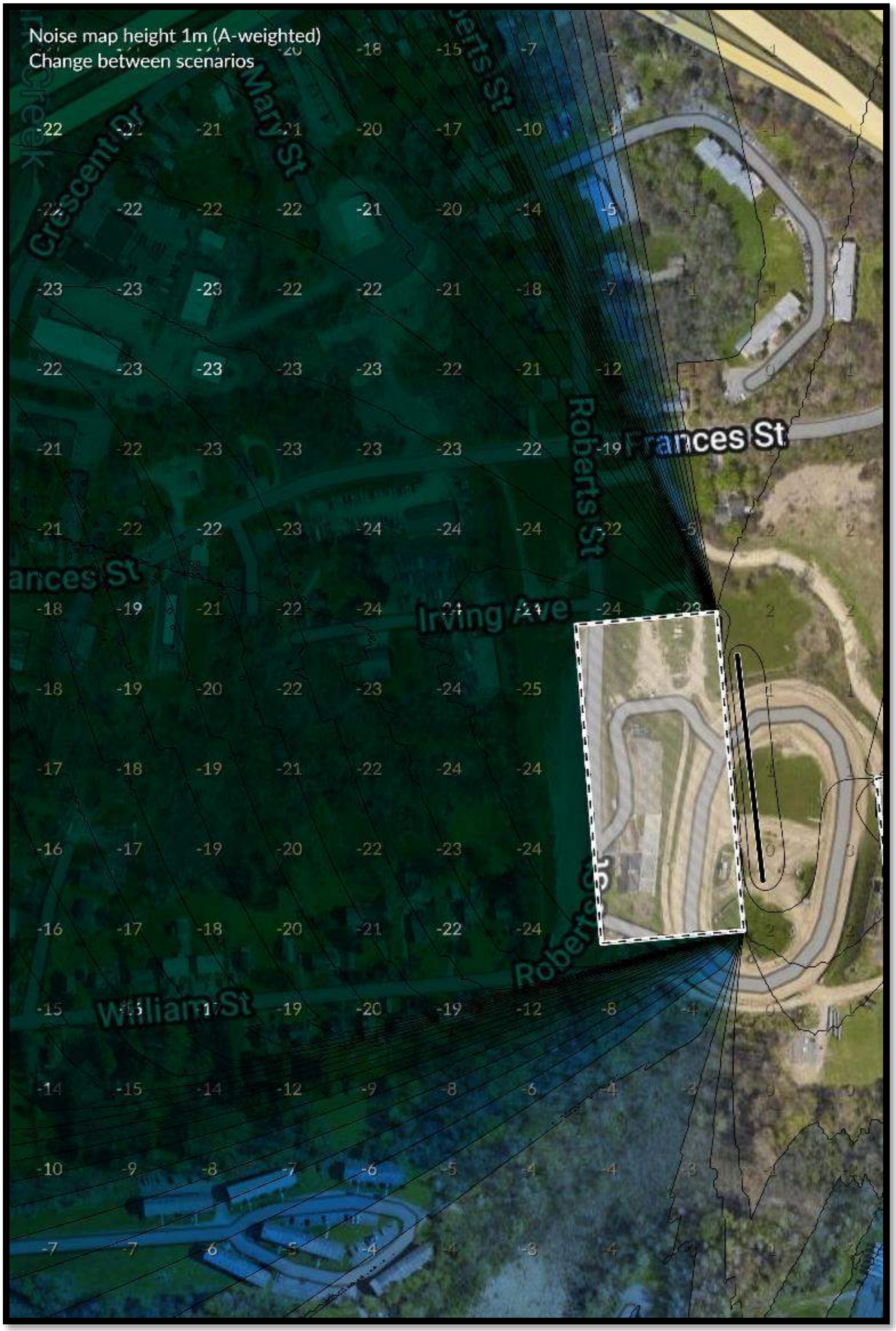

Figure 16 Zoomed view of Figure 15 highlighting the IL numbers.

The proposed buildings will also act as noise barriers to reduce the noise emitted by I-81 as it is incident on the neighborhood located West of the development. The IL that the buildings will provide for any sound emitted by I-81 (East of each building) is shown in Figure 17. The buildings will reduce the highway noise emitted into the neighborhood located to the West of the buildings by as much as 21 dB(A) at the nearest locations.

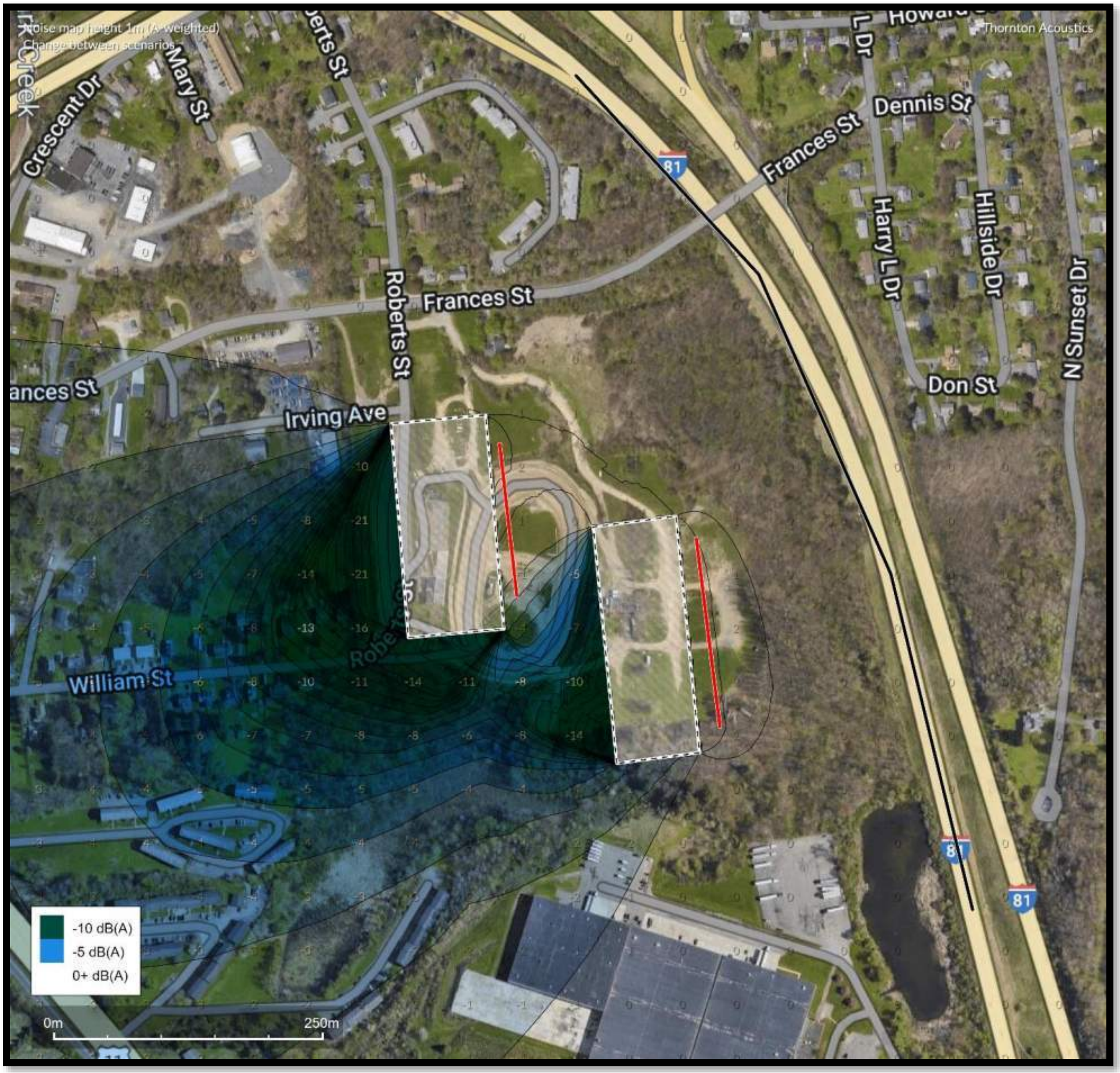

Figure 17 Predicted Insertion Loss (IL) that will be provided by the development buildings for any Highway noise emitted by I-81 to the East of the development.

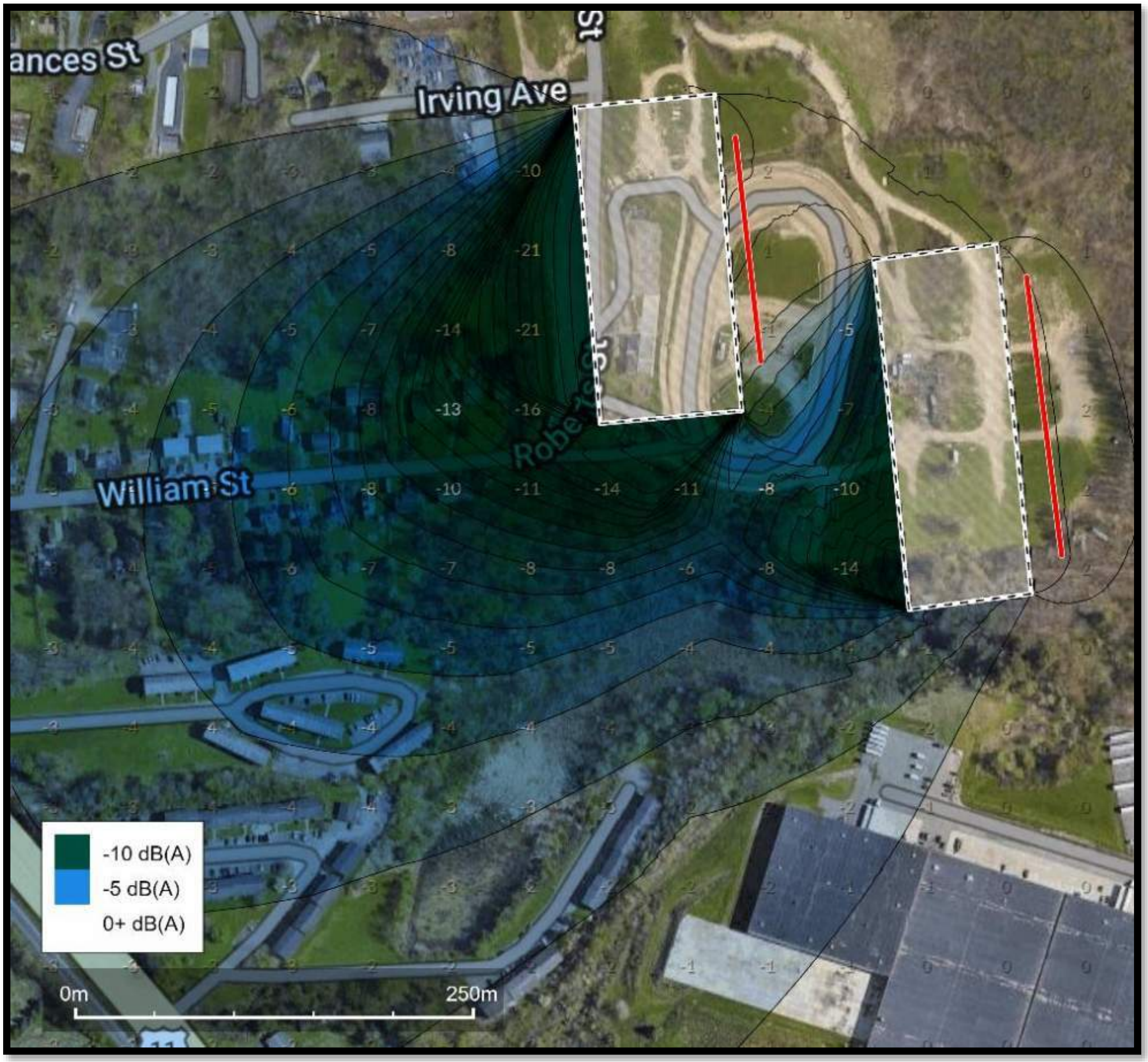

Figure 18 Zoomed view of Figure 17 highlighting the IL numbers.

4 CONCLUSIONS

The proposed development site, is governed by the Kirkwood Noise Ordinance. The site will be developed and operated in compliance with these regulations using engineering noise controls to reduce sound emissions to meet these Ordinance limits.

The site has been designed and laid out to minimize any potential sound impact on the community and will actually provide reduced Highway Noise for the communities to the West of the site due to the building Barrier Effect.

The areas surrounding the development site currently experience ambient noise levels that grossly exceed the Ordinance limits. The sound that will be emitted from the development will be significantly lower in level (quieter) than the existing ambient noise due to the combined, noise controls, barrier effects and distance to the receivers. As the sound that will be emitted by the development will be 10 dB or more, below the ambient noise, the development will NOT increase the overall community noise levels and will not have an adverse noise impact on the surrounding community and residents.

Note that the analysis in this report has focused on typical/average community noise surrounding the site. However, the Race Track that currently occupies the site routinely (on all race and practice days/nights) emits noise that is grossly in excess of typical ambient noise. The change from Racing to the proposed site use will eliminate this noise source and the corresponding routine Noise Code Violation.

Regards,

William Thornton

4.1 APPENDIX: WILLIAM D. THORNTON CV

William David Thornton
Thornton Acoustics
521 Clay Run Road, Mill Run, PA 15464
(724)400-5001
will@thorntonav.com

www.thorntonav.com

EDUCATION

Purdue University, West Lafayette, IN **2004**
M.S. Mechanical Engineering
Concentration: Acoustics and Vibrations

North Carolina State University, Raleigh, NC
B.S. Mechanical Engineering- Magna Cum Laude **2001**
Concentration: Acoustics and Vibrations

RELATED EXPERIENCE

2001-2002
Thornton Acoustics & Vibrations, Cheswick, PA
Consultant- Acoustics, Vibrations and Noise Control Consulting

Institute for Safe, Quiet and Durable Highways, Purdue University, West Lafayette, IN **2004-2005**
Researcher – Investigation and testing of experimental quiet pavement systems

Thornton Acoustics, Mill Run, PA **2005-Present**
Consultant –Engineering Acoustics, Vibration and Noise Control Consulting

PROJECTS (PARTIAL LIST OF RECENT PROJECTS)

US Air Force School of Aerospace Medicine (USAF-SAM) : Engineering services to evaluate firearms noise emissions and exposure and to reduce firearms range noise and personnel exposure

Battelle/USAF-SAM: Engineering services to model and predict the risk of personnel noise exposure/hearing damage due to firearms training (Combat Arms Training & Maintenance-CATM) noise exposure

Florida State University National High Magnetic Field Laboratory: Engineering services to reduce acoustical loading and mechanical vibration of research high field MRI facilities to achieve ultra low temperatures

Carnegie Mellon University SIBR: Acoustical engineering services to evaluate clinical noise exposure due to MRI scanning and to develop clinical hearing conservation program for human research subjects

Longview Power Project: Developed an environmental/community noise model and predictive noise study (to meet WV Public Service Commission application requirements) for a large-scale natural gas fired power plant

LITIGATION PROJECTS

Helmick v. Scranton Manufacturing, PAPI-01196: Expert witness for the defense in product liability noise case

Reynolds v. Toll Brothers: Expert witness for the plaintiff in suit against home builder due to noise defects

Scott v. Toll Brothers: Expert witness for the plaintiff in suit against home builder due to noise defects

John J. & Sandra D. Weinhofer and Matthew & Wendy Jennewine v. Laurel Mountain Midstream Operating, LLC, Case No. 5870 of 2012 (Westmoreland County): Expert witness for the plaintiffs in community noise suit.

Tramontana v. Vermilion Fish & Game: Expert witness for the plaintiffs in a community noise nuisance suit.

Danelski, et al. -v- Washington Radiology Associates, P.C.: Expert witness for the defendant in a medical injury/malpractice suit.

Terrace XV at Lakeside Greens Association, INC., v. Heritage palms Golf & Country Club, INC. Lee County FL Circuit Court Case No 17-CA-1752: Expert witness for the plaintiffs in a commercial development suit.

Board of County Road Commissioners for the County of Oakland, MI v Gingellville Community Church [FSCS-LEGAL.FID925614]: Expert witness for the defendant in an eminent domain suit.

Havens v. Red Robin INT'L, INC., Court of Common Pleas Cuyahoga County OH, Case No.: CV-18-900683: Expert witness for the defendant in a personal injury suit.

Iberdrola Energy Projects, Inc.v. Footprint Power Salem Harbor Development, LP American Arbitration Association ICDR Case No. 01-18-0001-6009: Expert witness for the defendant in a contractual suit.

COURT OF COMMON PLEAS MONTGOMERY COUNTY, OHIO: DAVID KINDEL, et al., :Plaintiffs, :vs. PIQUA STEEL CO., et al., Defendants : CASE NO. 2018 CV 05134: Expert witness for the plaintiff in an occupational noise induced hearing loss case.

JEFFERSON CIRCUIT COURT DIVISION ELEVEN (11) HON. BRIAN C. EDWARDS NO. 21-CI-006431 PATRICIA L. CHICK AND DAVID L. CHICK, ET AL., Plaintiff V. JON C. BOHNERT AND KELLY M. BOHNERT: Expert witness for the plaintiffs in a community noise suit.

TEACHING EXPERIENCE

Applied Physical Acoustics, Signal Processing & Mechanical Vibrations

PROFESSIONAL AFFILIATIONS

American Society of Mechanical Engineers (ASME)-past member
Institute of Noise Control Engineers (INCE)-past member
Acoustical Society of America-past member

PUBLICATIONS AND PAPERS (PARTIAL LIST OF PUBLICATIONS)

Dare, Tyler; Bernhard, Robert; Thornton, William. **Effects of contraction joint width, fill condition, faulting and beveling on wheel-slap noise**. Noise Control Engineering Journal, Volume 59, Number 3, 1 May 2011, pp. 228-233(6)

Thornton, William D.; Baumann, Jonathan M.; Bernhard, Robert J. **Tire construction and pavement texture effects upon tire/pavement noise generation and radiation**. INTER-NOISE and NOISE-CON Congress and Conference Proceedings, NoiseCon03, Cleveland OH, pp. 161-167(7)

Thornton, William D.; Bernhard, Robert J.; Hansen, Douglas I.; Scofield, Larry. **Acoustical variability of existing pavements**. INTER-NOISE and NOISE-CON Congress and Conference Proceedings, NoiseCon04, Baltimore MD, pp. 275-285(11)

Dare, Tyler P.; Bernhard, Robert J.; Thornton, William D**. Effects of diamond grinding and grooving on tire/pavement noise.** INTER-NOISE and NOISE-CON Congress and Conference Proceedings, NoiseCon07, Reno NV, pp. 1558-1566(9)