DEVLIN ROAD WIDENING
(UNIVERSITY BOULEVARD TO JENNELL DRIVE)

PRINCE WILLIAM COUNTY LOCALLY ADDMINISTERED PROJECT VDOT PROJECT NO.: 0621-076-605-C501, UPC 118253

BRISTOW, VA

PRELIMINARY NOISE ANALYSIS TECHNICAL REPORT

November 2021

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Prince William County Department of Transportation

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Executive Summary

This Preliminary Noise Analysis Technical Report analyzes possible future worst-case traffic noise impacts and possible abatement measures resulting from the Devlin Road Widening Project. Prince William County Department of Transportation (PWC DOT) has proposed widening of approximately 0.7 miles of Devlin Road (Route 621) from University Boulevard to Jennell Drive. The existing two-lane road would be widened to four lanes with a median, curb and gutter, a sidewalk, and a shared-use path. This project is an extension of the Balls Ford Road / Route 234 interchange project that is currently under construction.

The report conforms to the regulations and standards of the Federal Highway Administration's (FHWA) 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise (July 13, 2011) for Type I projects as well as the current Virginia Department of Transportation (VDOT) State Noise Abatement Policy. The Noise Abatement Criteria (NAC), which represent the threshold at which abatement of highway traffic noise must be considered for specific types of land uses, was used for determining traffic noise impacts as established by FHWA (23 CFR 772). 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 noise abatement criteria are approached or exceeded.

This study details the noise impact assessment for existing (2021) conditions as well as for the design year (2045) No-Build and Build conditions. Traffic on Devlin Road was determined to be the primary source of noise attributed to the traffic noise impacts within the study area. Traffic noise modeling was performed using FHWA's Traffic Noise Model (TNM) Version 2.5.

Noise impacts were predicted for the design year (2045) Build condition resulting from worst noise hour traffic noise levels approaching or exceeding the NAC. Land use in the study area is predominately single-family residential and includes a portion of outdoor use areas of the Chris Yung Elementary School.

Traffic noise levels under the Build condition would result in a total of 24 impacted receptors that represent 24 single-family residential outdoor use areas. Since the maximum increase in traffic noise levels from existing (2021) to build (2045) conditions was determined to be 4 dB, there would be no substantial traffic noise impacts (an increase of 10 dB or more) within the study area. **Table ES-1** shows the range of modeled traffic noise levels and resulting impact counts for each condition.

Table ES-1. Summary of Modeled Traffic Noise Levels and Impacted Receptors

Condition (Year)	Predicted Range of Traffic Noise Levels (dBA)	Total Impacted Receptors	Total impacted Frequent Outdoor Use Areas
Existing (2021)	32 - 66	1	1
No-Build (2045)	35 - 69	30	30
Build (2045)	35 - 68	27	27

Noise abatement measures were evaluated where future noise impacts are predicted to occur. Four noise barriers were evaluated in this report and would provide both feasible and reasonable traffic noise abatement for all 24 impacted receptors as well as for 11 non-impacted receptors.

The total length of the feasible and reasonable barriers would be approximately 4,404 feet; the height would range from 8 to 16 feet and the total surface area would be 45,365 square feet. These dimensions would result in a total cost of $1,905,330 with an assumed cost per square foot of $42, which is the statewide average in Virginia. An overview of the parameters and analysis calculations for each barrier is shown in **Table ES-2**.

Table ES-2. Summary of Noise Abatement Measures

Barrier	Insertion Loss (IL) (dBA)	Height (ft)	Total Length (ft)	Total Area (ft^2)	Impacted and Benefited / Total Impacted	Additional Benefits / Total Benefits	Area / Benefited	Cost ($42/$ft^2$)
Soundwall A	5 to 10	14 to 16	955	13,787	8 / 8	4 / 12	1,149	$579,054
Soundwall B	5 to 10	12	998	11,973	11 / 11	1 / 12	998	$502,866
Soundwall E	6 to 9	8	1,376	11,008	6 / 6	7 / 13	847	$462,336
Soundwall F	5 to 9	8	1,075	8,597	2 / 2	4 / 6	1,433	$361,074

Note:

Indicates that evaluated noise barrier meets both feasible and reasonable criteria.

During the construction phase of the proposed project, noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. Any construction noise impacts that may occur as a result of roadway construction are anticipated to be temporary in nature and would cease upon completion of the project construction phase. The contractor will be required to conform to the specifications found in VDOT's 2020 *Road and Bridge Specifications*, Section 107.16(b.3), "Noise." Adherence to this policy of establishing a maximum level of noise that construction operations can generate would reduce the potential impact of construction noise on the surrounding community.

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1.1. Project Description

Prince William County Department of Transportation (PWC DOT) has proposed widening of approximately 0.7 miles of Devlin Road (Route 621) from University Boulevard to Jennell Drive. The existing two-lane road would be widened to four lanes with a median, curb and gutter, a sidewalk, and a shared-use path. This project is an extension of the Balls Ford Road / Route 234 interchange project that is currently under construction. The project location is shown in **Figure 1-1**.

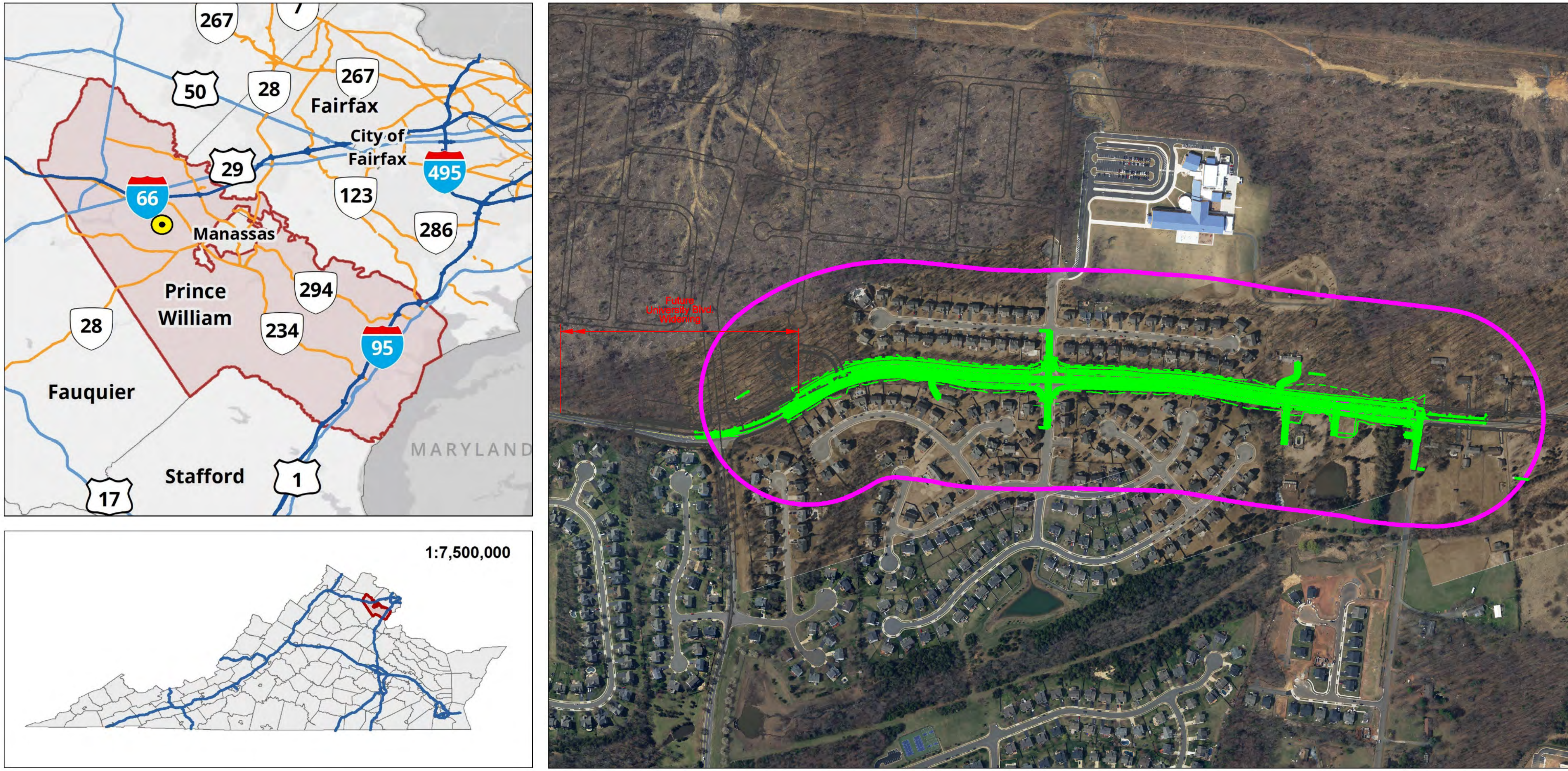
1.2. Purpose of the Preliminary Noise Analysis Technical Report

The purpose of this Preliminary Noise Analysis Technical Report is to evaluate noise impacts and abatement under the requirements of Title 23, Part 772 of the Code of Federal Regulations (23 CFR 772) "Procedures for Abatement of Highway Traffic Noise." The 23 CFR 772 regulations provide procedures for preparing operational and construction noise studies and evaluating noise abatement/mitigation considered for federal and federal-aid highway projects. According to 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with Federal Highway Administration (FHWA) noise regulations.

The report evaluated barriers for any locations where future design year build impacts were predicted to occur.

This study includes (a) short-term noise measurements; (b) roadway traffic noise modeling using FHWA's Traffic Noise Model (TNM); and (c) feasible and reasonable noise abatement measures.

Figure 1-1. Project Location Map



Devlin Road Widening
(University Blvd. to Jennell Dr.)
Preliminary Noise Analysis
Prince William County
Project Number
0621-076-605-C501
UPC 118253

VDOT

0 500 1000 FEET

Noise Study Area
Devlin Road Project
Local Roads

Figure 1-1

Devlin Road Widening
Project Location Map

2 Methodology

2.1. Federal Regulation and State Policy Compliance

The Noise Control Act of 1972 gives the US Environmental Protection Agency (USEPA) the authority to establish noise regulations to control major noise sources, including motor vehicles and construction equipment. Furthermore, the USEPA is required to set noise emission standards for motor vehicles used for interstate commerce and the FHWA is required to enforce the USEPA noise emission standards through the Office of Motor Carrier Safety. The National Environmental Policy Act (NEPA) of 1969 gives broad authority and responsibility to Federal agencies to evaluate and mitigate adverse environmental impacts caused by Federal actions. FHWA is required to comply with NEPA, including mitigating adverse highway traffic noise effects.

The Federal-Aid Highway Act of 1970 mandates FHWA to develop standards for mitigating highway traffic noise. It also requires FHWA to establish traffic noise level criteria for various types of land uses. The Act prohibits FHWA approval of federal-aid highway projects unless adequate consideration has been made for noise abatement measures to comply with the standards. FHWA regulations for highway traffic noise for federal-aid highway projects are contained in 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 CFR 772 2011). The regulations contain noise abatement criteria, which represent the threshold at which abatement of highway traffic noise must be considered for specific types of land uses. 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.

The Virginia Department of Transportation (VDOT) State Noise Abatement Policy was developed to implement the requirements of 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise, FHWA’s Highway Traffic Noise Analysis and Abatement Policy and Guidance (FHWA 2011), and the noise-related requirements of NEPA. The current VDOT State Noise Abatement Policy became effective on July 13, 2011 and was last updated on February 20, 2018 (VDOT 2018).

Under Title 23 CFR 772.7, projects are categorized as Type I, Type II, or Type III projects. Type I projects include those that create a completely new noise source, as well as those that increase the volume or speed of traffic or move the traffic closer to a receiver. Type I projects include the physical alteration of an existing highway where there is substantial horizontal alterations and the addition of through-traffic lanes. A Type II project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. Projects unrelated to increased noise levels, such as striping, lighting, signing, and landscaping projects would be considered Type III. This project would be considered a Type I project.

2.2. Sound Level Metrics

The following sections describe the necessary technical terminologies and concepts that are used when presenting and discussing the noise study analysis.

2.2.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound. In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determines the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

2.2.2. Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

2.2.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (µPa). One µPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 µPa. Because of this huge range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for humans is 0 dB, which corresponds to 20 µPa.

2.2.4. Addition of Decibels

Because decibels are logarithmic units, SPLs cannot be added or subtracted through ordinary arithmetic means. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

2.2.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz, and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an “A-weighted” sound level (expressed in units of dBA) can be computed based on this information.

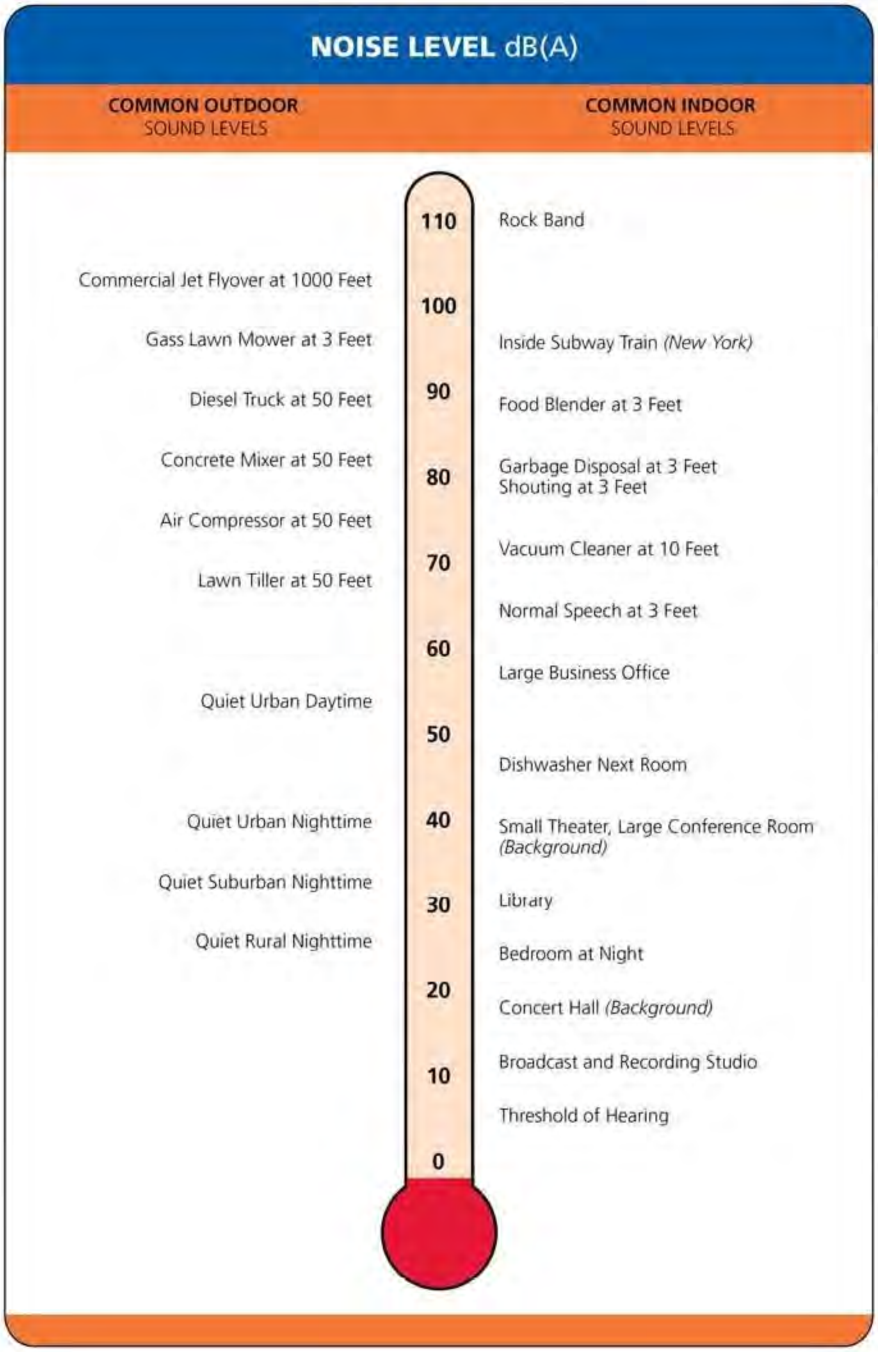
The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with highway-traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted decibels or dBA. **Figure 2-1** shows typical A-weighted noise levels for various noise sources.

2.2.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a 3-dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different than what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1-dB changes in sound levels, when exposed to steady, single-frequency (“pure-tone”) signals in the mid-frequency (1,000 Hz–8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments. Furthermore, a 5-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3-dB increase in sound would generally be perceived as barely detectable.

Figure 2-1. Typical A-Weighted Noise Levels



2.3. Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends on the following factors.

2.3.1. Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source.

2.3.2. Ground Absorption

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance.

2.3.3. Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have some effects.

2.3.4. Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. Taller barriers provide increased noise reduction.

2.4. Noise Descriptors

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously and fluctuate over time. Some fluctuations are minor, but some are substantial. Some noise levels occur in regular patterns, but others are random. Some noise levels fluctuate rapidly, but others slowly. Some noise levels vary widely, but others are relatively constant. Most environmental noise includes a conglomeration of noise from distant sources, creating a relatively steady background noise in which no particular source is identifiable. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors most commonly used in traffic noise analysis:

- **Equivalent Sound Level (L_{eq}):** L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level ($L_{eq[h]}$) is the energy average of A-weighted sound levels occurring during a one-hour period.
- **Percentile-Exceeded Sound Level (L_n):** L_n represents the sound level exceeded for a given percentage of a specified period (e.g., L_{10} is the sound level exceeded 10 percent of the time, and L_{90} is the sound level exceeded 90 percent of the time).
- **Maximum Sound Level (L_{max}):** L_{max} is the highest instantaneous sound level measured during a specified period.
- **Day-Night Level (L_{dn}):** L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.

2.5. Noise Abatement Criteria

The State Noise Abatement Policy has adopted the Noise Abatement Criteria (NAC) that have been established by FHWA (23 CFR 772) for determining traffic noise impacts for a variety of land uses. The NAC, listed in **Table 2-1** for various activities, represent threshold at which, if approached or exceeded, consideration of noise abatement is required. The NAC apply to outdoor areas having frequent human use and where lowered noise levels are desired. They do not apply to the entire tract of land on which the activity is based, but only to that portion where the activity takes place. The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). The noise impact assessment is made using the guidelines listed in Table 2-1.

Table 2-1. Activity Categories and Noise Abatement Criteria

PART 772—NOISE ABATEMENT CRITERIA (Hourly A–Weighted Sound Level decibels (dBA)[1]				
Activity Category	**Activity $L_{eq(h)}$[4]**	**Criteria[2] $L_{10(h)}$**	**Evaluation Location**	**Activity Description**
A	57	60	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[3]	67	70	Exterior	Residential.
C[3]	67	70	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	55	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[3]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F.
F	--	--	Exterior	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	--	--	Undeveloped lands that are not permitted.

[1] Either $L_{eq(h)}$ or $L_{10(h)}$ (but not both) may be used on a project.
[2] The $L_{eq(h)}$ and $L_{10(h)}$ Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
[3] Includes undeveloped lands permitted for this activity category.
[4] VDOT uses the $L_{eq(h)}$ designation

Source: 23 CFR Part 772, 2016.

2.6. Noise Impact Determination and Analysis Procedure

Traffic noise impacts, as defined in 23 CFR 772.5, occur when the predicted noise level in the design year approaches or exceeds the NAC specified in 23 CFR 772, or a predicted noise level substantially exceeds the existing noise level (a "substantial" noise increase). The terms "substantial increase" or "approach" are not specifically defined in 23 CFR 772; these criteria are defined on a state-by-state basis. Under VDOT policy, traffic noise impacts occur if either of the following two conditions is met:

- The predicted traffic noise levels (future design year) approach or exceed the NAC, as shown in Table 2-1. The VDOT State Noise Abatement Policy defines an approach level to be used when determining a traffic noise impact. The "Approach" level has been defined by VDOT as 1 dB less than the NAC for Activity Categories A to E. For example, for a Category B receptor, 66 dBA would be approaching 67 dBA and would be considered an impact. If design year noise levels “approach or exceed” the NAC, then the activity is impacted and abatement measures must be considered.

- ❖ The predicted traffic noise levels are substantially higher than the existing noise levels. A substantial noise increase has been defined by VDOT when the predicted (future design year) highway traffic noise levels exceed existing noise levels by 10 dB or more for all noise-sensitive exterior activity categories. For example, if a receptor’s existing noise level is 50 dBA, and if the future noise level is 60 dBA, then it would be considered an impact. The noise levels of the substantial increase impact do not have to exceed the appropriate NAC. Receptors that satisfy this condition warrant consideration of highway traffic noise abatement.

If a traffic noise impact is identified within the project corridor, then consideration of noise abatement measures is necessary. The final decision on whether or not to provide noise abatement along a project corridor will take into account the feasibility of the design, the reasonableness or cost-effectiveness, and input from benefited property owners.

2.7. Traffic Noise Level Prediction

2.7.1. Highway Noise Computation Model

Since roadway noise can be determined accurately through computer modeling techniques for areas that are dominated by roadway traffic, design year traffic noise calculations have been predicted using FHWA’s Traffic Noise Model (TNM) Version 2.5. The TNM was developed and sponsored by the U. S. Department of Transportation and John A. Volpe National Transportation Systems Center, Acoustics facility. The TNM estimates vehicle noise emissions and resulting noise levels based on reference energy mean emission levels. The existing and proposed alignments (horizontal and vertical) are input into the model, along with the receptor locations, traffic volumes of cars, medium trucks (vehicles with 2 axles and 6 tires), heavy trucks, average vehicle speeds, pavement type, and any traffic control devices. The TNM uses its acoustic algorithms to predict noise levels at the selected receptor locations by taking into account sound propagation variables, such as atmospheric absorption, divergence, intervening ground, barriers, and building rows (FHWA, 2004).

TNM input is based on a three-dimensional grid created for the study area to be modeled. All roadways, barriers, terrain lines, and receiver points are defined by x, y, and z coordinates. Receptors, defined as single points, are typically located at frequent outdoor use areas such as residences, playgrounds, and golf courses. Roadways, terrain lines, and barriers are coded into TNM as line segments defined by a series of points. A series of line segments that represent a particular modeling feature is often referred as a “line string”. Line strings are created for all pertinent roadways and distinguishing terrain features within the study area. To obtain the elevations for existing areas, line strings are draped onto three dimensional (3D) digital terrain map files. The line strings are then extracted from the design files and imported into TNM. Elevations for proposed roadways are extracted from the proposed plan and profile data.

2.7.2. Modeling Assumptions and Considerations

Receptors were modeled at a height of 5 feet above the corresponding elevation of their represented frequent outdoor use area, namely the backyards of residential properties. The propagation path between source and receiver is modeled in TNM by specifying special terrain features and building structures. Propagation of noise can be further specified by selecting ground types such as hard soil, loose soil, pavement, lawn, and field grass. The lawn option was chosen as the overall ground type for this study because other than roads, the study area is grassy and vegetated.

2.7.3. Traffic Volumes and Flow Control

Traffic noise is a function of traffic volumes and traffic speed. Noise increases with speed and higher volumes of traffic. However, at higher volumes, speed decreases (stop and go), so the worst-case traffic noise levels are experienced when there is a balance between the volume and speed also referred to as Level of Service (LOS) C traffic conditions. Since TNM produces hourly L_{eq} values, all traffic inputs are based on hourly traffic volumes. In order to determine the noise levels generated by traffic, the TNM computer program requires inputs of traffic volumes, speeds, and vehicle types. The source of the volumes and speeds used for the noise analysis as well as the determination of the worst noise hour is discussed in the next section.

Traffic volumes and vehicle type percentages were provided by Prince William County for the Existing (2021), future No-Build (2045) and future Build (2045) conditions. The Average Annual Daily Traffic, k-factor, and directional split values from the traffic data was used to calculate the peak hour to produce the worst-case noise hour for Devlin Road and University Boulevard. ***Appendix C*** presents the comprehensive listing of the worst noise hour traffic volumes, speeds, and traffic distribution per direction of travel used for the noise analysis for the Existing, No-Build, and Build conditions.

3 Existing Noise Environment

A field investigation was conducted to identify frequent outdoor use areas that could be subject to traffic noise impacts from the proposed project. Noise monitoring was also conducted in order to develop a comparison between the monitored results and the output obtained from the noise prediction model. This exercise was performed to validate the model so that it could be used with confidence to predict the worst hour traffic noise levels for the existing and future conditions. Short-term noise measurements of 20 minutes in duration were conducted at a total of four sites on June 23, 2021 within the project corridor. All four of the short-term measurements were conducted with simultaneous traffic recordings for noise model validation purposes. The short-term noise measurements were conducted during free flow traffic conditions.

3.1. Noise Measurement Procedure

Noise measurements were conducted in conformance with the guidelines outlined in the FHWA's "Measuring of Highway Related Noise," FHWA-DP-96-046. The following are brief descriptions of the measurement procedures used for this project:

- ❖ Microphones were primarily placed approximately 5 feet above the ground and were positioned more than 10 feet from any wall or building to prevent reflections or unrepresentative shielding of the noise where possible.
- ❖ Sound level meters were calibrated before and after each set of measurements.
- ❖ Following the calibration of equipment, a windscreen was placed over the microphone.
- ❖ Frequency weighting was set on "A", and the slow detector response was selected.
- ❖ Results of the short-term noise measurements were recorded on data sheets in the field.
- ❖ Traffic was counted during the short-term measurements for model validation. Vehicle types were separated into three vehicle groups: automobiles, medium trucks (2-axle with 6-wheels but not including dually pick-up trucks), and heavy trucks (3 or more axle vehicles). Average traffic speeds were determined by pacing the traffic before and/or after the measurement.
- ❖ Wind speed, temperature, humidity, and sky conditions were observed and documented during the short-term noise measurements.

The instruments used for the noise measurements included the following:

- ❖ Sound Level Meter – Larson Davis model 812.
- ❖ Larson Davis 812 Transducer Components – Larson Davis model PRM828 microphone preamp; PCB model 2559, ½-inch pressure microphone.

- ❖ Acoustic Field Calibrators – Larson Davis model CA250 constant pressure microphone calibrator.
- ❖ 4-inch diameter windscreen and tripods.
- ❖ Wind Monitor/Temperature and Humidity Gauge – Kestrel 3000 Pocket Weather Meter.

Documentation of the short-term measurements, graphs, site photographs, and equipment certifications are located in ***Appendix B***.

NOTE: Short-term noise monitoring is not a process to determine design year noise impacts or barrier locations. Short-term noise monitoring provides a level of consistency between what is present in real-world situations and how that is represented in the computer noise model. Short-term monitoring does not need to occur within every Common Noise Environment (CNE) to validate the computer noise model.

3.2. Noise Measurement Results

The dominant source of noise for all short-term measurement sites was traffic on Devlin Road. Project layout plans shown in Figures 1 and 2 in ***Appendix A*** present the measurement locations and the CNE designations. A CNE is defined as a group of receptors that share similar noise sources, traffic variables, and topographic features. Results for the short-term measurements are presented in **Table 3-1**.

Table 3-1. Short-Term Noise Measurement Results

Site No.	Street Address, City	CNE	Land Use	Meas. Date	Start Time	Meas. L_{eq}, dBA[1]
ST1	8681 Night Watch Court	A	Residential	6/23/2021	10:00 AM	61.5
ST2	8617 Placid Lake Court	B	Residential	6/23/2021	9:20 AM	62.3
ST3	12620 Tide View Court	E	Residential	6/23/2021	10:00 AM	55.3
ST4	8506 Trade Wind Court	F	Residential	6/23/2021	9:20 AM	63.9

Note:

1. All short-term measured noise levels are 20-minute L_{eq}.

3.3. Traffic Noise Model Validation

Measurement data at the four short-term sites were used for model validation. During the validation measurements, traffic volumes on Devlin Road were concurrently recorded. Traffic speeds were determined to match the posted speed of 45 mph by driving with traffic before and after the measurement period. The traffic counts were tabulated according to vehicle types, including automobiles, medium trucks (2-axle with 6-wheels but not including dually pick-up trucks), and heavy trucks (3 or more axle vehicles). Traffic volumes were normalized to 1-hour after counting the traffic during the measurement periods by reviewing simultaneous video recordings of traffic. These normalized volumes were assigned to the corresponding roadways within the project area to simulate the noise source strength at the roadways during the actual measurement periods. After inputting the traffic counts, site geometry, and any other pertinent existing features, noise levels at the validation sites were calculated in the TNM software. **Table 3-2** presents the results of the model validation. Traffic volumes collected during the validation measurements are included in ***Appendix C.***

Table 3-2. Noise Model Validation Results

Measurement Site	Date	Start Time	Noise Levels, $L_{eq(h)}$, dBA		Deviation, dB (Modeled - Measured)	Applied Adjustment, dB
			Measured	Modeled		
ST1	06/23/21	10:00	61.5	59.7	-1.8	0.0
ST2	06/23/21	9:20	62.3	61.5	-0.8	0.0
ST3	06/23/21	10:00	55.3	57.8	2.5	0.0
ST4	06/23/21	9:20	63.9	63.8	-0.1	0.0

Source: Parsons 2021.

According to VDOT's *Highway Traffic Noise Impact Analysis Guidance Manual*, the difference between measured and modeled values must lie within ±3 dB to fall within the accepted level of accuracy. Differences greater than ±3 dB require that both the observed and predicted data be carefully examined to determine the reason(s) for the margin of error (VDOT, 2018). Because the difference between measured and modeled values fall within ±3 dB, the noise model is within the accepted level of accuracy. [Note: Measurement site ST3 was the only site where a wooden fence was located between the receptor and the roadway, which is most likely the cause of traffic noise levels being lower at that site compared to the other measurement sites.]

3.4. Undeveloped Lands and Permitted Developments

Highway traffic noise analyses are performed for developed lands as well as undeveloped lands if they are considered "permitted." Undeveloped lands are deemed to be permitted when there is a definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of at least one building permit.

In accordance with the VDOT Traffic Noise Policy, an undeveloped lot is considered to be planned, designed, and programmed if a building permit has been issued by the local authorities prior to the Date of Public Knowledge for the relevant project. VDOT considers the "Date of Public Knowledge" as the date that the final NEPA approval is made. VDOT has no obligation to provide noise mitigation for any undeveloped land that is permitted or constructed after this date. There are no undeveloped parcels within the study limits of this project that have filed building permits at the time of this study. Appendix E shows the correspondence with the County confirming that there were no issued building permits for a future subdivision to be located south of CNE A.

3.5. Common Noise Environment (CNE) Determination and Existing Noise Setting

This section outlines the CNEs within the project area that contain all of the noise sensitive receptors within at least 500 feet of the proposed project limits that were considered for evaluation of traffic noise analysis. A CNE is defined as a group of receptors that share similar noise sources, traffic variables, and topographic features. Seven CNE areas were determined to be present within the study area.

Land use in the study area is predominately single-family residential and includes a portion of outdoor use areas of the Chris Yung Elementary School. Modeled noise receptors were placed at the frequent outdoor use areas of the residential properties and elementary school property. Some of the residential properties had patios or balconies on the second floor in addition to the backyards at ground level. In such cases, both receptors were considered in the analysis. However, only a single dwelling unit per property was counted at these residences with more than one outdoor use area (NAC Category B land use allows for one dwelling unit per single family residential property).

Tables 4-1 in the next section presents the existing (2021) noise levels for all sites. Traffic noise levels under the existing condition are predicted to range from 32 to 66 dBA and would not result in any impacted receptors.

CNE A

CNE A is located along the southbound lanes of Devlin Road south of Fog Light Way and contains 35 receptors (A1 through A25), representing 25 single-family residences. The dominant noise sources within CNE A is traffic on Devlin Road. The existing condition (2021) noise levels are predicted to range from 32 to 63 dBA. Traffic noise impacts are not predicted for this CNE under the existing condition (2021).

CNE B

CNE B is located along the southbound lanes of Devlin Road north of Fog Light Way and contains 34 receptors (B1 through B25), representing 25 single-family residences. The dominant noise sources within CNE B is traffic on Devlin Road. The existing condition (2021) noise levels are predicted to range from 32 to 64 dBA. Traffic noise impacts are not predicted for this CNE under the existing condition (2021).

CNE C

CNE C is located along the southbound lanes of Devlin Road north of Fog Light Way and contains five receptors (C1 through C5), representing five single-family residences. These residences are on larger lots and are offset from Devlin Road further than those in CNE B. The dominant noise sources within CNE C is traffic on Devlin Road. The existing condition (2021) noise levels are predicted to range from 48 to 51 dBA. Traffic noise impacts are not predicted for this CNE under the existing condition (2021).

CNE D

CNE D is located along the southbound lanes of Devlin Road north of Fog Light Way and contains four receptors (D1 through D4), representing the open area of the Chris Yung Elementary School. The dominant noise sources for CNE D is traffic on Devlin Road. The existing condition (2021) noise levels are predicted to range from 35 to 40 dBA. Traffic noise impacts are not predicted for this CNE under the existing condition (2021).

CNE E

CNE E is located along the northbound lanes of Devlin Road from University Boulevard to Pike Branch and contains 38 receptors (E1 through E38), representing 38 single-family residences. The dominant noise sources within CNE E is traffic on Devlin Road and University Boulevard. The existing condition (2021) noise levels are predicted to range from 36 to 65 dBA. Traffic noise impacts are not predicted for this CNE under the existing condition (2021).

CNE F

CNE F is located along the northbound lanes of Devlin Road north of Pike Branch and contains 32 receptors (F1 through F32), representing 32 single-family residences. The dominant noise sources within CNE F is traffic on Devlin Road. The existing condition (2021) noise levels are predicted to range from 35 to 66 dBA. A traffic noise impact for Receptor F10 which represents one single family residence was predicted to occur for this CNE under the existing condition (2021).

CNE G

CNE G is located along the northbound lanes of Devlin Road north of Pike Branch and contains six receptors (G1 through G6), representing six single-family residences. These residences are on large lots and are offset from Devlin Road similar to those in CNE C. The dominant noise sources within CNE G is traffic on Devlin Road and Jennell Drive. The existing condition (2021) noise levels are predicted to range from 49 to 54 dBA. Traffic noise impacts are not predicted for this CNE under the existing condition (2021).

4 Future Noise Environment, Impacts, and Noise Abatement Determination

This section presents predicted worst noise hour traffic noise levels within the project area under the No-Build and Build Alternative. An analysis with barrier heights ranging from 6 to 20 feet was conducted for the potentially impacted areas. Analysis for barriers above 20 feet was not considered because all impacted receptor sites are located at ground elevation and analysis showed that additional benefits could not be gained by heights above 20 feet. The worst noise hour traffic noise levels for the design year were predicted using TNM.

4.1. Traffic Noise Impacts

Table 4-1 presents the calculated noise levels for noise sensitive sites for the worst noise hour under existing, No-Build, and Build conditions in design year 2045. Traffic noise levels under No-Build conditions are predicted to range between 35 and 69 dBA and range between 35 and 68 dBA under Build conditions in design year 2045.

Some of the residential properties in CNE A and CNE B have more than one exterior frequent outdoor use area where both ground level patios and second story balconies are present. Where this occurs Receptor labels use the format CNE#.Receptor#.Floor#. If both receptors were determined to be impacted in the Build scenario, the abatement analysis attempted to provide feasible abatement for both receptors. There would be a total of 45 receptors that are representative of 30 residential properties that would be impacted under No-Build conditions. There would be a total of 34 receptors that are representative of 27 residential properties that would be impacted under Build conditions.

Since the maximum increase in traffic noise levels from existing conditions to build conditions throughout the entire project area was determined to be 5 dB, there would be no substantial traffic noise impacts (an increase of 10 dB or more) within the study area. Figures 1 and 2 in ***Appendix A*** show the predicted 66 dBA contours for Build conditions.

CNE A

Noise levels under both Future design year (2045) No Build and Build conditions are predicted to range from 35 to 67 dBA. Eight single-family residential properties (Receptors A2, A3.2, A5.2, A6.2, A7.2, A8, A10.2, and A11.2) are predicted to experience noise impacts due to levels exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figure 1 in ***Appendix A*** shows CNE A.

CNE B

Noise levels under Future design year (2045) No Build and Build conditions are predicted to range from 36 to 67 dBA and from 35 to 68 dBA, respectively. Eleven single-family residential properties (Receptors B1.2, B2.2, B3.2, B4, B6, B7, B8, B9, B10, B11, B12) are predicted to experience noise impacts due to levels exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figures 1 and 2 in ***Appendix A*** show CNE B.

CNE C

Noise levels under Future design year (2045) No Build and Build conditions are predicted to range from 52 to 54 dBA and from 51 to 53 dBA, respectively. There are no sites that are predicted to experience noise impacts due to levels approaching or exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figure 2 in ***Appendix A*** shows CNE C.

CNE D

Future design year (2045) No Build and Build noise levels are predicted to range from 39 to 44 dBA and from 38 to 44 dBA, respectively. There are no sites that are predicted to experience noise impacts due to levels approaching or exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figure 2 in ***Appendix A*** shows CNE D.

CNE E

Noise levels under Future design year (2045) No Build and Build conditions are predicted to range from 40 to 69 dBA and from 40 to 67 dBA, respectively. There would be six impacted receptors (Receptors E1, E2, E5, E6, E12, and E16) representing single-family residences that are predicted to experience noise impacts due to levels approaching or exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figure 1 in ***Appendix A*** shows CNE E.

CNE F

Noise levels under Future design year (2045) No Build and Build conditions are predicted to range from 38 to 69 dBA and from 39 to 68 dBA, respectively. There would be two impacted receptors (Receptors F10 and F11) representing single-family residences that are predicted to experience noise impacts due to levels approaching or exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figures 1 and 2 in ***Appendix A*** show CNE F.

CNE G

Future design year (2045) No Build and Build noise levels are both predicted to range from 53 to 57 dBA. There are no sites that are predicted to experience noise impacts due to levels approaching or exceeding the NAC under the future design year (2045) Build condition. None of the sites are predicted to be impacted under the substantial increase criterion. Figure 2 in ***Appendix A*** shows CNE G.

Table 4-1. Predicted Traffic Noise Levels

Receptor Number*	NAC	Land Use	No. of Dwelling Units	Predicted Noise Levels (dBA)			Noise Abatement Criteria**	Abatement Considered
				Existing Condition (2021)	No Build Condition (2045)	Build Condition (2045)		
CNE A								
A1.1	B	Residential	1	60	64	63	66	Yes
A1.2	B	Residential	--	61	65	65	66	Yes
A2.1	B	Residential	1	64	67	67	66	Yes
A2.2	B	Residential	--	63	67	67	66	Yes
A3.1	B	Residential	--	62	66	65	66	Yes
A3.2	B	Residential	1	62	66	66	66	Yes
A4	B	Residential	1	63	66	65	66	Yes
A5.1	B	Residential	--	63	66	65	66	Yes
A5.2	B	Residential	1	62	66	66	66	Yes
A6.1	B	Residential	--	62	66	64	66	Yes
A6.2	B	Residential	1	62	66	66	66	Yes
A7.1	B	Residential	--	63	66	65	66	Yes
A7.2	B	Residential	1	62	66	66	66	Yes
A8.1/ST1	B	Residential	1	63	66	66	66	Yes
A8.2	B	Residential	--	62	66	66	66	Yes
A9	B	Residential	1	62	66	65	66	Yes
A10.1	B	Residential	--	62	66	65	66	Yes
A10.2	B	Residential	1	62	66	66	66	Yes
A11.1	B	Residential	--	62	66	65	66	Yes
A11.2	B	Residential	1	62	66	66	66	Yes
A12.1	B	Residential	--	62	65	64	66	No
A12.2	B	Residential	1	62	65	65	66	No
A13	B	Residential	1	50	53	53	60	No
A14	B	Residential	1	45	49	48	55	No
A15	B	Residential	1	34	38	38	44	No
A16	B	Residential	1	35	38	39	45	No
A17	B	Residential	1	33	36	36	43	No
A18	B	Residential	1	32	36	36	42	No
A19	B	Residential	1	32	35	35	42	No

Receptor Number*	NAC	Land Use	No. of Dwelling Units	Predicted Noise Levels (dBA)			Noise Abatement Criteria**	Abatement Considered
				Existing Condition (2021)	No Build Condition (2045)	Build Condition (2045)		
A20	B	Residential	1	32	35	35	42	No
A21	B	Residential	1	32	36	36	42	No
A22	B	Residential	1	34	37	37	44	No
A23	B	Residential	1	33	36	36	43	No
A24	B	Residential	1	34	38	37	44	No
A25	B	Residential	1	36	39	39	46	No
CNE B								
B1.1	B	Residential	--	63	66	65	66	Yes
B1.2	B	Residential	1	62	66	66	66	Yes
B2.1	B	Residential	--	62	66	65	66	Yes
B2.2	B	Residential	1	62	66	66	66	Yes
B3.1	B	Residential	--	62	65	64	66	Yes
B3.2	B	Residential	1	62	66	66	66	Yes
B4.1	B	Residential	1	63	66	66	66	Yes
B4.2	B	Residential	--	63	66	66	66	Yes
B5	B	Residential	1	62	66	65	66	Yes
B6	B	Residential	1	63	66	66	66	Yes
B7.1	B	Residential	1	63	67	66	66	Yes
B7.2	B	Residential	--	63	66	66	66	Yes
B8.1	B	Residential	1	64	67	67	66	Yes
B8.2	B	Residential	--	63	66	67	66	Yes
B9.1/ST2	B	Residential	1	64	67	68	66	Yes
B9.2	B	Residential	--	63	66	67	66	Yes
B10	B	Residential	1	63	67	67	66	Yes
B11	B	Residential	1	64	67	67	66	Yes
B12.1	B	Residential	1	64	67	68	66	Yes
B12.2	B	Residential	--	64	67	68	66	Yes
B13.1	B	Residential	1	59	63	62	66	No
B13.2	B	Residential	--	60	63	63	66	No
B14	B	Residential	1	34	38	38	44	No
B15	B	Residential	1	34	38	37	44	No
B16	B	Residential	1	33	36	36	43	No
B17	B	Residential	1	32	36	35	42	No
B18	B	Residential	1	33	36	36	43	No
B19	B	Residential	1	33	36	36	43	No
B20	B	Residential	1	34	37	37	44	No

Receptor Number*	NAC	Land Use	No. of Dwelling Units	Predicted Noise Levels (dBA)			Noise Abatement Criteria**	Abatement Considered
				Existing Condition (2021)	No Build Condition (2045)	Build Condition (2045)		
B21	B	Residential	1	34	37	37	44	No
B22	B	Residential	1	38	41	42	48	No
B23	B	Residential	1	38	41	41	48	No
B24	B	Residential	1	41	44	45	51	No
B25	B	Residential	1	49	52	53	59	No
CNE C								
C1	B	Residential	1	48	52	52	58	No
C2	B	Residential	1	48	52	51	58	No
C3	B	Residential	1	50	53	53	60	No
C4	B	Residential	1	50	53	53	60	No
C5	B	Residential	1	51	54	52	61	No
CNE D								
D1	C	School	1	35	39	38	45	No
D2	C	School	1	36	39	39	46	No
D3	C	School	1	37	41	41	47	No
D4	C	School	1	40	44	44	50	No
CNE E								
E1	B	Residential	1	65	69	66	66	Yes
E2	B	Residential	1	65	69	67	66	Yes
E3	B	Residential	1	60	63	63	66	Yes
E4	B	Residential	1	60	63	64	66	Yes
E5	B	Residential	1	63	66	66	66	Yes
E6	B	Residential	1	65	68	67	66	Yes
E7/ST3	B	Residential	1	61	64	64	66	Yes
E8	B	Residential	1	62	66	64	66	Yes
E9	B	Residential	1	60	63	62	66	Yes
E10	B	Residential	1	52	56	56	62	Yes
E11	B	Residential	1	50	53	53	60	Yes
E12	B	Residential	1	62	66	67	66	Yes
E13	B	Residential	1	59	62	62	66	Yes
E14	B	Residential	1	60	64	64	66	Yes
E15	B	Residential	1	61	64	65	66	Yes
E16	B	Residential	1	62	65	66	66	Yes
E17	B	Residential	1	56	57	56	66	No
E18	B	Residential	1	59	60	59	66	No
E19	B	Residential	1	62	65	62	66	No

Receptor Number*	NAC	Land Use	No. of Dwelling Units	Predicted Noise Levels (dBA)			Noise Abatement Criteria**	Abatement Considered
				Existing Condition (2021)	No Build Condition (2045)	Build Condition (2045)		
E20	B	Residential	1	56	59	57	66	No
E21	B	Residential	1	47	50	49	57	No
E22	B	Residential	1	41	44	44	51	No
E23	B	Residential	1	38	41	41	48	No
E24	B	Residential	1	40	42	42	50	No
E25	B	Residential	1	40	43	43	50	No
E26	B	Residential	1	45	49	47	55	No
E27	B	Residential	1	45	48	48	55	No
E28	B	Residential	1	44	48	48	54	No
E29	B	Residential	1	40	43	44	50	No
E30	B	Residential	1	40	43	43	50	No
E31	B	Residential	1	39	43	43	49	No
E32	B	Residential	1	38	41	42	48	No
E33	B	Residential	1	39	43	43	49	No
E34	B	Residential	1	41	44	45	51	No
E35	B	Residential	1	36	40	40	46	No
E36	B	Residential	1	40	43	43	50	No
E37	B	Residential	1	43	46	46	53	No
E38	B	Residential	1	44	48	47	54	No
CNE F								
F1	B	Residential	1	57	60	60	66	No
F2	B	Residential	1	50	54	54	60	No
F3	B	Residential	1	56	59	59	66	No
F4	B	Residential	1	59	62	62	66	No
F5	B	Residential	1	57	60	60	66	No
F6	B	Residential	1	55	58	58	65	No
F7	B	Residential	1	51	54	54	61	No
F8	B	Residential	1	47	50	51	57	No
F9	B	Residential	1	50	53	53	60	No
F10/ST4	B	Residential	1	66	69	68	66	Yes
F11	B	Residential	1	64	68	67	66	Yes
F12	B	Residential	1	58	61	62	66	No
F13	B	Residential	1	43	46	47	53	No
F14	C	Recreation	1	44	48	48	54	No
F15	C	Recreation	1	42	46	46	52	No
F16	B	Residential	1	42	45	45	52	No

Receptor Number*	NAC	Land Use	No. of Dwelling Units	Predicted Noise Levels (dBA)			Noise Abatement Criteria**	Abatement Considered
				Existing Condition (2021)	No Build Condition (2045)	Build Condition (2045)		
F17	B	Residential	1	37	40	40	47	No
F18	B	Residential	1	39	43	43	49	No
F19	B	Residential	1	39	43	43	49	No
F20	B	Residential	1	36	39	40	46	No
F21	B	Residential	1	35	38	39	45	No
F22	B	Residential	1	40	43	43	50	No
F23	B	Residential	1	53	56	57	63	No
F24	B	Residential	1	52	56	56	62	No
F25	B	Residential	1	48	51	52	58	No
F26	B	Residential	1	46	49	50	56	No
F27	B	Residential	1	44	47	48	54	No
F28	B	Residential	1	42	45	46	52	No
F29	B	Residential	1	40	43	43	50	No
F30	B	Residential	1	41	44	44	51	No
F31	B	Residential	1	45	48	49	55	No
F32	B	Residential	1	42	46	46	52	No
CNE G								
G1	B	Residential	1	54	57	57	64	No
G2	B	Residential	1	52	56	55	62	No
G3	B	Residential	1	49	53	53	59	No
G4	B	Residential	1	49	53	53	59	No
G5	B	Residential	1	50	54	53	60	No
G6	B	Residential	1	50	54	54	60	No
Number of Impacted Sites								
				Existing	**No Build**	**Build**		
				1	**30**	**27**		
Range of Predicted Noise Levels								
				Existing	**No Build**	**Build**		
			Min ->	**32**	**35**	**35**		
			Max ->	**66**	**69**	**68**		

Notes:

* Some residential properties have additional outdoor use areas at the second story. Receptor labels use the format CNE#.Receptor#.Floor#.

** Criteria based on NAC or substantial increase, whichever is lower.

Indicates noise impact.

4.2. Noise Abatement Determination

The progression of noise abatement determination follows three phases where each must be considered and satisfied before proceeding further.

4.2.1. Warranted Criterion

This first phase of the process is to determine if highway traffic noise abatement consideration is warranted for the affected land uses and/or the affected receptors. In order to make a determination that a noise impact exists, one of the following conditions must be met:

- ❖ Predicted highway traffic noise levels (for the design year) approach or exceed the highway traffic noise abatement criteria in Table 2-1. “Approach” has been defined by VDOT as 1 dB below the noise abatement criteria.
- ❖ A substantial noise increase has been defined by VDOT as a 10 dB increase above existing noise levels for all noise-sensitive exterior activity categories. A 10 dB increase in noise reflects the generally accepted range of a perceived doubling of the loudness.

Receptors that satisfy either of these conditions warrant consideration of highway traffic noise abatement.

4.2.2. Feasibility Criteria for Noise Barriers

To determine feasibility of a highway traffic noise barrier, the following two conditions shall be considered:

- ❖ At least a 5 dB highway traffic noise reduction at impacted receptors. Per 23 CFR 772, FHWA requires the highway agency to determine the number of impacted receptors required to achieve at least 5 dB of reduction. VDOT requires that fifty percent (50%) or more of the impacted receptors experience 5 dB or more of insertion loss to be feasible.
- ❖ The determination that it is possible to design and construct the noise abatement measure. The factors related to the design and construction include: safety, barrier height, topography, drainage, utilities, and maintenance of the abatement measure, maintenance access to adjacent properties, and general access to adjacent properties (i.e. arterial widening projects).

4.2.3. Reasonableness Criteria for Noise Barriers

Noise barrier reasonableness is determined by assessing multiple issues including:

- ❖ The viewpoints of the benefited receptors;
- ❖ Cost effectiveness value, based on a square foot cost ceiling (maximum square footage of abatement per benefited receptor); and

- ❖ Noise reduction design goal of 7 dB of insertion loss for at least one impacted receptor.

Typically, the limiting factor related to barrier reasonableness is the cost effectiveness value, where the total surface area of the barrier is divided by the number of benefited receptors receiving at least a 5 dB reduction in noise level. VDOT's approved cost is based on a maximum square footage of abatement per benefited receptor. VDOT's noise barrier cost effectiveness value is 1,600 square feet per benefited receptor.

4.3. Alternative Abatement Measures

VDOT guidelines recommend a variety of mitigation measures that should be considered in response to transportation-related noise impacts. While noise barriers and/or earth berms are generally the most effective form of noise mitigation, additional mitigation measures exist that have the potential to provide considerable noise reductions, under certain circumstances. Mitigation measures considered for this project included:

- ❖ Traffic management;
- ❖ Alignment modifications;
- ❖ Acoustical insulation of public use and non-profit facilities;
- ❖ Buffer lands;
- ❖ Construction of noise barriers; and
- ❖ Construction of earth berms.

Additionally, the Noise Policy Code of Virginia (HB 2577, as amended by HB 2025) "*Requires that whenever the Commonwealth Transportation Board or the Department plan for or undertake any highway construction or improvement project and such project includes or may include the requirement for the mitigation of traffic noise impacts, first consideration should be given to the use of noise reducing design and low noise pavement materials and techniques in lieu of construction of noise walls or sound barriers. Vegetative screening, such as the planting of appropriate conifers, in such a design would be utilized to act as a visual screen if visual screening is required.* Consideration will be given to these measures during the final design stage, where feasible.

Each of the mitigation measures is further described below.

Traffic Control Measures (TCM): Traffic control measures, such as speed limit restrictions, truck traffic restrictions, and other traffic control measures that may be considered for the reduction of noise emission levels are not considered practical for this project. These traffic control measures would be counterproductive to the project's objectives. Reducing speeds will not be an effective noise mitigation measure since a substantial decrease in speed is necessary to provide adequate noise reduction. Typically, a 10 mph reduction in speed will result in only a 2 dB decrease in noise level, which would not eliminate all impacts.

Alteration of Horizontal and Vertical Alignments: The alteration of the horizontal alignment would not be considered practical for this project due to developed lands on both sides of the roadway which would not allow for any alteration of alignments that would produce noise reducing effects. Alteration of vertical alignment also is not practical due to the need to maintain intersections with existing connecting roads.

Insulation: This noise abatement measure option applies only to public and institutional use buildings. Since no public use or institutional structures are anticipated to have interior noise levels exceeding FHWA's interior NAC, this noise abatement option will not be applied.

Acquisition of Buffering Land: The purchase of property and/or buildings for noise barrier construction or the creation of a "buffer zone" to reduce noise impacts is only considered for predominantly unimproved properties because the amount of property required for this option to be effective would create additional impacts (e.g., in terms of residential displacements), which were determined to outweigh the benefits of land acquisition.

Construction of Noise Barriers / Berms: Construction of noise barriers can be an effective way to reduce noise levels at areas of outdoor activity. Noise barriers can be wall structures, earthen berms, or a combination of the two. The effectiveness of a noise barrier depends on the distance and elevation difference between roadway and receptor and the available placement location for a barrier.

Noise walls and earth berms are often implemented in the highway design in response to the identified traffic noise impacts. The effectiveness of a freestanding (post and panel) noise barrier and an earth berm of equivalent height are relatively consistent; however, an earth berm is perceived as a more aesthetically pleasing option.

In contrast, the use of earth berms is not always an option due to the excessive space they require adjacent to the roadway corridor. At a standard slope of 2:1, every one foot in height would require four feet of horizontal width. This requirement becomes more complex in urban settings where residential properties often abut the proposed roadway corridor. In these situations, implementation of earth berms can require substantial property acquisitions to accommodate noise mitigation. The cost associated with the acquisition of property to construct a berm can significantly increase the total costs to implement this form of noise mitigation and make it unreasonable. Therefore, earth berms have not been considered for this project. Noise barriers considered for this project are noise walls.

As a general practice, noise barriers are most effective when placed at a relatively high point between the roadway and the impacted noise sensitive land use. To achieve the greatest benefit from a potential noise barrier, the goal of the barrier should focus on breaking the line-of-sight (to the greatest degree possible) from the roadway to the receptor.

The effectiveness of a noise barrier is measured by examining the barrier's capability to reduce future noise levels. Noise reduction is measured by comparing design year pre- and post-barrier noise levels. This difference between unabated and abated noise levels is known as insertion loss (IL). The following discussion presents potential mitigation measures for each of the impacted noise sensitive land uses.

4.4. Noise Barriers

Noise barriers in the form of noise walls were evaluated for areas predicted to experience traffic noise impacts in the Build Alternative. Four noise barriers were evaluated in this analysis and the evaluated noise barriers would all be ground mounted. All four noise barriers were determined to be feasible and reasonable in accordance with VDOT's State Noise Abatement Policy. Figures 1 and 2 in ***Appendix A*** show the barrier locations as well as the lengths required to provide feasible and reasonable abatement.

Table 4-2 presents an overview of the evaluated barrier parameters. Details of the barrier insertion loss associated with the evaluated barriers are listed in Tables 4-3. Warranted, Feasible, and Reasonableness Worksheets are located in ***Appendix D***.

The following discussion presents the noise abatement measure for the impacted CNE area. Barriers were not evaluated for CNEs C, D, and G since there were no traffic noise impacts within these CNEs and traffic noise abatement consideration is not warranted.

4.4.1. Barrier A – CNE A

Barrier A would be located along southbound Devlin Road near the right-of-way line within CNE A south of Fog Light Way. There is a proposed bike path and retaining wall parallel to the shoulder of Devlin Road which is part of the project design. The noise barrier analysis was performed at the location of the proposed retaining wall. Barrier A would have a height of 14 and 16 feet and an approximate total length of 955 feet, resulting in a total surface area of 13,787 square feet. With an assumed cost per square foot of $42, which is the statewide average in Virginia, the estimated cost of Barrier A would be $579,054. Figure 1 in ***Appendix A*** shows Barrier A.

Barrier A would provide feasible abatement for impacted Receptors A2.1, A3.2, A5.2, A6.2, A7.2, A8.1, A10.2, and A11.2, which represent a total of eight single-family residences. In addition, the barrier would also provide feasible abatement for non-impacted Receptors A1, A4, A9, and A12.2 which represent a total of four single-family residences. Several of the secondary outdoor use area receptor locations were also shown to achieve feasible abatement; however, no more than one benefit per residence was included in the total amount of impacted or non-impacted benefit counts. An overview of the evaluated barrier parameters and analysis calculations are shown in Table 4-2. Details of the barrier analysis including barrier insertion losses are listed in Table 4-3.

This barrier would provide feasible abatement for at least 50% of impacted receivers, meets the noise reduction design goal of 7 dB for at least one impacted receptor, and has a square feet per benefited receptor value of 1,115, which is less than 1,600; therefore, Barrier A would be feasible and reasonable in accordance with VDOT's State Noise Abatement Policy. The total number of receptors and frequent outdoor use areas used for feasibility and reasonableness calculations are presented in ***Appendix D*** within the *Warranted, Feasible, and Reasonableness Worksheet*.

4.4.2. Barrier B – CNE B

Barrier B would be located along southbound Devlin Road near the right-of-way line within CNE B north of Fog Light Way. There is a proposed bike path and retaining wall parallel to the shoulder of Devlin Road which is part of the project design. The noise barrier analysis was performed at the location of the proposed retaining wall and proposed right-of-way. Barrier B would have a height of 12 feet and an approximate total length of 998 feet, resulting in a total surface area of 11,973 square feet. With an assumed cost per square foot of $42, which is the statewide average in Virginia, the estimated cost of Barrier B would be $502,866. Figures 1 and 2 in ***Appendix A*** show Barrier B.

Barrier B would provide feasible abatement for impacted Receptors B1.2, B2.2, B3.2, B4.1, B6, B7.1, B8.1, B9.1, B10, B11, and B12.1, which represent a total of 11 single-family residences. In addition, the barrier would also provide feasible abatement for non-impacted Receptor B5 which represents a single-family residence. Several of the secondary outdoor use area receptor locations were also shown to achieve feasible abatement; however, no more than one benefit per residence was included in the total amount of impacted or non-impacted benefit counts. An overview of the evaluated barrier parameters and analysis calculations are shown in Table 4-2. Details of the barrier analysis including barrier insertion losses are listed in Table 4-3.

This barrier would provide feasible abatement for at least 50% of impacted receivers, meets the noise reduction design goal of 7 dB for at least one impacted receptor, and has a square feet per benefited receptor value of 998, which is less than 1,600; therefore, Barrier B would be feasible and reasonable in accordance with VDOT's State Noise Abatement Policy. The total number of receptors and frequent outdoor use areas used for feasibility and reasonableness calculations are presented in ***Appendix D*** within the *Warranted, Feasible, and Reasonableness Worksheet*.

4.4.3. Barrier E – CNE E

Barrier E would be located along northbound Devlin Road between the shoulder and the right-of-way line within CNE E south of Pike Branch. There is a proposed retaining wall parallel to the shoulder of Devlin Road which is part of the project design. The noise barrier analysis was performed at the location of the proposed retaining wall. Barrier E would have a gap for the driveway of a single family residence represented by Receptor E12. Barrier E would have a height of eight feet and a combined approximate total length of 1,376 feet, resulting in a total surface area of 11,008 square feet. With an assumed cost per square foot of $42, which is the statewide average in Virginia, the estimated cost of Barrier B would be $462,336. Figure 1 in ***Appendix A*** shows Barrier E.

Barrier E would provide feasible abatement for impacted Receptors E1, E2, E5, E6, E12, and E16 which represent a total of six single-family residences. In addition, the barrier would also provide feasible abatement for seven non-impacted Receptors E3, E4, E7, E8, E13, E14, and E15 which each represent one single-family residence. An overview of the evaluated barrier parameters and analysis calculations are shown in Table 4-2. Details of the barrier analysis including barrier insertion losses are listed in Table 4-3.

This barrier would provide feasible abatement for at least 50% of impacted receivers, meets the noise reduction design goal of 7 dB for at least one impacted receptor, and has a square feet per benefited receptor value of 847, which is less than 1,600; therefore, Barrier E would be feasible and reasonable in accordance with VDOT's State Noise Abatement Policy. The total number of receptors and frequent outdoor use areas used for feasibility and reasonableness calculations are presented in ***Appendix D*** within the *Warranted, Feasible, and Reasonableness Worksheet*.

4.4.4. Barrier F – CNE F

Barrier F would be located along northbound Devlin Road between the shoulder and the right-of-way line within CNE F north of Pike Branch. There is a proposed retaining wall parallel to the shoulder of Devlin Road which is part of the project design. The noise barrier analysis was performed at the location of the proposed retaining wall. Barrier F would have a height of eight feet and an approximate total length of 1,075 feet, resulting in a total surface area of 8,597 square feet. With an assumed cost per square foot of $42, which is the statewide average in Virginia, the estimated cost of Barrier F would be $361,074. Figures 1 and 2 in ***Appendix A*** show Barrier F.

Barrier F would provide feasible abatement for impacted Receptors F10 and F11, which represent a total of two single-family residences. At a height of eight feet along the location of the proposed retaining wall, non-impacted Receptors F1, F3, F4, and F5 would provide another four benefited dwelling units allowing the reasonableness criteria to be achieved. An overview of the evaluated barrier parameters and analysis calculations are shown in Table 4-2. Details of the barrier analysis including barrier insertion losses are listed in Table 4-3.

This barrier would provide feasible abatement for at least 50% of impacted receivers, meets the noise reduction design goal of 7 dB for at least one impacted receptor, and has a square feet per benefited receptor value of 1,433, which is less than 1,600; therefore, Barrier F would be feasible and reasonable in accordance with VDOT's State Noise Abatement Policy. The total number of receptors and frequent outdoor use areas used for feasibility and reasonableness calculations are presented in ***Appendix D*** within the *Warranted, Feasible, and Reasonableness Worksheet*.

Table 4-2. Evaluated Noise Barrier Parameters

Barrier	Insertion Loss (IL) (dBA)	Height (ft)	Total Length (ft)	Total Area (ft^2)	Impacted and Benefited / Total Impacted	Additional Benefits / Total Benefits	Area / Benefited	Cost ($42/$ft^2$)
Soundwall A	5 to 10	14 to 16	955	13,787	8 / 8	4 / 12	1,149	$579,054
Soundwall B	5 to 10	12	998	11,973	11 / 11	1 / 12	998	$502,866
Soundwall E	6 to 9	8	1,376	11,008	6 / 6	7 / 13	847	$462,336
Soundwall F	5 to 9	8	1,075	8,597	2 / 2	4 / 6	1,433	$361,074

Note:

Indicates that evaluated noise barrier meets both feasible and reasonable criteria.

Table 4-3. Predicted Noise Barrier Insertion Loss

Receptor Number	Predicted Noise Levels (dBA)																	
	Build Condition (2045) No Barrier	No. of Dwelling Units	Build Condition (2045) - With Barrier															
			6ft		8ft		10ft		12ft		14ft		16ft		18ft		20ft	
			Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*
Barrier A																		
A1.1	63	1	61	2	60	3	59	4	58	5	57	6	57	6	57	6	56	6 *
A1.2	65	--	64	1	63	2	62	3	60	5	59	6	58	7	57	8	57	8
A2.1	67	1	66	1	64	3	61	6	59	8	57	10	55	12	54	13	53	14
A2.2	67	--	67	0	66	1	66	1	65	2	63	4	61	6	59	8	57	10
A3.1	65	--	63	2	61	4	59	6	58	7	56	9	55	10	54	11	53	12
A3.2	66	1	65	1	64	1 *	63	3	61	5	59	7	58	8	57	9	56	10
A4	65	1	64	1	62	3	60	5	59	7 *	57	8	55	10	54	11	54	11
A5.1	65	--	64	1	62	3	60	6 *	58	7	56	9	55	10	54	11	53	12
A5.2	66	1	65	1	65	1	65	2 *	63	3	60	6	58	8	57	9	56	10
A6.1	64	--	63	1	62	3 *	59	5	58	7 *	57	8 *	55	9	54	10	53	11
A6.2	66	1	65	1	65	1	64	2	62	4	60	6	58	8	57	9	56	10
A7.1	65	--	65	1 *	63	2	61	5 *	59	6	58	8 *	56	9	55	11 *	54	11
A7.2	66	1	66	1 *	65	1	65	1	64	2	61	5	59	7	58	8	57	10 *
A8.1/ST1	66	1	65	1	64	2	62	4	60	6	58	8	57	9	55	10 *	55	11
A8.2	66	--	65	1	65	1	64	2	62	4	60	6	58	8	57	9	56	10
A9	65	1	64	1	63	2	60	4 *	59	6	57	8	56	9	55	9 *	55	10
A10.1	65	--	64	1	62	3	60	5	58	7	57	8	56	9	56	10 *	55	10
A10.2	66	1	65	1	64	2	62	3 *	60	6	59	7	58	8	57	9	56	9 *
A11.1	65	--	63	3 *	61	5 *	59	6	58	7	57	8	57	8	57	9 *	56	9
A11.2	66	1	65	1	63	3	61	5	59	6 *	59	7	58	8	57	8 *	57	9
A12.1	64	--	61	3	60	4	60	4	60	4	60	4	60	5 *	59	5	59	5
A12.2	65	1	63	3 *	62	4 *	61	4	60	5	60	5	60	5	60	6 *	60	6 *

Notes:

Denotes predicted noise impact at the primary frequent outdoor use area.

Denotes benefit.

Denotes benefit and recommended barrier height.

* Predicted Insertion Losses (IL) may be different than the no barrier noise level minus the level with barrier due to rounding.

Table 4-3. Predicted Noise Barrier Insertion Loss (continued)

Receptor Number	Predicted Noise Levels (dBA)																	
	Build Condition (2045) No Barrier	No. of Dwelling Units	Build Condition (2045) - With Barrier															
			6ft		8ft		10ft		12ft		14ft		16ft		18ft		20ft	
			Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*
Barrier B																		
B1.1	65	--	61	4	60	6 *	59	6	59	7 *	58	7	58	7	58	8 *	58	8 *
B1.2	66	1	65	1	64	2	62	4	61	5	60	6	60	7 *	59	7	59	7
B2.1	65	--	60	4 *	59	6	57	8	56	9	56	9	55	10	55	10	54	10 *
B2.2	66	1	65	1	65	2 *	62	5 *	59	7	58	8	57	9	57	10 *	56	10
B3.1	64	--	59	5	57	7	56	8	55	9	54	10	54	11 *	53	11	53	12 *
B3.2	66	1	65	1	63	3	60	6	58	8	57	9	56	10	55	11	55	11
B4.1	66	1	63	3	60	6	58	8	56	10	55	11	54	12	53	12 *	53	13
B4.2	66	--	66	1 *	65	1	64	2	62	5 *	59	8 *	57	10 *	56	11 *	55	12 *
B5	65	1	62	3	59	6	57	8	56	9	55	10	54	11	53	12	53	12
B6	66	1	63	2 *	61	5	59	7	57	9	56	10	55	11	54	12	53	13
B7.1	66	1	63	3	61	6 *	59	8 *	57	9	56	10	55	11	54	12	54	13 *
B7.2	66	--	65	1	64	3 *	62	5 *	60	7 *	58	9 *	56	10	55	11	55	12 *
B8.1	67	1	63	4	61	7 *	59	9 *	57	10	56	11	55	12	54	13	54	14 *
B8.2	67	--	65	1 *	63	3 *	61	6	59	8	57	9 *	56	10 *	55	11 *	55	12
B9.1/ST2	68	1	65	3	63	5	60	7 *	59	9	58	10	56	11 *	55	12 *	55	13
B9.2	67	--	65	2	63	4	61	6	59	8	58	9	57	10	56	11	55	11 *
B10	67	1	64	3	63	4	61	6	59	7 *	58	9	57	10	56	11	55	12
B11	67	1	67	1 *	66	2 *	64	4 *	62	6 *	60	8 *	58	9	57	10	56	11
B12.1	68	1	67	0 *	67	1	65	2 *	63	5	60	7 *	58	9 *	57	11	56	11 *
B12.2	68	--	68	0	68	0	67	0 *	67	1	66	1 *	65	2 *	64	4	61	7
B13.1	62	1	62	0	61	1	60	2	59	3	58	4	58	4	57	5	57	5
B13.2	63	--	63	0	63	1 *	63	1 *	61	2	61	2	60	3	60	3	60	4 *

Notes:

- (yellow) Denotes predicted noise impact at the primary frequent outdoor use area.
- (green) Denotes benefit.
- (blue) Denotes benefit and recommended barrier height.
- * Predicted Insertion Losses (IL) may be different than the no barrier noise level minus the level with barrier due to rounding.

Table 4-3. Predicted Noise Barrier Insertion Loss (continued)

Receptor Number	Predicted Noise Levels (dBA)																	
	Build Condition (2045) No Barrier	No. of Dwelling Units	Build Condition (2045) - With Barrier															
			6ft		8ft		10ft		12ft		14ft		16ft		18ft		20ft	
			Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*
Barrier E																		
E1	66	1	60	6	59	7	57	9	56	10	55	11	55	12 *	54	12	54	12
E2	67	1	60	7	58	9	56	11	55	12	54	13	53	14	52	15	51	16
E3	63	1	59	4	57	7 *	55	8	54	9	53	10	52	11	52	11	51	12
E4	64	1	59	5	57	7	56	8	55	9	54	10	53	11	52	12	52	12
E5	66	1	59	6 *	57	9	56	10	55	11	54	12	53	13	52	13 *	52	14
E6	67	1	60	7	58	9	56	11	55	12	54	12 *	54	13	53	14	52	15
E7/ST3	64	1	59	5	58	6	57	7	56	8	56	8	55	8 *	55	9	55	9
E8	64	1	59	6 *	58	7 *	56	8	55	9	55	10 *	54	10	54	11 *	54	11 *
E9	62	1	59	3	59	4 *	58	4	58	5 *	57	5	57	5	57	5	57	6 *
E10	56	1	53	3	52	3 *	51	4 *	51	5	50	5 *	50	5 *	51	5	50	5 *
E11	53	1	51	3 *	50	3	48	5	47	6	48	6 *	47	6	46	7	46	7
E12	67	1	60	7	58	8 *	57	10	56	10 *	56	11	55	11 *	55	12	55	12
E13	62	1	58	4	56	6	55	7	54	8	54	9 *	53	9	52	10	52	10
E14	64	1	58	6	56	7 *	55	8 *	54	9 *	54	10	53	11	52	12	52	12
E15	65	1	58	6 *	56	8 *	55	9 *	54	10 *	54	11	53	12	52	13	51	13 *
E16	66	1	59	7	57	8 *	57	9	56	10	55	10 *	55	11	55	11	54	11 *

Notes:

- (yellow) Denotes predicted noise impact at the primary frequent outdoor use area.
- (green) Denotes benefit.
- (blue) Denotes benefit and recommended barrier height.
- * Predicted Insertion Losses (IL) may be different than the no barrier noise level minus the level with barrier due to rounding.

Table 4-3. Predicted Noise Barrier Insertion Loss (continued)

Receptor Number	Build Condition (2045) No Barrier	No. of Dwelling Units	Predicted Noise Levels (dBA)															
			Build Condition (2045) - With Barrier															
			6ft		8ft		10ft		12ft		14ft		16ft		18ft		20ft	
			Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*	Level	IL*
Barrier F																		
F1	60	1	56	4	55	6 *	53	8 *	52	9 *	51	10 *	50	11 *	49	11	49	12 *
F2	54	1	51	3	50	4	48	6	47	7	46	8	45	9	44	10	44	10
F3	59	1	56	4 *	55	5 *	52	7	51	8	50	9	50	10 *	49	10	48	11
F4	62	1	58	4	56	6	55	7	54	8	53	8 *	53	9	52	10	52	10
F5	60	1	56	4	54	5 *	53	7	53	7	52	8	51	9	50	10	50	10
F6	58	1	55	3	53	4 *	52	6	51	7	50	8	49	9	48	10	48	10
F7	54	1	52	2	51	3	49	6 *	48	7 *	47	8 *	46	9 *	45	9	45	10 *
F8	51	1	49	2	48	3	46	5	45	6	44	7	43	8	43	8	42	9
F9	53	1	51	2	50	3	48	5	47	6	46	8 *	45	8	44	9	43	10
F10/ST4	68	1	61	7	59	9	57	11	56	12	55	13	54	14	54	14	53	15
F11	67	1	61	6	60	7	58	9	57	10	56	11	56	11	56	11	55	12
F12	62	1	58	4	57	4 *	56	6	55	6 *	55	6 *	55	7	55	7	54	7 *
F23	57	1	54	3	53	4	52	5	51	6	50	7	50	7	50	7	50	7
F24	56	1	53	3	52	4	51	5	49	7	49	7	48	8	48	8	48	8
F25	52	1	49	3	48	4	47	5	45	7	44	7 *	44	8	43	9	43	9

Notes:

- (yellow) Denotes predicted noise impact at the primary frequent outdoor use area.
- (green) Denotes benefit.
- (blue) Denotes benefit and recommended barrier height.
- * Predicted Insertion Losses (IL) may be different than the no barrier noise level minus the level with barrier due to rounding.

5 Construction Noise

VDOT is also concerned with noise generated during the construction phase of the proposed project since noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. The degree of construction noise impact will vary, as it is directly related to the types and number of equipment used and the proximity to the noise-sensitive land uses within the project area. Land uses that are sensitive to traffic noise are also potentially considered to be sensitive to construction noise. Any construction noise impacts that do occur as a result of roadway construction measures are anticipated to be temporary in nature and will cease upon completion of the project construction phase.

A method of controlling construction noise is to establish the maximum level of noise that construction operations can generate. In view of this, VDOT has developed and FHWA has approved a specification that establishes construction noise limits. This specification can be located in VDOT's 2020 *Road and Bridge Specifications*, Section 107.16(b.3), “Noise”. The contractor will be required to conform to this specification to reduce the impact of construction noise on the surrounding community.

The specifications have been reproduced below:

- The Contractor’s operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall not exceed 80 decibels. Such noise level measurements shall be taken at a point on the perimeter of the construction limit that is closest to the adjoining property on which a noise-sensitive activity is occurring. A noise-sensitive activity is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose and not present an unreasonable public nuisance. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.
- VDOT may monitor construction-related noise. If construction noise levels exceed 80 decibels during noise-sensitive activities, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.
- VDOT may prohibit or restrict certain portions of the project any work that produces objectionable noise between 10 PM and 6 AM. If other hours are established by local ordinance, the local ordinance shall govern.
- Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.

- When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

These requirements shall not be applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

6 Public Involvement Process

FHWA and VDOT policies require that VDOT provides certain information to local officials within whose jurisdiction the highway project is located to minimize future traffic noise impacts of Type I projects on currently undeveloped lands (Type I projects involve highway improvements with noise analysis). This information must include information on noise-compatible land-use planning and noise impact zones in undeveloped land in the highway project corridor. This section of the report provides that information, as well as information about VDOT's noise abatement program.

6.1. Noise-Compatible Land-Use Planning

Sections 12.1 and 12.2 of VDOT's 2011 Highway Traffic Noise Impact Analysis Guidance Manual outline VDOT's approach to communication with local officials and provide information and resources on highway noise and noise-compatible land-use planning. VDOT's intention is to assist local officials in planning the uses of undeveloped land adjacent to highways to minimize the potential impacts of highway traffic noise.

Entering the Quiet Zone is a brochure that provides general information and examples to elected officials, planners, developers, and the general public about the problem of traffic noise and effective responses to it. A link to this brochure on FHWA's website is provided:

http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/land_use/qz00.cfm

A wide variety of administrative strategies may be used to minimize or eliminate potential highway noise impacts, thereby preventing the need or desire for costly noise abatement structures such as noise barriers in future years. There are five broad categories of such strategies:

- Zoning,
- Other legal restrictions (subdivision control, building codes, health codes),
- Municipal ownership or control of the land,
- Financial incentives for compatible development, and
- Educational and advisory services.

The Audible Landscape: A Manual for Highway and Land Use is a very well-written and comprehensive guide addressing these noise-compatible land use planning strategies, with significant detailed information. This document is available through FHWA's Website, at

http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/audible_landscape/al00.cfm

Noise Impact Zones in Undeveloped Land along the Study Corridor

Also required under the revised 2011 FHWA and VDOT noise policies is information on the noise impact zones adjacent to project roadways in undeveloped lands. To determine these zones, noise levels are computed at various distances from the edge of the project roadways in each of the undeveloped areas of the project study area. Then, the distances from the edge of the roadway to the NAC sound levels are determined through interpolation. Distances vary in the project corridor due to changes in traffic volumes or terrain features. Any noise sensitive sites within these zones should be considered noise impacted if no barrier is present to reduce sound levels. The figures in ***Appendix A*** show the predicted 66 dBA contours for the project.

6.2. Public Involvement Efforts

For noise barriers determined to be feasible and reasonable, the affected public will be given an opportunity to decide whether they are in favor of construction of the noise barrier. A final determination as to the construction of barriers will be made after the public hearing process. As part of the final design noise analysis, for barriers that are determined to be feasible and reasonable, input from the impacted property owners and renters must be obtained through citizen surveys via certified mail. Of the votes tallied, 50% or more must be in favor of a proposed noise barrier in order for that barrier to be considered further.

Upon completion of the citizen survey, the VDOT Noise Abatement staff which will make recommendations to the Chief Engineer for approval. Approved barriers will be incorporated into the road project plans. A technical memorandum (noise barrier survey addendum report) will be prepared after the voting process has been completed, which documents the voting results and summary of public comments of the noise barrier public survey process.

7 References

23 CFR Part 772, 2020. *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, 23 Codes of Federal Regulations, Part 772, July.

FHWA, 2004. U.S. Department of Transportation, FHWA Traffic Noise Model, TNM 2.5, Report No. FHWA–PD–96–010, Revision No. 1, April.

FHWA, 2011. U.S. Department of Transportation, *FHWA Highway Traffic Noise Analysis and Abatement Policy and Guidance*, December.

VDOT, 2018. *Highway Traffic Noise Impact Analysis Guidance Manual*. Virginia Department of Transportation. Version No. 8. February.

8 List of Preparers

Jason Ogden, Senior Noise Control Specialist. Bachelor of Arts, Acoustics, Columbia College Chicago, Chicago, IL; Master of Science, Mechanical Engineering, California State Los Angeles, CA; 14 years of experience in environmental noise and vibration analysis. Contribution: Lead author of Noise Analysis Technical Report. Performed traffic noise analysis, noise barrier design, and quality assurance/quality control.

Thanh Luc, Principal Project Manager. Master of Science, Energy, Resources, and Environment, George Washington University, Washington, D.C.; 31 years of experience in environmental and transportation noise and vibration analysis. Contribution: Conducted review and quality control for the Noise Analysis Technical Report.

Appendix A Receptor Locations and Evaluated Noise Barrier Locations

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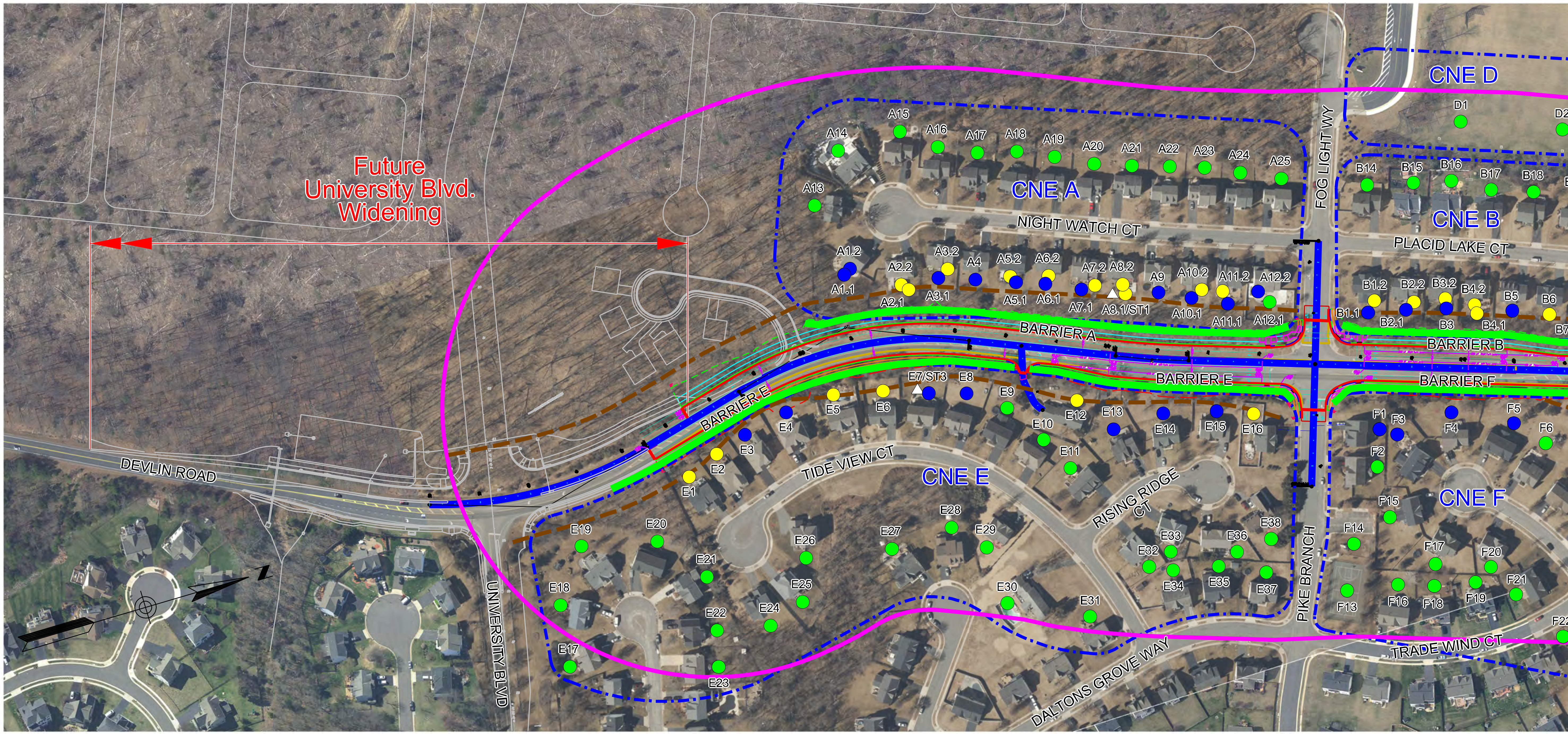
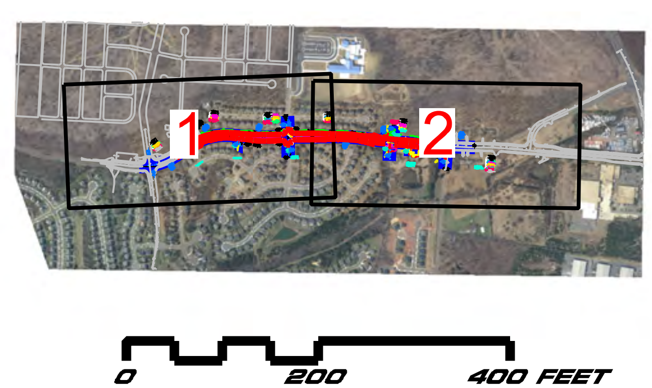
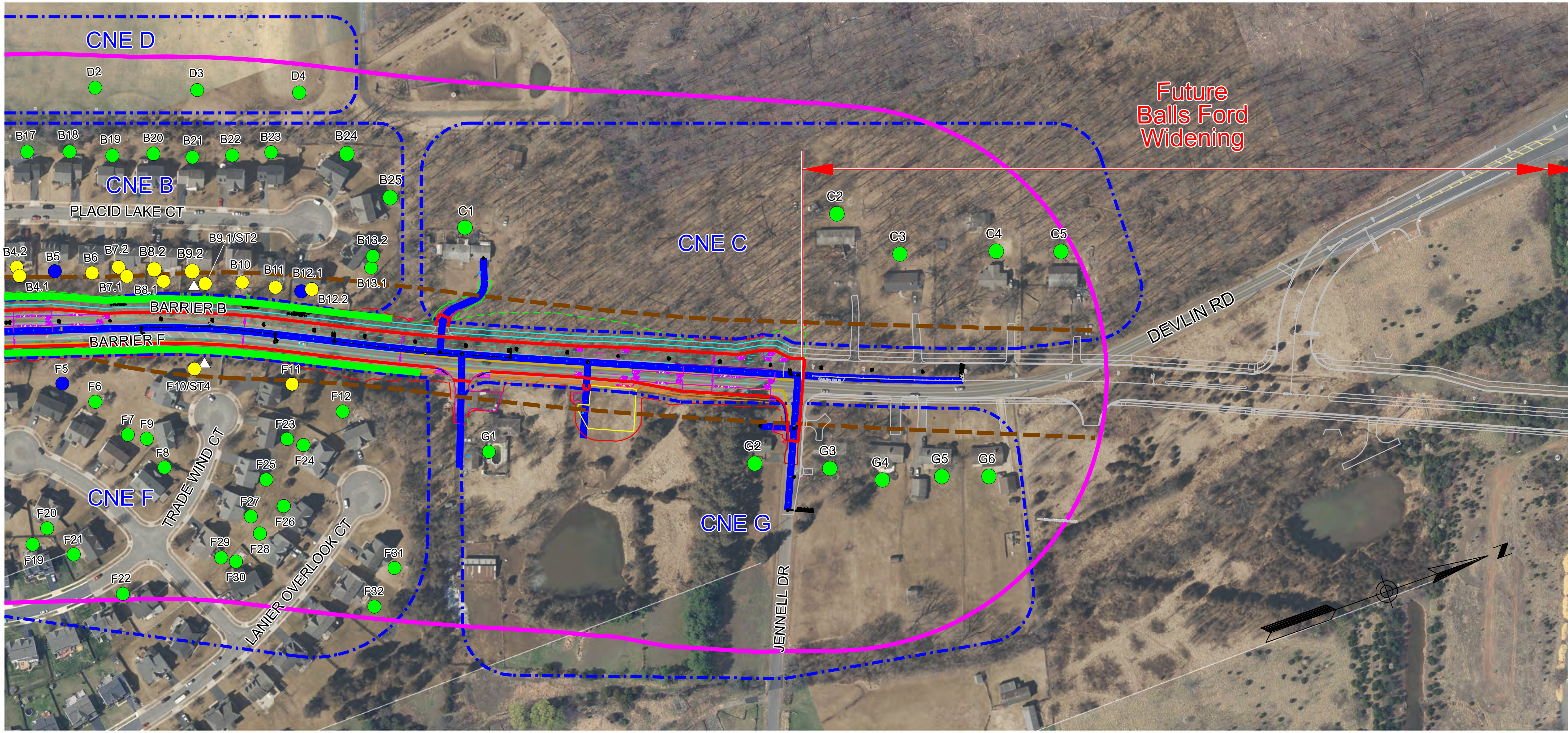


Devlin Road Widening
(University Blvd. to Jennell Dr.)
Preliminary Noise Analysis
Prince William County
Project Number
0621-076-605-C501
UPC 118253

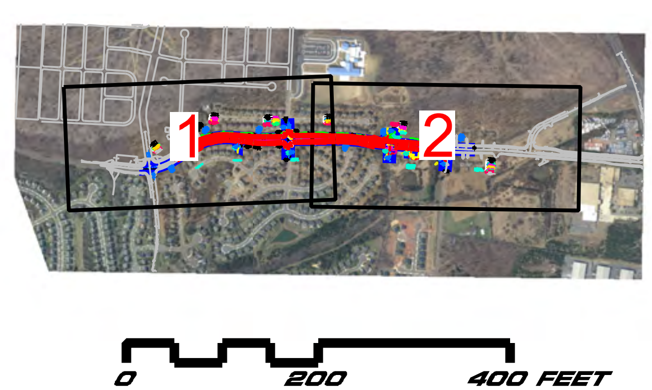


- Not Impacted Not Benefited
- Not Impacted Benefited
- Impacted and Benefited
- Impacted and Not Benefited
- Noise Measurement Site
- Evaluated Barrier-Feasible and Reasonable
- Evaluated Barrier-Feasible and Not Reasonable
- 66 dBA $L_{eq(h)}$ Noise Contour
- Right of Way
- Common Noise Environment (CNE) Areas
- 500' Noise Study Areas

Figure A-1
Build Alternative
Noise Prediction
Locations and Potential
Noise Barriers



Devlin Road Widening
(University Blvd. to Jennell Dr.)
Preliminary Noise Analysis
Prince William County
Project Number
0621-076-605-C501
UPC 118253



- Not Impacted Not Benefited
- Not Impacted Benefited
- Impacted and Benefited
- Impacted and Not Benefited
- Noise Measurement Site
- Evaluated Barrier-Feasible and Reasonable
- Evaluated Barrier-Feasible and Not Reasonable
- 66 dBA $L_{eq(h)}$ Noise Contour
- Right of Way
- Common Noise Environment (CNE) Areas
- 500' Noise Study Areas

Figure A-2
Build Alternative
Noise Prediction
Locations and Potential
Noise Barriers

Appendix B Noise Measurement Data, Site Photographs, and Equipment Calibration Records

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FIELD SURVEY FORM

PROJECT:	ENGINEER:	DATE:
Devlin Road Widening (North)	OGDEN	6/23/21

MEASUREMENT ADDRESS:	CITY:		SITE NO.:
8617 Placid Lake	Bristow, VA	☒ Single-Family ☐ Multi-Family ☐ School ☐ Recreational ☐ Commercial ☐ Church	ST1

SOUND LEVEL METER:	MICROPHONE:	PRE AMP:	NOTES:
☐ LD-870 ☐ LD-820 ☐ LD-LxT ☐ LD-824 ☒ LD-812 ☐ B&K-2250 ☐ LD-2900 ☐ ______	☐ NON-POLAR ☒ POLARIZED ☒ 1/2-INCH ☐ FREEFIELD ☐ 1-INCH ☒ RANDOM ☒ WIND SCREEN	☐ LD-900 ☐ LD-LxT ☒ LD-828 ☐ ZC-0032 ☐ LD-902 ☐ ______	SYSTEM PWR: ☐ BAT ☐ AC
SERIAL #: 0638	SERIAL #: 3155	SERIAL #: 1891	(observations during measurement)

TEMP: 82 °F R.H.: 51 %

WIND SPEED: 0.8 MPH

TOWARD (DIR): west

SKIES: Clear

CAMERA ______

☐ VIDEO ☐ RADAR

CALIBRATOR:

☒ LD CA250 ☐ LD CA200 ☐ B&K 4231 ☐ ______

Freq, Hz.: ☒ 250 ☐ 1000 ☐ 84 ☐ ______

S/N 2480

CALIBRATION RECORD:

Input, dB / Reading, dB / Offset, dB / Time

Before 114 , 114.0 , 6.9 , 8:46

After 114 , 114.0 , 6.9 , 10:34

METER SETTINGS:

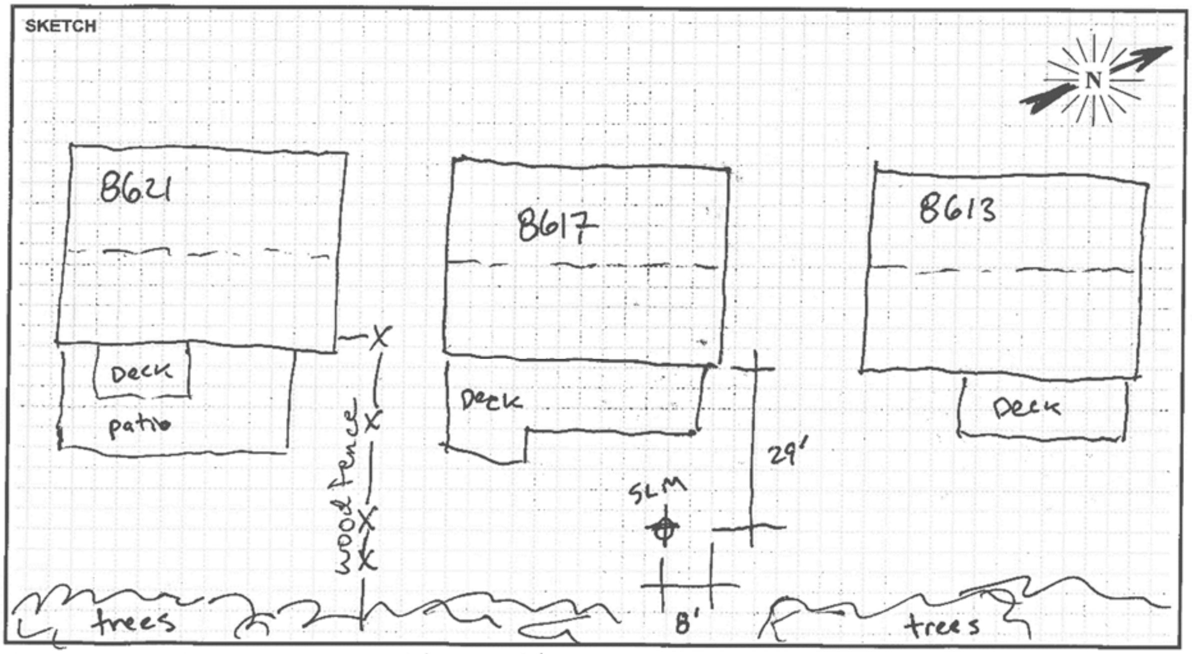
☒ A-WTD ☐ LINEAR ☒ SLOW ☐ 1/1 OCT ☒ INTERVALS 20 - MINUTE
☐ C-WTD ☐ IMPULSE ☐ FAST ☐ 1/3 OCT ☒ L_N PERCENTILE VALUES

NOTES:

MEASUREMENT TYPE: ☐ Long Term ☒ Short Term

DATE	START TIME	STOP TIME	L_{MIN}	L_{99}	L_{90}	L_{50}	L_{25}	L_{10}	L_{01}	L_{MAX}	L_{EQ}	NOTES:
6/23	8:50	9:00	43.5		51.5	61.0	63.6	65.2		69.3	61.8	
	9:20	9:40	45.5		52.9	60.9	64.0	65.8		72.4	62.3	✓
	9:40	9:43	43.0		48.8	61.1	64.0	65.6		71.2	62.1	

SKETCH



PARSONS

↓ Devlin Rd ↓

Short-Term Measurement Site ST1 - Field Form

(Facing North)

(Facing East)

Short-Term Measurement Site ST1 – Site Photos

FIELD SURVEY FORM

PROJECT: Devlin Road Widening (North)
ENGINEER: OGDEN
DATE: 6/23/21

MEASUREMENT ADDRESS: 8506 Tailwind Ct.
CITY: Bristow, VA
☒ Single-Family ☐ Multi-Family ☐ School ☐ Recreational ☐ Commercial ☐ Church
SITE NO.: ST2

SOUND LEVEL METER:
☐ LD-870 ☐ LD-820 ☐ LD-LxT
☐ LD-824 ☒ LD-812 ☐ B&K-2250
☐ LD-2900 ☐ ____________
SERIAL #: 0639

MICROPHONE:
☐ NON-POLAR ☒ POLARIZED
☒ 1/2-INCH ☐ FREEFIELD
☐ 1-INCH ☒ RANDOM
☒ WIND SCREEN
SERIAL #: 3159

PRE AMP:
☐ LD-900 ☐ LD-LxT
☒ LD-828 ☐ ZC-0032
☐ LD-902 ☐ ________
SERIAL #: 1901

CALIBRATOR:
☒ LD CA250 ☐ LD CA200
☐ B&K 4231 ☐ ______
S/N 2480

Freq, Hz.
☒ 250
☐ 1000
☐ 84
☐ ______

CALIBRATION RECORD:
Input, dB / Reading, dB / Offset, dB / Time
Before 114 , 114.0 , 9.1 , 8:47
After 114 , 114.0 , 9.1 , 10:27

METER SETTINGS:
☒ A-WTD ☐ LINEAR ☒ SLOW ☐ 1/1 OCT ☒ INTERVALS 20 - MINUTE
☐ C-WTD ☐ IMPULSE ☐ FAST ☐ 1/3 OCT ☒ L_N PERCENTILE VALUES

NOTES:
SYSTEM PWR: ☐ BAT ☐ AC
(observations during measurement)
TEMP: 83 °F R.H.: 51 %
WIND SPEED: 0.8 MPH
TOWARD (DIR): west
SKIES: Clear
CAMERA ____________
☐ VIDEO ☐ RADAR

NOTES:

MEASUREMENT TYPE:
☐ Long Term
☒ Short Term

DATE	START TIME	STOP TIME	L_{MIN}	L_{99}	L_{90}	L_{50}	L_{25}	L_{10}	L_{01}	L_{MAX}	L_{EQ}	NOTES:
6/23	9:00	9:20	46.5		51.9	61.3	66.0	68.3		75.6	64.5	
	9:20	9:40	42.3		47.9	61.1	66.0	68.0		75.9	63.9	✓
	9:40	9:43	47.6		50.4	63.0	66.4	68.6		71.4	64.4	

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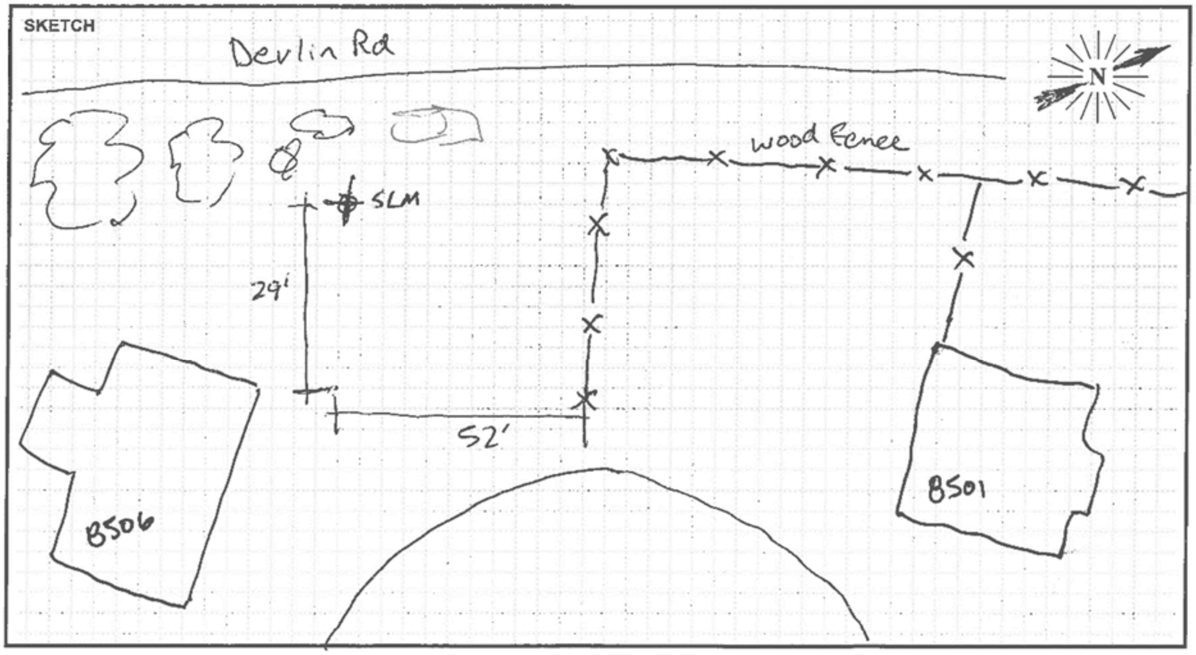

PARSONS

Short-Term Measurement Site ST 2 - Field Form

(Facing West)

(Facing North)

Short-Term Measurement Site ST2 – Site Photos

FIELD SURVEY FORM

PROJECT: Devlin Road Widening (North)
ENGINEER: OGDEN
DATE: 6/23/21

MEASUREMENT ADDRESS: 12620 Tide View Ct.
CITY: Bristow, VA
☒ Single-Family ☐ Multi-Family ☐ School ☐ Recreational ☐ Commercial ☐ Church
SITE NO.: ST3

SOUND LEVEL METER: ☐ LD-870 ☐ LD-820 ☐ LD-LxT ☐ LD-824 ☒ LD-812 ☐ B&K-2250 ☐ LD-2900 ☐ ______
SERIAL #: 0639

MICROPHONE: ☐ NON-POLAR ☒ POLARIZED ☒ 1/2-INCH ☐ FREEFIELD ☐ 1-INCH ☒ RANDOM ☒ WIND SCREEN
SERIAL #: 3159

PRE AMP: ☐ LD-900 ☐ LD-LxT ☒ LD-828 ☐ ZC-0032 ☐ LD-902 ☐ ______
SERIAL #: 1901

NOTES:
SYSTEM PWR: ☐ BAT ☐ AC
(observations during measurement)
TEMP: 83 °F R.H.: 40.7 %
WIND SPEED: 0 MPH
TOWARD (DIR): west
SKIES: Clear
CAMERA ______
☐ VIDEO ☐ RADAR

CALIBRATOR: ☒ LD CA250 ☐ LD CA200 ☐ B&K 4231 ☐ ______
S/N 2480
Freq, Hz.: ☒ 250 ☐ 1000 ☐ 84 ☐ ______

CALIBRATION RECORD:
Input, dB / Reading, dB / Offset, dB / Time
Before 114 / 114.0 / 9.1 / 8:47
After 114 / 114.0 / 9.1 / 10:27

METER SETTINGS: ☒ A-WTD ☐ C-WTD ☐ LINEAR ☐ IMPULSE ☒ SLOW ☐ FAST ☐ 1/1 OCT ☐ 1/3 OCT ☒ INTERVALS 20 - MINUTE ☒ L_N PERCENTILE VALUES

NOTES:

MEASUREMENT TYPE: ☐ Long Term ☒ Short Term

DATE	START TIME	STOP TIME	L_{MIN}	L_{99}	L_{90}	L_{50}	L_{25}	L_{10}	L_{01}	L_{MAX}	L_{EQ}	NOTES:
6/23	9:53	10:00	42.7		47.1	53.5	57.1	59.2		65.8	55.5	
	10:00	10:20	41.9		45.4	53.4	56.3	58.5		68.6	55.3	✓

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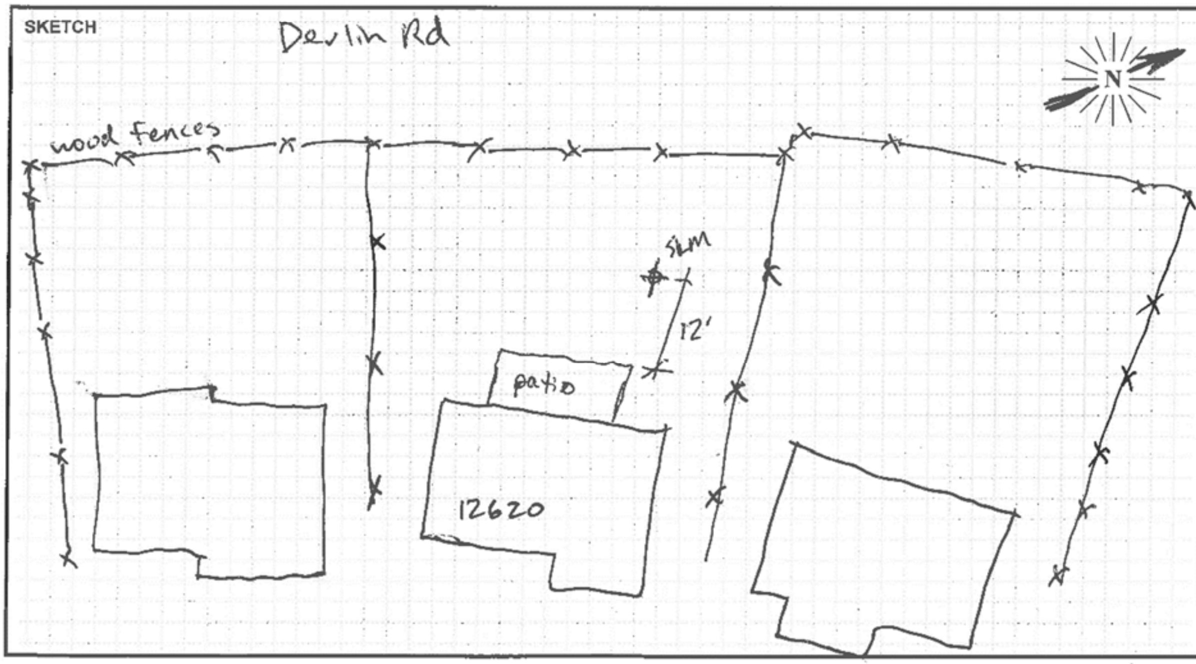

PARSONS

Short-Term Measurement Site ST3 - Field Form

(Facing South)

(Facing West)

Short-Term Measurement Site ST3 – Site Photos

FIELD SURVEY FORM

PROJECT: Devlin Road Widening (North)
ENGINEER: Ogden
DATE: 6/23/21

MEASUREMENT ADDRESS: 8681 Nightwatch Ct.
CITY: Bristow, VA
☒ Single-Family ☐ Multi-Family ☐ School ☐ Recreational ☐ Commercial ☐ Church
SITE NO.: ST4

SOUND LEVEL METER: ☐ LD-870 ☐ LD-820 ☐ LD-LxT ☐ LD-824 ☒ LD-812 ☐ B&K-2250 ☐ LD-2900 ☐ ____
SERIAL #: 0638

MICROPHONE: ☐ NON-POLAR ☒ POLARIZED ☒ 1/2-INCH ☐ FREEFIELD ☐ 1-INCH ☒ RANDOM ☒ WIND SCREEN
SERIAL #: 3155

PRE AMP: ☐ LD-900 ☐ LD-LxT ☒ LD-828 ☐ ZC-0032 ☐ LD-902 ☐ ____
SERIAL #: 1891

NOTES:
SYSTEM PWR: ☐ BAT ☐ AC
(observations during measurement)
TEMP: 83 °F R.H.: 41 %
WIND SPEED: 0 MPH
TOWARD (DIR): west
SKIES: Clear
CAMERA ____
☐ VIDEO ☐ RADAR

CALIBRATOR: ☒ LD CA250 ☐ LD CA200 ☐ B&K 4231 ☐ ____
S/N 2480
Freq, Hz. ☒ 250 ☐ 1000 ☐ 84 ☐ ____

CALIBRATION RECORD:
Input, dB / Reading, dB / Offset, dB / Time
Before 114 , 114.0 , 6.9 , 8:46
After 114 , 114.0 , 6.9 , 10:34

METER SETTINGS: ☒ A-WTD ☐ LINEAR ☒ SLOW ☐ 1/1 OCT ☒ INTERVALS 20 - MINUTE ☐ C-WTD ☐ IMPULSE ☐ FAST ☐ 1/3 OCT ☒ L_N PERCENTILE VALUES

NOTES:

MEASUREMENT TYPE: ☐ Long Term ☒ Short Term

DATE	START TIME	STOP TIME	L_{MIN}	L_{99}	L_{90}	L_{50}	L_{25}	L_{10}	L_{01}	L_{MAX}	L_{EQ}	NOTES:
6/23	9:48	10:00	43.9		47.9	59.7	63.5	66.2		74.2	62.3	
	10:00	10:20	42.6		50.3	60.3	63.0	65.1		69.5	61.5	✓
	10:20	10:30	47.9		52.7	59.8	62.6	65.0		69.9	61.4	

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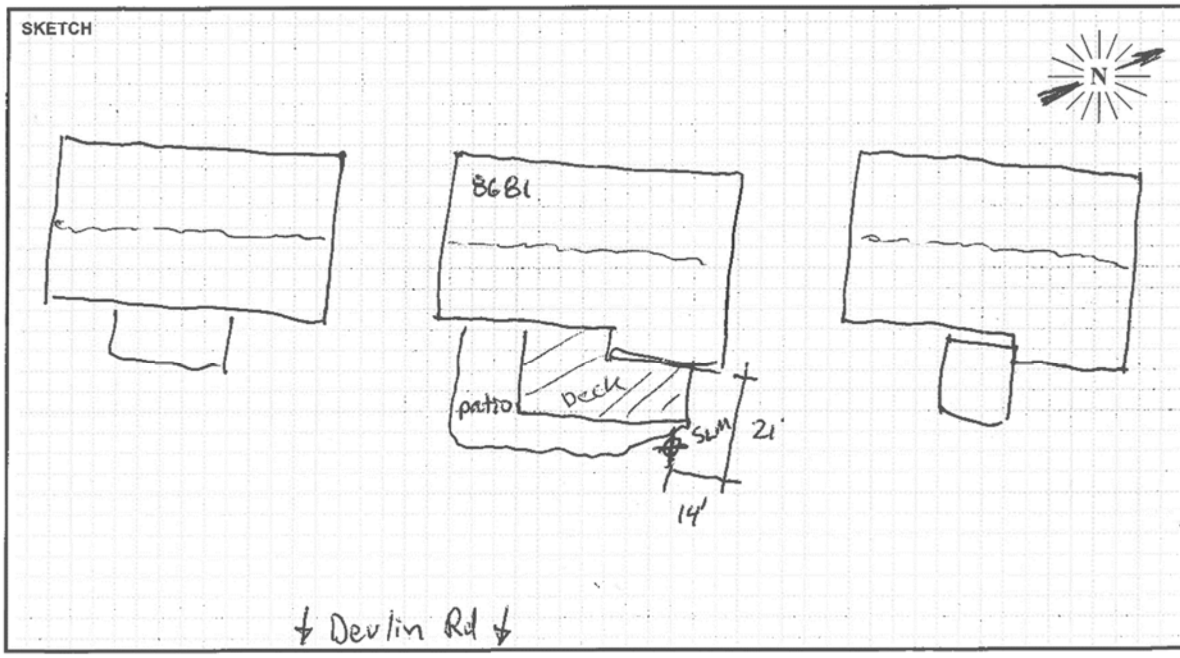


PARSONS

Short-Term Measurement Site ST4 - Field Form

(Facing East)

(Facing North)

Short-Term Measurement Site ST4 – Site Photos

CERTIFICATE OF CALIBRATION
25634-2
FOR LARSON DAVIS
PRECISION INTEGRATING AND LOGGING SOUND LEVEL METER

Model **812** Serial No. **0638**
ID No. **N/A**

With Microphone Model **2560** Serial No. **3159**
With Preamplifier Model **PRM828** Serial No. **1891**

Customer: **Parsons**
Pasadena, CA 91124
P.O. No. **Verbal/M. Sharp**

was tested and met Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 651-1979 Type 1

on **01 JUN 2020** BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **01 JUN 2021**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	1051	1777523	30 SEP 2019	30 SEP 2020
B&K	2636	1423390	02 JAN 2020	02 JAN 2021
B&K	4226	1774068	17 MAR 2020	17 MAR 2021
B&K	4231	1770857	11 SEP 2019	11 SEP 2020
HP	34401A	MY45023668	05 FEB 2020	05 FEB 2021
HP	3458A	2823A07179	24 JUL 2019	24 JUL 2020

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" condition.

Reference Test Procedure: **ACCT Procedure 812-820 Version 3.5.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	**40** %	**987.28** hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed:

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

CERTIFICATE OF CALIBRATION
25634-5
FOR LARSON DAVIS
PRECISION INTEGRATING AND LOGGING SOUND LEVEL METER

Model **812** — Serial No. **0639**
ID No. **N/A**

With Microphone Model **2560** — Serial No. **3155**
With Preamplifier Model **PRM828** — Serial No. **1938**

Customer: **Parsons**
Pasadena, CA 91124 — P.O. No. **Verbal/M. Sharp**

was tested and met Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 651-1979 Type 1

on **02 JUN 2020** — **BY HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **02 JUN 2021**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	1051	1777523	30 SEP 2019	30 SEP 2020
B&K	2636	1423390	02 JAN 2020	02 JAN 2021
B&K	4226	1774068	17 MAR 2020	17 MAR 2021
B&K	4231	1770857	11 SEP 2019	11 SEP 2020
HP	34401A	MY45023668	05 FEB 2020	05 FEB 2021
HP	3458A	2823A07179	24 JUL 2019	24 JUL 2020

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" condition.

Reference Test Procedure: **ACCT Procedure 812-820 Version 3.5.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	**39** %	**989.96** hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed: Harold Lynch

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

Doc. Rev. 16 Feb 2018 — Page 1 of 10

CERTIFICATE OF CALIBRATION
25634-4
FOR LARSON DAVIS
1/2" MICROPHONE PREAMPLIFIER

Model **PRM828**

Serial No. **1891**
ID No. **N/A**

Customer: **Parsons**
Pasadena, CA 91124

P.O. No. **Verbal/M. Sharp**

was tested and met Larson Davis specifications at the points tested according to the Referenced Test Procedure

on **02 JUN 2020**

BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **02 JUN 2021**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	4155	1593777	24 APR 2020	24 APR 2021
B&K	1051	1777523	30 SEP 2019	30 SEP 2020
B&K	2636	1423390	02 JAN 2020	02 JAN 2021
B&K	4226	1774068	17 MAR 2020	17 MAR 2021
B&K	4231	1770857	11 SEP 2019	11 SEP 2020
HP	34401A	MY45023668	05 FEB 2020	05 FEB 2021
HP	3458A	2823A07179	24 JUL 2019	24 JUL 2020

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left."

Reference Test Procedure: **ACCT Procedure PRM828 Version 0.0.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	**39** %	**989.96** hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed Harold Lynch

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

CERTIFICATE OF CALIBRATION
25634-10
FOR LARSON DAVIS
1/2" MICROPHONE PREAMPLIFIER

Model **PRM828**

Serial No. **1901**
ID No. **N/A**

Customer: **Parsons**
Pasadena, CA 91124

P.O. No. **Verbal/M. Sharp**

was tested and met Larson Davis specifications at the points tested according to the Referenced Test Procedure

on **02 JUN 2020**

BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **02 JUN 2021**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	4155	1593777	24 APR 2020	24 APR 2021
B&K	1051	1777523	30 SEP 2019	30 SEP 2020
B&K	2636	1423390	02 JAN 2020	02 JAN 2021
B&K	4226	1774068	17 MAR 2020	17 MAR 2021
B&K	4231	1770857	11 SEP 2019	11 SEP 2020
HP	34401A	MY45023668	05 FEB 2020	05 FEB 2021
HP	3458A	2823A07179	24 JUL 2019	24 JUL 2020

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left."

Reference Test Procedure: **ACCT Procedure PRM828 Version 0.0.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	**39 %**	**989.96** hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **25634-6**

Certificate of Calibration for
Larson Davis 1/2" Random Incidence Microphone

This calibration is performed by comparison with measurement reference standard microphone:

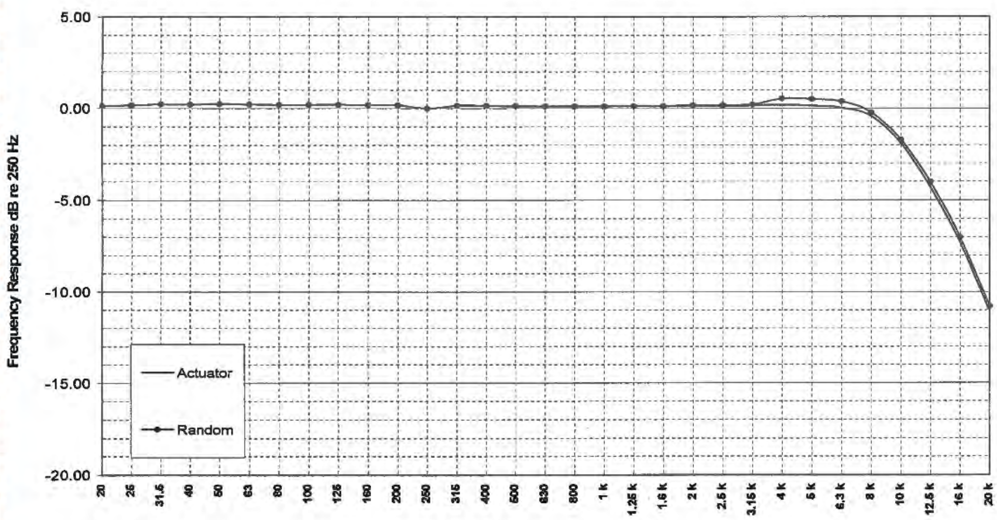
REFERENCE STANDARDS	
Type No.	4134/UA0825
Serial No.	1866524
Calibrated by	DANAK
Cal Date	07 OCT 2019
Due Date	07 OCT 2021

Type no.	**2560**
Serial no.	**3155**
With preamplifier type no.	**N/A**
Preamplifier Serial no.	**N/A**
Submitted by	**Parsons** **Pasadena, CA 91124**
Purchase order no.	**Verbal/Matthew Sharp**
Asset no.	**N/A**

a) Estimated uncertainty of comparison: ± **0.05** dB
b) Estimated uncertainty of reference microphone: ± **0.04** dB
c) Total uncertainty: $\sqrt{a^2+b^2}$ = **± 0.064** dB
d) Expanded uncertainty (coverage factor k = 2 for 95% confidence level): = **± 0.13 dB**

PERFORMANCE DATA		
Open circuit sensitivity at 1,013 hPa, 23°C, 50% RH, 251.2 Hz	**-26.17**	dB re 1 V/Pa
	49.14	mV/Pa
System sensitivity (with preamplifier) at 251.2 Hz	**N/A**	dB re 1 V/Pa
	N/A	mV/Pa

Microphone Frequency Response Type 2560
S/N 3155 : Measured 1 Jun 2020



Calibration performed by Harold Lynch

Harold Lynch, Service Manager

CONDITION OF TEST		
Ambient Pressure	**987.28**	hPa
Temperature	**23**	°C
Relative Humidity	**40**	%
Polarization Voltage	**200**	V
Frequency	**251.2**	Hz
Date of Calibration	**01 JUN 2020**	
Re-calibration due on	**01 JUN 2021**	

ODIN METROLOGY, INC.
3533 OLD CONEJO ROAD, SUITE 125
THOUSAND OAKS, CA 91320
PHONE: (805) 375-0830; FAX: (805) 375-0405

The calibration data is both "as found" and "as final." At the time of calibration this microphone was found to be **within** the manufacturer's specifications. Calibration Procedure: **OM-P-1008-Microphone Rev. 1.2 20130618.**

This calibration is traceable to DANAK/DPLA No. **M2.10-1350-3.1** and through inter-laboratory comparisons to NIST Test Number: **TN-683/286992-15** for transfer standard **4160# 512338 24 JUN 2015**. *See page 2 Traceability.

Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **25634-3**

Certificate of Calibration for
Larson Davis 1/2" Random Incidence Microphone

This calibration is performed by comparison with measurement reference standard microphone:

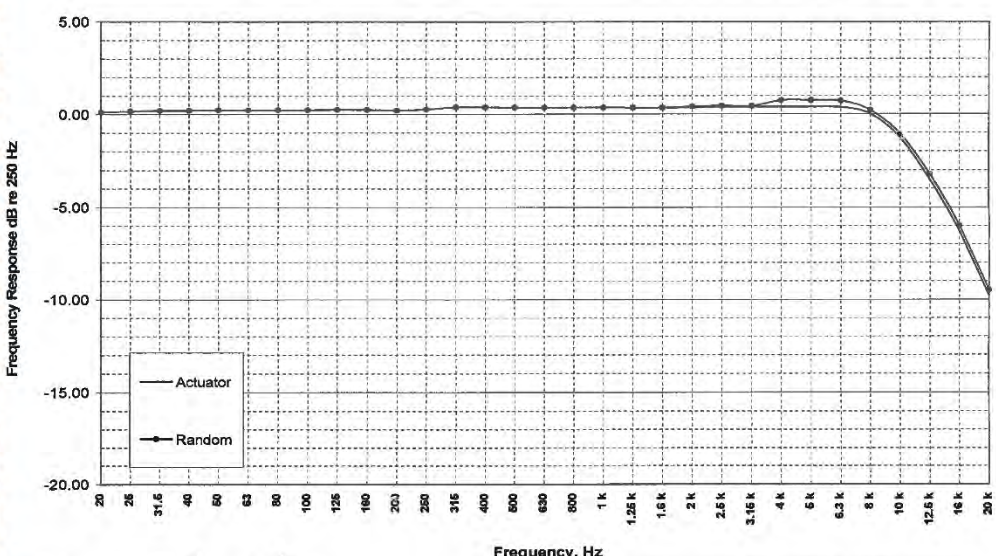
Reference Standards	
Type No.	4134/UA0825
Serial No.	1866524
Calibrated by	DANAK
Cal Date	07 OCT 2019
Due Date	07 OCT 2021

Type no.	**2560**
Serial no.	**3159**
With preamplifier type no.	**N/A**
Preamplifier Serial no.	**N/A**
Submitted by	**Parsons** **Pasadena, CA 91124**
Purchase order no.	**Verbal/Matthew Sharp**
Asset no.	**N/A**

Performance Data		
Open circuit sensitivity at 1,013 hPa, 23°C, 50% RH, 251.2 Hz	**-26.52**	dB re 1 V/Pa
	47.19	mV/Pa
System sensitivity (with preamplifier) at 251.2 Hz	**N/A**	dB re 1 V/Pa
	N/A	mV/Pa

a) Estimated uncertainty of comparison: ± **0.05** dB
b) Estimated uncertainty of reference microphone: ± **0.04** dB
c) Total uncertainty: $\sqrt{a^2+b^2}$ = ± **0.064** dB
d) Expanded uncertainty (coverage factor *k* = 2 for 95% confidence level): = ± **0.13** dB

Microphone Frequency Response Type 2560
S/N 3159 : Measured 1 Jun 2020



Calibration performed by Harold Lynch

Harold Lynch, Service Manager

Condition of Test		
Ambient Pressure	**987.28**	hPa
Temperature	**23**	°C
Relative Humidity	**40**	%
Polarization Voltage	**200**	V
Frequency	**251.2**	Hz
Date of Calibration	**01 JUN 2020**	
Re-calibration due on	**01 JUN 2021**	

ODIN METROLOGY, INC.
3533 OLD CONEJO ROAD, SUITE 125
THOUSAND OAKS, CA 91320
PHONE: (805) 375-0830; FAX: (805) 375-0405

The calibration data is both "as found" and "as final." At the time of calibration this microphone was found to be **within** the manufacturer's specifications. Calibration Procedure: **OM-P-1008-Microphone Rev. 1.2 20130618.**

This calibration is traceable to DANAK/DPLA No. **M2.10-1350-3.1** and through inter-laboratory comparisons to NIST Test Number: **TN-683/286992-15** for transfer standard **4160# 512338 24 JUN 2015**. *See page 2 Traceability.

Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **25218-7**

Certificate of Calibration for Larson Davis Acoustic Calibrator

This calibration is performed by comparison with the following reference standards:

Type No.	4228	4228
Serial No.	1681331	2127028
Calibrated by	TE	TE
Cal Date	06 JUN 2019	06 JUN 2019
Due Date	06 JUN 2020	06 JUN 2020

a) Estimated uncertainty of comparison: ± **0.05** dB
b) Estimated uncertainty of calibration service for standard pistonphone: ± **0.06** dB
c) Total uncertainty: $\sqrt{a^2+b^2}$ = ± **0.08** dB
d) Expanded uncertainty (coverage factor k = 2 for 95% confidence level): = ± **0.16** dB

This acoustic calibrator has been calibrated using standards with values traceable to the National Institute of Standards and Technology. This calibration is traceable to NIST Test Number **TN-683/286992-15.**

Condition of Test		
Ambient Pressure	**984.08**	hPa
Temperature	**23**	°C
Relative Humidity	**34**	%
Date of Calibration	**21 NOV 2019**	
Re-calibration due on	**21 NOV 2020**	

The calibration of this acoustic calibrator was performed using a test system conforming to the requirements of ANSI/NCSLZ540-1, 1994, ISO 17025, and ISO 9001:2015, Certification NQA No. 11252.

Calibration performed by

Harold Lynch, Service Manager

ODIN METROLOGY, INC.
3533 OLD CONEJO ROAD, SUITE 125
THOUSAND OAKS, CA 91320
PHONE: (805) 375-0830; FAX: (805) 375-0405

Calibrator type **CA250**
Serial no. **2480**
Submitted by **Parsons**
Pasadena, CA 91124
Purchase order no. **Verbal/Matthew Sharp**
Asset no. **N/A**

This calibrator has been found to perform **within** the specifications listed below at the normalized conditions stated.

SPL produced in coupler terminated by a loading volume of a ½" microphone	114 ± 0.2 dB
Frequency	250 Hz ± 1%
Distortion	< 3%
At 1,013 hPa, 20°C, and 65% relative humidity	

Performance as Received		
Frequency	**251.04**	Hz
SPL	**114.00**	dB
Distortion	**0.6**	%
Battery Voltage	**9.6**	V

Was adjustment performed? **No**
Were batteries replaced? **No**

Final Performance		
Frequency	**251.04**	Hz
SPL	**114.00**	dB
Distortion	**0.6**	%

Note: This calibrator was **within** manufacturer's specifications as received.

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Appendix C Model Validation, Existing, and Future Traffic Data

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Table C-1. Noise Model Validation Traffic Counts

Description of Traffic Lane	Number of Lanes	Total Peak Hour Traffic Volumes	Travel Speeds, mph	Volumes by Vehicle Type		
				Cars	Medium Trucks	Heavy Trucks
Hourly Traffic Counts for Measurements ST1 & ST3 dated 6/23/21 from 10:00 to 10:20						
Northbound Devlin Road	1	231	45	222	9	0
Southbound Devlin Road	1	396	45	387	6	3
Hourly Traffic Counts for Measurements ST2 & ST4 dated 6/23/21 from 9:20 to 9:40						
Northbound Devlin Road	1	249	45	237	6	6
Southbound Devlin Road	1	387	45	378	9	0

Table C-2. Existing (2021) Modeled Traffic Volumes

Description of Traffic Lane	Number of Lanes	Total Peak Hour Traffic Volumes	Travel Speeds, mph	Volumes by Vehicle Type		
				Cars	Medium Trucks*	Heavy Trucks*
Devlin Road - Linton Hall Road to Wellington Road						
NB Devlin Road	1	682	45	661	14	7
SB Devlin Road	1	292	45	283	6	3
University Boulevard						
EB University Blvd	1	240	35	237	2	1
WB University Blvd	1	136	35	134	1	1

Notes:

* - Medium and heavy truck percentage based on VDOT Traffic Engineering Division 2019 AADT volume estimates.

Table C-3. No-Build (2045) Modeled Traffic Volumes

Description of Traffic Lane	Number of Lanes	Total Peak Hour Traffic Volumes	Travel Speeds, mph	Volumes by Vehicle Type		
				Cars	Medium Trucks*	Heavy Trucks*
Devlin Road - Linton Hall Road to Wellington Road						
NB Devlin Road	1	1,528	45	1,482	31	15
SB Devlin Road	1	655	45	635	13	7
University Boulevard						
EB University Blvd	1	323	35	319	2	2
WB University Blvd	1	183	35	181	1	1

Notes:

* - Medium and heavy truck percentage based on VDOT Traffic Engineering Division 2019 AADT volume estimates.

Table C-4. Build (2045) Modeled Traffic Volumes

Description of Traffic Lane	Number of Lanes	Total Peak Hour Traffic Volumes	Travel Speeds, mph	Volumes by Vehicle Type		
				Cars	Medium Trucks*	Heavy Trucks*
Devlin Road - Linton Hall Road to Wellington Road						
NB Devlin Road	2	1,528	45	1,482	31	15
NB Delvin Road Lane 1	1		45	741	15	7
NB Delvin Road Lane 2	1		45	741	16	8
SB Devlin Road	2	655	45	635	13	7
SB Delvin Road Lane 1	1		45	318	6	3
SB Delvin Road Lane 2	1		45	317	7	4
University Boulevard						
EB University Blvd	1	323	35	319	2	2
WB University Blvd	1	183	35	181	1	1

Notes:

* - Medium and heavy truck percentage based on VDOT Traffic Engineering Division 2019 AADT volume estimates.

Appendix D Warranted, Feasible, and Reasonable Worksheets

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Warranted, Feasible, and Reasonable Worksheet

Note: the answers provided in the worksheet may differ between preliminary and final design. This worksheet is available in a protected digital format upon request.

Date:	10/11/2021
Project No. and UPC:	0621-076-605-C501 UPC118253
County:	Prince William County
Facility:	Devlin Road
Barrier System ID:	Barrier A
Noise Abatement Category(s)	NAC B
Community Name and/or CNE#	CNE A

Design phase: ☑ Preliminary Design ☐ Final Design

Warranted

1. Community Documentation (if applicable)
   a. Date community was permitted. (Per 23CFR 772 this is the date the building permit was issued). 1985
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): September 21, 1994
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of CE, ROD, or FONSI, as appropriate." ☑ Yes ☐ No

2. Criteria requiring consideration of noise abatement
   a. Project causes design year noise levels to approach or exceed the Noise Abatement Criteria? ☑ Yes ☐ No
   b. Project causes a substantial noise increase of 10 dBA or more? ☐ Yes ☑ No

Feasibility

1. Impacted receptor units
   a. Number of impacted receptor units: 8
   b. Number of impacted receptor units receiving 5 dBA or more insertion loss (IL): 8
   c. Percentage of impacted receptor units receiving 5 dB(A) or more IL 100%
   d. Is the percentage 50 or greater? ☑ Yes ☐ No

2	Will placement of the noise barrier cause engineering or safety conflicts, e.g. drainage or site distance issues?	☐ Yes	☑ No
3	Will placement of the noise barrier restrict access to vehicular or pedestrian travel?	☐ Yes	☑ No
4	Will placement of the noise barrier conflict with existing utility locations?	☐ Yes	☑ No

Reasonableness

1. Cost-Benefit Factors
   - a. Surface Area (Total square foot) of the proposed noise barrier. (ft^2) — 13,787
   - b. Impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more. — 8
   - c. Non-impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more. — 4
   - d. Total number of benefited receptors. — 12
   - e. Surface Area per benefited receptor unit. (ft^2/BR) — 1,149
   - f. Is (1e) less than or equal to the maximum square feet per benefited receptor (MaxSF/BR) value of 1600? — Yes
   - g. Does the barrier provide an IL of at least 7 dB(A) for at least one impacted receptor in the design year? — Yes

2. Community Desires Related to the Barrier
   - a. Do at least 50 percent of the benefited receptor unit owner(s) and renters desire the noise barrier? If yes, continue to "decision" block. If no, the barrier can be considered not to be reasonable. Proceed to "decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the impacted receptor unit owners do not desire the barrier." — ☐ Yes ☐ No

3. Additional Noise Barrier Details
   - a. Length of the proposed noise barrier — 955 Ft
   - b Height range of the proposed noise barrier — 14 to 16Ft
   - c. Average height of the proposed noise barrier — 14 Ft
   - d Cost per square foot. ($/$ft^2$) — $42
   - e. Total Barrier Cost ($) — $579,054
   - f. Additional comments (if applicable) —
   - g. Barrier material — ☐ Absorptive ☑ Reflective

Decision

Is the Noise Barrier(s) WARRANTED?	☑ Yes	☐ No
Is the Noise Barrier(s) FEASIBLE?	☑ Yes	☐ No
Is the Noise Barrier(s) REASONABLE?	☑ Yes	☐ No

Additional Reasons for Decision:

Warranted, Feasible, and Reasonable Worksheet

Note: the answers provided in the worksheet may differ between preliminary and final design. This worksheet is available in a protected digital format upon request.

Date:	10/11/2021
Project No. and UPC:	0621-076-605-C501 UPC118253
County:	Prince William County
Facility:	Devlin Road
Barrier System ID:	Barrier B
Noise Abatement Category(s)	NAC B
Community Name and/or CNE#	CNE B

Design phase: ☑ Preliminary Design ☐ Final Design

Warranted

1. Community Documentation (if applicable)
   a. Date community was permitted. (Per 23CFR 772 this is the date the building permit was issued). 1985
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): September 21, 1994
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of CE, ROD, or FONSI, as appropriate." ☑ Yes ☐ No

2. Criteria requiring consideration of noise abatement
   a. Project causes design year noise levels to approach or exceed the Noise Abatement Criteria? ☑ Yes ☐ No
   b. Project causes a substantial noise increase of 10 dBA or more? ☐ Yes ☑ No

Feasibility

1. Impacted receptor units
   a. Number of impacted receptor units: 11
   b. Number of impacted receptor units receiving 5 dBA or more insertion loss (IL): 11
   c. Percentage of impacted receptor units receiving 5 dB(A) or more IL 100%
   d. Is the percentage 50 or greater? ☑ Yes ☐ No

2	Will placement of the noise barrier cause engineering or safety conflicts, e.g. drainage or site distance issues?	☐ Yes	☑ No
3	Will placement of the noise barrier restrict access to vehicular or pedestrian travel?	☐ Yes	☑ No
4	Will placement of the noise barrier conflict with existing utility locations?	☐ Yes	☑ No

Reasonableness

1. Cost-Benefit Factors
   a. Surface Area (Total square foot) of the proposed noise barrier. (ft²) — 11,973
   b. Impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more. — 11
   c. Non-impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more. — 1
   d. Total number of benefited receptors. — 12
   e. Surface Area per benefited receptor unit. (ft²/BR) — 998
   f. Is (1e) less than or equal to the maximum square feet per benefited receptor (MaxSF/BR) value of 1600? — Yes
   g. Does the barrier provide an IL of at least 7 dB(A) for at least one impacted receptor in the design year? — Yes

2. Community Desires Related to the Barrier
   a. Do at least 50 percent of the benefited receptor unit owner(s) and renters desire the noise barrier? If yes, continue to "decision" block. If no, the barrier can be considered not to be reasonable. Proceed to "decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the impacted receptor unit owners do not desire the barrier." — ☐ Yes ☐ No

3. Additional Noise Barrier Details
   a. Length of the proposed noise barrier — 998 Ft
   b Height range of the proposed noise barrier — 12 Ft
   c. Average height of the proposed noise barrier — 12 Ft
   d Cost per square foot. ($/ft²) — $42
   e. Total Barrier Cost ($) — $502,866
   f. Additional comments (if applicable) —
   g. Barrier material — ☐ Absorptive ☑ Reflective

Decision

Is the Noise Barrier(s) WARRANTED?	☑ Yes	☐ No
Is the Noise Barrier(s) FEASIBLE?	☑ Yes	☐ No
Is the Noise Barrier(s) REASONABLE?	☑ Yes	☐ No

Additional Reasons for Decision: ______________________

Warranted, Feasible, and Reasonable Worksheet

Note: the answers provided in the worksheet may differ between preliminary and final design. This worksheet is available in a protected digital format upon request.

Date:	11/17/2021
Project No. and UPC:	0621-076-605-C501 UPC118253
County:	Prince William County
Facility:	Devlin Road
Barrier System ID:	Barrier E
Noise Abatement Category(s)	NAC B
Community Name and/or CNE#	CNE E

Design phase: ☑ Preliminary Design ☐ Final Design

Warranted

1. Community Documentation (if applicable)
   a. Date community was permitted. (Per 23CFR 772 this is the date the building permit was issued). 1985
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): September 21, 1994
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of CE, ROD, or FONSI, as appropriate." ☑ Yes ☐ No

2. Criteria requiring consideration of noise abatement
   a. Project causes design year noise levels to approach or exceed the Noise Abatement Criteria? ☑ Yes ☐ No
   b. Project causes a substantial noise increase of 10 dBA or more? ☐ Yes ☑ No

Feasibility

1. Impacted receptor units
   a. Number of impacted receptor units: 6
   b. Number of impacted receptor units receiving 5 dBA or more insertion loss (IL): 6
   c. Percentage of impacted receptor units receiving 5 dB(A) or more IL 100%
   d. Is the percentage 50 or greater? ☑ Yes ☐ No

2	Will placement of the noise barrier cause engineering or safety conflicts, e.g. drainage or site distance issues?	☐ Yes	☑ No
3	Will placement of the noise barrier restrict access to vehicular or pedestrian travel?	☐ Yes	☑ No
4	Will placement of the noise barrier conflict with existing utility locations?	☐ Yes	☑ No

Reasonableness

1. Cost-Benefit Factors

a. Surface Area (Total square foot) of the proposed noise barrier. (ft²)	11,008
b. Impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more.	6
c. Non-impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more.	7
d. Total number of benefited receptors.	13
e. Surface Area per benefited receptor unit. (ft²/BR)	847
f. Is (1e) less than or equal to the maximum square feet per benefited receptor (MaxSF/BR) value of 1600?	Yes
g. Does the barrier provide an IL of at least 7 dB(A) for at least one impacted receptor in the design year?	Yes

2. Community Desires Related to the Barrier

a. Do at least 50 percent of the benefited receptor unit owner(s) and renters desire the noise barrier? If yes, continue to "decision" block. If no, the barrier can be considered not to be reasonable. Proceed to "decision" block and answer "no" to reasonableness question. As the reason for this decision, state that "The majority of the impacted receptor unit owners do not desire the barrier." ☐ Yes ☐ No

3. Additional Noise Barrier Details

a. Length of the proposed noise barrier	1,376 Ft
b Height range of the proposed noise barrier	8 Ft
c. Average height of the proposed noise barrier	8 Ft
d Cost per square foot. ($/ft²)	$42
e. Total Barrier Cost ($)	$462,336
f. Additional comments (if applicable)	
g. Barrier material	☐ Absorptive ☑ Reflective

Decision

Is the Noise Barrier(s) WARRANTED?	☑ Yes	☐ No
Is the Noise Barrier(s) FEASIBLE?	☑ Yes	☐ No
Is the Noise Barrier(s) REASONABLE?	☑ Yes	☐ No

Additional Reasons for Decision:

Warranted, Feasible, and Reasonable Worksheet

Note: the answers provided in the worksheet may differ between preliminary and final design. This worksheet is available in a protected digital format upon request.

Date:	10/11/2021
Project No. and UPC:	0621-076-605-C501 UPC118253
County:	Prince William County
Facility:	Devlin Road
Barrier System ID:	Barrier F
Noise Abatement Category(s)	NAC B
Community Name and/or CNE#	CNE F

Design phase: ☑ Preliminary Design ☐ Final Design

Warranted

1. Community Documentation (if applicable)
   a. Date community was permitted. (Per 23CFR 772 this is the date the building permit was issued). 1985
   b. Date of approval for the Categorical Exclusion (CE), Record of Decision (ROD), or Finding of No Significant Impact (FONSI): September 21, 1994
   c. Does the date in 1.a precede the date in 1.b? If yes, proceed to Warranted Item 2. If no, consideration of noise abatement is not warranted. Proceed to "Decision" block and answer "no" to warranted question. As the reason for this decision, state that "Community was permitted after the date of approval of CE, ROD, or FONSI, as appropriate." ☑ Yes ☐ No

2. Criteria requiring consideration of noise abatement
   a. Project causes design year noise levels to approach or exceed the Noise Abatement Criteria? ☑ Yes ☐ No
   b. Project causes a substantial noise increase of 10 dBA or more? ☐ Yes ☑ No

Feasibility

1. Impacted receptor units
   a. Number of impacted receptor units: 2
   b. Number of impacted receptor units receiving 5 dBA or more insertion loss (IL): 2
   c. Percentage of impacted receptor units receiving 5 dB(A) or more IL 100%
   d. Is the percentage 50 or greater? ☑ Yes ☐ No

2	Will placement of the noise barrier cause engineering or safety conflicts, e.g. drainage or site distance issues?	☐ Yes	☑ No
3	Will placement of the noise barrier restrict access to vehicular or pedestrian travel?	☐ Yes	☑ No
4	Will placement of the noise barrier conflict with existing utility locations?	☐ Yes	☑ No

Reasonableness

1. Cost-Benefit Factors

a. Surface Area (Total square foot) of the proposed noise barrier. (ft²)	8,597
b. Impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more.	2
c. Non-impacted noise sensitive receptor(s) receiving 5 dB(A) IL or more.	4
d. Total number of benefited receptors.	6
e. Surface Area per benefited receptor unit. (ft²/BR)	1,433
f. Is (1e) less than or equal to the maximum square feet per benefited receptor (MaxSF/BR) value of 1600?	Yes
g. Does the barrier provide an IL of at least 7 dB(A) for at least one impacted receptor in the design year?	Yes

2. Community Desires Related to the Barrier

a. Do at least 50 percent of the benefited receptor unit owner(s) and renters desire the noise barrier? If yes, continue to "decision" block. If no, the barrier can be considered not to be reasonable. Proceed to “decision” block and answer “no” to reasonableness question. As the reason for this decision, state that “The majority of the impacted receptor unit owners do not desire the barrier.”	☐ Yes	☐ No

3. Additional Noise Barrier Details

a. Length of the proposed noise barrier	1,075 Ft
b Height range of the proposed noise barrier	8 Ft
c. Average height of the proposed noise barrier	8 Ft
d Cost per square foot. ($/ft²)	$42
e. Total Barrier Cost ($)	$361,074
f. Additional comments (if applicable)	
g. Barrier material	☐ Absorptive ☑ Reflective

Decision

Is the Noise Barrier(s) WARRANTED?	☑ Yes	☐ No
Is the Noise Barrier(s) FEASIBLE?	☑ Yes	☐ No
Is the Noise Barrier(s) REASONABLE?	☑ Yes	☐ No

Additional Reasons for Decision:

Appendix E County Response to Permits on Undeveloped Lands

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Ogden, Jason

From: Tyler, Stuart
Sent: Tuesday, November 9, 2021 13:48
To: Ogden, Jason
Cc: Lovejoy Muchenje
Subject: FW: Devlin Road Widening - Status of building permits on new development

See below, confirmation from Prince William County that no building permits have been issued for the new subdivision.

Stuart

Stuart Tyler, P.E.
Project Manager / Senior Environmental Planner
2101 Wilson Boulevard
Suite 900
Arlington, Virginia 22201
email: stuart.tyler@parsons.com
Mobile: 571-437-3098
Parsons / LinkedIn / Twitter / Facebook / Instagram

PARSONS

From: Scullin, Elizabeth D. <EScullin@pwcgov.org>
Sent: Tuesday, November 09, 2021 1:14 PM
To: Tyler, Stuart <Stuart.Tyler@parsons.com>
Subject: [EXTERNAL] RE: Devlin Road Widening - Status of building permits on new development

Good afternoon Stuart,

No building permits have been issued for this development at this time.

E

From: Tyler, Stuart <Stuart.Tyler@parsons.com>
Sent: Monday, November 8, 2021 2:36 PM
To: Scullin, Elizabeth D. <EScullin@pwcgov.org>
Subject: Devlin Road Widening - Status of building permits on new development

Hi Elizabeth, not sure where the summer went, but here we are. We're working on finalizing the preliminary noise analysis for the Devlin Road widening and are trying to determine the status of building permits for the development on the attached graphic. The Devlin Road design consultant says he thought the grading had been approved by the County (and was supposed to start this month) but that no building permits had yet been issued for houses. Would it be possible for you to let me know the status of building permits for this development?

Thanks much.

Stuart

Stuart Tyler, P.E.
Project Manager / Senior Environmental Planner
2101 Wilson Boulevard
Suite 900
Arlington, Virginia 22201
email: stuart.tyler@parsons.com
Mobile: 571-437-3098
Parsons / LinkedIn [linkedin.com] / Twitter [twitter.com] / Facebook [facebook.com] / Instagram [instagram.com]

PARSONS