MVP Southgate Amendment Project

Docket No. CP25-XX-000

Resource Report 9 – Air and Noise Quality

November 2018 (Docket No. CP19-14-000)

Amended February 2025

MVP Southgate Amendment Project
Resource Report 9 – Air and Noise Quality

Resource Report 9 – Filing Requirements	
Information	**Location in Resource Report**
Minimum Filing Requirements	
1. Describe existing air quality in the vicinity of the project. (§ 380.12(k)(1)) • Identify criteria pollutants that may be emitted above EPA-identified significance levels.	Section 9.2.1
2. Quantify the existing noise levels (day-night sound level (L_{dn}) and other applicable noise parameters) at noise sensitive areas and at other areas covered by relevant state and local noise ordinances. (§ 380.12(k)(2)) • If new compressor station sites are proposed, measure or estimate the existing ambient sound environment based on current land uses and activities. • For existing compressor stations (operated at full load), include the results of a sound level survey at the site property line and nearby noise-sensitive areas. • Include a plot plan that identifies the locations and duration of noise measurements. • All surveys must identify the time of day, weather conditions, wind speed and direction, engine load, and other noise sources present during each measurement.	Section 9.3.3
3. Quantify existing and proposed emissions of compressor equipment, plus construction emissions, including nitrogen oxides (NO_x) and carbon monoxide (CO), and the basis for these calculations. Summarize anticipated air quality impacts for the project. (§ 380.12(k)(3)) • Provide the emission rate of NOx from existing and proposed facilities, expressed in pounds per hour and tons per year for maximum operating conditions, include supporting calculations, emission factors, fuel consumption rate, and annual hours of operation.	Section 9.2.2, Appendix 9-A, Appendix 9-B
4. Describe the existing compressor units at each station where new, additional, or modified compressor units are proposed, including the manufacturer, model number, and horsepower of the compressor units. For proposed new, additional, or modified compressor units include the horsepower, type, and energy source. (§ 380.12(k)(4))	There are no existing compressor units.
5. Identify any nearby noise-sensitive area by distance and direction from the proposed compressor unit building/enclosure. (§ 380.12(k)(4))	Section 9.3.3
6. Identify any applicable state or local noise regulations. (§ 380.12(k)(4)) • Specify how the facility will meet the regulations.	Section 9.3.2
7. Calculate the noise impact at noise-sensitive areas of the proposed compressor unit modifications or additions, specifying how the impact was calculated, including manufacturer's data and proposed noise control equipment. (§ 380.12(k)(4))	Section 9.3.5
Additional Information Often Missing and Resulting in Data Requests	
8. Include climate information as part of the air quality information provided for the project area.	Section 9.2.1.1
9. Identify potentially applicable federal and state air quality regulations.	Section 9.2.4
10. Provide construction emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for proposed pipelines and aboveground facilities.	Section 9.2.5, Appendix 9-A
11. Provide copies of state and federal applications for air permits.	There are no air permit applications required.

Resource Report 9 – Filing Requirements	
Information	**Location in Resource Report**
12. Provide operation and fugitive emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and aboveground facilities.	Section 9.2.5.2, Appendix 9-B
13. Provide air quality modeling for entire compressor stations.	There are no proposed compressor stations.
14. Identify temporary and permanent emissions sources that may have cumulative air quality effects in addition to those resulting from the project.	Section 9.2.6, Table 9.2-5
Noise and Vibration (see further discussion below)	
15. Describe the existing noise environment and ambient noise surveys for compressor stations, liquefied natural gas facilities, meter and regulation facilities, and drilling locations.	Section 9.3.3
16. Identify any state or local noise regulations applicable to construction and operation of the project.	Section 9.3.2
17. Indicate whether construction activities would occur over 24-hour periods.	Section 9.3.4
18. Discuss construction noise impacts and quantify construction noise impacts from drilling, pile driving, dredging, etc.	Section 9.3.4.3
19. Quantify operation noise from aboveground facilities, including blowdowns.	Section 9.3.5
20. Describe the potential for the operation of the proposed facilities to result in an increase in perceptible vibration and how this would be prevented.	Section 9.3.5.2
21. Identify temporary and permanent noise sources that may have cumulative noise effects in addition to those resulting from the project.	Section 9.3.6

RESOURCE REPORT 9
AIR AND NOISE QUALITY

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LIST OF ACRONYMS AND ABBREVIATIONS

Amendment Project	MVP Southgate Amendment Project
ANSI	American National Standard Institute
AQCR	air quality control region
ASA	American National Standards Association
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
dB	decibels
dBA	A-weighted decibels
ESD	emergency shutdown
°F	degrees Fahrenheit
FEIS	Final Environmental Impact Statement
FERC or Commission	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
GHG	greenhouse gas
HAP	hazardous air pollutant
HDD	horizontal directional drill
Hz	Hertz
km	kilometers
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
L_P	sound pressure level
L_W	sound power level
MACT	Maximum Achievable Control Technology
Mountain Valley	Mountain Valley Pipeline, LLC
MP	milepost
MRR	Greenhouse Gas Mandatory Reporting Rule
NAAQS	National Ambient Air Quality Standards
NCAC	North Carolina Administrative Code
NESHAP	National Emission Standards for Hazardous Air Pollutants
NNSR	Non-attainment NSR
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
NSAs	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
Original Certificated Project	MVP Southgate Project, as approved on June 18, 2020
Pb	lead
ppb	parts per billion by volume
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
ppm	parts per million by volume
PSD	Prevention of Significant Deterioration

SO_2	sulfur dioxide
Title V	Federal Title V operating permit program
tpy	tons per year
Transco	Transcontinental Gas Pipe Line Company, LLC
µg/m3	micrograms per cubic meter
USEPA	U.S. Environmental Protection Agency
VAC	Virginia Administrative Code
VOC	volatile organic compounds

RESOURCE REPORT 9
AIR AND NOISE QUALITY

9.1 INTRODUCTION

On June 18, 2020, in Docket No. CP19-14-000, the Federal Energy Regulatory Commission ("FERC" or "Commission") issued a Certificate of Public Convenience and Necessity pursuant to Section 7(c) of the Natural Gas Act to Mountain Valley Pipeline, LLC ("Mountain Valley") authorizing Mountain Valley to construct and operate the MVP Southgate Project (or "Original Certificated Project"). A Final Environmental Impact Statement ("FEIS") was issued by FERC on February 14, 2020.

In December 2023, Mountain Valley submitted an update on the status of the Original Certificated Project, indicating that it had entered into precedent agreements for a redesigned pipeline route. Mountain Valley is currently seeking to amend the MVP Southgate Project ("Amendment Project") by truncating the Original Certificated Project to approximately 31.3 miles, incorporating certain route deviations, increasing the diameter of the pipeline, removing the Lambert Compressor Station, and modifying the proposed meter (interconnect) stations. The Amendment Project facilities will be located in Pittsylvania County, Virginia, and Rockingham County, North Carolina. See Resource Report 1 for additional information on the Original Certificated Project and Amendment Project.

9.1.1 Environmental Resource Report Organization

Resource Report 9 covers air quality and noise in the Amendment Project area, detailing potential project-related impacts. This report follows the FERC (2017) *Guidance Manual for Environmental Report Preparation*. While this report remains consistent with the Final Environmental Impact Statement ("FEIS") issued on February 14, 2020, updates have been made where necessary.

Given the updates in air quality data and regulations since the FEIS, modifications to the Amendment Project's scope, the removal of the Lambert Compressor Station, and changes in construction timelines and durations, most sections on air and noise have been reviewed, retained, and revised accordingly.

9.2 AIR QUALITY

Potential short-term and temporary air quality impacts may result from construction activities necessary to install the pipeline and meter station/interconnect facilities. Long-term air impacts may result from the operation of equipment associated with these facilities. From a regulatory standpoint, the emissions and associated air quality impacts are addressed in two separate ways:

1) Construction Permitting – Construction (and operation) permitting addresses the emissions and associated impacts from the operational equipment and sources at the Amendment Project facilities. Depending on the major/minor status of the Amendment Project and the location of the Amendment project, Prevention of Significant Deterioration ("PSD"), Non-attainment NSR ("NNSR"), and/or associated state permitting programs ensure that the proposed installation of new air emissions sources (i.e., operational equipment) meet required emission levels, install appropriate control technologies, and meet other regulatory requirements, where appropriate. The regulatory applicability of permitting programs to the Amendment Project is discussed in Section 9.2.4.

2) General Conformity – General Conformity addresses the sources of emissions not covered by permitting actions (e.g., construction activities or an increase in traffic to the sites) and ensures that they comply with the applicable State Implementation Plan(s). Generally, these include the short-term/temporary emissions from construction activities and new emissions increases from non-permitted emission sources such as mobile sources. General Conformity, discussed in Section 9.2.5, is only applicable in maintenance/non-attainment areas. All counties that are impacted by the Amendment Project are in attainment for all criteria pollutants (United States Environmental Protection Agency ["USEPA"] 2024). As such, General Conformity does not apply. However, the Amendment Project has included the construction emissions per the FERC's (2017) *Guidance Manual for Environmental Report Preparation*.

9.2.1 Existing Air Quality

9.2.1.1 Climate

The climate in the Amendment Project area is primarily continental but is subject to modification by the Atlantic Ocean; the proper classification for the climate is "modified continental." The mid-latitude site location and proximity to the Atlantic Ocean exposes the region to a variety of meteorological conditions and events. Varying weather conditions can occur in the Amendment Project area, including tropical storms and hurricanes, thunderstorms, and droughts. The mid-latitude location exposes the area to large annual ranges in temperatures. Cold outbreaks originating from the northern latitudes contrast significantly with the heat and humidity that is often transported from the Gulf of Mexico. The primary interaction point between these mid-latitude regions results in weather characterized by frequent, sometimes powerful, change. At times, mesoscale influences alter this meteorological variety.

South-central Virginia and northern North Carolina have a varied climate. The eastern half of each state, including the eastern shores, lies within the Humid Subtropical climate zone. This region experiences hot, humid summers and mild to cool winters, with evenly dispersed precipitation. The western half of the states are within the transition zone between the Humid Subtropical and Humid Continental zones, with more mild summertime temperatures and colder winters that experience frequent subfreezing low temperatures and moderate snowfall (Britannica 2024).

In the Amendment Project area, summers are warm and humid, and winters are cold but not severe. Thunderstorms can occur at any time but are most frequent during the late spring and summer. The storms are most often accompanied by downpours and gusty winds but are not usually severe. Tornadoes, which infrequently occur, have resulted in significant damage. Severe hailstorms have occurred in the spring. Tropical storms can bring heavy rain, high winds, and flooding in the late summer and fall.

The National Centers for Environmental Information's 1991 – 2020 Climate Normals (National Centers for Environmental Information 2021) were evaluated from meteorological stations located in Chatham, Pittsylvania County, Virginia, and in Reidsville, Rockingham County, North Carolina. Temperatures near the Amendment Project facilities are generally highest in July and lowest in January. Maximum temperatures of 90 degrees Fahrenheit ("°F") or higher occur about 20 days per year on average, while minimum temperatures of 0°F or lower occur less than one day per year on average. The mean annual precipitation is about 47 to 48 inches, with monthly average precipitation ranging from a low of about 3 inches in February to a maximum of about 5 inches in September. The average annual snowfall for the region is approximately 6 to 7 inches.

9.2.1.2 National Ambient Air Quality Standards

National Ambient Air Quality Standards ("NAAQS") have been established for each of the following criteria air pollutants: particulate matter with an aerodynamic diameter of 10 microns or less ("PM_{10}"), particulate matter with an aerodynamic diameter of 2.5 microns or less ("$PM_{2.5}$"), sulfur dioxide ("SO_2"), ozone ("O_3"), nitrogen dioxide ("NO_2"), carbon monoxide ("CO"), and lead ("Pb"). Standards are designated as primary or secondary. Primary standards are set at a level designed to protect public health. Secondary standards are set to protect welfare values such as vegetation, visibility, and property values. NAAQS values are listed in the Code of Federal Regulations ("CFR") at 40 CFR Part 50. The current NAAQS for these criteria pollutants are summarized in Table 9.2-1. Footnotes to Table 9.2-1 explain how compliance with each NAAQS is assessed. Note that both states have adopted State Ambient Air Quality Standards that are equivalent to the NAAQS.

Table 9.2-1

National Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Averaging Period	Standards	
		Primary	Secondary
SO_2	1-hour a/, b/	75 ppb 196 µg/m^3	--
	3-hour c/	--	0.5 ppm 1300 µg/m^3
PM_{10}	24-hour d/	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual e/	9.0 µg/m^3	15.0 µg/m^3
	24-hour f/	35 µg/m^3	35 µg/m^3
NO_2	Annual g/	0.053 ppm (53 ppb) 100 µg/m^3	0.053 ppm (53 ppb) 100 µg/m^3
	1-hour h/	100 ppb 188 ug/m^3	--
CO	8-hour c/	9 ppm 10,000 µg/m^3	--
	1-hour c/	35 ppm 40,000 µg/m^3	--
O_3 (2015 Standard)	8-hour i/, j/	0.070 ppm	0.070 ppm
Pb	Rolling 3-month g/	0.15 µg/m^3	0.15 µg/m^3

a/ Compliance based on 3-year average of 99th percentile of the daily maximum 1-hour average at each monitor within an area.
b/ The 24-hour and annual average primary standards for SO_2 have been revoked.
c/ Not to be exceeded more than once per year.
d/ Not to be exceeded more than once per year on average over 3 years.
e/ Compliance based on 3-year average of weighted annual mean $PM_{2.5}$ concentrations at community-oriented monitors.
f/ Compliance based on 3-year average of 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.
g/ Not to be exceeded.
h/ Compliance based on 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area.
i/ Permit applications that have not met USEPA's grandfathering criteria would have to demonstrate that the proposed project does not cause or contribute to a violation of any revised ozone standards that are in effect when the permit is issued, including the 2015 revised standards.
j/ The 1-hour ozone standard has been revoked in all areas in which Amendment Project activities will occur.
ppm = parts per million by volume; ppb = parts per billion by volume; µg/m^3 = micrograms per cubic meter.

9.2.1.3 Section 107 Attainment Status Designations

The standard method for characterizing existing air quality in a given area is to identify the attainment status of the air quality control region ("AQCR") in which it is located, as described in the FEIS.

The Amendment Project area in Virginia is located in AQCR 222, the Central Virginia Intrastate AQCR. This region is designated as attainment/unclassifiable for all criteria air pollutants (USEPA 2024). The Amendment Project area in North Carolina is located in AQCR 150, the Northern Piedmont Intrastate AQCR. This region is designated as attainment/unclassifiable for all criteria air pollutants (USEPA 2024).

9.2.1.4 Existing Ambient Background Levels

The Amendment Project is located in Pittsylvania County, Virginia, and in Rockingham County, North Carolina. These counties contain ambient air quality monitors that collect data concerning existing levels of various air pollutants. Updated Summary data from the USEPA AirData database were reviewed to characterize existing concentrations at the Amendment Project for comparison with primary NAAQS. Specifically, data from the closest ambient air quality monitoring stations were used to represent existing air quality at the Amendment Project area. If no county data were available, data from a nearby county were used as a substitute (USEPA 2024).

Ambient air quality monitoring data from the 3-year period between 2021 – 2023 are summarized in Table 9.2-1 for monitoring stations nearest to the Amendment Project. Table 9.2-2 lists the maximum annual mean concentration and/or a near-maximum short-term concentration by station.

Table 9.2-2

Existing Ambient Background Levels in the Vicinity of the Amendment Project

Pollutant	Averaging Period	Monitoring Station	AQS Site ID	County	State	Approx. Distance from Facility (km)	Background Concentration	Primary NAAQS	Units a/
Ozone	8-hour	Reidsville	37-033-0001	Caswell	NC	59	0.059	0.070	ppm
CO	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	0.9	35	ppm
CO	8-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	0.8	9	ppm
NO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	32	100	ppb
NO_2	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	5	53	ppb
PM_{10}	24-hour	Mendenhall School	37-081-0013	Guilford	NC	90	38	150	ug/m^3
$PM_{2.5}$	24-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	20	35	ug/m^3
$PM_{2.5}$	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	7.1	9	ug/m^3
SO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	3	75	ppb

a/ ppm = parts per million by volume; ppb = parts per billion by volume; $\mu g/m^3$ = micrograms per cubic meter; km = kilometers

Second-high short-term concentrations are listed for most pollutants, but Table 9.2-2 includes the fourth-highest 8-hour average concentration for ozone, the 98th percentile 1-hour average concentration for NO_2, the 98th percentile 24-hour average concentration for $PM_{2.5}$, and the 99th percentile 1-hour average concentration for SO_2, consistent with the structure of the NAAQS for those pollutants and averaging periods.

9.2.1.5 Federal Class I Areas

Federal Class I areas are certain areas established by Congress, such as wilderness areas and national parks, that are afforded special protection under the Clean Air Act ("CAA"). Once designated as a Class I area, an area cannot be re-designated to another (lower) classification. Class I areas are allowed the smallest degree of air quality deterioration through New Source Review ("NSR")/Prevention of Significant Deterioration ("PSD") permitting, and special considerations must be made in the NSR permitting process when a Class I area is located close to a site. The Amendment Project is not anticipated to require major source PSD review, and thus, Class I air quality modeling will not be required. Regardless, the Class I areas nearest to the new pipeline connection have been identified. The Class I areas are listed in Table 9.2-3.

Table 9.2-3

Federal Class I Areas Closest to the Amendment Project

Class I Area	Managing Agency	Direction from New Pipeline Connection Lambert Interconnect	Distance to New Pipeline Connection	
			Kilometers	Miles
James River Face Wilderness Area, VA	U.S. Forest Service	North	81	50
Shenandoah National Park, VA	National Park Service	North	143	89
Linville Gorge Wilderness Area, NC	U.S. Forest Service	Southwest	251	156

9.2.2 Project Emissions

9.2.2.1 Construction

Construction activities associated with the Amendment Project will result in temporary increases in emissions of some pollutants due to the use of non-stationary equipment powered by diesel fuel or gasoline engines; the temporary generation of fugitive dust due to disturbance of the ground surface, vegetation clearing, and other dust generating actions; and indirect emissions attributable to workers commuting to and from work sites during construction. Detailed construction emissions calculations, along with the methodology and emissions factors used, are provided in Appendix 9-A.

These sources are not considered stationary sources, and their impacts will generally be temporary and localized. Therefore, the emissions are not required to be evaluated as part of the PSD or NNSR major source determination analysis. Furthermore, the emissions from construction activities are not expected to cause or significantly contribute to an exceedance of the NAAQS.

Potential emissions from the construction of the Amendment Project are presented in Section 9.2.5.

9.2.2.2 Operation (including maintenance and malfunctions)

Operational emission estimates associated with fugitive gas releases from the pipeline, valves, and meter stations are provided in Table 9.2-4. The calculations are based on a methodology described in Interstate Natural Gas Association of America guidelines[1] and a representative natural gas sample. Detailed emissions calculations are also included in Appendix 9-B.

Table 9.2-4

Estimated Operational Emissions from the Amendment Project

Component	County	Length (miles)	Total VOC (tons)	Total CO_2 (tons)	Methane (tons)	Total CO_2e (tons)
H-650 Pipeline	Pittsylvania, VA	26.75	0.18	0.21	17.29	484.43
	Rockingham, NC	4.59	0.03	0.04	2.97	83.12
Aboveground Facilities						
Lambert Interconnect	Pittsylvania, VA	NA	0.68	0.34	65.60	1837.20
LN 3600 Interconnect	Rockingham, NC	NA	0.68	0.34	65.60	1837.20
Dan River Interconnect #1	Rockingham, NC	NA	0.68	0.34	65.60	1837.20
Dan River Interconnect #2	Rockingham, NC	NA	0.68	0.34	65.60	1837.2
NA indicates that the pollutant emissions are not calculated using that parameter.						

9.2.2.3 Decommissioning

Decommissioning is not currently planned. Mountain Valley will obtain the necessary state and federal permits for decommissioning at the end of the useful life of the Amendment Project facilities.

9.2.3 Air Permitting Requirements

The Virginia Administrative Code ("VAC") requires sources of air contamination to notify the state and receive a permit to construct, modify, relocate, and operate the stationary source unless otherwise exempt. Similarly, the North Carolina Administrative Code ("NCAC") requires owners or operators, unless otherwise exempted, to apply for and obtain an air quality permit to construct, operate, or modify a source. Mountain Valley will not be required to submit construction permits for the stationary sources associated with the Amendment Project meter station facilities, as the proposed stationary sources are exempt under the VAC or NCAC.

9.2.4 Regulatory Review and Applicability

This section lists federal and state air quality regulations that may be applicable to the Amendment Project.

9.2.4.1 Prevention of Significant Deterioration Source Classification

Federal construction permitting programs regulate new and modified sources of attainment pollutants under PSD and new and modified sources of non-attainment pollutants under NNSR. PSD regulations apply when a new source is constructed in which emissions exceed PSD major source thresholds, an existing

[1] Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage, Volume 1 – GHG Emission Estimation Methodologies and Procedures, Interstate Natural Gas Association of America, September 28, 2005.

minor source undergoes a modification in which emission increases exceed PSD major source thresholds, or an existing major source undergoes a modification in which emission increases exceed PSD significant emission rates. The permanent, stationary sources' emissions associated with the Amendment Project are insignificant in nature, and therefore, PSD permitting is not triggered.

NNSR regulations apply only in areas designated as non-attainment. The Amendment Project will be constructed in Pittsylvania County, Virginia, and Rockingham County, North Carolina, both of which are designated as attainment/unclassifiable areas for all criteria pollutants (USEPA 2024). Therefore, NNSR regulations do not apply.

9.2.4.2 Title V Operating Permit Program

40 CFR Part 70 establishes the Federal Title V operating permit program ("Title V"). Virginia has incorporated the elements of this federal program in its Title V operating permit program in Virginia Article 1 of 9 VAC 5 Chapter 80 (9 VAC 5-80-50 et seq.). North Carolina has incorporated the elements of this federal program in its Title V operating permit program in Chapter 15A North Carolina Administrative Code Chapter 2, Subchapter 2Q, Section .0500 (15A NCAC 02Q .0500). The major source thresholds with respect to the Virginia and North Carolina Title V operating permit program regulations are 10 tons per year ("tpy") of a single hazardous air pollutant ("HAP"), 25 tpy of any combination of HAPs and 100 tpy of any other regulated pollutants, except greenhouse gas ("GHG").[2]

The Amendment Project is not expected to construct or operate any major sources for Title V purposes.

9.2.4.3 New Source Performance Standards

New Source Performance Standards ("NSPS"), located in 40 CFR Part 60, require new, modified, or reconstructed sources to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. Moreover, any source subject to an NSPS is also subject to the general provisions of NSPS Subpart A, except where expressly noted. The following is a summary of applicability and non-applicability determinations for NSPS regulations of relevance to the facilities.

NSPS Subpart OOOO – Natural Gas Production, Transmission, and Storage

Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution, applies to facilities that were constructed (new)/reconstructed/modified after August 23, 2011, and on or before September 18, 2015. This NSPS was published in the Federal Register on August 16, 2012, and was subsequently amended. The list of potentially affected facilities includes gas wells, centrifugal compressors, reciprocating compressors, pneumatic controllers, storage vessels, and sweetening units within the crude oil and natural gas sector. For the sector's natural gas transmission segment, Subpart OOOO defines standards for storage vessels. Since the Amendment Project will be constructed after September 18, 2015, this subpart does not apply to the proposed Project facilities.

NSPS Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution

40 CFR Part 60, Subpart OOOOa applies to sources that are constructed (new)/modified/reconstructed after September 18, 2015, and on or before December 6, 2022, including oil and gas wells, centrifugal

[2] On June 23, 2014, the U.S Supreme Court decision in the case of *Utility Air Regulatory Group v. EPA* effectively changed the permitting procedures for GHGs under the PSD and Title V programs.

compressors, reciprocating compressors, pneumatic controllers, storage vessels, process units, sweetening units, pneumatic pumps and equipment leaks within the crude oil and natural gas sector. For the sector's natural gas transmission segment, Subpart OOOOa defines standards for each of these affected facilities, except for gas wells, pneumatic pumps, and sweetening units. Since the Amendment Project will be constructed after December 6, 2022, this subpart does not apply to the proposed Project facilities.

NSPS Subpart OOOOb – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution

40 CFR Part 60, Subpart OOOOb applies to sources that are constructed (new)/modified/reconstructed after December 6, 2022, including oil and gas wells, centrifugal compressors, reciprocating compressors, process controllers, pumps, storage vessels, equipment leaks, and sweetening units within the crude oil and natural gas sector. Subpart OOOOb has requirements for process controllers and pumps at a well site, centralized production facility, onshore natural gas processing plant, or a compressor station. Similarly, Subpart OOOOb has requirements for fugitive emissions components at a well site, centralized production facility, or a compressor station. Since Mountain Valley will not be constructing the identified facilities, this subpart does not apply.

9.2.4.4 National Emission Standards for Hazardous Air Pollutants

Regulatory requirements for facilities subject to National Emission Standards for Hazardous Air Pollutants ("NESHAP") standards, otherwise known as Maximum Achievable Control Technology ("MACT") standards for source categories, are contained in 40 CFR Part 63. 40 CFR Part 61 NESHAP standards are defined for specific pollutants, while Part 63 NESHAPs are defined for source categories where allowable emission limits are established on the basis of a MACT determination for a particular major source. A major source of HAP is defined as having potential emissions in excess of 25 tpy for total HAPs and/or potential emissions in excess of 10 tpy for any individual HAP. Area sources consist of smaller facilities that release lesser quantities of HAPs into the air and are defined as sources that emit less than 10 tpy of a single HAP or less than 25 tpy of a combination of HAPs. Part 63 NESHAPs apply to sources in specifically regulated industrial source categories (CAA Section 112(d)), and MACT requirements can also apply on a case-by-case basis (Section 112(g)) for facilities not yet regulated as a specific industrial source category.

Potential HAP emissions from the facilities will be below the major source thresholds (i.e., less than 10 tpy of any individual HAP and less than 25 tpy of total HAPs), and therefore, the facilities will be an area source of HAPs.

NESHAP Subpart HH – Natural Gas Production Facilities

This standard applies to sources at natural gas production facilities that are major or area sources of HAP emissions. The Amendment Project facilities are in the transmission segment; therefore, the Amendment Project facilities will not be subject to Subpart HH.

NESHAP Subpart HHH – Natural Gas Transmission and Storage Facilities

This standard applies to sources at natural gas transmission and storage facilities that are major sources of HAP emissions located downstream of the point of custody transfer (after processing and/or treatment in the production sector) but upstream of the distribution sector. The Amendment Project facilities are transmission facilities and area (not major) sources of HAP emissions. Therefore, the Amendment Project facilities will not be subject to Subpart HHH.

9.2.4.5 Greenhouse Gas Reporting Rule

Per 40 CFR § 98.2(a)(2), facilities that contain a source category listed in Table A-4 and emit 25,000 metric tons or more per year of carbon dioxide equivalent ("CO_2e") in combined emissions from stationary fuel combustion units, miscellaneous uses of carbonate, and all applicable source categories in Tables A-3 and A-4 are subject to reporting under the Greenhouse Gas Mandatory Reporting Rule ("MRR"). Table A-4 of 40 CFR 98 Subpart A includes Petroleum and Natural Gas Systems. Potential greenhouse gas emissions from the facilities are calculated to be less than 25,000 metric tpy. The actual emissions will be calculated annually following the 40 CFR Part 98, Subpart W applicability and calculation methodology and compared with the 25,000 metric tpy of carbon dioxide ("CO_2") threshold to address the potential applicability of the rule. The Amendment Project will meet all requirements of the MRR, as applicable. No other subparts under the MRR are applicable to the Amendment Project facilities.

9.2.4.6 Virginia Air Quality Regulations

The Amendment Project is subject to regulations contained in the VAC, which requires sources of air contamination to notify the state and receive a permit to construct, modify, relocate, and operate the stationary source unless otherwise exempt. The air quality regulations for the Commonwealth of Virginia are codified at 9 VAC 5, State Air Pollution Control Board. The following sections present a discussion of potentially applicable Virginia air quality regulations.

9 VAC 5-80-1100: Construction Permits

Article 6 permitting must be completed before the construction of a new source. The Amendment Project does not include any facilities that will require an air permit.

9 VAC 5-130-40: Open Burning

Open burning is permitted on site for the destruction of clean-burning waste and debris waste resulting from the development or modification of roads and highways, pipelines, buildings, or any other clearing operations. Open burning is prohibited from May 1 through September 30. The contractor(s) may utilize open burning as a means of disposing of clean-burning land-clearing waste during the construction of the Amendment Project. Mountain Valley's contractor(s) will comply with the provisions of 9 VAC 5-130-40 during construction.

9.2.4.7 North Carolina Air Quality Regulations

15A NCAC 02D.1900: Open Burning

This rule outlines the requirements for permissible open burning during land clearing and right-of-way maintenance. Contractor(s) may utilize open burning as a means of disposing of land-clearing waste during the construction of the Amendment Project. This rule regulates items such as the timing, location, meteorological conditions, and type of waste for burning. Mountain Valley's contractor(s) will comply will all provisions of 15A NCAC 02D.1900 during construction.

15A NCAC 02Q.0300: Construction and Operation Permits

This rule outlines the requirements for construction permits for new and modified sources. The proposed Amendment Project does not contain facilities that are subject to construction permitting.

9.2.4.8 Chemical Accident Prevention Provisions

USEPA has established accidental release prevention and risk management plan requirements as part of 40 CFR Part 68 (Chemical Accident Prevention Provisions). Part 68 lists regulated substances along with thresholds for determining the applicability of the associated requirements. If a regulated substance is handled, stored, or processed in greater than threshold quantities at a stationary source, then a risk management plan must be prepared (40 CFR Sections 68.10(a) and 68.12(a)).

Except for constituents of natural gas, such as ethane and methane, Mountain Valley is not expected to produce, process, handle, or store any substance regulated under Part 68 in quantities exceeding applicability thresholds as part of the Amendment Project.

9.2.5 General Conformity

Under the CAA, a General Conformity analysis is required for any project that requires federal action. General Conformity applies to those emission generating activities resulting from the Amendment Project that are not already covered by permitting and located in an area that is designated as non-attainment or a maintenance area (40 CFR 93.153(b)).

The pipeline in Virginia is located in AQCR 222, the Central Virginia Intrastate AQCR. This region is designated as attainment/unclassifiable for all criteria air pollutants (USEPA 2024). The pipeline in North Carolina is located in AQCR 136, the Northern Piedmont Intrastate AQCR. This region is designated as attainment/unclassifiable for all criteria air pollutants (USEPA 2024). Therefore, a General Conformity analysis is not required for the Amendment Project.

Construction emissions are presented in Section 9.2.5.1 per FERC's (2017) *Guidance Manual for Environmental Report Preparation*.

9.2.5.1 Construction Emissions

The use of equipment to construct the Amendment Project will result in temporary, short-term emissions of air pollutants that will be restricted to the construction period for the Amendment Project facilities and will terminate once construction has been completed. Construction for the Amendment Project is expected to take place in 2027 and 2028. In addition, some right-of-way restoration will occur in 2027 and may continue into 2029, dependent upon growing conditions.

Construction activities can generally be categorized into the following activities:

- Construction Equipment Engines – Emissions associated with off-road construction equipment such as air compressors, backhoes, cranes, and other construction equipment;
- On-Road Vehicle Travel – Emissions from commuter buses, passenger vehicles, and diesel or gasoline trucks;
- Construction Vehicle Travel – Emissions associated with on-road vehicle travel by dump trucks, light/medium duty trucks, and water/fuel trucks;
- Earthmoving Fugitives – Emissions resulting from bulldozing, grading, and land disturbance; and
- Wind Erosion – Emissions resulting from soil piles.

Emissions from these source categories were calculated using emission factors and USEPA models from the following sources:

- Western Regional Air Partnership Fugitive Dust Handbook, Countess Environmental, September 2006;
- USEPA MOVES4 Vehicle Emission Modeling Software.

Note that fugitive dust emissions from on-road construction equipment and on-road commuter traffic are included in the emission calculations provided in Appendix 9-A. Additionally, note that for the types of sources of GHG emissions associated with the Amendment Project construction, total CO_2 is essentially the same as CO_2e because the CO_2 component of CO_2e for these sources is much greater than 99 percent.

Meter Station Emissions

Emissions from the meter stations were estimated based on the type of construction activity occurring and the length of time that type of activity was expected to last at each station. The total emissions are based on the year the construction is expected to occur at each station and are exhibited in Table 9.2-5 and Table 9.2-6. Detailed construction emissions calculations, along with the methodology and emissions factors used, are provided in Appendix 9-A.

Pipeline Emissions

Emissions from the construction of the pipeline are calculated based on the length of pipeline being constructed in each county. Emissions were estimated based on the type of construction activity occurring and the length of time that type of activity was expected to last within each county of pipeline construction. The total emissions expected to occur for each construction year by county are exhibited in Table 9.2-5 and Table 9.2-6. Detailed construction emissions calculations, along with the methodology and emissions factors used, are provided in Appendix 9-A.

Table 9.2-5

Estimated Construction Emissions from the Amendment Project – 2027

Source	2027 Construction Emissions (TPY)							
	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
Meter Stations								
Construction Equipment Engines	1260	0.42	1.35	0.08	0.08	0.00	0.12	0.05
On-Road Vehicle Travel	492.99	1.69	0.48	0.01	0.01	0.00	0.18	0.04
Off-Road Vehicle Travel	NA	NA	NA	60.75	6.07	NA	NA	NA
Earthmoving Fugitives	NA	NA	NA	5.25	0.53	NA	NA	NA
Open Burning	17.17	0.75	0.02	0.09	0.09	NA	0.13	NA
Wind Erosion	NA	NA	NA	0.76	0.08	NA	NA	NA
Meter Station Total	**1770**	**2.87**	**1.86**	**66.94**	**6.86**	**0.01**	**0.42**	**0.10**
H-650 Pipeline								
Construction Equipment Engines	49889	17.18	69.68	3.02	2.93	0.14	3.51	1.53
On-Road Vehicle Travel	2491	15.81	1.78	0.05	0.05	0.01	1.26	0.34
Off-Road Vehicle Travel	NA	NA	NA	209.45	20.94	NA	NA	NA
Earthmoving Fugitives	NA	NA	NA	380.10	38.01	NA	NA	NA
Open Burning	3431	150.79	4.28	18.39	18.39	NA	25.88	NA
Wind Erosion	NA	NA	NA	54.71	5.47	NA	NA	NA
H-650 Pipeline Total	**55811**	**183.79**	**75.73**	**665.73**	**85.80**	**0.15**	**30.64**	**1.87**
Pipeline in Pittsylvania, VA	46929	157.67	64.22	494.93	66.58	0.12	26.80	1.48
Pipeline in Rockingham, NC	8881	26.12	11.51	170.80	19.22	0.03	3.84	0.39
2027 Amendment Project Total:	**57581**	**186.66**	**77.59**	**732.67**	**92.65**	**0.15**	**31.07**	**1.97**

NA indicates that the specific pollutant emissions are not expected from that source.
NO_x = nitrogen oxide

Table 9.2-6

Estimated Construction Emissions from the Amendment Project – 2028

Source	2028 Construction Emissions (TPY)							
	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
Meter Stations								
Construction Equipment Engines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
On-Road Vehicle Travel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road Vehicle Travel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Earthmoving Fugitives	NA	NA	NA	0.00	0.00	NA	NA	NA
Open Burning	NA	NA	NA	0.00	0.00	NA	NA	NA
Wind Erosion	0.00	0.00	0.00	0.00	0.00	NA	0.00	NA
Meter Station Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
H-650 Pipeline								
Construction Equipment Engines	3827	0.71	3.14	0.14	0.14	0.01	0.17	0.07
On-Road Vehicle Travel	210.39	1.14	0.15	0.00	0.00	0.00	0.09	0.02
Off-Road Vehicle Travel	NA	NA	NA	19.13	1.91	NA	NA	NA
Earthmoving Fugitives	NA	NA	NA	221.73	22.17	NA	NA	NA
Open Burning	0.00	0.00	0.00	0.00	0.00	NA	0.00	NA
Wind Erosion	NA	NA	NA	31.92	3.19	NA	NA	NA
Pipeline Total	**4038**	**1.85**	**3.29**	**272.91**	**27.42**	**0.01**	**0.26**	**0.09**
Pipeline in Pittsylvania, VA	3379	1.20	2.76	226.18	22.72	0.01	0.19	0.07
Pipeline in Rockingham, NC	658	0.65	0.53	46.73	4.69	0.00	0.07	0.02
2028 Amendment Project Total:	**4038**	**1.85**	**3.29**	**272.91**	**27.42**	**0.01**	**0.26**	**0.09**

NA indicates that the specific pollutant emissions are not expected from that source.
NO_x = nitrogen oxide

9.2.6 Air Quality Mitigation Measures

9.2.6.1 Construction Emissions

The construction emissions associated with the Amendment Project are temporary in nature and are expected to have minimal impact on the air quality in the surrounding area. However, Mountain Valley will implement various mitigation measures to minimize construction emissions. These include:

- Avoiding unnecessary construction activities leading to increased emissions, where possible;
- Utilizing low sulfur diesel fuel with a maximum sulfur content of 15 ppm based upon the requirements of 40 CFR Part 80;
- When practical, requesting that contractor(s) use newer model equipment that is equipped with the latest emission reduction technologies that are in compliance with USEPA's mobile source emission standards;
- Following the manufacturer's operating recommendations regarding good combustion practices to ensure that fuel efficiency is maximized, and engines are operated such that emissions are minimized;
- Implementing the fugitive dust control measures as described below; and
- Avoiding idling of the construction equipment to the extent possible.

The fugitive dust control measures will include the following specific steps to be taken during construction:

- Fugitive dust emissions from vegetation removal, clearing and grading, cutting and filling, topsoil removal, trenching, backfilling, and stockpile storage will be controlled to a great extent by following construction sequencing and by limiting disturbance of multiple areas for construction activities at any one time;
- Fugitive dust emissions generated by motorized equipment and miscellaneous vehicle traffic will be controlled by wet suppression as necessary;
- Fugitive dust emissions from paved roads will be controlled by using a combination of water trucks, power washers, sweeping, and/or vacuuming. If necessary, additional potential sources of water for dust control may include other municipal systems, groundwater supply wells, and, if approved, surface waters;
- Track out of loose materials will be controlled using rock construction entrances on access roads that begin at a junction with paved roads; and
- When environmental conditions are dry, inspection of dust control measures will be conducted daily.

Table 9.2-7 presents the list of the major existing and reasonably foreseeable future projects that may cumulatively or additively impact air quality along with an approximate distance from the nearest Amendment Project facility. Operation of the existing and reasonably foreseeable major air emissions sources listed in Table 9.2-7 will have air emissions associated with them; however, the other sources of air emissions from the operation of these existing or planned projects are or will be controlled in accordance with state and federal air pollution laws and regulations. Additionally, Transcontinental Gas Pipe Line Company, LLC ("Transco") will need to obtain FERC authorization for the natural gas transmission facilities associated with the Southeast Supply Enhancement Project prior to construction and operation; the review of those facilities will include a detailed air quality assessment for construction and operation.

Table 9.2-7

Major Air Quality Facilities within 20 miles of the Amendment Project

County, State	Facility	Approximate Distance to the New Pipeline Connection (miles)
Pittsylvania, VA	Transco – Station 165	<1
Pittsylvania, VA	Transco – Station 166	<1
Pittsylvania, VA	Arkema Inc.	5
Pittsylvania, VA	Owens-Brockway Glass Container Inc.	16
Pittsylvania, VA	Intertape Polymer Corporation	16
Pittsylvania, VA	Elkay Wood Product Company	17
Pittsylvania, VA	Dominion – Pittsylvania Power Station	19

The existing and proposed offsite major air emissions sources are or will be required to operate in compliance with all applicable state and federal air regulations, including stack testing, recordkeeping, reporting, and monitoring requirements to establish compliance with federally enforceable emissions standards. Because operations of both the Amendment Project and the other existing and proposed major Title V projects/facilities will be regulated by the Virginia Department of Environmental Quality and North Carolina Department of Environmental Quality through the air permitting process, the cumulative effect of operation of the Amendment Project with operations of other projects is not expected to result in adverse air quality impacts.

9.2.6.2 Climate Change and Greenhouse Gases

Using good management practices and energy-efficient design, Mountain Valley has employed measures to minimize GHG emissions and any resulting impact on climate change from the construction and operation of the Amendment Project. Construction activities will result in temporary increases in GHG emissions due to the use of non-stationary equipment powered by diesel fuel or gasoline engines and indirect emissions attributable to workers commuting to and from work sites during construction. These sources are not considered stationary sources, and their impacts will generally be temporary and localized. Mountain Valley will employ good management practices, as described above, to limit these emissions.

With respect to operational emissions, GHG emissions would be expected to be limited to the use of energy efficient design and the minimization of GHG releases through standard work practices for the natural gas industry.

Fugitive GHG (and, to a lesser extent, volatile organic compounds ["VOC"]) leaks will be minimized by adhering to good operating and maintenance practices. Mountain Valley designed the Amendment Project to reduce GHG emissions where technically and economically feasible. Total VOC and GHG emissions from fugitive and blowdown sources are estimated to be low and well below major source permitting thresholds. Therefore, any additional emission reduction will not be cost-effective due to the minimal emission reductions achieved.

The natural gas that will flow on the Amendment Project will be received at the Mountain Valley Pipeline (the Mainline Project) interconnection near Chatham, Virginia, and is a portion of the total natural gas capacity of the Mainline Project. In its approval of the Mainline Project, the Commission analyzed the GHG emissions from end-use combustion of the total capacity of the Mainline Project. Accordingly, any GHGs attributed from end-use combustion of the natural gas that will flow on the Amendment Project have already been considered as part of the Commission's approval of the Mainline Project. The Amendment Project will not result in any additional end-use GHG emissions.

9.3 Noise

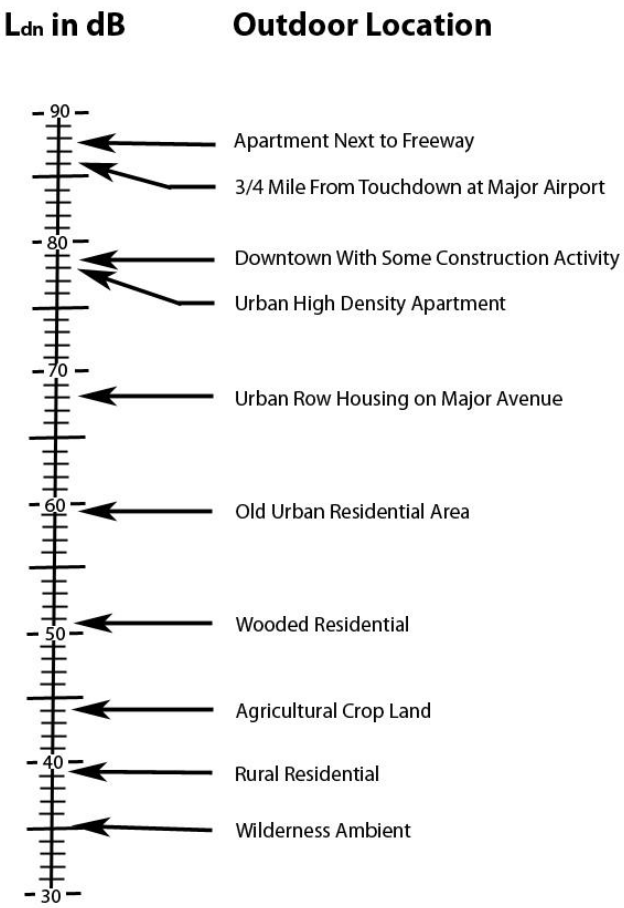
This section provides an overview of the noise-generating equipment for the Amendment Project, the noise study approach for each meter station, locations of horizontal directional drill ("HDD") and railroad conventional bores, a description of noise associated with construction activities, and a discussion of typical noise mitigation methods for the type of equipment associated with each component of the Amendment Project. Environmental noise will be generated during the operation of the meter stations associated with the Amendment Project. There will also be noise associated with the construction of the Amendment Project facilities.

9.3.1 Background Information on Sound and Noise

A sound source is defined by a sound power level ("L_W"), which is the rate at which acoustical energy is radiated outward and is expressed in units of watts. A sound pressure level ("L_P") is a measure of fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information associated with the source sound power level and surrounding environment. Sound power cannot be measured directly but can be calculated from measurements of sound intensity or sound pressure at a given distance from the source.

The perception of sound as "noise" is influenced by several technical factors such as intensity, sound quality, tonality, duration, and existing background levels. Sound levels are presented on a logarithmic scale to account for the large range of acoustic pressures that the human ear is exposed to and are expressed in units of decibels ("dB"). Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is used to determine tonal characteristics. The unit of frequency is Hertz ("Hz"), which is a measure of the cycles per second of the sound pressure waves. Typically, the frequency analysis examines 11 octave (or 33 1/3 octave) bands ranging from 16 Hz (low) to 16,000 Hz (high). One-third (1/3) octave bands have one-third the width of full octave bands, which gives a higher resolution and a more detailed description of the frequency content of the sound. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter.

The A-weighted filter is applied to compensate for the frequency response of the human auditory system and sound exposure in acoustic assessments and is designated in A-weighted decibels ("dBA"). Environmental noise is commonly described in terms of equivalent sound level ("L_{eq}"). The L_{eq} value, conventionally expressed in dBA, is the energy-averaged, A-weighted sound level for the complete time period represented as a steady, continuous sound level. Another common noise descriptor used when assessing environmental noise is the day-night sound level ("L_{dn}"), which is calculated by averaging the 24-hour hourly L_{eq} levels at a given location and adding 10 dB to noise emitted during the nighttime period (10:00 p.m. to 7:00 a.m.) to account for the increased sensitivity of people to noises that occur at night. The L_{max} is the maximum instantaneous sound level as measured during a specified time period. It can also be used to quantify the time-varying maximum instantaneous sound pressure level (as generated by equipment or an activity) or a manufacturer maximum source emission level. Estimates of common noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Figure 9.3-1.



(Adapted from USEPA 1974)

Figure 9.3-1 Environmental Sound Pressure Levels (L_{dn})

9.3.2 Applicable Noise Regulations

The Amendment Project is located in Virginia and North Carolina and crosses portions of two counties. Mountain Valley reviewed federal, state, county, and local noise regulations to identify regulations that may be applicable to construction and operation. A regulatory search found no state noise standards applicable to the Amendment Project; however, there are federal requirements and county noise regulations that are potentially applicable to the Amendment Project as described in Sections 9.3.2.1 and 9.3.2.2, respectively.

9.3.2.1 FERC Requirements

The FERC noise regulations, set forth in 18 CFR § 380.12(k)(2), require an applicant to identify existing noise sensitive areas ("NSAs") (e.g., residences, schools, churches) within 0.5 mile of Amendment Project facilities (meter stations) and quantitatively describe existing sound levels at NSAs and at other areas covered by relevant state and local noise ordinances. The following stipulations are given:

- If new meter station sites are proposed, measure or estimate the existing ambient sound environment based on current land uses and activities;
- Include a plot plan that identifies the locations and duration of noise measurements; and
- All surveys must identify the time of day, weather conditions, wind speed and direction, and other noise sources present during each measurement.

In addition, the FERC requirement for noise quality, in the absence of any applicable state or local noise regulation, is that the post-construction noise attributable to any new compressor station must not exceed an L_{dn} of 55 dBA at any pre-existing NSA, such as schools, hospitals, or residences. This criterion limits the sound level contribution from the Amendment Project at any pre-existing NSA to 55 dBA (L_{dn}). An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA L_{eq} for facilities that operate at a constant level of noise. While the Amendment Project does not involve the addition of compression, for purposes of this resource report, Mountain Valley conservatively has used the FERC requirement as a baseline to analyze the Amendment Project.

Regarding HDD construction sites, conditions set forth by the FERC typically require that the sound attributable to nighttime drilling operations should not exceed 55 dBA (L_{dn}) at any NSA during HDD operations. If this sound criterion/guideline is expected to exceed this level at any nearby NSA, it is generally necessary to describe noise mitigation measures/options that would be implemented during the drilling activity to reduce the noise impact of the drilling operations and achieve the sound criterion/guideline.

As per FERC's (2017) *Guidance Manual for Environmental Report Preparation*, "Construction activity that would or may occur during nighttime hours should be performed with the goal that the activity contributes noise levels below 55 dBA L_{dn} and 48.6 dBA L_{eq}, or no more than 10 dBA over background if ambient noise levels are above 55 dBA L_{dn}." at all surrounding NSAs.

In addition to the 55 dBA L_{dn} and 48.6 dBA L_{eq} nighttime sound level targets, for the Amendment Project, the nighttime construction noise has been compared to the existing nighttime ambient sound levels to calculate the short-term increase in sound levels expected due to the construction activities.

9.3.2.2 County Limits

The two counties that the Amendment Project crosses have noise ordinances that may be applicable to the Amendment Project. Table 9.3-1 provides a summary of the noise limits identified within the ordinances. The Pittsylvania County ordinance provides quantitative sound level limits. Rockingham County has an ordinance that is primarily nuisance-based and provides no numerical limits.

The Pittsylvania County limits apply at the property boundary of the noise source or any point within any other affected property rather than at the NSA structure, so they cannot be directly compared to the FERC sound level requirements. The Pittsylvania County ordinance has an exemption for construction, provided it takes place between 7:00 a.m. and 10:00 p.m. The Lambert Interconnect is in Pittsylvania County, Virginia. The sound levels from the meter station have been evaluated against both the FERC and the county sound level requirements.

Table 9.3-1

Noise Level Limits for Counties with Noise Ordinances Crossed by the Amendment Project

County, State	Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)
Pittsylvania, VA	Agricultural/Residential: 57 L_{eq} dBA Industrial: 77 L_{eq} dBA	Agricultural/Residential: 52 L_{eq} dBA Industrial: 77 L_{eq} dBA
Rockingham, NC	Not applicable (Nuisance based)	

9.3.3 Existing Sound Environment

The existing sound environment surrounding each meter station and HDD work area or railroad crossing was quantified during a baseline environmental sound level survey in the vicinity of each site conducted in August 2024. Sound levels were measured at accessible locations near the NSAs at each site. Observations of the primary existing environmental sound sources were documented.

Type 1 sound level instrumentation was used, with field calibration conducted before and after each measurement. Windscreens were installed on all microphones. All instrumentation has current laboratory certification. Weather conditions during each survey were recorded, and the measurements were taken during weather periods appropriate for environmental sound-level surveys.

Insect activity was the dominant source of ambient noise at most of the measurement locations. Since insect activity varies seasonally, insect noise may not be present during substantial portions of the year. Ambient data are therefore presented both as measured with the insect noise present and with the insect noise filtered out by omitting sound energy in the whole octave bands above 1,250 Hz in accordance with the American National Standard Institute ("ANSI"), American National Standards Association ("ASA") method (ANSI/ASA 2014). For the purposes of evaluating operational sound level impact, the insect-filtered data is used as the primary point of comparison to be conservative. However, if construction is going to take place in the spring or summer, when insects will be present, it may be more appropriate to compare construction sound levels to the unfiltered ambient data.

9.3.3.1 Meter Stations

There are currently four meter stations planned as part of the Amendment Project.

Lambert Interconnect

The Lambert Interconnect site is located in Pittsylvania County, Virginia, approximately three miles east of Chatham, Virginia. The area surrounding the station is mostly rural, consisting of a mix of forest and open land, though there are several residences and Highway 57 within a one-mile radius of the meter station site. There is an existing "Transco Village," which contains several compressor buildings and auxiliary equipment located just northeast of the site. The two closest NSAs were identified; both are residences. Figure 1 (Appendix 9-C) shows the NSAs in proximity to the Lambert Interconnect and the sound level measurement locations.

LN 3600 Interconnect

The LN 3600 Interconnect site is located in Rockingham County, North Carolina, approximately four miles northeast of Meadow Summit, North Carolina. The closest NSA to the site is a residence. See Figure 2 (Appendix 9-C) for the NSA and measurement locations for this site.

Dan River Interconnect #1 & #2

The Dan River Interconnect #1 and #2 sites are located in Rockingham County, North Carolina, approximately five miles east of Eden, North Carolina. The two closest NSAs to the site are residences. See Figure 3 (Appendix 9-C) for the NSA and measurement locations for this site.

Table 9.3-2 shows a summary of the weather conditions during the ambient sound level surveys.

Table 9.3-2

Summary of Weather Conditions During Meter Station Sound Level Surveys

Station	Lambert Interconnect	LN 3600 Interconnect	Dan River Interconnect #1 and #2
Dates	August 14 – August 15, 2024		
Temperature Range	61°F – 101.3°F		
Relative Humidity Range	32% – 100 %		
Wind Speed	0 mph – 6.2 mph		
Wind From	Northeast		
Precipitation	Clear		

Table 9.3-3 summarizes the NSAs near the four meter station sites.

Table 9.3-3

Summary of Noise Sensitive Areas During Meter Station Sound Level Surveys

Facility ID and Approx. MP	Noise Sensitive Area	Description	Approximate Distance from Interconnect (feet)	Direction to NSA from Interconnect	NSA Coordinates	
					Latitude	Longitude
Lambert Interconnect MP 0.0	NSA 1	Residence	2,830	West-southwest	36.826780°	-79.353259°
	NSA 2	Residence	2,180	Northwest	36.834832°	-79.348904°
LN 3600 Interconnect MP 29.9	NSA 1	Residence	1,650	North-northwest	36.522603°	-79.657882°
Dan River Interconnect #1	NSA 1	Residence	480 a/	South-southeast	36.492462°	-79.679168°
Dan River Interconnect #2 MP 31.3	NSA 2	Residence	930 a/	South-southwest	36.491370°	-79.681487°

a/ Distances reference the center of the two meter station sites since they are adjacent to each other.
MP = milepost

Table 9.3-4 shows the measured daytime and nighttime sound levels (L_d and L_n, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA) near the meter stations.

Table 9.3-4

Summary of Sound Level Measurements – Meter Stations

Facility ID	NSA	Meas. Location (" ML")	Measurement Duration	Measured Sound Level, Unfiltered			Measured Sound Level, Filtered to Remove Noise from Birds and Insects		
				dBA			dBA a/		
			HH:MM:SS	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
Lambert Interconnect	NSA 1	ML 1	16:41:43	42.4	42.6	49.0	39.1	39.0	45.4
	NSA 2	ML 2	17:19:09	41.9	42.0	48.4	38.7	41.0	47.1
LN 3600 Interconnect	NSA 1	ML 1	22:29:20	49.8	46.6	53.6	47.4	37.6	47.5
Dan River Interconnect #1 Dan River Interconnect #2	NSA 1	ML 2	27:39:02	45.4	43.8	50.5	43.8	42.9	49.5
	NSA 2		25:50:36						

a/ Post-processed to remove noise from birds and insects in accordance with ANSI ANSI/ASA S3/SC1.100-2014.

9.3.3.2 Horizontal Directional Drilling and Railroad Crossing Sites

Mountain Valley proposes to cross the Sandy River in Virginia and the Dan River in North Carolina by HDD. In addition, there will be two railroad crossings that will be performed using the conventional bore method and will likely require nighttime construction work. A noise evaluation has been performed for each HDD site and railroad crossing. An ambient noise survey at the potential HDD and railroad crossing sites was conducted to quantify the current ambient sound levels around each site and to document/identify existing NSAs. All NSAs are residences.

Mountain Valley is currently evaluating crossing methods for other crossing areas in order to determine the most appropriate crossing method and will provide this information in a supplemental filing. If additional HDDs or conventional bores are identified, further noise evaluations will be completed and submitted as part of a supplemental filing.

Table 9.3-5 shows the weather conditions during the HDD and railroad crossing sound level measurements.

Table 9.3-5

Summary of Weather Conditions During HDD/Railroad Crossing Surveys

Location	HDD: Sandy River	HDD: Dan River	MP 5.6 Railroad Crossing	MP 25.7 Railroad Crossing	Reference Overnight ML (Near MP 29.3)
Dates	August 14 – August 15, 2024				
Temperature	61°F – 101.3°F				
Relative Humidity	32% – 100 %				
Wind Speed	0 mph – 6.2 mph				
Wind From	Northeast				
Precipitation	Clear				

NSA(s) were identified by SLR using aerial imagery and field observations. Four NSAs were identified for the Sandy River HDD site and three NSAs for the Dan River HDD site. The NSAs consist of the closest

residences. The NSAs are summarized in Table 9.3-6. There were no NSAs identified within 0.5 mile of the railroad crossings. The nearest NSAs to the MP 5.6 and 25.7 railroad crossings are a school and residence, respectively, each located more than a mile from the railroad crossing work areas.

Table 9.3-6

Summary of Noise Sensitive Areas During HDD/Railroad Bore Sound Level Surveys

HDD/Bore and MP	NSA	Description	Approximate Distance from Crossing (feet)	Direction to NSA from Crossing	NSA Coordinates	
					Latitude	Longitude
Sandy River HDD MP 18.1	NSA 1	Residence	1,320	West-southwest	36.637136°	-79.543980°
	NSA 2	Residence	1,100	West	36.639264°	-79.540350°
	NSA 3	Residence	650	North-northwest	36.640120°	-79.538130°
	NSA 4	Residence	1,850	Southwest	36.635487°	-79.531551°
Dan River HDD MP 30.8	NSA 1	Residence	740	South-southwest	36.492462°	-79.679168°
	NSA 2	Residence	2,290	West	36.499735°	-79.682037°
	NSA 3	Residence	1,200	North-northwest	36.501900°	-79.676652°
MP 5.6 Railroad Crossing	NSA 1	School	5,370	Southwest	36.761864°	-79.387580°
MP 25.7 Railroad Crossing	NSA 1	Residence	5,360	West-northwest	36.559075°	-79.637382°

Figures 1 and 2 (Appendix 9-D) and Figures 1 and 2 (Appendix 9-E) show the HDD and railroad crossing work areas along with the identified NSAs and sound level measurement locations. Table 9.3-7 shows the measured daytime and nighttime sound levels (L_d and L_n, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA) near the HDD and railroad crossing work areas.

At both railroad crossing locations, short-duration daytime sound level measurements were collected near the crossing. Effort was made to exclude noise from passing vehicles from the measurements. No nighttime sound levels were measured at the railroad crossings (see Table 9.3-7). A reference overnight sound meter was placed near MP 29.3 in an area where the observed ambient sounds were similar to those observed at MP 5.6 and MP 25.7. The reference overnight measurement location is shown in Figure 3 (Appendix 9-E). The sound level difference between the daytime and nighttime levels at the reference overnight measurement location was subtracted from the L_d values measured at the railroad crossings to estimate their L_n values. The overall measured sound levels are inclusive of all environmental noise sources and include noise from birds, insects, and foliage.

Table 9.3-7 shows the measured daytime and nighttime sound levels ($L_{d\ and}$ L_n, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA) near the HDD and railroad crossings.

Table 9.3-7

Summary of Sound Level Measurements – HDD/Railroad Crossings

HDD	NSA	Meas. Location (ML)	Measurement Duration HH:MM:SS	Measured Sound Level, Unfiltered			Measured Sound Level, Filtered to Remove Noise from Birds and Insects		
				dBA			dBA a/		
				L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
Sandy River HDD MP 18.1	NSA 1	ML 2	15:20:59	44.4	42.8	49.5	42.9	41.8	48.4
	NSA 2	ML 1	15:26:08	44.6	42.1	49.0	42.5	40.6	47.3
	NSA 3			44.6	42.1	49.0	42.5	40.6	47.3
	NSA 4	ML 3	15:28:55	42.9	42.3	48.8	40.2	39.1	45.7
Dan River HDD MP 30.8	NSA 1	ML 2	25:50:36	45.4	43.8	50.5	43.8	42.9	49.5
	NSA 2			45.4	43.8	50.5	43.8	42.9	49.5
	NSA 3	ML 1	25:10:03	43.0	41.7	48.3	40.4	39.2	45.8
MP 5.6 Railroad Crossing	NSA 1	ML 1	00:15:33	40.0	38.0 b/	44.9	39.4	37.90 c/	44.6
MP 25.7 Railroad Crossing	NSA 1	ML 1	00:18:31	41.7	39.90 b/	46.6	41.1	39.6 c/	46.3
MP 29.3 Reference Overnight ML	NA	MP 29.3 Reference Overnight ML	22:54:10	48.2	51.8	57.8	37.6	32.3	40.0

a/ Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b/ The difference between the unfiltered MP 29.3 daytime and nighttime measurements was used to estimate the unfiltered L_n at the railroad crossings.
c/ The difference between the filtered MP 29.3 daytime and nighttime was used to estimate the filtered L_n at the railroad crossings.

9.3.4 Amendment Project Construction Noise

9.3.4.1 Pipeline Construction Noise and Mitigation

Potential impacts from pipeline construction could include short-term increases in sound level. Construction of the pipeline will generate noise from heavy machinery and equipment as construction moves in phases along the right-of-way (see Resource Report 1 for description of pipeline construction). Sound from pipeline construction will generally be temporary, sporadic, and short-term in any one location along the pipeline route. Because of the temporary and generally daytime nature of pipeline construction activities, no special noise mitigation or noise monitoring program will be implemented during the construction phase, except in locations where blasting or HDDs are required. These special cases are discussed below.

9.3.4.2 Meter Station Construction Noise and Mitigation

Potential impacts at meter station locations could include short-term increases in sound levels during construction. Only standard construction equipment will be used in the construction of the stations, with no dynamic compaction or pile driving expected. Most construction will occur during daytime working

hours of 7:00 a.m. until 7:00 p.m. Emergencies or other non-typical circumstances may necessitate limited nighttime work. The highest sound levels during construction of meter stations are expected during the early earthmoving phase. Equipment that may be operating during this phase would include bulldozers, front-end loaders, dump trucks, generators, etc.

Based on the equipment usage predictions, a sound level calculation was performed for meter station construction using the Federal Highway Administration's ("FHWA") Roadway Construction Noise Model version 1.1 (FHWA 2008). The following equipment was included in the construction evaluation:

Daytime Civil Work – total sound power level of 123.9 dBA L_w

- Three (3) Excavators, Komatsu 228 or similar
- Three (3) Bulldozers, Cat D6 or similar
- Three (3) Dump trucks, 26-ton, articulated
- One (1) Generator
- Three (3) Drilling rigs
- Two (2) Pile augers
- One (1) Roller, smooth drum, 25-ton, Bomag or similar

Nighttime Civil Work – total sound power level of 120.2 dBA L_w

- Two (2) Excavators, Komatsu 228 or similar
- Two (2) Bulldozers, Cat D6 or similar
- Two (2) Dump trucks, 26 ton, articulated
- Three (3) Light plants
- One (1) Roller, smooth drum, 25-ton, Bomag or similar

Table 9.3-8 shows a summary of the predicted short-term daytime construction sound levels at the NSAs for the meter stations. The worst-case NSAs are not necessarily the closest NSAs due to terrain shielding between the meter stations and the NSAs.

Table 9.3-8

Predicted Temporary Sound Levels Due to Construction, Single 12-Hour Daytime Shift

Interconnect	NSA	Existing Ambient Sound Levels, dBA a/			Predicted Sound Level 12-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Day	L_{dn} b/	Day	L_{dn}	Day	L_{dn}
Lambert Interconnect	1	39.1	39.0	45.4	**50.0**	47.0	50.3	49.3	11.2	3.9
	2	38.7	41.0	47.1	**54.3**	51.3	54.4	52.7	15.7	5.6
LN 3600 Interconnect	1	47.4	37.6	47.5	**51.9**	48.9	53.2	51.3	5.8	3.8
Dan River Interconnect #1	1	43.8	42.9	49.5	**69.4**	66.4	69.4	66.5	25.6	17.0
	2	43.8	42.9	49.5	**62.6**	59.6	62.7	60.0	18.9	10.5
Dan River Interconnect #2	1	43.8	42.9	49.5	**68.1**	65.1	68.1	65.2	24.3	15.7
	2	43.8	42.9	49.5	**63.0**	60.0	63.1	60.4	19.3	10.9

a/ Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b/ L_{dn} was calculated using 12 daytime hours.

The standard work schedule will typically be six days per week during daylight hours, as described in Section 1.4.5 of Resource Report 1. Nighttime work will be conducted for specific situations related to safety, permit compliance, or construction activities that cannot be stopped until completion (e.g., HDD, conventional bores, dry waterbody crossings). Low noise-generating activities (e.g., x-ray, inspections, hydrostatic test, drying, etc.) may also occur during limited nighttime hours.

No nighttime construction activities are planned for meter station site construction. FERC does not limit daytime construction sound levels, and the Pittsylvania County, Virginia limit has an exception for daytime construction noise, so no noise mitigation is required for the construction phase of the meter station sites. However, due to the uncertainty of the equipment that might be operating during night construction, Mountain Valley will develop a nighttime construction noise management plan if nighttime construction is required at the meter stations. This noise management plan will outline the specific equipment that will be operating at night, location of the equipment, and will predict the sound levels from the expected nighttime equipment. The management plan will include specific noise mitigation, such as noise barriers, quieter equipment, or partial equipment enclosures to ensure that sound levels at the NSAs do not exceed 48.6 dBA L_{eq} at night or 55 dBA L_{dn} overall.

9.3.4.3 Blasting

Blasting may be necessary for ditch excavation in locations where shallow bedrock is encountered. Most of the energy released during blasting goes towards rock breakage and movement, but a small portion passes outside the intended work zone in the form of ground or air vibrations. Air vibrations are pressure waves generated by the blast, referred to as "airblast" or "air overpressure." High-frequency pressure waves (above about 20 Hz) may be heard as sound, while lower-frequency pressure waves may be felt rather than heard, similar to a gust of wind. In general, surface detonations involving unconfined or poorly confined blasts will cause audible noise; well-confined blasts, such as those used to excavate rock, generate lower frequency effects with airblast energy predominantly in the inaudible range. For this reason, and because noise from blasting is inherently short-term, there are often no audible noise limits for blasting projects. Blast emission criteria are specified on the basis of safe limits designed to minimize the risk of cosmetic damage, such as surface cracks due to either vibration or airblast.

The Amendment Project has developed a General Project Blasting Plan (see Resource Report 1 – Appendix 1-G). When the locations and extent of blasting are known, a noise and vibration assessment will be completed for residences and historical structures that could be affected by blasting. Noise and vibration due to blasting will be evaluated in accordance with the International Society of Explosives Engineers Blasters' Handbook, which contains recommended ground vibration limits. If necessary, charge size per delay will be reduced to ensure these limits are not exceeded to prevent structural damage to nearby buildings.

9.3.4.4 Horizontal Directional Drilling and Railroad Crossing Construction Noise and Mitigation

The HDD method will be used to install the pipeline underneath the Dan River in North Carolina and the Sandy River in Virginia. In addition, there will be two railroad crossings that will be performed using the conventional bore method. Each site will likely require nighttime construction work. A noise evaluation has been performed for each HDD site and railroad crossing.

Equipment Data

The HDD entry and exit sites will have several sound sources in operation during the temporary construction work. Table 9.3-9 below presents the proposed construction equipment for the HDD entry and exit locations. The actual equipment used, as well as the site layout and configuration, will depend on the drilling contractor(s) selected for the Amendment Project, the site conditions, and other factors.

Table 9.3-9

HDD Proposed Equipment List

Equipment	Quantity
Entry Work Area	
HDD Pilot/Reaming/Pullback Rig	**1**
P-750 Mud Pump	**1**
MCD-1000 Cleaning System	**1**
6” Dri Prime Pump	**4**
Cat 336 Excavator	**2**
Cat CTL-299D3	**1**
Miller 500-amp Welder	**2**
3” Trash Pump	**4**
2” Trash Pump	**1**
Light Plants*	**6**
Generator-CAT – 100KW XQ125 T4F	**1**
Hydrovac Truck Peterbilt 548 or equiv.	**5**
Exit Work Area	
CAT 349 Excavator	**1**
CAT 583- Pipelayer	**5**
Grove RT890E Rough Terrain Crane, or equiv.	**2**
Light Plants*	**2**
*Used during nighttime only	

Typical sound power levels (L_w) for peak HDD construction operations based on the proposed equipment list above are shown in Table 9.3-10 below. These levels were used in all HDD calculations in this study.

Table 9.3-10

Sound Power Levels of HDD Equipment

Noise Source	Sound Power Level at Octave Band Center Frequency									Total
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
HDD Entry Site, dB	122	127	127	132	127	122	117	112	107	129
HDD Exit Site, dB	108	113	113	118	113	108	103	98	93	115

The railroad conventional bore entry and exit sites will have several sound sources in operation during the temporary construction work. Table 9.3-11 below presents the proposed construction equipment for the railroad crossing entry and exit locations. The actual equipment used, and the site layout and configuration will depend on the drilling contractor(s) selected for the Amendment Project, the site conditions, and other factors.

Table 9.3-11 Railroad Conventional Boring Operation Equipment List	
Equipment	**Quantity**
Entry Work Area	
Sideboom -CAT 583	**2**
Excavator - CAT 345 - CAT 352 / JD 470 or Comparable	**1**
Excavator - CAT 335 & 336 / JD 350 or Comparable	**1**
Excavator Attachment - 349 - Hammer 12,000 ft lb.	**1**
Dozer - D8T	**1**
Air Compressor - 185	**1**
Bore - Track Machine - w/ Push Plate, Head, Auger	**1**
Pump - Mud (TT Tech Bentonite Pump or Comparable)	**1**
Morooka - 3000 or Comparable	**2**
Welder - Engine Driven (Lincoln/Miller or Comparable)	**2**
Light Plant *	**6**
Exit Work Area	
Excavator - CAT 345 - CAT 352 / JD 470 or Comparable	**1**
Excavator - CAT 335 & 336 / JD 350 or Comparable	**1**
Pump - Mud (TT Tech Bentonite Pump or Comparable)	**1**
Light Plant *	**2**
*Used during nighttime only	

Typical sound power levels (L_w) for peak railroad crossing construction operations are based on the proposed equipment list above and are shown in Table 9.3-12 below. These levels will be used in all railroad crossing bore calculations in this study.

Table 9.3-12 Sound Power Levels of Railroad Crossing Equipment										
Noise Source	**Sound Power Level at Octave Band Center Frequency, Hz**									**Total**
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
Railroad Crossing Entry Site, dB	115	120	120	125	120	115	110	105	100	122
Rrailroad Crossing Exit Site, dB	110	115	115	120	115	110	105	100	95	116

Sound level data for the ancillary equipment were derived from the FHWA's Roadway Construction Noise Model (FHWA 2008). The sources were used as inputs in a three-dimensional computer noise model developed using CadnaA acoustical modeling software.

These values represent conservative estimates without the assumption of any additional noise control treatments. These levels do assume that all original equipment manufacturer noise control treatments are correctly installed, and that all operating equipment is well-maintained and in good operating condition. These levels also assume some slight typical shielding and screening effects from the tanks and trailers that are used in typical construction operations.

Operations Schedule

The current drilling operation plan is to perform HDD activities whenever dictated by schedule or operations, 24 hours per day if necessary. As such, all calculations are based on the maximum HDD activity sound power levels shown in Table 9.3-10 without any adjustment for reduced activities during nighttime hours.

For the railroad crossings, 24-hour construction activities will be required for six days at MP 5.6 and three days at MP 25.7. The duration could extend up to 14 days if problems are encountered during construction.

Calculations

A noise model was developed for each HDD work area and railroad crossing using CadnaA 2024, MR 1 version 205.5427. The models were used to calculate the expected temporary sound level contributions due to the HDD and railroad crossing equipment. The International Organization for Standardization 9613-2 standard was used to calculate the divergence, atmospheric absorption, foliage, and ground absorption for the path from the HDD entry or exit site to the closest NSA.

The drilling entry and exit locations were based on the planned drilling direction provided by the Amendment Project. The models were used to identify the worst-case NSA (i.e., the NSA likely to experience the highest noise). If the calculations indicated that the sound level at the worst-case NSA would exceed the sound level target, then noise mitigation has been developed to meet the targets.

Predicted Temporary Sound Level Impact

The predicted HDD and railroad crossing equipment sound level contribution for each NSA was calculated using the noise model. The calculated sound level contribution was then combined with the measured ambient sound levels to determine the potential short-term sound level impact of the HDD or railroad crossing activities. A summary of the calculation results for all the HDD sites and railroad crossings is included in Table 9.3-13 below.

Table 9.3-13

Predicted Temporary Sound Levels Due to HDD/Railroad Crossing Operations 24-Hour Construction Activities (Unmitigated)

HDD	NSA	Existing Ambient Sound Levels, dBA a/			Predicted Sound Level 24-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} b/	Night	L_{dn}	Night	L_{dn}
Sandy River HDD MP 18.1	1	42.9	41.8	48.4	**58.2**	64.6	58.3	64.7	16.5	16.3
	2	42.5	40.6	47.3	**60.3**	66.7	60.3	66.7	19.7	19.4
	3	42.5	40.6	47.3	**68.7**	75.1	68.7	75.1	28.1	27.8
	4	40.2	39.1	45.7	**60.5**	66.9	60.5	66.9	21.4	21.2
Dan River HDD MP 30.8	1	43.8	42.9	49.5	**69.7**	76.1	69.7	76.1	26.8	26.6
	2	43.8	42.9	49.5	**57.3**	63.7	57.5	63.9	14.6	14.4
	3	40.4	39.2	45.8	**56.4**	62.8	56.5	62.9	17.3	17.1
MP 5.6 Railroad Crossing	1	39.4	34.1	41.8	**37.2**	43.6	38.9	45.8	4.8	4.0
MP 25.7 Railroad Crossing	1	41.1	35.8	43.5	**36.5**	42.9	39.2	46.2	3.4	2.7

a/ Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b/ L_{dn} was obtained by adding 6.4 dB to the predicted sound levels due to nighttime construction.

Noise Mitigation for HDD

For HDD crossing sites where the HDD activity sound levels at the NSAs are predicted to be greater than a nighttime construction sound level limit of 48.6 dBA L_{eq} or 55 dBA L_{dn}, noise mitigation for the equipment or compensation/relocation will likely be necessary in order to achieve the noise goals. For noise mitigation on HDD or conventional bore equipment, engine exhaust and barrier treatments are typically used to reduce the sound level contribution to less than 48.6 dBA L_{eq} nighttime. Typically, all engines on power units, gensets, etc., would be fitted with residential-grade exhaust mufflers, and temporary barriers may be installed between the HDD/conventional bore site and the nearest NSAs. Secondary noise control treatments may be required, depending on the actual equipment and site layout used.

The following noise control treatments have been evaluated in the noise model. With these noise control treatments, the noise models predict sound levels lower than 48.6 dBA at all NSAs during nighttime HDD activities.

This is one potential set of noise control treatments. There are various combinations of noise control treatments that can effectively reduce the HDD activity sound levels. After an HDD contractor is selected, the noise control treatments should be reevaluated, and a site-specific noise control plan developed for each site.

Sandy River Noise Control Treatments

- Entry Work Area:
    - Reduce vacuum truck activity at night from five to one.
    - Install small enclosures constructed of mass-loaded vinyl or plywood over the drill rig engine(s), mud and trash pumps, generator, and the mud processing system during nighttime operations.
    - A temporary barrier wall on the north (approximately 40 feet tall, 560 feet long) and south sides (approximately 30 feet tall, 340 feet long) of the entry work area.
- Exit Work Area:
    - A temporary barrier wall on the north side of the exit pit (approximately 20 feet tall, 440 feet long).

Figure 11 and Figure 12 (Appendix 9-D) show examples of possible enclosure layouts, and Figure 7 (Appendix 9-D) shows a close-up view of the HDD entry and exit barriers.

Dan River Noise Control Treatments

- Entry Work Area:
    - Reduce vacuum truck activity at night from five to one.
    - Install small enclosures constructed of mass-loaded vinyl or plywood over the generator, drill rig engine(s), mud and trash pumps, and the mud processing system during nighttime operations.
    - A temporary barrier wall on the north (approximately 16 feet tall, 210 feet long), west (20 feet tall, 215 feet long), and south sides (approximately 40 feet tall, 655 feet long) of the entry work area.
- Exit Work Area:
    - A temporary barrier wall on the north side of the exit pit (approximately 24 feet tall, 250 feet long).

Figure 11 and Figure 12 (Appendix 9-D) show examples of possible enclosure layouts. Figure 10 (Appendix 9-D) shows a close-up view of the HDD entry and exit barriers.

Typical sound power levels (L_w) for peak HDD construction operations based on the proposed mitigated equipment list above are shown in Table 9.3-14 below. These levels were used in all mitigated HDD calculations in this study.

Table 9.3-14

Sound Power Levels of HDD and Railroad Crossing Equipment (Mitigated)

Noise Source	Unweighted Sound Power Level (L_w) at Octave Band Center Frequency, Hz									Total
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
Sandy River HDD Entry Site Night L_w (with mitigation)	119	121	118	122	117	112	107	102	97	119
Dan River HDD Entry Site Night L_w (with mitigation)	119	122	120	124	119	114	109	104	99	121
HDD Exit Site	108	113	113	118	113	108	103	98	93	115

Table 9.3-15 provides a summary of the Predicted sound level results for the planned HDD crossing sites after the mitigation described above is applied at the closest NSAs to the entry and exit side of the planned HDD.

Table 9.3-15

Predicted Sound Levels During HDD Operations 24-Hour Construction Activities (Mitigated)

HDD	NSA	Existing Ambient Sound Levels, dBA a/			Predicted Sound Level 24-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} b/	Night	L_{dn}	Night	L_{dn}
Sandy River HDD	1	42.9	41.8	48.4	**46.1**	52.5	47.5	53.9	5.7	5.5
	2	42.5	40.6	47.3	**46.4**	52.8	47.4	53.9	6.8	6.6
	3	42.5	40.6	47.3	**48.0**	54.4	48.7	55.2	8.1	7.9
	4	40.2	39.1	45.7	**48.0**	54.4	48.5	54.9	9.4	9.2
Dan River HDD	1	43.8	42.9	49.5	**48.1**	54.5	49.2	55.7	6.3	6.2
	2	43.8	42.9	49.5	**48.2**	54.6	49.3	55.8	6.4	6.3
	3	40.4	39.2	45.8	**48.4**	54.8	48.9	55.3	9.7	9.5

a/ Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b/ L_{dn} was obtained by adding 6.4 dB to the predicted sound levels due to nighttime construction.

As an alternative to these primary and/or secondary noise control treatments, Mountain Valley may consider offering the residents compensation or temporary relocation as a means of reducing the temporary construction noise impact. If all impacted residents choose to accept temporary relocation compensation, then temporary barriers or other treatments will not be necessary. HDD activities can occur over the course of several weeks, so compensation or relocation is typically not practical for HDD work areas.

The Sandy River HDD and railroad crossings at MPs 5.6 and 25.7 are located in Pittsylvania County and, therefore, are subject to the county noise ordinance. Construction noise is exempt from the Pittsylvania County noise ordinance if it occurs between 7:00 a.m. and 10:00 p.m. However, if nighttime construction is necessary, the sound due to construction is expected to be less than 52 dBA L_{eq} at the nearest resident's property line for both entry and exit locations at the Sandy River HDD.

Sound levels during 24-hour boring were also predicted at the nearest property lines to each railroad crossing to assess compliance with the Pittsylvania County noise limit.

At the MP 25.7 railroad crossing, the worst-case property line sound level is 52.1 dBA L_{eq} during nighttime boring activity. Sound levels from boring are not expected to exceed the Pittsylvania County limit at any location around the property line.

At the MP 5.6 railroad crossing, the worst-case property line sound level is 59.4 dBA L_{eq} at the current leased property boundary to the north of the MP 5.6 railroad crossing. This area is vacant wooded land with no visible structures (based on SLR's review of aerial imagery available at the time of writing this report). Sound levels at the closest property line with residential structures are 39.8 dBA L_{eq}, significantly lower than the ordinance. If it is determined that the sound levels need to be reduced below the Pittsylvania County limit at the northern property line, a nighttime construction noise plan will need to be developed to reduce sound levels to below the limit at the applicable property boundaries.

9.3.5 Project Operation Noise

9.3.5.1 Meter Station Operational Noise and Mitigation

Operation of the Amendment Project has the potential to result in operational noise impacts at nearby NSAs from the proposed meter stations.

SLR has used sound power level (L_w) data that is consistent with previously modeled meter stations associated with the Original Certificated Project. Measurements of valve and piping noise at a similar meter station were also used to determine the sound power level spectrum shape. The sound power levels for the proposed piping are equivalent to a sound pressure level of 79 dBA at a distance of 3 feet from the valve. The valve noise was assumed to propagate upstream and downstream through the attached piping.

The octave band sound power level (L_w) data for the meter stations, as used in the noise model, is provided in Appendix 9E, Table 5-1. The equipment was incorporated into a detailed acoustic model to evaluate potential impacts resulting from the operation of the four Amendment Project meter station locations.

The result of the most recent assessments and the estimated noise impact of the Amendment Project with the ambient sound levels that were used to develop the predicted noise impact is shown in Table 9.3-16.

Table 9.3-16

Summary of Project Operational Noise Impacts (Meter Stations)

Interconnect	NSA	Existing Ambient Sound Levels, dBA a/			Predicted Sound Level 24-Hour Normal Operation, dBA		Normal Operation Plus Ambient, dBA		Predicted Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} b/	Night	L_{dn}	Night	L_{dn}
Lambert Interconnect	1	39.1	39.0	45.4	19.6	**26.0**	39.0	45.4	0.0	0.0
	2	38.7	41.0	47.1	25.3	**31.7**	41.1	47.2	0.1	0.1
LN 3600 Interconnect	1	47.4	37.6	47.5	23.6	**30.0**	37.8	47.6	0.2	0.1
Dan River Interconnect #1	1	43.8	42.9	49.5	44.3	**50.7**	46.7	53.2	3.8	3.7
	2	43.8	42.9	49.5	36.1	**42.5**	43.7	50.3	0.8	0.8
Dan River Interconnect #2	1	43.8	42.9	49.5	42.7	**49.1**	45.8	52.3	2.9	2.8
	2	43.8	42.9	49.5	36.6	**43.0**	43.8	50.4	0.9	0.9

a/ Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b/ L_{dn} was obtained by adding 6.4 dB to the predicted sound levels to account for continuous 24-hour operation.

Based on this assessment, projected sound levels attributable to normal full load operation of the Amendment Project 50.7 dBA L_{dn} or lower at the identified NSAs, which is in compliance with the FERC permit criterion of 55 dBA L_{dn}.

9.3.5.2 Meter Station Operational Vibration

Low-frequency noise can result in acoustically induced vibrations if the sound pressure level is above 65 dB in the 31.5 Hz octave band or above 75 dB in the 63 Hz octave band. Meter stations typically do not emit significant low-frequency noise. Therefore, low-frequency noise-induced vibration of structures should not be a concern.

9.4 References

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MVP Southgate Amendment Project

Docket No. CP25-XX-000

Resource Report 9

Appendix 9-A

Construction Emissions Calculations

Table 1. Estimated Construction Emissions from the Amendment Project – 2027

Source	CO_2 (tons)	CO (tons)	NO_X (tons)	PM_{10} (tons)	$PM_{2.5}$ (tons)	SO_2 (tons)	VOC (tons)	HAPs (tons)
Meter Stations:								
Construction Equipment Engines	1260	0.42	1.35	0.08	0.08	0.00	0.12	0.05
On-Road Vehicle Travel	492.99	1.69	0.48	0.01	0.01	0.00	0.18	0.04
Off-Road Vehicle Travel	N/A	N/A	N/A	60.75	6.07	N/A	N/A	N/A
Earthmoving Fugitives	N/A	N/A	N/A	5.25	0.53	N/A	N/A	N/A
Open Burning	17.17	0.75	0.02	0.09	0.09	N/A	0.13	N/A
Wind Erosion	N/A	N/A	N/A	0.76	0.08	N/A	N/A	N/A
Meter Station Total	**1770**	**2.87**	**1.86**	**66.94**	**6.86**	**0.01**	**0.42**	**0.10**
Pipeline:								
Construction Equipment Engines	49889	17.18	69.68	3.02	2.93	0.14	3.51	1.53
On-Road Vehicle Travel	2491	15.81	1.78	0.05	0.05	0.01	1.26	0.34
Off-Road Vehicle Travel	N/A	N/A	N/A	209.45	20.94	N/A	N/A	N/A
Earthmoving Fugitives	N/A	N/A	N/A	380.10	38.01	N/A	N/A	N/A
Open Burning	3431	150.79	4.28	18.39	18.39	N/A	25.88	N/A
Wind Erosion	N/A	N/A	N/A	54.71	5.47	N/A	N/A	N/A
Pipeline Total	**55811**	**183.79**	**75.73**	**665.73**	**85.80**	**0.15**	**30.64**	**1.87**
Pipeline in Pittsylvania, VA	46929	157.67	64.22	494.93	66.58	0.12	26.80	1.48
Pipeline in Rockingham, NC	8881	26.12	11.51	170.80	19.22	0.03	3.84	0.39
TOTAL:	**57581**	**186.66**	**77.59**	**732.67**	**92.65**	**0.15**	**31.07**	**1.97**

Table 2. Estimated Construction Emissions from the Amendment Project – 2028

Source	CO_2 (tons)	CO (tons)	NO_X (tons)	PM_{10} (tons)	$PM_{2.5}$ (tons)	SO_2 (tons)	VOC (tons)	HAPs (tons)
Meter Station Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Pipeline:								
Construction Equipment Engines	3827	0.71	3.14	0.14	0.14	0.01	0.17	0.07
On-Road Vehicle Travel	210.39	1.14	0.15	0.00	0.00	0.00	0.09	0.02
Off-Road Vehicle Travel	N/A	N/A	N/A	19.13	1.91	N/A	N/A	N/A
Earthmoving Fugitives	N/A	N/A	N/A	221.73	22.17	N/A	N/A	N/A
Open Burning	0.00	0.00	0.00	0.00	0.00	N/A	0.00	N/A
Wind Erosion	N/A	N/A	N/A	31.92	3.19	N/A	N/A	N/A
Pipeline Total	**4038**	**1.85**	**3.29**	**272.91**	**27.42**	**0.01**	**0.26**	**0.09**
Pipeline in Pittsylvania, VA	3379	1.20	2.76	226.18	22.72	0.01	0.19	0.07
Pipeline in Rockingham, NC	658	0.65	0.53	46.73	4.69	0.00	0.07	0.02
TOTAL:	**4038**	**1.85**	**3.29**	**272.91**	**27.42**	**0.01**	**0.26**	**0.09**

1. No construction will occur at the meter stations in 2028

Amendment Project

Table 3. Criteria Pollutant Emissions from Construction Engines - Interconnect - 2027

Equipment Name	MOVES Equipment Classification	Fuel Type	Rated Engine Load (hp)	Construction Emissions																				
				Operations				Emission Factor[1] (g/hp-hr)									Emissions (tons)								
				Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	CH_4	N_2O	CO_2	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	CH_4	N_2O	CO_2
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	Plate Compactors	Diesel	19	6	10	2080	0.43	3.79	1.53	0.00	0.36	0.18	0.17	0.03	0.00	589.34	0.07	0.03	0.00	0.01	0.00	0.00	0.00	0.00	11.04
Light plants	Signal Boards/Light Plants	Diesel	15	6	10	3640	0.43	3.77	1.52	0.00	0.36	0.18	0.17	0.03	0.00	589.36	0.10	0.04	0.00	0.01	0.00	0.00	0.00	0.00	15.25
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	2080	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	236.00
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	1040	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	98.39
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	260	0.59	0.21	0.06	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.43
Concrete or stone industrial saws	Concrete/Industrial Saws	Diesel	10	6	10	780	0.59	4.18	2.47	0.00	0.84	0.24	0.23	0.07	0.00	593.76	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	3.01
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	10	1040	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	112.19
Water Truck	Off-highway Trucks	Diesel	175	6	10	1300	0.59	0.17	0.05	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	79.43
Utility Truck	Off-highway Trucks	Diesel	100	6	6	1560	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rough terrain forklifts (CASE 588H)	Rough Terrain Forklifts	Diesel	78	6	10	1300	0.59	1.09	0.32	0.00	0.03	0.05	0.05	0.00	0.00	596.09	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.00	39.31
Rubber tire front loaders (CAT 972K)	Rubber Tire Loaders	Diesel	288	6	6	468	0.59	0.21	0.06	0.00	0.02	0.01	0.01	0.00	0.00	536.79	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	47.05
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	8	1040	0.21	1.74	0.88	0.00	0.29	0.18	0.18	0.02	0.00	626.10	0.06	0.03	0.00	0.01	0.01	0.01	0.00	0.00	21.71
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	1300	0.59	0.25	0.07	0.00	0.01	0.02	0.02	0.00	0.00	536.80	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	56.73
Loaders (Tracked - CAT 953D)	Skid Steer Loaders	Diesel	148	6	6	780	0.21	4.32	2.37	0.00	0.79	0.46	0.45	0.04	0.00	625.71	0.12	0.06	0.00	0.02	0.01	0.01	0.00	0.00	16.72
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	520	0.59	2.96	0.66	0.00	0.24	0.14	0.14	0.01	0.00	530.78	0.25	0.06	0.00	0.02	0.01	0.01	0.00	0.00	44.52
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	260	0.59	0.37	0.13	0.00	0.03	0.03	0.03	0.00	0.00	536.75	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	22.69
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	260	0.59	2.53	0.28	0.00	0.09	0.02	0.02	0.01	0.00	595.88	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.72
Chain Saw	Other Construction Equipment	Gas	10	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	Other Construction Equipment	Diesel	49	6	10	1300	0.21	2.53	0.28	0.00	0.09	0.02	0.02	0.01	0.00	595.88	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.79
Self-propelled sweeping and scrubbing vehicles	Other Construction Equipment	Diesel	70	6	5	650	0.43	2.67	0.42	0.00	0.08	0.05	0.04	0.01	0.00	595.93	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	12.85
Hydraulic Crane	Cranes	Diesel	268	6	10	780	0.43	0.24	0.06	0.00	0.02	0.01	0.01	0.00	0.00	531.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	52.61
Marooka	Crawler Tractor/Dozers	Diesel	250	6	6	780	0.59	0.15	0.04	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.08
Pumps	Other Construction Equipment	Diesel	15	6	5	2080	0.43	3.76	1.49	0.00	0.35	0.17	0.17	0.03	0.00	595.15	0.06	0.02	0.00	0.01	0.00	0.00	0.00	0.00	8.80
Air compressors	Other Construction Equipment	Diesel	275	6	10	3120	0.43	0.37	0.13	0.00	0.03	0.03	0.03	0.00	0.00	536.75	0.15	0.05	0.00	0.01	0.01	0.01	0.00	0.00	218.29
Welders	Other Construction Equipment	Diesel	55	6	10	2340	0.21	2.67	0.42	0.00	0.08	0.05	0.04	0.01	0.00	595.93	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	17.75
Pressure washers	Other Construction Equipment	Diesel	5	6	5	520	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	1040	0.43	0.37	0.13	0.00	0.03	0.03	0.03	0.00	0.00	536.75	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	52.92
															Total Emissions (tons)		**1.35**	**0.42**	**0.00**	**0.12**	**0.08**	**0.08**	**0.01**	**0.00**	**1260.30**

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissions.

[2]N_2O emission factor is based on 2020 Climate Registry Default Emission Factors, Released: April 2020, Tables 2.1 and 2.7, ratioed based on CO_2 emission factor from EPA MOVES4.0 (https://www.theclimateregistry.org/wp-content/uploads/2020/04/The-Climate-Registry-2020-Default-Emission-Factor-Document.pdf).

[3]Based on data provided by client.

[4]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

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Table 4. HAP Pollutant Emissions from Construction Engines - Interconnect - 2027

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load (hp)	Fuel Code (Hide)	Construction Emissions																											
					Operations				Emission Factor[1] (g/hp-hr)												Emissions (tons)													
					Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Hexane	Naphthalene	Ethyl Benzene	Toluene	Xylene	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Hexane	Naphthalene	Ethyl Benzene	Toluene	Xylene					
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	Plate Compactors	Diesel	19	23	6	10	2080	0.43	0.04	0.01	0.02	0.00	0.11	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Light plants	Signal Boards/Light Plants	Diesel	15	23	6	10	3640	0.43	0.04	0.01	0.02	0.00	0.10	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Excavators (CAT 345C)	Excavators	Diesel	325	23	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Excavators (JD 350G LC)	Excavators	Diesel	271	23	6	10	1040	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Excavators (CAT 320DL)	Excavators	Diesel	148	23	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Concrete or stone industrial saws	Concrete/Industrial Saws	Diesel	10	23	6	10	780	0.59	0.09	0.02	0.05	0.00	0.24	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	23	6	10	1040	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Water Truck	Off-highway Trucks	Diesel	175	23	6	10	1300	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Utility Truck	Off-highway Trucks	Diesel	100	23	6	6	1560	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Rough terrain forklifts (CASE 588H)	Rough Terrain Forklifts	Diesel	78	23	6	10	1300	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Rubber tire front loaders (CAT 972K)	Rubber Tire Loaders	Diesel	288	23	6	6	468	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	23	6	8	1040	0.21	0.03	0.01	0.01	0.00	0.07	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	23	6	10	1300	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Loaders (Tracked - CAT 953D)	Skid Steer Loaders	Diesel	148	23	6	6	780	0.21	0.07	0.02	0.03	0.00	0.20	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00					
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	23	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	23	6	10	520	0.59	0.02	0.00	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00					
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	23	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	23	6	10	260	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	23	6	10	260	0.59	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Chain Saw	Other Construction Equipment	Gas	10	1	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Aerial Lifts	Other Construction Equipment	Diesel	49	23	6	10	1300	0.21	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Self-propelled sweeping and scrubbing vehicles	Other Construction Equipment	Diesel	70	23	6	5	650	0.43	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Hydraulic Crane	Cranes	Diesel	268	23	6	10	780	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Marooka	Crawler Tractor/Dozers	Diesel	250	23	6	6	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Pumps	Other Construction Equipment	Diesel	15	23	6	5	2080	0.43	0.04	0.01	0.02	0.00	0.10	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Air compressors	Other Construction Equipment	Diesel	275	23	6	10	3120	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Welders	Other Construction Equipment	Diesel	55	23	6	10	2340	0.21	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Pressure washers	Other Construction Equipment	Diesel	5	23	6	5	520	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Hydro power units	Other Construction Equipment	Diesel	200	23	6	10	1040	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
									Total Emissions (tons)										**0.01**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**					
																									0.05							

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissions

[2]Based on data provided by client.

[3]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

Amendment Project

Table 5. Metal HAP Emissions from Construction Engines - Interconnect - 2027

Equipment Name	MOVES Equipment Classification	Fuel Type	Rated Engine Load (hp)	Construction Emissions											
				Operations				Emission Factor[1] (g/hp-hr)				Emissions (tons)			
				Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	Arsenic	Chromium VI	Mercury Elemental Gaseous	Nickel	Arsenic	Chromium VI	Mercury Elemental Gaseous	Nickel
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	Plate Compactors	Diesel	19	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Light plants	Signal Boards/Light Plants	Diesel	15	6	10	3640	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	1040	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete or stone industrial saws	Concrete/Industrial Saws	Diesel	10	6	10	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	10	1040	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	Off-highway Trucks	Diesel	175	6	10	1300	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utility Truck	Off-highway Trucks	Diesel	100	6	6	1560	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rough terrain forklifts (CASE 588H)	Rough Terrain Forklifts	Diesel	78	6	10	1300	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rubber tire front loaders (CAT 972K)	Rubber Tire Loaders	Diesel	288	6	6	468	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	8	1040	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	1300	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loaders (Tracked - CAT 953D)	Skid Steer Loaders	Diesel	148	6	6	780	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chain Saw	Other Construction Equipment	Gas	10	6	10	520	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	Other Construction Equipment	Diesel	49	6	10	1300	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Self-propelled sweeping and scrubbing vehicles	Other Construction Equipment	Diesel	70	6	5	650	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydraulic Crane	Cranes	Diesel	268	6	10	780	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marooka	Crawler Tractor/Dozers	Diesel	250	6	6	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	5	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air compressors	Other Construction Equipment	Diesel	275	6	10	3120	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Welders	Other Construction Equipment	Diesel	55	6	10	2340	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure washers	Other Construction Equipment	Diesel	5	6	5	520	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	1040	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
											Total Emissions (tons)	**0.00**	**0.00**	**0.00**	**0.00**
												0.00			

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emission

[2]Based on data provided by client

[3]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

Amendment Project

Table 6. Criteria Pollutant Emissions from Construction Engines - Pipeline - 2027

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load	Construction Emissions																				
				Operations				Emission Factor[1] (g/hp-hr)									Emissions (tons)								
			(hp)	Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	CH_4	N_2O	CO_2	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	CH_4	N_2O	CO_2
Light plants	Signal Boards/Light Plants	Diesel	15	2	4	2149	0.43	3.77	1.52	0.00	0.36	0.18	0.17	0.03	0.00	589.36	0.06	0.02	0.00	0.01	0.00	0.00	0.00	0.00	9.00
Bore rigs	Bore/Drill Rigs	Diesel	250	6	10	2080	0.43	2.96	0.66	0.00	0.23	0.14	0.14	0.01	0.00	530.78	0.73	0.16	0.00	0.06	0.03	0.03	0.00	0.00	130.83
HDD Reaming/Pullback Rig	Bore/Drill Rigs	Diesel	875	6	10	2080	0.43	5.40	0.93	0.00	0.29	0.17	0.17	0.01	0.00	530.55	4.65	0.80	0.00	0.25	0.15	0.14	0.01	0.00	457.69
HDD Assist Reaming/Pilot Hole Rig	Bore/Drill Rigs	Diesel	440	6	10	2080	0.43	3.70	0.94	0.00	0.19	0.14	0.14	0.01	0.00	530.75	1.60	0.41	0.00	0.08	0.06	0.06	0.00	0.00	230.24
P-750 Mud Pump- American Augers, or Equiv.	Other Construction Equipment	Diesel	617	6	10	2080	0.43	1.37	0.72	0.00	0.07	0.08	0.08	0.00	0.00	536.67	0.83	0.44	0.00	0.04	0.05	0.05	0.00	0.00	326.46
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	71240	0.59	0.23	0.08	0.00	0.02	0.02	0.02	0.00	0.00	536.79	3.50	1.23	0.02	0.26	0.26	0.25	0.02	0.00	8082.90
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	8060	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.19	0.04	0.00	0.02	0.01	0.01	0.00	0.00	762.56
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	71240	0.59	0.21	0.06	0.00	0.01	0.01	0.01	0.00	0.00	536.81	1.41	0.41	0.01	0.07	0.10	0.09	0.00	0.00	3680.94
Excavators (JD 135G) or equiv.	Excavators	Diesel	101	6	10	8060	0.59	0.21	0.06	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.11	0.03	0.00	0.01	0.01	0.01	0.00	0.00	284.20
Excavators (CAT 306) or equiv.	Excavators	Diesel	56	6	10	71240	0.59	2.55	0.21	0.00	0.05	0.02	0.02	0.01	0.00	596.00	6.63	0.55	0.00	0.14	0.05	0.05	0.02	0.00	1546.37
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	8	6656	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.18	0.04	0.00	0.01	0.01	0.01	0.00	0.00	718.03
Hydrovac Truck Peterbilt 548 or equiv.	Off-highway Trucks	Diesel	350	6	10	10140	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.30	0.07	0.00	0.02	0.02	0.02	0.00	0.00	1239.01
Water Truck	Off-highway Trucks	Diesel	175	6	10	4160	0.59	0.17	0.05	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.08	0.02	0.00	0.00	0.01	0.01	0.00	0.00	254.16
Utility Truck	Off-highway Trucks	Diesel	100	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	6	1560	0.21	1.74	0.88	0.00	0.28	0.18	0.18	0.02	0.00	626.10	0.09	0.05	0.00	0.01	0.01	0.01	0.00	0.00	32.56
Dump Truck- Tri-Axle- Peterbilt 567 or equiv.	Off-highway Trucks	Diesel	510	6	10	10140	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.44	0.10	0.00	0.04	0.03	0.03	0.00	0.00	1805.42
Grapple Truck Freightliner M2106 or equiv.	Off-highway Trucks	Diesel	350	6	10	10140	0.59	0.13	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.30	0.07	0.00	0.02	0.02	0.02	0.00	0.00	1239.01
Dozers (CATD5K) or equiv.	Crawler Tractor/Dozers	Diesel	100	6	10	49920	0.59	0.93	0.13	0.00	0.01	0.02	0.02	0.00	0.00	596.13	3.01	0.41	0.01	0.04	0.08	0.07	0.00	0.00	1935.39
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	49920	0.59	0.25	0.07	0.00	0.01	0.02	0.02	0.00	0.00	536.80	1.01	0.30	0.01	0.05	0.07	0.07	0.00	0.00	2178.48
Dozers (CAT D7E)	Crawler Tractor/Dozers	Diesel	235	6	10	49400	0.59	0.15	0.04	0.00	0.01	0.01	0.01	0.00	0.00	536.80	1.14	0.29	0.01	0.09	0.08	0.07	0.00	0.00	4052.86
Dozers (CAT D8T)	Crawler Tractor/Dozers	Diesel	354	6	10	49920	0.59	0.34	0.13	0.00	0.02	0.03	0.02	0.00	0.00	536.77	3.90	1.49	0.02	0.26	0.29	0.28	0.02	0.00	6169.14
TRACKED CARRIER - PRINOTH PANTHER T14R or equiv.	Crawler Tractor/Dozers	Diesel	275	6	10	49920	0.21	0.15	0.04	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.48	0.12	0.00	0.04	0.03	0.03	0.00	0.00	1705.85
TRACKED CARRIER - PRINOTH T8 or equiv.	Crawler Tractor/Dozers	Diesel	225	6	10	49920	0.21	0.15	0.04	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.39	0.10	0.00	0.03	0.03	0.03	0.00	0.00	1395.70
Wheel Loader CAT 972M, or equiv. W/ Bucket, Forks, Sweeper	Skid Steer Loaders	Diesel	299	6	10	572	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAT TELEHANDLER TL1255D	Skid Steer Loaders	Diesel	134	6	10	572	0.21	4.32	2.37	0.00	0.77	0.46	0.45	0.04	0.00	625.71	0.08	0.04	0.00	0.01	0.01	0.01	0.00	0.00	11.10
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	6	1404	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	3120	0.59	2.96	0.66	0.00	0.23	0.14	0.14	0.01	0.00	530.78	1.49	0.33	0.00	0.12	0.07	0.07	0.01	0.00	267.10
Feller Buncher (CAT 553C)	Other Construction Equipment	Diesel	173	6	10	260	0.59	0.50	0.17	0.00	0.03	0.04	0.04	0.00	0.00	536.75	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	15.70
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	780	0.59	0.37	0.13	0.00	0.03	0.03	0.03	0.00	0.00	536.75	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	68.07
Sideboom (CAT 583T Pipelayer)	Other Construction Equipment	Diesel	347	6	10	37700	0.59	1.39	0.54	0.00	0.08	0.08	0.07	0.00	0.00	536.66	11.80	4.61	0.01	0.65	0.65	0.63	0.04	0.00	4565.89
Bending Machine	Other Construction Equipment	Diesel	175	6	10	3900	0.59	0.50	0.17	0.00	0.03	0.04	0.04	0.00	0.00	536.75	0.22	0.08	0.00	0.01	0.02	0.02	0.00	0.00	238.25
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	1560	0.59	2.53	0.28	0.00	0.09	0.02	0.02	0.01	0.00	595.88	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	16.32
Chain Saw	Other Construction Equipment	Diesel	10	6	10	7540	0.59	4.18	2.47	0.00	0.84	0.24	0.23	0.07	0.00	593.76	0.21	0.12	0.00	0.04	0.01	0.01	0.00	0.00	29.12
Bobcat with sweeper attachment	Skid Steer Loaders	Diesel	70	6	2	572	0.43	5.20	5.52	0.00	1.02	0.77	0.75	0.04	0.00	694.65	0.10	0.10	0.00	0.02	0.01	0.01	0.00	0.00	13.18
Bobcat with brush hog attachement	Skid Steer Loaders	Diesel	70	6	2	312	0.43	5.20	5.52	0.00	1.02	0.77	0.75	0.04	0.00	694.65	0.05	0.06	0.00	0.01	0.01	0.01	0.00	0.00	7.19
CTL - CAT 299 D3	Skid Steer Loaders	Diesel	98	6	10	572	0.21	4.82	5.50	0.00	1.01	0.77	0.75	0.04	0.00	694.83	0.06	0.07	0.00	0.01	0.01	0.01	0.00	0.00	9.02
Grove RT890E Rough Terrain Crane, or equiv.	Off-highway Trucks	Diesel	275	6	10	10140	0.43	0.11	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.15	0.03	0.00	0.01	0.01	0.01	0.00	0.00	709.51
JD GATOR XUV 835E, or equiv.	Other Construction Equipment	Gas	54	6	10	18200	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	6	13416	0.43	3.76	1.49	0.00	0.35	0.17	0.17	0.03	0.00	595.15	0.36	0.14	0.00	0.03	0.02	0.02	0.00	0.00	56.77
Air compressors	Other Construction Equipment	Diesel	275	6	10	18200	0.43	0.37	0.13	0.00	0.03	0.03	0.03	0.00	0.00	536.75	0.87	0.30	0.00	0.07	0.06	0.06	0.00	0.00	1273.36
Air Compressor-1550 CFM Atlas Copco XRVS 1550, or equiv.	Other Construction Equipment	Diesel	765	6	10	18200	0.43	3.31	0.58	0.00	0.14	0.10	0.10	0.00	0.00	536.43	21.82	3.81	0.01	0.90	0.69	0.67	0.03	0.00	3540.14
Welders	Other Construction Equipment	Diesel	55	6	9	19422	0.21	2.67	0.42	0.00	0.08	0.05	0.04	0.01	0.00	595.93	0.66	0.10	0.00	0.02	0.01	0.01	0.00	0.00	147.36
Pressure washers	Other Construction Equipment	Diesel	5	6	4	2392	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	520	0.43	0.37	0.13	0.00	0.03	0.03	0.03	0.00	0.00	536.75	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	26.46
Generator- CAT - 100KW XQ125 T4F	Other Construction Equipment	Diesel	142	6	10	18200	0.43	0.50	0.17	0.00	0.03	0.04	0.04	0.00	0.00	536.75	0.61	0.21	0.00	0.04	0.05	0.05	0.00	0.00	657.52
															Total Emissions (tons)		**69.68**	**17.18**	**0.14**	**3.51**	**3.02**	**2.93**	**0.20**	**0.00**	**49889**

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissi

[2]N_2O emission factor is based on 2020 Climate Registry Default Emission Factors, Released: April 2020, Tables 2.1 and 2.7, ratioed based on GWmission factor from EPA MOVES4.0 (https://www.theclimateregistry.org/wp-content/uploads/2020/04/The-Climate-Registry-2020-Default-Emission-Factor-Document.pdf).

[3]Based on data provided by client

[4]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not ava

[5]Construction Engine Emissions represent total emissions in a single county (Rockingham or Pittsylvania).

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Table 7. HAP Emissions from Construction Engines - Pipeline - 2027

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load	Construction Emissions																					
				Operations				Emission Factor[1] (g/hp-hr)									Emissions (tons)									
			(hp)	Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Hexane	Naphthalene	Ethyl Benzene	Toluene	Xylene	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Hexane	Naphthalene	Ethyl Benzene	Toluene	Xylene
Light plants	Signal Boards/Light Plants	Diesel	15	2	4	2149	0.43	0.04	0.01	0.02	0.00	0.10	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bore rigs	Bore/Drill Rigs	Diesel	250	6	10	2080	0.43	0.02	0.00	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
HDD Reaming/Pullback Rig	Bore/Drill Rigs	Diesel	875	6	10	2080	0.43	0.02	0.01	0.01	0.00	0.07	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.00
HDD Assist Reaming/Pilot Hole Rig	Bore/Drill Rigs	Diesel	440	6	10	2080	0.43	0.02	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
P-750 Mud Pump- American Augers, or Equiv.	Other Construction Equipment	Diesel	617	6	10	2080	0.43	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	71240	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.01	0.01
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	8060	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	71240	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Excavators (JD 135G) or equiv.	Excavators	Diesel	101	6	10	8060	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 306) or equiv.	Excavators	Diesel	56	6	10	71240	0.59	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.04	0.00	0.00	0.00	0.01	0.00
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	8	6656	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrovac Truck Peterbilt 548 or equiv.	Off-highway Trucks	Diesel	350	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	Off-highway Trucks	Diesel	175	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utility Truck	Off-highway Trucks	Diesel	100	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	6	1560	0.21	0.03	0.01	0.01	0.00	0.07	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck- Tri-Axle- Peterbilt 567 or equiv.	Off-highway Trucks	Diesel	510	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Grapple Truck Freightliner M2106 or equiv.	Off-highway Trucks	Diesel	350	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CATD5K) or equiv.	Crawler Tractor/Dozers	Diesel	100	6	10	49920	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	49920	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D7E)	Crawler Tractor/Dozers	Diesel	235	6	10	49400	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D8T)	Crawler Tractor/Dozers	Diesel	354	6	10	49920	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.01
TRACKED CARRIER - PRINOTH PANTHER T14R or equiv.	Crawler Tractor/Dozers	Diesel	275	6	10	49920	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH T8 or equiv.	Crawler Tractor/Dozers	Diesel	225	6	10	49920	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Wheel Loader CAT 972M, or equiv. W/ Bucket, Forks, Sweeper	Skid Steer Loaders	Diesel	299	6	10	572	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAT TELEHANDLER TL1255D	Skid Steer Loaders	Diesel	134	6	10	572	0.21	0.07	0.02	0.03	0.00	0.20	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	6	1404	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	3120	0.59	0.02	0.00	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Feller Buncher (CAT 553C)	Other Construction Equipment	Diesel	173	6	10	260	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	780	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sideboom (CAT 583T Pipelayer)	Other Construction Equipment	Diesel	347	6	10	37700	0.59	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.03	0.00	0.16	0.00	0.00	0.00	0.02	0.01
Bending Machine	Other Construction Equipment	Diesel	175	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	1560	0.59	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chain Saw	Other Construction Equipment	Diesel	10	6	10	7540	0.59	0.09	0.02	0.05	0.00	0.24	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Bobcat with sweeper attachment	Skid Steer Loaders	Diesel	70	6	2	572	0.43	0.09	0.02	0.03	0.00	0.25	0.00	0.00	0.01	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with brush hog attachement	Skid Steer Loaders	Diesel	70	6	2	312	0.43	0.09	0.02	0.03	0.00	0.25	0.00	0.00	0.01	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTL - CAT 299 D3	Skid Steer Loaders	Diesel	98	6	10	572	0.21	0.09	0.02	0.03	0.00	0.25	0.00	0.00	0.01	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grove RT890E Rough Terrain Crane, or equiv.	Off-highway Trucks	Diesel	275	6	10	10140	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JD GATOR XUV 835E, or equiv.	Other Construction Equipment	Gas	54	6	10	18200	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	6	13416	0.43	0.04	0.01	0.02	0.00	0.10	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Air compressors	Other Construction Equipment	Diesel	275	6	10	18200	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Air Compressor-1550 CFM Atlas Copco XRVS 1550, or equiv.	Other Construction Equipment	Diesel	765	6	10	18200	0.43	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.08	0.02	0.03	0.00	0.21	0.00	0.00	0.00	0.02	0.01
Welders	Other Construction Equipment	Diesel	55	6	9	19422	0.21	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Pressure washers	Other Construction Equipment	Diesel	5	6	4	72	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	520	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generator- CAT - 100KW XQ125 T4F	Other Construction Equipment	Diesel	142	6	10	18200	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
																Total Emissions (tons)		**0.31**	**0.06**	**0.13**	**0.01**	**0.83**	**0.00**	**0.00**	**0.02**	**0.10**	**0.08**
																Total Organic HAP Emissions (tons)						**1.53**					

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissions.

[2]Based on data provided by client.

[3]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

[4]Construction Engine Emissions represent total emissions in a single county (Rockingham or Pittsylvania).

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Table 8. Metal HAP Emissions from Construction Engines - Pipeline - 2027

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load	Construction Emissions											
				Operations				Emission Factor[1] (g/hp-hr)				Emissions (tons)			
			(hp)	Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	Arsenic	Chromium VI	Mercury Elemental Gaseous	Nickel	Arsenic	Chromium VI	Mercury Elemental Gaseous	Nickel
Light plants	Signal Boards/Light Plants	Diesel	15	2	4	2149	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bore rigs	Bore/Drill Rigs	Diesel	250	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Reaming/Pullback Rig	Bore/Drill Rigs	Diesel	875	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Assist Reaming/Pilot Hole Rig	Bore/Drill Rigs	Diesel	440	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-750 Mud Pump- American Augers, or Equiv.	Other Construction Equipment	Diesel	617	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	71240	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	8060	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	71240	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 135G) or equiv.	Excavators	Diesel	101	6	10	8060	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 306) or equiv.	Excavators	Diesel	56	6	10	71240	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	8	6656	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrovac Truck Peterbilt 548 or equiv.	Off-highway Trucks	Diesel	350	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	Off-highway Trucks	Diesel	175	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utility Truck	Off-highway Trucks	Diesel	100	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	6	1560	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck- Tri-Axle- Peterbilt 567 or equiv.	Off-highway Trucks	Diesel	510	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grapple Truck Freightliner M2106 or equiv.	Off-highway Trucks	Diesel	350	6	10	10140	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CATD5K) or equiv.	Crawler Tractor/Dozers	Diesel	100	6	10	49920	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	49920	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D7E)	Crawler Tractor/Dozers	Diesel	235	6	10	49400	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D8T)	Crawler Tractor/Dozers	Diesel	354	6	10	49920	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH PANTHER T14R or equiv.	Crawler Tractor/Dozers	Diesel	275	6	10	49920	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH T8 or equiv.	Crawler Tractor/Dozers	Diesel	225	6	10	49920	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wheel Loader CAT 972M, or equiv. W/ Bucket, Forks, Sweeper	Skid Steer Loaders	Diesel	299	6	10	572	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAT TELEHANDLER TL1255D	Skid Steer Loaders	Diesel	134	6	10	572	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	6	1404	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	3120	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feller Buncher (CAT 553C)	Other Construction Equipment	Diesel	173	6	10	260	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	780	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sideboom (CAT 583T Pipelayer)	Other Construction Equipment	Diesel	347	6	10	37700	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bending Machine	Other Construction Equipment	Diesel	175	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	1560	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chain Saw	Other Construction Equipment	Diesel	10	6	10	7540	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with sweeper attachment	Skid Steer Loaders	Diesel	70	6	2	572	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with brush hog attachement	Skid Steer Loaders	Diesel	70	6	2	312	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTL - CAT 299 D3	Skid Steer Loaders	Diesel	98	6	10	572	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grove RT890E Rough Terrain Crane, or equiv.	Off-highway Trucks	Diesel	275	6	10	10140	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JD GATOR XUV 835E, or equiv.	Other Construction Equipment	Gas	54	6	10	18200	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	6	13416	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air compressors	Other Construction Equipment	Diesel	275	6	10	18200	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor-1550 CFM Atlas Copco XRVS 1550, or equiv.	Other Construction Equipment	Diesel	765	6	10	18200	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Welders	Other Construction Equipment	Diesel	55	6	9	19422	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure washers	Other Construction Equipment	Diesel	5	6	4	2392	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	520	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generator- CAT - 100KW XQ125 T4F	Other Construction Equipment	Diesel	142	6	10	18200	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
										Total Emissions (tons)		**0.00**	**0.00**	**0.00**	**0.00**

Total Metal HAP Emissions (tons)	**0.00**

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissions.

[2]Based on data provided by client.

[3]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

[4]Construction Engine Emissions represent total emissions in a single county (Rockingham or Pittsylvania).

Amendment Project

Table 9. Criteria Pollutant Emissions from Construction Engines - Pipeline - 2028

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load	Construction Emissions																				
				Operations				Emission Factor[1] (g/hp-hr)									Emissions (tons)								
			(hp)	Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	CH_4	N_2O	CO_2	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	CH_4	N_2O	CO_2
Light plants	Signal Boards/Light Plants	Diesel	15	2	4	277	0.43	3.77	1.50	0.00	0.36	0.17	0.17	0.03	0.00	589.36	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16
Bore rigs	Bore/Drill Rigs	Diesel	250	6	10	0	0.43	2.49	0.56	0.00	0.19	0.12	0.12	0.01	0.00	530.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Reaming/Pullback Rig	Bore/Drill Rigs	Diesel	875	6	10	0	0.43	5.06	0.84	0.00	0.27	0.16	0.15	0.01	0.00	530.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Assist Reaming/Pilot Hole Rig	Bore/Drill Rigs	Diesel	440	6	10	0	0.43	3.31	0.85	0.00	0.17	0.13	0.12	0.01	0.00	530.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-750 Mud Pump- American Augers, or Equiv.	Other Construction Equipment	Diesel	617	6	10	0	0.43	1.21	0.63	0.00	0.06	0.07	0.07	0.00	0.00	536.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	3640	0.59	0.19	0.06	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.15	0.05	0.00	0.01	0.01	0.01	0.00	0.00	413.00
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	0	0.59	0.12	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	3900	0.59	0.18	0.06	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.00	201.51
Excavators (JD 135G) or equiv.	Excavators	Diesel	101	6	10	3900	0.59	0.18	0.06	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	137.52
Excavators (CAT 306) or equiv.	Excavators	Diesel	56	6	10	3900	0.59	2.55	0.19	0.00	0.05	0.02	0.02	0.01	0.00	596.00	0.36	0.03	0.00	0.01	0.00	0.00	0.00	0.00	84.66
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	8	1456	0.59	0.12	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	157.07
Hydrovac Truck Peterbilt 548 or equiv.	Off-highway Trucks	Diesel	350	6	10	2080	0.59	0.12	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	254.16
Water Truck	Off-highway Trucks	Diesel	175	6	10	1560	0.59	0.17	0.05	0.00	0.01	0.01	0.01	0.00	0.00	536.81	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	95.31
Utility Truck	Off-highway Trucks	Diesel	100	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	6	0	0.21	1.53	0.76	0.00	0.25	0.16	0.15	0.01	0.00	626.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck- Tri-Axle- Peterbilt 567 or equiv.	Off-highway Trucks	Diesel	510	6	10	2080	0.59	0.12	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.08	0.02	0.00	0.01	0.00	0.00	0.00	0.00	370.34
Grapple Truck Freightliner M2106 or equiv.	Off-highway Trucks	Diesel	350	6	10	2080	0.59	0.12	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	254.16
Dozers (CATD5K) or equiv.	Crawler Tractor/Dozers	Diesel	100	6	10	4160	0.59	0.91	0.11	0.00	0.01	0.02	0.02	0.00	0.00	596.13	0.25	0.03	0.00	0.00	0.01	0.01	0.00	0.00	161.28
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	4160	0.59	0.23	0.07	0.00	0.01	0.02	0.02	0.00	0.00	536.80	0.08	0.02	0.00	0.00	0.01	0.01	0.00	0.00	181.54
Dozers (CAT D7E)	Crawler Tractor/Dozers	Diesel	235	6	10	3900	0.59	0.14	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.08	0.02	0.00	0.01	0.01	0.01	0.00	0.00	319.96
Dozers (CAT D8T)	Crawler Tractor/Dozers	Diesel	354	6	10	4160	0.59	0.30	0.11	0.00	0.02	0.02	0.02	0.00	0.00	536.78	0.28	0.10	0.00	0.02	0.02	0.02	0.00	0.00	514.10
TRACKED CARRIER - PRINOTH PANTHER T14R or equiv.	Crawler Tractor/Dozers	Diesel	275	6	10	4160	0.21	0.14	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	142.15
TRACKED CARRIER - PRINOTH T8 or equiv.	Crawler Tractor/Dozers	Diesel	225	6	10	4160	0.21	0.14	0.03	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	116.31
Wheel Loader CAT 972M, or equiv. W/ Bucket, Forks, Sweeper	Skid Steer Loaders	Diesel	299	6	10	364	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAT TELEHANDLER TL1255D	Skid Steer Loaders	Diesel	134	6	10	364	0.21	3.87	2.13	0.00	0.69	0.42	0.41	0.04	0.00	625.79	0.04	0.02	0.00	0.01	0.00	0.00	0.00	0.00	7.07
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	6	468	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	0	0.59	2.49	0.56	0.00	0.19	0.12	0.12	0.01	0.00	530.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feller Buncher (CAT 553C)	Other Construction Equipment	Diesel	173	6	10	0	0.59	0.43	0.15	0.00	0.02	0.04	0.04	0.00	0.00	536.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	0	0.59	0.32	0.11	0.00	0.02	0.02	0.02	0.00	0.00	536.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sideboom (CAT 583T Pipelayer)	Other Construction Equipment	Diesel	347	6	10	0	0.59	1.22	0.47	0.00	0.07	0.07	0.06	0.00	0.00	536.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bending Machine	Other Construction Equipment	Diesel	175	6	10	0	0.59	0.43	0.15	0.00	0.02	0.04	0.04	0.00	0.00	536.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	0	0.59	2.53	0.28	0.00	0.09	0.02	0.02	0.01	0.00	595.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chain Saw	Other Construction Equipment	Diesel	10	6	10	0	0.59	4.18	2.46	0.00	0.84	0.24	0.23	0.07	0.00	593.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with sweeper attachment	Skid Steer Loaders	Diesel	70	6	2	364	0.43	4.91	4.99	0.00	0.91	0.69	0.67	0.04	0.00	694.76	0.06	0.06	0.00	0.01	0.01	0.01	0.00	0.00	8.39
Bobcat with brush hog attachement	Skid Steer Loaders	Diesel	70	6	2	0	0.43	4.91	4.99	0.00	0.91	0.69	0.67	0.04	0.00	694.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTL - CAT 299 D3	Skid Steer Loaders	Diesel	98	6	10	364	0.21	4.39	4.95	0.00	0.90	0.69	0.67	0.04	0.00	694.94	0.04	0.04	0.00	0.01	0.01	0.01	0.00	0.00	5.74
Grove RT890E Rough Terrain Crane, or equiv.	Off-highway Trucks	Diesel	275	6	10	2080	0.43	0.11	0.02	0.00	0.01	0.01	0.01	0.00	0.00	536.80	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	145.54
JD GATOR XUV 835E, or equiv.	Other Construction Equipment	Gas	54	6	10	1092	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	6	1092	0.43	3.76	1.49	0.00	0.35	0.17	0.17	0.03	0.00	595.15	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	4.62
Air compressors	Other Construction Equipment	Diesel	275	6	10	0	0.43	0.32	0.11	0.00	0.02	0.02	0.02	0.00	0.00	536.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor-1550 CFM Atlas Copco XRVS 1550, or equiv.	Other Construction Equipment	Diesel	765	6	10	1092	0.43	3.17	0.51	0.00	0.12	0.09	0.09	0.00	0.00	536.47	1.25	0.20	0.00	0.05	0.04	0.04	0.00	0.00	212.42
Welders	Other Construction Equipment	Diesel	55	6	9	0	0.21	2.64	0.37	0.00	0.07	0.04	0.04	0.01	0.00	595.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure washers	Other Construction Equipment	Diesel	5	6	4	728	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	0	0.43	0.32	0.11	0.00	0.02	0.02	0.02	0.00	0.00	536.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generator- CAT - 100KW XQ125 T4F	Other Construction Equipment	Diesel	142	6	10	1092	0.43	0.43	0.15	0.00	0.02	0.04	0.04	0.00	0.00	536.76	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	39.45
															Total Emissions (tons)		**3.14**	**0.71**	**0.01**	**0.17**	**0.14**	**0.14**	**0.01**	**0.00**	**3827.46**

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissi

[2]N_2O emission factor is based on 2020 Climate Registry Default Emission Factors, Released: April 2020, Tables 2.1 and 2.7, ratioed based on G0mission factor from EPA MOVES4.0 (https://www.theclimateregistry.org/wp-content/uploads/2020/04/The-Climate-Registry-2020-Default-Emission-Factor-Document.pdf).

[3]Based on data provided by client

[4]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not ava

[5]Construction Engine Emissions represent total emissions in a single county (Rockingham or Pittsylvania).

Amendment Project

Table 10. HAP Emissions from Construction Engines - Pipeline - 2028

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load	Construction Emissions																					
				Operations				Emission Factor[1] (g/hp-hr)										Emissions (tons)									
			(hp)	Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Hexane	Naphthalene	Ethyl Benzene	Toluene	Xylene	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Hexane	Naphthalene	Ethyl Benzene	Toluene	Xylene
Light plants	Signal Boards/Light Plants	Diesel	15	2	4	277	0.43	0.04	0.01	0.02	0.00	0.10	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bore rigs	Bore/Drill Rigs	Diesel	250	6	10	0	0.43	0.02	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Reaming/Pullback Rig	Bore/Drill Rigs	Diesel	875	6	10	0	0.43	0.02	0.01	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Assist Reaming/Pilot Hole Rig	Bore/Drill Rigs	Diesel	440	6	10	0	0.43	0.02	0.00	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-750 Mud Pump- American Augers, or Equiv.	Other Construction Equipment	Diesel	617	6	10	0	0.43	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	3640	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 135G) or equiv.	Excavators	Diesel	101	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 306) or equiv.	Excavators	Diesel	56	6	10	3900	0.59	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	8	1456	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrovac Truck Peterbilt 548 or equiv.	Off-highway Trucks	Diesel	350	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	Off-highway Trucks	Diesel	175	6	10	1560	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utility Truck	Off-highway Trucks	Diesel	100	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	6	0	0.21	0.02	0.00	0.01	0.00	0.06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck- Tri-Axle- Peterbilt 567 or equiv.	Off-highway Trucks	Diesel	510	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grapple Truck Freightliner M2106 or equiv.	Off-highway Trucks	Diesel	350	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CATD5K) or equiv.	Crawler Tractor/Dozers	Diesel	100	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D7E)	Crawler Tractor/Dozers	Diesel	235	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D8T)	Crawler Tractor/Dozers	Diesel	354	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH PANTHER T14R or equiv.	Crawler Tractor/Dozers	Diesel	275	6	10	4160	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH T8 or equiv.	Crawler Tractor/Dozers	Diesel	225	6	10	4160	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wheel Loader CAT 972M, or equiv. W/ Bucket, Forks, Sweeper	Skid Steer Loaders	Diesel	299	6	10	364	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAT TELEHANDLER TL1255D	Skid Steer Loaders	Diesel	134	6	10	364	0.21	0.06	0.01	0.03	0.00	0.18	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	6	468	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	0	0.59	0.02	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feller Buncher (CAT 553C)	Other Construction Equipment	Diesel	173	6	10	0	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	0	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sideboom (CAT 583T Pipelayer)	Other Construction Equipment	Diesel	347	6	10	0	0.59	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bending Machine	Other Construction Equipment	Diesel	175	6	10	0	0.59	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	0	0.59	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chain Saw	Other Construction Equipment	Diesel	10	6	10	0	0.59	0.09	0.02	0.05	0.00	0.24	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with sweeper attachment	Skid Steer Loaders	Diesel	70	6	2	364	0.43	0.08	0.02	0.03	0.00	0.22	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with brush hog attachement	Skid Steer Loaders	Diesel	70	6	2	0	0.43	0.08	0.02	0.03	0.00	0.22	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTL - CAT 299 D3	Skid Steer Loaders	Diesel	98	6	10	364	0.21	0.08	0.02	0.03	0.00	0.22	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grove RT890E Rough Terrain Crane, or equiv.	Off-highway Trucks	Diesel	275	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JD GATOR XUV 835E, or equiv.	Other Construction Equipment	Gas	54	6	10	1092	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	6	1092	0.43	0.04	0.01	0.02	0.00	0.10	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air compressors	Other Construction Equipment	Diesel	275	6	10	0	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor-1550 CFM Atlas Copco XRVS 1550, or equiv.	Other Construction Equipment	Diesel	765	6	10	1092	0.43	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Welders	Other Construction Equipment	Diesel	55	6	9	0	0.21	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure washers	Other Construction Equipment	Diesel	5	6	4	728	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	0	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generator- CAT - 100KW XQ125 T4F	Other Construction Equipment	Diesel	142	6	10	1092	0.43	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
																	Total Emissions (tons)	0.01	0.00	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00
																	Total Organic HAP Emissions (tons)	0.07									

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissions.

[2]Based on data provided by client.

[3]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

[4]Construction Engine Emissions represent total emissions in a single county (Rockingham or Pittsylvania).

Amendment Project

Table 11. Metal HAP Emissions from Construction Engines - Pipeline - 2028

Equipment Name	MOVEs Equipment Classification	Fuel Type	Rated Engine Load	Construction Emissions											
				Operations				Emission Factor[1] (g/hp-hr)				Emissions (tons)			
			(hp)	Days/Week	Hours/Day	Hours of Operation	Engine Load Factor	Arsenic	Chromium VI	Mercury Elemental Gaseous	Nickel	Arsenic	Chromium VI	Mercury Elemental Gaseous	Nickel
Light plants	Signal Boards/Light Plants	Diesel	15	2	4	277	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bore rigs	Bore/Drill Rigs	Diesel	250	6	10	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Reaming/Pullback Rig	Bore/Drill Rigs	Diesel	875	6	10	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDD Assist Reaming/Pilot Hole Rig	Bore/Drill Rigs	Diesel	440	6	10	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-750 Mud Pump- American Augers, or Equiv.	Other Construction Equipment	Diesel	617	6	10	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 345C)	Excavators	Diesel	325	6	10	3640	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 350G LC)	Excavators	Diesel	271	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 320DL)	Excavators	Diesel	148	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (JD 135G) or equiv.	Excavators	Diesel	101	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavators (CAT 306) or equiv.	Excavators	Diesel	56	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-highway trucks -1-2.5 ton trucks (CAT 725)	Off-highway Trucks	Diesel	309	6	8	1456	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrovac Truck Peterbilt 548 or equiv.	Off-highway Trucks	Diesel	350	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	Off-highway Trucks	Diesel	175	6	10	1560	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utility Truck	Off-highway Trucks	Diesel	100	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tractors, loaders, and backhoes (CAT 450F)	Tractors/Loaders/Backhoes	Diesel	144	6	6	0	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck- Tri-Axle- Peterbilt 567 or equiv.	Off-highway Trucks	Diesel	510	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grapple Truck Freightliner M2106 or equiv.	Off-highway Trucks	Diesel	350	6	10	2080	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CATD5K) or equiv.	Crawler Tractor/Dozers	Diesel	100	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D6K)	Crawler Tractor/Dozers	Diesel	125	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D7E)	Crawler Tractor/Dozers	Diesel	235	6	10	3900	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozers (CAT D8T)	Crawler Tractor/Dozers	Diesel	354	6	10	4160	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH PANTHER T14R or equiv.	Crawler Tractor/Dozers	Diesel	275	6	10	4160	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRACKED CARRIER - PRINOTH T8 or equiv.	Crawler Tractor/Dozers	Diesel	225	6	10	4160	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wheel Loader CAT 972M, or equiv. W/ Bucket, Forks, Sweeper	Skid Steer Loaders	Diesel	299	6	10	364	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAT TELEHANDLER TL1255D	Skid Steer Loaders	Diesel	134	6	10	364	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off- highway tractors (John Deere 6115D)	Off-Highway Tractors	Diesel	115	6	6	468	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	Bore/Drill Rigs	Diesel	248	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feller Buncher (CAT 553C)	Other Construction Equipment	Diesel	173	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logging Skidder (CAT 525C)	Skid Steer Loaders	Diesel	182	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chipper (Bandit 1850)	Other Construction Equipment	Diesel	250	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sideboom (CAT 583T Pipelayer)	Other Construction Equipment	Diesel	347	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bending Machine	Other Construction Equipment	Diesel	175	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stump Grinder (Vermeer SC252)	Other Construction Equipment	Diesel	27	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chain Saw	Other Construction Equipment	Diesel	10	6	10	0	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with sweeper attachment	Skid Steer Loaders	Diesel	70	6	2	364	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bobcat with brush hog attachement	Skid Steer Loaders	Diesel	70	6	2	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTL - CAT 299 D3	Skid Steer Loaders	Diesel	98	6	10	364	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grove RT890E Rough Terrain Crane, or equiv.	Off-highway Trucks	Diesel	275	6	10	2080	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JD GATOR XUV 835E, or equiv.	Other Construction Equipment	Gas	54	6	10	1092	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	Other Construction Equipment	Diesel	15	6	6	1092	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air compressors	Other Construction Equipment	Diesel	275	6	10	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor-1550 CFM Atlas Copco XRVS 1550, or equiv.	Other Construction Equipment	Diesel	765	6	10	1092	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Welders	Other Construction Equipment	Diesel	55	6	9	0	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure washers	Other Construction Equipment	Diesel	5	6	4	728	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro power units	Other Construction Equipment	Diesel	200	6	10	0	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generator- CAT - 100KW XQ125 T4F	Other Construction Equipment	Diesel	142	6	10	1092	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
										Total Emissions (tons)		**0.00**	**0.00**	**0.00**	**0.00**

Total Metal HAP Emissions (tons)	**0.00**

[1]Per EPA MOVES4.0. To be conservative, MOVES models were run for Pittsylvania, VA and Rockingham, NC and the worst-case emission factors (maximum) were utilized to quantify emissions.

[2]Based on data provided by client.

[3]EPA MOVES4.0 Model does not contain Emission Factors for some equipment types. Used Emission Factors for Other Construction Equipment as a substitution when equipment-specific emissions factors were not available.

[4]Construction Engine Emissions represent total emissions in a single county (Rockingham or Pittsylvania).

Table 12. On-Road Engine Emission Factors - Interconnect and Pipeline - 2027

Pollutant	2027 Emission Factors (grams/mile)[1] Passenger Car	Passenger Truck	Short Haul Truck	Long Haul Truck
NO_X	1.10E-01	1.66E-01	8.76E-01	8.33E-01
CO	3.17E+00	2.85E+00	2.62E+00	2.35E+00
SO_2	1.40E-03	1.80E-03	3.41E-03	3.20E-03
VOC	2.34E-01	1.85E-01	2.94E-01	2.40E-01
PM_{10}	4.02E-03	5.76E-03	2.43E-02	2.77E-02
$PM_{2.5}$	3.55E-03	5.14E-03	2.22E-02	2.54E-02
CO_2	2.76E+02	3.60E+02	8.66E+02	8.09E+02
CH_4	1.23E-02	1.16E-02	1.16E-01	8.61E-02
N_2O	4.43E-03	6.85E-03	8.42E-02	7.36E-02
CO_2e	2.78E+02	3.62E+02	8.94E+02	8.33E+02
Acetaldehyde	1.05E-03	1.03E-03	3.96E-03	2.69E-03
Acrolein	6.62E-05	7.87E-05	4.13E-04	3.38E-04
Benzene	3.67E-03	3.10E-03	3.43E-03	2.31E-03
1,3-Butadiene	4.33E-04	3.68E-04	3.69E-04	2.14E-04
Formaldehyde	7.08E-04	8.94E-04	5.10E-03	4.57E-03
Hexane	6.63E-03	4.98E-03	5.82E-03	4.70E-03
Xylenes (mixed isomers)	1.40E-02	1.11E-02	1.61E-02	1.19E-02
2,2,4-Trimethylpentane	6.37E-03	4.86E-03	6.07E-03	5.24E-03
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	5.74E-05	5.41E-05	8.67E-05	7.99E-05
Ethyl Benzene	3.75E-03	2.97E-03	3.96E-03	3.12E-03
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	2.84E-02	2.17E-02	2.69E-02	2.28E-02
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	2.10E-06	2.16E-06	2.27E-06	2.26E-06
Chromium VI	1.09E-08	1.11E-08	5.57E-09	5.70E-09
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	1.37E-06	1.43E-06	1.01E-06	1.10E-06

1. Per EPA MOVES4.0. MOVES models were run for Pittsylvania, VA and Rockingham, NC and emissions factors were calculated by taking total grams emitted divided by total miles traveled.

Table 13. On-Road Engine Emission Factors - Interconnect and Pipeline - 2028

Pollutant	2028 Emission Factors (grams/mile)[1] Passenger Car	Passenger Truck	Short Haul Truck	Long Haul Truck
NO_X	9.29E-02	1.43E-01	7.91E-01	7.48E-01
CO	2.98E+00	2.63E+00	2.44E+00	2.04E+00
SO_2	1.34E-03	1.74E-03	3.34E-03	3.13E-03
VOC	2.17E-01	1.72E-01	2.69E-01	2.11E-01
PM_{10}	3.97E-03	5.19E-03	2.00E-02	2.29E-02
$PM_{2.5}$	3.51E-03	4.62E-03	1.82E-02	2.09E-02
CO_2	2.66E+02	3.47E+02	8.47E+02	7.91E+02
CH_4	1.14E-02	1.07E-02	1.13E-01	8.19E-02
N_2O	4.21E-03	6.47E-03	8.36E-02	7.28E-02
CO_2e	2.67E+02	3.49E+02	8.74E+02	8.15E+02
Acetaldehyde	9.73E-04	9.30E-04	3.69E-03	2.51E-03
Acrolein	6.15E-05	6.93E-05	3.71E-04	3.21E-04
Benzene	3.38E-03	2.87E-03	3.19E-03	1.91E-03
1,3-Butadiene	4.00E-04	3.38E-04	3.43E-04	1.72E-04
Formaldehyde	6.45E-04	7.71E-04	4.52E-03	4.30E-03
Hexane	5.95E-03	4.56E-03	5.18E-03	3.92E-03
Xylenes (mixed isomers)	1.33E-02	1.05E-02	1.51E-02	1.04E-02
2,2,4-Trimethylpentane	5.95E-03	4.56E-03	5.52E-03	4.52E-03
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	5.24E-05	4.86E-05	7.64E-05	7.02E-05
Ethyl Benzene	3.55E-03	2.81E-03	3.69E-03	2.71E-03
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	2.65E-02	2.04E-02	2.46E-02	1.97E-02
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	2.05E-06	2.12E-06	2.25E-06	2.24E-06
Chromium VI	1.07E-08	1.09E-08	5.44E-09	5.61E-09
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	1.34E-06	1.39E-06	9.38E-07	1.07E-06

1. Per EPA MOVES4.0. MOVES models were run for Pittsylvania, VA and Rockingham, NC and emissions factors were calculated by taking total grams emitted divided by total miles traveled.

Amendment Project

Table 14. On-Road Vehicle Travel - On-Site & Deliveries/Removals/Commutes

2027

Vehicle Type	Deliveries/Removal/Commutes - Interconnect			Deliveries/Removal/Commutes - Pipeline - Pittsylvania			Deliveries/Removal/Commutes - Pipeline - Rockingham			On-Site - Interconnect	On-Site - Pipeline - Pittsylvania	On-Site - Pipeline - Rockingham
	Round Trip (miles)	Total Trips	Total Miles	Round Trip (miles)	Total Trips	Total Miles	Round Trip (miles)	Total Trips	Total Miles	Total Miles	Total Miles	Total Miles
Light duty gasoline vehicles (< 6,000 lb GVW)	---	---	---	---	---	---	---	---	---	156,000	46,800	46,800
Heavy duty gasoline vehicles (>6,000 lb GVW)	50	25	1,250	---	---	---	---	---	---	97,500	393,120	393,120
Light duty diesel vehicles (< 6,000 lb GVW)	---	---	---	---	---	---	---	---	---	175,500	82,680	82,680
Heavy duty diesel vehicles (>6,000 lb GVW)	50	90	4,500	70	1404	98,280	70	505	35,350	48,750	42,120	42,120
Passenger Cars	---	---	45000	---	---	916585.5	---	---	916585.5	---	---	---
Passenger Trucks	---	---	45000	---	---	916585.5	---	---	916585.5	---	---	---

1. Worker Commmutes are assumed to be Passenger Cars and Passenger Trucks

2028

Vehicle Type	Deliveries/Removal/Commutes - Interconnect			Deliveries/Removal/Commutes - Pipeline - Pittsylvania			Deliveries/Removal/Commutes - Pipeline - Rockingham			On-Site - Interconnect	On-Site - Pipeline - Pittsylvania	On-Site - Pipeline - Rockingham
	Round Trip (miles)	Total Trips	Total Miles	Round Trip (miles)	Total Trips	Total Miles	Round Trip (miles)	Total Trips	Total Miles	Total Miles	Total Miles	Total Miles
Light duty gasoline vehicles (< 6,000 lb GVW)	---	---	---	---	---	---	---	---	---	---	1,560	1,560
Heavy duty gasoline vehicles (>6,000 lb GVW)	---	---	---	---	---	---	---	---	---	---	39,000	39,000
Light duty diesel vehicles (< 6,000 lb GVW)	---	---	---	---	---	---	---	---	---	---	10,920	10,920
Heavy duty diesel vehicles (>6,000 lb GVW)	---	---	---	70	338	23,660	70	115	8,050	---	---	---
Passenger Cars	---	---	---	---	---	62653	---	---	62653	---	---	---
Passenger Trucks	---	---	---	---	---	62653	---	---	62653	---	---	---

1. Worker Commmutes are assumed to be Passenger Cars and Passenger Trucks
2. Vehicle On-site travel apportioned between Pittsylvania and Rockingham counties based on disturbed acreage in each county
3. No contruction at the Interconnects in 2028

Amendment Project

Table 15. On-Road Engine Emissions - Interconnect - 2027

Pollutant	2027 Interconnect Emissions (tons)						Total
	Light duty gasoline vehicles (< 6,000 lb GVW)	Heavy duty gasoline vehicles (>6,000 lb GVW)	Light duty diesel vehicles (< 6,000 lb GVW)	Heavy duty diesel vehicles (>6,000 lb GVW)	Passenger Cars	Passenger Trucks	
NO_X	1.51E-01	9.53E-02	1.69E-01	5.14E-02	5.44E-03	8.21E-03	4.80E-01
CO	4.50E-01	2.85E-01	5.06E-01	1.54E-01	1.57E-01	1.41E-01	1.69E+00
SO_2	5.86E-04	3.71E-04	6.60E-04	2.00E-04	6.92E-05	8.93E-05	1.98E-03
VOC	5.05E-02	3.20E-02	5.68E-02	1.72E-02	1.16E-02	9.17E-03	1.77E-01
PM_{10}	4.18E-03	2.64E-03	4.70E-03	1.43E-03	1.99E-04	2.86E-04	1.34E-02
$PM_{2.5}$	3.81E-03	2.41E-03	4.29E-03	1.30E-03	1.76E-04	2.55E-04	1.22E-02
CO_2	1.49E+02	9.42E+01	1.67E+02	5.08E+01	1.37E+01	1.79E+01	4.93E+02
CH_4	1.99E-02	1.26E-02	2.24E-02	6.79E-03	6.10E-04	5.76E-04	6.28E-02
N_2O	1.45E-02	9.16E-03	1.63E-02	4.94E-03	2.20E-04	3.40E-04	4.54E-02
CO_2e	1.54E+02	9.73E+01	1.73E+02	5.25E+01	1.38E+01	1.80E+01	5.08E+02
Acetaldehyde	6.80E-04	4.31E-04	7.65E-04	2.32E-04	5.23E-05	5.10E-05	2.21E-03
Acrolein	7.10E-05	4.50E-05	7.99E-05	2.43E-05	3.29E-06	3.90E-06	2.27E-04
Benzene	5.89E-04	3.73E-04	6.63E-04	2.01E-04	1.82E-04	1.54E-04	2.16E-03
1,3-Butadiene	6.34E-05	4.01E-05	7.13E-05	2.16E-05	2.15E-05	1.82E-05	2.36E-04
Formaldehyde	8.76E-04	5.55E-04	9.86E-04	2.99E-04	3.51E-05	4.44E-05	2.80E-03
Hexane	1.00E-03	6.33E-04	1.13E-03	3.41E-04	3.29E-04	2.47E-04	3.68E-03
Xylenes (mixed isomers)	2.78E-03	1.76E-03	3.12E-03	9.48E-04	6.95E-04	5.50E-04	9.85E-03
2,2,4-Trimethylpentane	1.04E-03	6.61E-04	1.17E-03	3.56E-04	3.16E-04	2.41E-04	3.79E-03
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	1.49E-05	9.43E-06	1.68E-05	5.09E-06	2.85E-06	2.68E-06	5.17E-05
Ethyl Benzene	6.81E-04	4.31E-04	7.66E-04	2.32E-04	1.86E-04	1.47E-04	2.44E-03
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	4.63E-03	2.93E-03	5.21E-03	1.58E-03	1.41E-03	1.08E-03	1.68E-02
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	3.90E-07	2.47E-07	4.38E-07	1.33E-07	1.04E-07	1.07E-07	1.42E-06
Chromium VI	9.58E-10	6.07E-10	1.08E-09	3.27E-10	5.43E-10	5.51E-10	4.06E-09
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	1.74E-07	1.10E-07	1.96E-07	5.94E-08	6.80E-08	7.08E-08	6.79E-07

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Table 16. On-Road Engine Emissions - Pipeline - 2027

Pollutant	2027 Pittsylvania, VA Pipeline Emissions (tons)						Total
	Light duty gasoline vehicles (< 6,000 lb GVW)	Heavy duty gasoline vehicles (>6,000 lb GVW)	Light duty diesel vehicles (< 6,000 lb GVW)	Heavy duty diesel vehicles (>6,000 lb GVW)	Passenger Cars	Passenger Trucks	
NO_X	4.52E-02	3.79E-01	7.98E-02	1.36E-01	1.11E-01	1.67E-01	9.18E-01
CO	1.35E-01	1.13E+00	2.39E-01	4.05E-01	3.20E+00	2.88E+00	8.00E+00
SO_2	1.76E-04	1.48E-03	3.11E-04	5.28E-04	1.41E-03	1.82E-03	5.72E-03
VOC	1.51E-02	1.27E-01	2.68E-02	4.54E-02	2.36E-01	1.87E-01	6.38E-01
PM_{10}	1.25E-03	1.05E-02	2.21E-03	3.76E-03	4.06E-03	5.82E-03	2.76E-02
$PM_{2.5}$	1.14E-03	9.61E-03	2.02E-03	3.43E-03	3.59E-03	5.19E-03	2.50E-02
CO_2	4.47E+01	3.75E+02	7.89E+01	1.34E+02	2.79E+02	3.64E+02	1.28E+03
CH_4	5.97E-03	5.01E-02	1.05E-02	1.79E-02	1.24E-02	1.17E-02	1.09E-01
N_2O	4.34E-03	3.65E-02	7.67E-03	1.30E-02	4.48E-03	6.92E-03	7.29E-02
CO_2e	4.61E+01	3.87E+02	8.15E+01	1.38E+02	2.81E+02	3.66E+02	1.30E+03
Acetaldehyde	2.04E-04	1.71E-03	3.61E-04	6.12E-04	1.06E-03	1.04E-03	4.99E-03
Acrolein	2.13E-05	1.79E-04	3.77E-05	6.39E-05	6.69E-05	7.95E-05	4.48E-04
Benzene	1.77E-04	1.48E-03	3.12E-04	5.30E-04	3.70E-03	3.14E-03	9.34E-03
1,3-Butadiene	1.90E-05	1.60E-04	3.36E-05	5.71E-05	4.38E-04	3.72E-04	1.08E-03
Formaldehyde	2.63E-04	2.21E-03	4.64E-04	7.89E-04	7.15E-04	9.03E-04	5.34E-03
Hexane	3.00E-04	2.52E-03	5.30E-04	9.00E-04	6.70E-03	5.03E-03	1.60E-02
Xylenes (mixed isomers)	8.33E-04	7.00E-03	1.47E-03	2.50E-03	1.42E-02	1.12E-02	3.72E-02
2,2,4-Trimethylpentane	3.13E-04	2.63E-03	5.53E-04	9.39E-04	6.44E-03	4.91E-03	1.58E-02
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	4.47E-06	3.76E-05	7.90E-06	1.34E-05	5.80E-05	5.47E-05	1.76E-04
Ethyl Benzene	2.04E-04	1.72E-03	3.61E-04	6.13E-04	3.78E-03	3.00E-03	9.68E-03
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	1.39E-03	1.17E-02	2.45E-03	4.16E-03	2.87E-02	2.20E-02	7.03E-02
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	1.17E-07	9.82E-07	2.06E-07	3.51E-07	2.13E-06	2.19E-06	5.97E-06
Chromium VI	2.88E-10	2.42E-09	5.08E-10	8.63E-10	1.11E-08	1.12E-08	2.64E-08
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	5.22E-08	4.39E-07	9.23E-08	1.57E-07	1.39E-06	1.44E-06	3.57E-06

Pollutant	Total (Pittsylvania, VA & Rockingham, NC)
NO_X	1.78E+00
CO	1.58E+01
SO_2	1.12E-02
VOC	1.26E+00
PM_{10}	5.36E-02
$PM_{2.5}$	4.84E-02
CO_2	2.49E+03
CH_4	2.09E-01
N_2O	1.40E-01
CO_2e	2.54E+03
Acetaldehyde	9.71E-03
Acrolein	8.68E-04
Benzene	1.85E-02
1,3-Butadiene	2.13E-03
Formaldehyde	1.03E-02
Hexane	3.16E-02
Xylenes (mixed isomers)	7.32E-02
2,2,4-Trimethylpentane	3.11E-02
Naphthalene	0.00E+00
Styrene	3.46E-04
Ethyl Benzene	1.91E-02
MTBE	0.00E+00
Toluene	1.39E-01
PAH	0.00E+00
Arsenic	1.18E-05
Chromium VI	5.23E-08
Mercury	0.00E+00
Nickel	7.07E-06

Pollutant	2027 Rockingham, NC Pipeline Emissions (tons)						Total
	Light duty gasoline vehicles (< 6,000 lb GVW)	Heavy duty gasoline vehicles (>6,000 lb GVW)	Light duty diesel vehicles (< 6,000 lb GVW)	Heavy duty diesel vehicles (>6,000 lb GVW)	Passenger Cars	Passenger Trucks	
NO_X	4.52E-02	3.79E-01	7.98E-02	7.48E-02	1.11E-01	1.67E-01	8.57E-01
CO	1.35E-01	1.13E+00	2.39E-01	2.24E-01	3.20E+00	2.88E+00	7.82E+00
SO_2	1.76E-04	1.48E-03	3.11E-04	2.91E-04	1.41E-03	1.82E-03	5.48E-03
VOC	1.51E-02	1.27E-01	2.68E-02	2.51E-02	2.36E-01	1.87E-01	6.17E-01
PM_{10}	1.25E-03	1.05E-02	2.21E-03	2.07E-03	4.06E-03	5.82E-03	2.59E-02
$PM_{2.5}$	1.14E-03	9.61E-03	2.02E-03	1.89E-03	3.59E-03	5.19E-03	2.34E-02
CO_2	4.47E+01	3.75E+02	7.89E+01	7.39E+01	2.79E+02	3.64E+02	1.22E+03
CH_4	5.97E-03	5.01E-02	1.05E-02	9.88E-03	1.24E-02	1.17E-02	1.01E-01
N_2O	4.34E-03	3.65E-02	7.67E-03	7.19E-03	4.48E-03	6.92E-03	6.71E-02
CO_2e	4.61E+01	3.87E+02	8.15E+01	7.63E+01	2.81E+02	3.66E+02	1.24E+03
Acetaldehyde	2.04E-04	1.71E-03	3.61E-04	3.38E-04	1.06E-03	1.04E-03	4.72E-03
Acrolein	2.13E-05	1.79E-04	3.77E-05	3.53E-05	6.69E-05	7.95E-05	4.20E-04
Benzene	1.77E-04	1.48E-03	3.12E-04	2.93E-04	3.70E-03	3.14E-03	9.11E-03
1,3-Butadiene	1.90E-05	1.60E-04	3.36E-05	3.15E-05	4.38E-04	3.72E-04	1.05E-03
Formaldehyde	2.63E-04	2.21E-03	4.64E-04	4.35E-04	7.15E-04	9.03E-04	4.99E-03
Hexane	3.00E-04	2.52E-03	5.30E-04	4.97E-04	6.70E-03	5.03E-03	1.56E-02
Xylenes (mixed isomers)	8.33E-04	7.00E-03	1.47E-03	1.38E-03	1.42E-02	1.12E-02	3.60E-02
2,2,4-Trimethylpentane	3.13E-04	2.63E-03	5.53E-04	5.18E-04	6.44E-03	4.91E-03	1.54E-02
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	4.47E-06	3.76E-05	7.90E-06	7.40E-06	5.80E-05	5.47E-05	1.70E-04
Ethyl Benzene	2.04E-04	1.72E-03	3.61E-04	3.38E-04	3.78E-03	3.00E-03	9.40E-03
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	1.39E-03	1.17E-02	2.45E-03	2.30E-03	2.87E-02	2.20E-02	6.84E-02
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	1.17E-07	9.82E-07	2.06E-07	1.93E-07	2.13E-06	2.19E-06	5.81E-06
Chromium VI	2.88E-10	2.42E-09	5.08E-10	4.76E-10	1.11E-08	1.12E-08	2.60E-08
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	5.22E-08	4.39E-07	9.23E-08	8.65E-08	1.39E-06	1.44E-06	3.50E-06

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Table 17. On-Road Engine Emissions - Pipeline - 2028

Pollutant	2028 Pittsylvania, VA Pipeline Emissions (tons)						Total
	Light duty gasoline vehicles (< 6,000 lb GVW)	Heavy duty gasoline vehicles (>6,000 lb GVW)	Light duty diesel vehicles (< 6,000 lb GVW)	Heavy duty diesel vehicles (>6,000 lb GVW)	Passenger Cars	Passenger Trucks	
NO_X	1.36E-03	3.40E-02	9.52E-03	2.06E-02	6.41E-03	9.86E-03	8.17E-02
CO	4.20E-03	1.05E-01	2.94E-02	6.37E-02	2.06E-01	1.82E-01	5.90E-01
SO_2	5.74E-06	1.44E-04	4.02E-05	8.71E-05	9.27E-05	1.20E-04	4.89E-04
VOC	4.62E-04	1.15E-02	3.23E-03	7.00E-03	1.50E-02	1.19E-02	4.91E-02
PM_{10}	3.44E-05	8.60E-04	2.41E-04	5.22E-04	2.74E-04	3.58E-04	2.29E-03
$PM_{2.5}$	3.13E-05	7.84E-04	2.19E-04	4.75E-04	2.42E-04	3.19E-04	2.07E-03
CO_2	1.46E+00	3.64E+01	1.02E+01	2.21E+01	1.84E+01	2.40E+01	1.12E+02
CH_4	1.94E-04	4.85E-03	1.36E-03	2.94E-03	7.84E-04	7.42E-04	1.09E-02
N_2O	1.44E-04	3.59E-03	1.01E-03	2.18E-03	2.91E-04	4.47E-04	7.66E-03
CO_2e	1.50E+00	3.76E+01	1.05E+01	2.28E+01	1.85E+01	2.41E+01	1.15E+02
Acetaldehyde	6.35E-06	1.59E-04	4.44E-05	9.63E-05	6.72E-05	6.42E-05	4.37E-04
Acrolein	6.37E-07	1.59E-05	4.46E-06	9.66E-06	4.25E-06	4.79E-06	3.97E-05
Benzene	5.48E-06	1.37E-04	3.83E-05	8.31E-05	2.33E-04	1.98E-04	6.95E-04
1,3-Butadiene	5.90E-07	1.48E-05	4.13E-06	8.96E-06	2.76E-05	2.33E-05	7.93E-05
Formaldehyde	7.77E-06	1.94E-04	5.44E-05	1.18E-04	4.45E-05	5.33E-05	4.72E-04
Hexane	8.90E-06	2.23E-04	6.23E-05	1.35E-04	4.11E-04	3.15E-04	1.15E-03
Xylenes (mixed isomers)	2.60E-05	6.51E-04	1.82E-04	3.95E-04	9.15E-04	7.22E-04	2.89E-03
2,2,4-Trimethylpentane	9.49E-06	2.37E-04	6.65E-05	1.44E-04	4.11E-04	3.15E-04	1.18E-03
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	1.31E-07	3.28E-06	9.19E-07	1.99E-06	3.62E-06	3.35E-06	1.33E-05
Ethyl Benzene	6.34E-06	1.59E-04	4.44E-05	9.62E-05	2.45E-04	1.94E-04	7.45E-04
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	4.22E-05	1.06E-03	2.96E-04	6.41E-04	1.83E-03	1.41E-03	5.28E-03
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	3.86E-09	9.66E-08	2.70E-08	5.86E-08	1.42E-07	1.46E-07	4.74E-07
Chromium VI	9.36E-12	2.34E-10	6.55E-11	1.42E-10	7.38E-10	7.51E-10	1.94E-09
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	1.61E-09	4.03E-08	1.13E-08	2.45E-08	9.25E-08	9.58E-08	2.66E-07

Pollutant	Total (Pittsylvania, VA & Rockingham, NC)
NO_X	1.50E-01
CO	1.14E+00
SO_2	9.21E-04
VOC	9.35E-02
PM_{10}	4.23E-03
$PM_{2.5}$	3.83E-03
CO_2	2.10E+02
CH_4	1.98E-02
N_2O	1.39E-02
CO_2e	2.15E+02
Acetaldehyde	8.11E-04
Acrolein	7.31E-05
Benzene	1.34E-03
1,3-Butadiene	1.53E-04
Formaldehyde	8.67E-04
Hexane	2.22E-03
Xylenes (mixed isomers)	5.52E-03
2,2,4-Trimethylpentane	2.27E-03
Naphthalene	0.00E+00
Styrene	2.53E-05
Ethyl Benzene	1.43E-03
MTBE	0.00E+00
Toluene	1.01E-02
PAH	0.00E+00
Arsenic	9.10E-07
Chromium VI	3.78E-09
Mercury	0.00E+00
Nickel	5.16E-07

Pollutant	2028 Rockingham, NC Pipeline Emissions (tons)						Total
	Light duty gasoline vehicles (< 6,000 lb GVW)	Heavy duty gasoline vehicles (>6,000 lb GVW)	Light duty diesel vehicles (< 6,000 lb GVW)	Heavy duty diesel vehicles (>6,000 lb GVW)	Passenger Cars	Passenger Trucks	
NO_X	1.36E-03	3.40E-02	9.52E-03	7.02E-03	6.41E-03	9.86E-03	6.81E-02
CO	4.20E-03	1.05E-01	2.94E-02	2.17E-02	2.06E-01	1.82E-01	5.48E-01
SO_2	5.74E-06	1.44E-04	4.02E-05	2.96E-05	9.27E-05	1.20E-04	4.32E-04
VOC	4.62E-04	1.15E-02	3.23E-03	2.38E-03	1.50E-02	1.19E-02	4.44E-02
PM_{10}	3.44E-05	8.60E-04	2.41E-04	1.78E-04	2.74E-04	3.58E-04	1.95E-03
$PM_{2.5}$	3.13E-05	7.84E-04	2.19E-04	1.62E-04	2.42E-04	3.19E-04	1.76E-03
CO_2	1.46E+00	3.64E+01	1.02E+01	7.51E+00	1.84E+01	2.40E+01	9.79E+01
CH_4	1.94E-04	4.85E-03	1.36E-03	1.00E-03	7.84E-04	7.42E-04	8.93E-03
N_2O	1.44E-04	3.59E-03	1.01E-03	7.42E-04	2.91E-04	4.47E-04	6.22E-03
CO_2e	1.50E+00	3.76E+01	1.05E+01	7.76E+00	1.85E+01	2.41E+01	1.00E+02
Acetaldehyde	6.35E-06	1.59E-04	4.44E-05	3.28E-05	6.72E-05	6.42E-05	3.74E-04
Acrolein	6.37E-07	1.59E-05	4.46E-06	3.29E-06	4.25E-06	4.79E-06	3.34E-05
Benzene	5.48E-06	1.37E-04	3.83E-05	2.83E-05	2.33E-04	1.98E-04	6.40E-04
1,3-Butadiene	5.90E-07	1.48E-05	4.13E-06	3.05E-06	2.76E-05	2.33E-05	7.34E-05
Formaldehyde	7.77E-06	1.94E-04	5.44E-05	4.01E-05	4.45E-05	5.33E-05	3.94E-04
Hexane	8.90E-06	2.23E-04	6.23E-05	4.59E-05	4.11E-04	3.15E-04	1.07E-03
Xylenes (mixed isomers)	2.60E-05	6.51E-04	1.82E-04	1.34E-04	9.15E-04	7.22E-04	2.63E-03
2,2,4-Trimethylpentane	9.49E-06	2.37E-04	6.65E-05	4.90E-05	4.11E-04	3.15E-04	1.09E-03
Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Styrene	1.31E-07	3.28E-06	9.19E-07	6.78E-07	3.62E-06	3.35E-06	1.20E-05
Ethyl Benzene	6.34E-06	1.59E-04	4.44E-05	3.27E-05	2.45E-04	1.94E-04	6.81E-04
MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	4.22E-05	1.06E-03	2.96E-04	2.18E-04	1.83E-03	1.41E-03	4.85E-03
PAH	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	3.86E-09	9.66E-08	2.70E-08	1.99E-08	1.42E-07	1.46E-07	4.35E-07
Chromium VI	9.36E-12	2.34E-10	6.55E-11	4.83E-11	7.38E-10	7.51E-10	1.85E-09
Mercury	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel	1.61E-09	4.03E-08	1.13E-08	8.32E-09	9.25E-08	9.58E-08	2.50E-07

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Table 18. Off-Road Emissions - Interconnect and Pipeline

Vehicle Type	Interconnect 2027 Total Miles Per Year	Mean Vehicle Weight (tons)	Emission Factor[1] PM_{10} (lb/VMT)	Emission Factor[1] $PM_{2.5}$ (lb/VMT)	Control Efficiency[2] (%)	2027 Annual Emissions PM_{10} (tpy)	2027 Annual Emissions $PM_{2.5}$ (tpy)
Light duty gasoline vehicles (< 6,000 lb GVW)	156,000	3	0.74	0.07	75%	14.34	1.43
Heavy duty gasoline vehicles (>6,000 lb GVW)	97,500	20	1.73	0.17	75%	21.04	2.10
Light duty diesel vehicles (< 6,000 lb GVW)	175,500	3	0.74	0.07	75%	16.13	1.61
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	48,750	15	1.52	0.15	75%	9.24	0.92
			2027 Interconnect Off-Road Emissions			60.75	6.07

Vehicle Type	Interconnect 2028 Total Miles Per Year	Mean Vehicle Weight (tons)	Emission Factor[1] PM_{10} (lb/VMT)	Emission Factor[1] $PM_{2.5}$ (lb/VMT)	Control Efficiency[2] (%)	2028 Annual Emissions PM_{10} (tpy)	2028 Annual Emissions $PM_{2.5}$ (tpy)
Light duty gasoline vehicles (< 6,000 lb GVW)	---	3	0.74	0.07	75%	0.00	0.00
Heavy duty gasoline vehicles (>6,000 lb GVW)	---	20	1.73	0.17	75%	0.00	0.00
Light duty diesel vehicles (< 6,000 lb GVW)	---	3	0.74	0.07	75%	0.00	0.00
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	---	15	1.52	0.15	75%	0.00	0.00
			2028 Interconnect Off-Road Emissions			0.00	0.00

Table 18. Off-Road Emissions - Interconnect and Pipeline

Vehicle Type	Pipeline 2027 - Pittsylvania Total Miles Per Year	Mean Vehicle Weight (tons)	Emission Factor[1] PM_{10} (lb/VMT)	Emission Factor[1] $PM_{2.5}$ (lb/VMT)	Control Efficiency[2] (%)	2027 Annual Emissions PM_{10} (tpy)	2027 Annual Emissions $PM_{2.5}$ (tpy)
Light duty gasoline vehicles (< 6,000 lb GVW)	46,800	3	0.74	0.07	75%	4.30	0.43
Heavy duty gasoline vehicles (>6,000 lb GVW)	393,120	20	1.73	0.17	75%	84.84	8.48
Light duty diesel vehicles (< 6,000 lb GVW)	82,680	3	0.74	0.07	75%	7.60	0.76
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	42,120	15	1.52	0.15	75%	7.99	0.80
		2027 Pipeline - Pittsylvania Off-Road Emissions				104.72	10.47

Vehicle Type	Pipeline 2028 - Pittsylvania Total Miles Per Year	Mean Vehicle Weight (tons)	Emission Factor[1] PM_{10} (lb/VMT)	Emission Factor[1] $PM_{2.5}$ (lb/VMT)	Control Efficiency[2] (%)	2028 Annual Emissions PM_{10} (tpy)	2028 Annual Emissions $PM_{2.5}$ (tpy)
Light duty gasoline vehicles (< 6,000 lb GVW)	1,560	3	0.74	0.07	75%	0.14	0.01
Heavy duty gasoline vehicles (>6,000 lb GVW)	39,000	20	1.73	0.17	75%	8.42	0.84
Light duty diesel vehicles (< 6,000 lb GVW)	10,920	3	0.74	0.07	75%	1.00	0.10
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	---	15	1.52	0.15	75%	0.00	0.00
		2028 Pipeline - Pittsylvania Off-Road Emissions				9.56	0.96

Table 18. Off-Road Emissions - Interconnect and Pipeline

Vehicle Type	Pipeline 2027 - Rockingham Total Miles Per Year	Mean Vehicle Weight (tons)	Emission Factor[1] PM_{10} (lb/VMT)	Emission Factor[1] $PM_{2.5}$ (lb/VMT)	Control Efficiency[2] (%)	2027 Annual Emissions PM_{10} (tpy)	2027 Annual Emissions $PM_{2.5}$ (tpy)
Light duty gasoline vehicles (< 6,000 lb GVW)	46,800	3	0.74	0.07	75%	4.30	0.43
Heavy duty gasoline vehicles (>6,000 lb GVW)	393,120	20	1.73	0.17	75%	84.84	8.48
Light duty diesel vehicles (< 6,000 lb GVW)	82,680	3	0.74	0.07	75%	7.60	0.76
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	42,120	15	1.52	0.15	75%	7.99	0.80
		2027 Pipeline - Rockingham Off-Road Emissions				104.72	10.47

Vehicle Type	Pipeline 2028 - Rockingham Total Miles Per Year	Mean Vehicle Weight (tons)	Emission Factor[1] PM_{10} (lb/VMT)	Emission Factor[1] $PM_{2.5}$ (lb/VMT)	Control Efficiency[2] (%)	2028 Annual Emissions PM_{10} (tpy)	2028 Annual Emissions $PM_{2.5}$ (tpy)
Light duty gasoline vehicles (< 6,000 lb GVW)	1,560	3	0.74	0.07	75%	0.14	0.01
Heavy duty gasoline vehicles (>6,000 lb GVW)	39,000	20	1.73	0.17	75%	8.42	0.84
Light duty diesel vehicles (< 6,000 lb GVW)	10,920	3	0.74	0.07	75%	1.00	0.10
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	---	15	1.52	0.15	75%	0.00	0.00
		2028 Pipeline - Rockingham Off-Road Emissions				9.56	0.96

	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
2027 Pipeline - Total Off-Road Emissions	209.45	20.94
2028 Pipeline - Total Off-Road Emissions	19.13	1.91

1. Emission factors calculated in accordance with AP-42 Section 13.2.2:

Unpaved Roads: $E = k(s/12)^a(W/3)^b*[(365-p)/365]$

k Factor (PM_{10}, $PM_{2.5}$) (lb/VMT)	1.5	0.15	AP-42 Table 13.2.2-2 (Final, 11/06)
Silt content, s	8.5	%	AP-42 Table 13.2.2-1 (Final, 11/06)
Number of Rain Days, p	121		Average Yearly Precipitation for Roanoke, VA. https://www.currentresults.com/Weather/Virginia/average-yearly-precipitation.php
a (PM_{10}, $PM_{2.5}$)	0.9	0.9	AP-42 Table 13.2.2-2 (Final, 11/06)
b (PM_{10}, $PM_{2.5}$)	0.45	0.45	AP-42 Table 13.2.2-2 (Final, 11/06)

2. Control Efficiency obtained from Figure 6-1 of WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1 for Wet Supression assuming a moisture ratio of 2.
3. Conservatively included all heavy duty vehicles type, excluding Dump Trucks.

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Table 19. Earthmoving Emissions

Site	Emission Factor (ton/acre-month)		Duration[4] (months)		Construction Area[4] (acres)	Uncontrolled Emissions (tons)				Controlled Emissions[3] (tons)			
						2027		2028		2027		2028	
	PM_{10}[1]	$PM_{2.5}$[2]	2027	2028		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Pipeline - Pittsylvania	0.11	0.011	12	7	491.6	648.86	64.89	378.50	37.85	324.43	32.44	189.25	18.93
Pipeline - Rockingham	0.11	0.011	12	7	84.3	111.34	11.13	64.95	6.49	55.67	5.57	32.47	3.25
Interconnect	0.11	0.011	5	0	19.1	10.51	1.05	0.00	0.00	5.25	0.53	0.00	0.00

	Controlled Emissions[3] (tons)			
	2027		2028	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Interconnect Earthmoving Emissions	**5.25**	**0.53**	**0.00**	**0.00**
Pipeline Earthmoving Emissions	**380.10**	**38.01**	**221.73**	**22.17**

1. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 1, average conditions.
2. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1)

3. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1)

4. Based on data provided by client.

Amendment Project

Table 20. Open Burning Emissions

Construction Areas	Potential Open Burning Area (acres)		2027 Emissions (tons)						2028 Emissions (tons)					
	2027	2028	PM_{10}	$PM_{2.5}$	CO	VOC	NO_X	CO_2	PM_{10}	$PM_{2.5}$	CO	VOC	NO_X	CO_2
Pipeline - Pittsylvania	214.64	0	16.47	16.47	135.01	23.17	3.83	3071	0	0	0	0	0	0
Pipeline - Rockingham	25.10	0	1.93	1.93	15.79	2.71	0.45	359	0	0	0	0	0	0
Total Pipeline Open Burning Emissions			**18.39**	**18.39**	**150.79**	**25.88**	**4.28**	**3431**	**0**	**0**	**0**	**0**	**0**	**0**

Construction Areas	Potential Open Burning Area (acres)		2027 Emissions (tons)						2028 Emissions (tons)					
	2027	2028	PM_{10}	$PM_{2.5}$	CO	VOC	NO_X	CO_2	PM_{10}	$PM_{2.5}$	CO	VOC	NO_X	CO_2
Lambert Interconnect	0.3	0	0.02	0.02	0.19	0.03	0.01	4	0	0	0	0	0	0
LN 3600 Interconnect	0.3	0	0.02	0.02	0.19	0.03	0.01	4	0	0	0	0	0	0
T-15 Dan River Interconnect	0.3	0	0.02	0.02	0.19	0.03	0.01	4	0	0	0	0	0	0
T-XX Dan River Interconnect	0.3	0	0.02	0.02	0.19	0.03	0.01	4	0	0	0	0	0	0
Total Interconnect Open Burning Emissions			**0.09**	**0.09**	**0.75**	**0.13**	**0.02**	**17**	**0**	**0**	**0**	**0**	**0**	**0**

1. Emissions were calculated using emission factors from Table 13.1-2, Emissions and Emission Factors for Forest Wildfires, USEPA AP-42, 10/96.

PM10	172	kg/Hectare	0.076727523	ton/acre
PM2.5	172	kg/Hectare	0.076727523	ton/acre
CO	1410	kg/Hectare	0.628987252	ton/acre
VOC	242	kg/Hectare	0.10795384	ton/acre
NOx	40	kg/Hectare	0.01784361	ton/acre

2. 2014 Climate Registry Default Emission Factors for CO2

14.31 ton/acre

Amendment Project

Table 21. Wind Erosion Emissions

Site	Emission Factor (ton/acre-month)		Duration[5] (months)		Construction Area[5] (acres)	Uncontrolled Emissions (tons)				Controlled Emissions[4] (tons)			
						2027		2028		2027		2028	
	PM_{10}[1,2]	$PM_{2.5}$[3]	2027	2028		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Pipeline - Pittsylvania	0.016	0.002	12	7	491.6	93.40	9.34	54.48	5.45	46.70	4.67	27.24	2.72
Pipeline - Rockingham	0.016	0.002	12	7	84.3	16.03	1.60	9.35	0.93	8.01	0.80	4.67	0.47
Interconnect	0.016	0.002	5	0	19.1	1.51	0.15	0.00	0.00	0.76	0.08	0.00	0.00

	Controlled Emissions[4]			
	2027		2028	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Interconnect Earthmoving Emissions	**0.76**	**0.08**	**0.00**	**0.00**
Pipeline Earthmoving Emissions	**54.71**	**5.47**	**31.92**	**3.19**

1. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 11-6, wind erosion of exposed areas (seeded land, stripped or graded overburden) 0.38 ton TSP/acre-yr
2. PM_{10}/TSP = 0.50 (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 9.3)
3. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1)
4. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1)
5. Based on data provided by client.

MVP Southgate Amendment Project

Docket No. CP25-XX-000

Resource Report 9

Appendix 9-B

Operational Emissions Calculations

Amendment Project
Maintenance Blowdown and Fugitive Emissions - Operational Emissions

Component	County	Length (miles)	Ongoing Operation			
			Total VOC (tons)	Total CO2 (tons)	Methane (tons)	Total CO2e (tons)
Pipeline[3]						
Mainline	Pittsylvania, VA	26.75	0.18	0.211	17.293	484.4
	Rockingham, NC	4.59	0.03	0.036	2.967	83.1
M&R Stations[3]						
Lambert Interconnect	Pittsylvania, VA	NA	0.679	0.338	65.60	1837.2
LN 3600	Rockingham, NC	NA	0.679	0.338	65.60	1837.2
T-15 Dan River	Rockingham, NC	NA	0.679	0.338	65.60	1837.2
T-XX Dan River	Rockingham, NC	NA	0.679	0.338	65.60	1837.2

Notes:

1. Based upon VOC, CO2, and methane contents of 0.82%, 0.41%, and 79.07%, respectively, based upon the representative gas analysis. Molar weight of natural gas is 17.815 lb/lb-mol, based on the representative gas analysis.

2. The global warming potential of CO2 and Methane is 1 and 28, respectively. Updated GWPs finalized for reporting year 2025 and beyond by "Revisions and Confidentiality Determinations for Data Elements Under the Greenhouse Gas Reporting Rule" (FR 31802).

3. Based upon the API Compendium Methodology provided below. Whole gas factors converted to specific components using the composition in footnote 1.

Summary by County

County	Ongoing Operation	
	Total VOC	Total CO2e
Pittsylvania, VA	0.86	2,321.6
Rockingham, NC	2.07	5,594.7

Basis - American Petroleum Institute Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry, November 2021 ("API Compendium")

Fugitive	Volume/ Mass Emission Factor	Units	Mass Emission Factor	Units
Transmission Pipeline	586.8	scf gas/mile-yr	1.09E-02	ton CH4/mile-yr
			5.62E-05	ton CO2/mile-yr
			1.13E-04	ton VOC/mile-yr
Transmission Pipeline - CO2 from Oxidation	7.59	lb CO2/mile-yr	3.80E-03	ton CO2/mile-yr
Transmission Pipeline - CO2 from Leaks	1.52	lb CO2/mile-yr	7.60E-04	ton CO2/mile-yr
M&R Stations	1.56E+06	scf gas/station-yr	2.90E+01	ton CH4/station-yr
			1.49E-01	ton CO2/station-yr
			3.00E-01	ton VOC/station-yr

Table 7-46 Equipment-Level Emission Factors for Natural Gas Transmission and Storage Equipment

Blowdown	Volume Emission Factor	Units	Mass Emission Factor	Units
M&R Station Blowdowns	7.56E+05	scf gas/station-yr	1.40E+01	ton CH4/station-yr
			7.24E-02	ton CO2/station-yr
			1.45E-01	ton VOC/station-yr
Miscellaneous (includes M&R, odorizer, drips, sampling, pigging, dehydrators)	1.21E+06	scf gas/station-yr	2.26E+01	ton CH4/station-yr
			1.16E-01	ton CO2/station-yr
			2.33E-01	ton VOC/station-yr
Transmission Pipeline Venting/Blowdown	3.42E+04	scf gas/mile-yr	6.36E-01	ton CH4/mile-yr
			3.28E-03	ton CO2/mile-yr
			6.58E-03	ton VOC/mile-yr

Table 6-43. Transmission and Storage Segment Methane Emission Factors for Non-Routine Activities

Example Calculations:
Mass Emission Factor (ton/mile-yr or ton/station-yr) = Volume Emission Factor (scf/mile-yr or scf/station-yr) * Molar weight of natural gas (lb/lb-mol) * Weight % Pollutant ÷ 379 (scf/lb-mol) ÷ 2,000 (lb/ton)

MVP Southgate Amendment Project

Docket No.CP25-XX-000

Resource Report 9

Appendix 9-C

Interconnect Construction and Normal Operation Noise Assessment

SLR International Corporation
100 S Commons, Suite 102, Pittsburgh, PA 15212

November 19, 2024

Attention: James Sabol
Mountain Valley
2200 Energy Drive
Canonsburg, PA 15317

SLR Project No.: 135.000031.00001

RE: Interconnect Construction and Normal Operation Noise Assessment–Rev. 0
MVP Southgate Amendment Project

1.0 Introduction

Mountain Valley Pipeline, LLC (Mountain Valley(has requested that SLR International Corporation (SLR) modify the noise models for the proposed interconnect (IC) sites along the MVP Southgate Amendment Project (Amendment Project). Mountain Valley is proposing to conduct daytime construction activities at the proposed interconnect sites, then once operational, natural gas would flow through each interconnect site 24-hours-per-day. SLR has updated the noise model with the latest information provided by Mountain Valley and this report presents the results and impact assessment. Baseline sound level measurements were conducted on August 14 to August 15, 2024, and daytime construction and operation sound level impacts were predicted for the nearest noise sensitive areas (NSAs).

2.0 Environmental Sound Level Criteria

The Federal Energy Regulatory Commission (FERC) limits for noise from nighttime construction work are typically based on a goal of 55 dBA L_{dn}. The L_{dn} is essentially the logarithmic average of the sound levels during a 24-hour period, with a 10 dBA penalty added to the sound levels occurring during the more noise sensitive nighttime period from 10:00 p.m. to 7:00 a.m. Because of the nighttime penalty, a constant sound level at 48.6 dBA for 24-hours will result in an L_{dn} of 55 dBA.

As per the latest FERC guidance (FERC 2017) for the preparation of Resource Report 9, "Construction activity that would or may occur during nighttime hours should be performed with the goal that the activity contributes noise levels below 55 dBA L_{dn} and 48.6 L_{eq}, or no more than 10 dBA over background if ambient noise levels are above 55 dBA L_{dn}." If construction activities are limited to the daytime hours, with no significant noise production at night, then there is no specific sound level target for those activities.

These FERC noise limits apply at the nearest Noise Sensitive Areas (NSAs), which are typically residences, churches, schools, or hospitals. The FERC noise limits are not property-line limits – they apply at the NSA structure itself. As per the latest FERC guidance (FERC 2017) for the preparation of Resource Report 9, NSAs should be defined within 0.5 miles of the proposed interconnect site.

Pittsylvania County, Virginia has a noise ordinance that applies at the property boundary of the noise source or at any point within any other affected property, rather than at the NSA structure,

so they cannot be directly compared to the FERC sound level requirements. The Pittsylvania County ordinance has an exemption for construction provided it takes place between 7:00 a.m. and 10:00 p.m. Pittsylvania County limits sound levels to 52 L_{eq} dBA at residential property boundaries during nighttime hours (10:00 p.m. to 7:00 a.m.). The Lambert IC is located within Pittsylvania County and is subject to the nighttime limit of 52 L_{eq} dBA at the nearest property boundaries.

There are no other known state, county, or local regulations that would apply to these interconnect sites.

3.0 Sound Level Survey

NSA(s) were identified by SLR using aerial imagery and field observations. Two NSAs were identified for the Lambert IC site, one NSA for the LN 3600 IC site, and two NSAs for the Dan River 1 and Dan River 2 IC sites. The NSAs consist of the closest residences within 0.5 mile. The NSAs are summarized in Table 3-1.

Table 3-1: Summary of Noise Sensitive Areas

Interconnect (IC)	Noise Sensitive Area	Description	Approximate Distance from IC, Feet	Direction to NSA from IC	NSA Coordinates	
					Lat	Long
Lambert IC	NSA 1	Residence	2,830	WSW	36.826780°	-79.353259°
	NSA 2	Residence	2,180	NW	36.834832°	-79.348904°
LN 3600 IC	NSA 1	Residence	1,650	NNW	36.522603°	-79.657882°
Dan River IC #1 & Dan River IC #2	NSA 1	Residence	480	SSE	36.492462°	-79.679168°
	NSA 2	Residence	930	SSW	36.491370°	-79.681487°

3.1 Measurement Equipment

Sound level equipment used during the sound study included the following instruments:

- Larson Davis 831 SLM; Type 1; s/n 3220, 2443, 1737, A3253
- Larson Davis 831C SLM; Type 1; s/n 10310
- Larson Davis® CAL200 Calibrator; s/n 15533, 6266

A windscreen was used on the measurement microphones. The sound level meters were field-calibrated before and after the survey. All instruments have current laboratory certification that can be provided upon request. Measurements were conducted five feet above the ground.

3.2 Weather Conditions

Weather conditions were appropriate for a sound level study. A summary of the weather conditions is shown in Table 3-2.

Table 3-2: Summary of Weather Conditions

Date	August 14 – August 15, 2024
Temperature Range	61°F – 101.3°F

Relative Humidity Range	32% – 100 %
Wind Speed (Average)	0 mph – 6.2 mph
Wind From	NE
Sky Condition	Clear
Ground Condition	Dry

Complete weather data from the measurement survey were obtained from a Kestrel® weather station deployed while on site and are shown in Figure 4 and Figure 5.

3.3 Measurement Methodology

Sound levels were measured using the slow meter response and A-weighting. Data were collected in 1/3-octave bands and recorded using a 10-second sampling period and 15-minute statistical intervals.

3.4 Environmental Sound Level Measurements

The sound study was performed on August 14 and 15, 2024 by Geoffrey Kulp and Rhianna Spong of SLR. Sound level measurements were conducted at two locations near the Lambert IC site, one location near the LN 3600 IC site, and three locations near the Dan River 1 and Dan River 2 IC sites, selected to quantify ambient sound levels near the closest NSAs. Measurements were collected for one overnight period.

Figure 1 through Figure 3 show the measurement locations. Sound sources observed at the measurement locations are summarized in Table 3-3.

Table 3-3: Summary of Measurement Locations

Interconnect Site	NSA	Measurement Location (ML)	Meas. Start Time	Meas. Duration HH:MM:SS	Source Observations During Measurements
Lambert IC	NSA 1	ML 1	4:15 PM	16:41:43	Audible sounds included insects, sound from the nearby residence, lawn equipment, foliage, bird caws, cows, nearby compressor station, and wildlife.
	NSA 2	ML 2	3:15 PM	17:19:09	Audible sounds included insects, sound from the nearby residence, foliage, the nearby compressor station, and truck backup alarms.
LN 3600 IC	NSA 1	ML 1	12:15 PM	22:29:20	Audible sounds included insects, cars, the nearby residence, and foliage.
Dan River 1 IC & Dan River 2 IC	NSA 1	ML 1 [a]	9:45 AM	27:39:02	Audible sounds included insects, cars, foliage, and possible drilling (installing telephone pole) near Quesinberry Road to the west.
		ML 2	9:30 AM	25:50:36	Audible sounds included insects, cars, foliage, bird caws, small planes, and possible drilling (installing telephone pole) near Quesinberry Road to the west.
	NSA 2	ML 1 [a]	9:45 AM	27:39:02	Audible sounds included insects, cars, foliage, and possible drilling (installing telephone pole) near Quesinberry Road to the west.
		ML 2	9:30 AM	25:50:36	Audible sounds included insects, cars, foliage, bird caws, small planes, and possible drilling (installing telephone pole) near Quesinberry Road to the west.

a. Sound levels were measured at this location, but conservatively, results from ML 2 will be used for the analysis at NSA 1 and NSA 2 for the Dan River Interconnect sites

3.5 Measurement Results

The sound level measurement results are summarized in Table 3-4. The measured day, night, and day-night sound levels are shown. Due to significant insect activity during the survey, measurement results were filtered to remove noise from these environmental sources. This was completed by correcting all sound energy at and above the 1,600 Hz one-third (1/3) octave band in accordance with ANSI/ASA S3/SC1.100-2014[1]. Data are presented with and without the filtering applied.

Table 3-4: Summary of Sound Level Measurements

Interconnect (IC) Site	NSA	Meas. Location (ML)	Dist. from IC to NSA	Direction from IC to NSA	Measured Sound Level, Unfiltered			Measured Sound Level, Filtered to Remove Noise from Birds and Insects			FERC Noise Limit Based on Ambient Measurements
					dBA			dBA [a]			dBA
			Feet		L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_n
Lambert IC	NSA 1	ML 1	2,830	WSW	42.4	42.6	49.0	39.1	39.0	45.4	48.6
	NSA 2	ML 2	2,180	NW	41.9	42.0	48.4	38.7	41.0	47.1	
LN 3600 IC	NSA 1	ML 1	1,650	NNW	49.8	46.6	53.6	47.4	37.6	47.5	
Dan River IC #1 & Dan River IC #2	NSA 1	ML 2	480 [b]	SSE	45.4	43.8	50.5	43.8	42.9	49.5	
	NSA 2		930 [b]	SSW							

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. Distances reference the center between both sites, since they are adjacent to each other.

The results in Table 3-4 show that the unfiltered ambient nighttime sound levels range from 42.0 to 42.6 dBA L_n at the Lambert IC site NSAs, 46.6 dBA L_n at the LN 3600 IC site NSA, and 43.8 dBA L_n at the Dan River IC #1 and Dan River IC #2 site NSAs. The main noise sources at these locations are wildlife, leaves, insects, and traffic. The overall measured sound levels are inclusive of all environmental noise sources and include noise from birds and insects. The filtered nighttime sound levels range from 39.0 to 41.0 dBA L_n at the Lambert IC site NSAs, 37.6 dBA L_n at the LN 3600 IC site NSA, and 42.9 dBA L_n at the Dan River IC #1 and Dan River IC #2 site NSAs.

[1] "Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas", ANSI/ASA S3/SC1.100-2014.

4.0 Site Description

The milepost along the pipeline and coordinates for each interconnect site are given in Table 4-1.

Table 4-1: Site Location, Milepost, and Coordinates

Location Name	Milepost	Coordinates	Estimated Length of Above Ground Piping
Lambert IC	0.0	36.829948, -79.344467	85 feet
LN 3600 IC	28.9	36.518266, -79.656137	85 feet
Dan River IC #1	31.2	36.493523, -79.679764	85 feet
Dan River IC #2	31.2	36.493593, -79.680299	85 feet

5.0 Sound Level Prediction

5.1 Prediction Methodology

A three-dimensional computer noise model was constructed to analyze the noise contributions expected from the proposed construction equipment. The model was developed using CadnaA, 2024, MR 1 version 205.5427, a commercial noise modeling package developed by DataKustik GmbH. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces and other sound propagation properties. The software is based on published engineering standards.

The ISO 9613-2 standard was used to calculate all propagation effects, including air and ground absorption, and spreading losses. Weather conditions used in the calculation were ISO 9613-2 default conditions. The default ISO conditions are representative of a moderate downwind condition under typical inversion conditions and are considered conservative as they will tend to overpredict sound levels in most cases.

Ground absorption for the entire Amendment Project area was conservatively set as 0.5, representing a mix of reflective and absorptive ground. This is a conservative assumption, as the majority of the Amendment Project area is undeveloped forests or fields, which are ground types that would typically be assigned a higher ground absorption coefficient of 1.0 (Kephalopoulos 2012). For interconnect sites, the ground absorption coefficient was set to 0.1 where the construction will take place to represent a gravel pad that is mostly reflective.

To be conservative, foliage was not included in the model. The terrain was modeled based on USGS topographical data at a resolution of 10 by 10 meters. A temperature of 20 degrees Celsius and 70 percent relative humidity were used for the atmospheric absorption calculations. The ground was modeled as mixed, with a 0.5 absorption coefficient.

All construction equipment was arranged as an area source over the work area, six and a half feet above grade. This is appropriate because the site contains stationery and mobile equipment. The mobile equipment may move around the work area, as needed.

5.2 Interconnect Construction Equipment

Potential impacts at interconnect locations could include short-term increases in sound levels during construction. Only standard construction equipment will be used in the construction of the stations, with no dynamic compaction or pile driving expected. Most construction will occur during daytime working hours of 7:00 a.m. until 7:00 p.m. Emergencies or other non-typical circumstances may necessitate limited nighttime work. The highest sound levels during construction are expected during the early earthmoving phase. Equipment that may be operating during this phase would include bulldozers, front end loaders, dump trucks, generators, etc.

Based on the equipment usage predictions, a sound level calculation was performed for interconnect site construction using the Federal Highway Administration's Roadway Construction Noise Model version 1.1 (FHWA, 2008) The following equipment was included in the construction evaluation:

Daytime Civil Work – total sound power level of 123.9 dBA L_w

- Three (3) Excavators, Komatsu 228 or similar
- Three (3) Bulldozers, Cat D6 or similar
- Three (3) Dump trucks, 26-ton, articulated
- One (1) Generator
- Three (3) Drilling rigs
- Two (2) Pile augers
- One (1) Roller, smooth drum, 25 ton, Bomag or similar

Nighttime Civil Work – total sound power level of 120.2 dBA L_w

- Two (2) Excavators, Komatsu 228 or similar
- Two (2) Bulldozers, Cat D6 or similar
- Two (2) Dump trucks, 26 ton, articulated
- Three (3) Light plants
- One (1) Roller, smooth drum, 25 ton, Bomag or similar

5.3 Interconnect Operation Equipment

Once construction at each interconnect site is complete, various lengths and diameters of piping and valves will be generating sound. Sound power data for the equipment in the noise model was calculated assuming a sound level due to piping of 79 dBA at three feet and measurements of similar equipment at other interconnect sites.

Table 5-1 shows the sound power levels used for the interconnect station modeling.

Table 5-1: Sound Power Levels (L_w) for Interconnect Equipment

Source	Linear L_w at Octave Center Frequency									Total
	31.5	63	125	250	500	1k	2k	4k	8k	dBA
Interconnects										
Total Interconnect Sound Power Level, L_w [a]	75.2	80.5	77.2	79.0	84.2	88.8	91.5	93.5	78.5	97.5

a. Based on measurements of similar installed equipment and assumed to be 79 dBA at three feet.

The length of piping and quantity of valves were modeled as per the latest piping layout drawings provided by Mountain Valley and modeled at 3.28 feet above grade.

6.0 Sound Level Assessment

6.1 Construction Model Results

Table 6-1 shows a summary of the predicted short-term, daytime construction sound levels at the NSAs for the interconnect sites.

Table 6-1: Predicted Temporary Sound Levels Due to Construction, Single 12-Hour Daytime Shift

IC	NSA	Existing Ambient Sound Levels, dBA [a]			Predicted Sound Level 12-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Day	L_{dn} [b]	Day	L_{dn}	Day	L_{dn}
Lambert IC	1	39.1	39.0	45.4	50.0	47.0	50.3	49.3	11.2	3.9
	2	38.7	41.0	47.1	54.3	51.3	54.4	52.7	15.7	5.6
LN 3600 IC	1	47.4	37.6	47.5	51.9	48.9	53.2	51.3	5.8	3.8
Dan River IC #1	1	43.8	42.9	49.5	69.4	66.4	69.4	66.5	25.6	17.0
	2	43.8	42.9	49.5	62.6	59.6	62.7	60.0	18.9	10.5
Dan River IC #2	1	43.8	42.9	49.5	68.1	65.1	68.1	65.2	24.3	15.7
	2	43.8	42.9	49.5	63.0	60.0	63.1	60.4	19.3	10.9

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. L_{dn} was calculated using 12 daytime hours.

Noise contour plots for daytime interconnect construction activity operations at each interconnect site are presented in Figure 6 through Figure 9.

No nighttime construction activities are planned. The FERC does not limit daytime construction sound levels and the Pittsylvania County, Virginia limit has an exception for daytime construction noise so no noise mitigation is required for the construction phase of the interconnect sites.

If nighttime construction is planned, a nighttime construction noise management plan should be developed at that time to ensure construction noise is compliant with the FERC and Pittsylvania County, Virginia noise limits.

6.2 Normal Operation Model Results

Table 6-2 below shows results for the noise model calculations as the A-weighted equivalent unmitigated sound level, dBA $L_{eq,}$ for normal operation at the interconnect sites. The FERC guidance limits interconnect contribution sound levels to 55 dBA L_{dn} (equivalent to a continuous sound level of 48.6 dBA) at the NSAs.

Table 6-2: Predicted Sound Levels During Normal 24-Hour Operations

IC	NSA	Existing Ambient Sound Levels, dBA [a]			Predicted Sound Level 24-Hour Normal Operation, dBA		Normal Operation Plus Ambient, dBA		Predicted Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} [b]	Night	L_{dn}	Night	L_{dn}
Lambert IC	1	39.1	39.0	45.4	19.6	26.0	39.0	45.4	0.0	0.0
	2	38.7	41.0	47.1	25.3	31.7	41.1	47.2	0.1	0.1
LN 3600 IC	1	47.4	37.6	47.5	23.6	30.0	37.8	47.6	0.2	0.1
Dan River IC #1	1	43.8	42.9	49.5	44.3	50.7	46.7	53.2	3.8	3.7
	2	43.8	42.9	49.5	36.1	42.5	43.7	50.3	0.8	0.8
Dan River IC #2	1	43.8	42.9	49.5	42.7	49.1	45.8	52.3	2.9	2.8
	2	43.8	42.9	49.5	36.6	43.0	43.8	50.4	0.9	0.9

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. L_{dn} was obtained by adding 6.4 dB to the predicted sound levels to account for continuous 24-hour operation.

Noise contour plots for normal operations at each interconnect site are presented in Figure 10 through Figure 13.

Modeled results indicate that sound levels from all interconnect normal operations will be compliant with the FERC limit of 55 dBA L_{dn} at all NSAs. Additionally, the Lambert IC is predicted to compliant with the Pittsylvania County, Virginia noise limit of 52 dBA L_{eq} during nighttime hours, as all predicted sound levels are below the limit at all adjacent property lines during normal operations.

7.0 Conclusion

SLR has updated the noise models for the Mountain Valley Amendment interconnect sites using an updated equipment list and piping layout drawings provided by Mountain Valley. The noise model predicts that sound levels will remain below the FERC criterion of 55 dBA L_{dn} at all occupied NSAs at night during normal interconnect operation. Additionally, the Lambert IC is predicted to compliant with the Pittsylvania County, Virginia noise limit of 52 dBA L_{eq} during nighttime hours, as all predicted sound levels are below the limit at all adjacent property lines during normal operations. Construction noise is planned during daytime hours and will not be subject to a noise limit. Due to the preliminary nature of the information presented in this report, results may change as the construction plan is finalized. This concludes our Technical Report for the Mountain Valley Amendment interconnect sites.

Please contact us if you have any questions.

Regards,

SLR International Corporation

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8.0 References

ANSI/ASA S3/SC1.100-2014, Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas

FERC (2017) Federal Energy Regulatory Commission, Office of Energy Projects "Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act." Volume 1, February 2017.

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Kephalopoulos, Stylianos et al. (2012). Common Noise Assessment Methods in Europe (CNOSSUS-EU) European Commission Joint Research Centre, Institute for Health and Consumer Protection, TP 281 21027 – Ispra (VA), Italy.

ISO 9613-2 (1996) Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General method of calculation

Figure 1: Lambert Interconnect NSAs and Measurement Locations

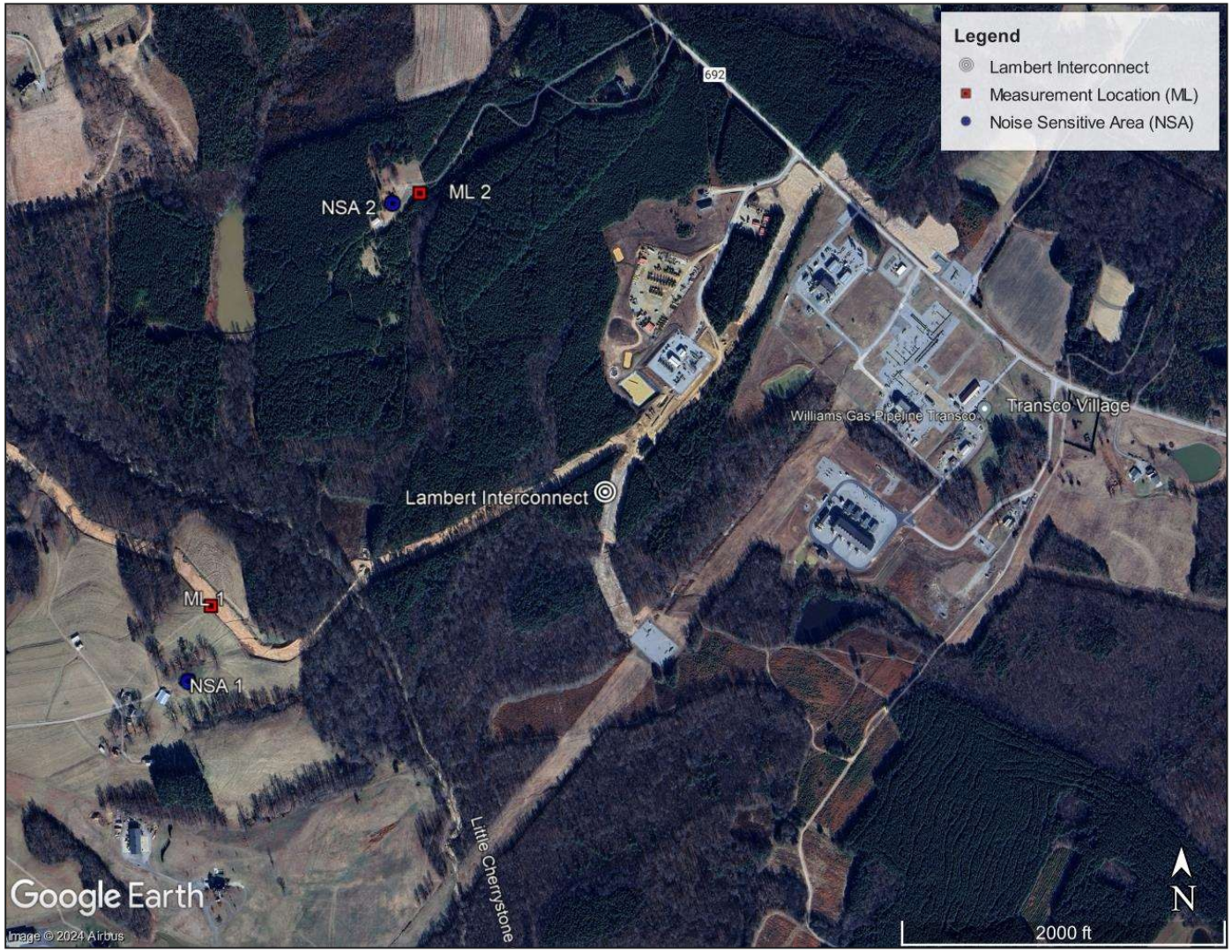


Figure 2: LN 3600 Interconnect NSAs and Measurement Location

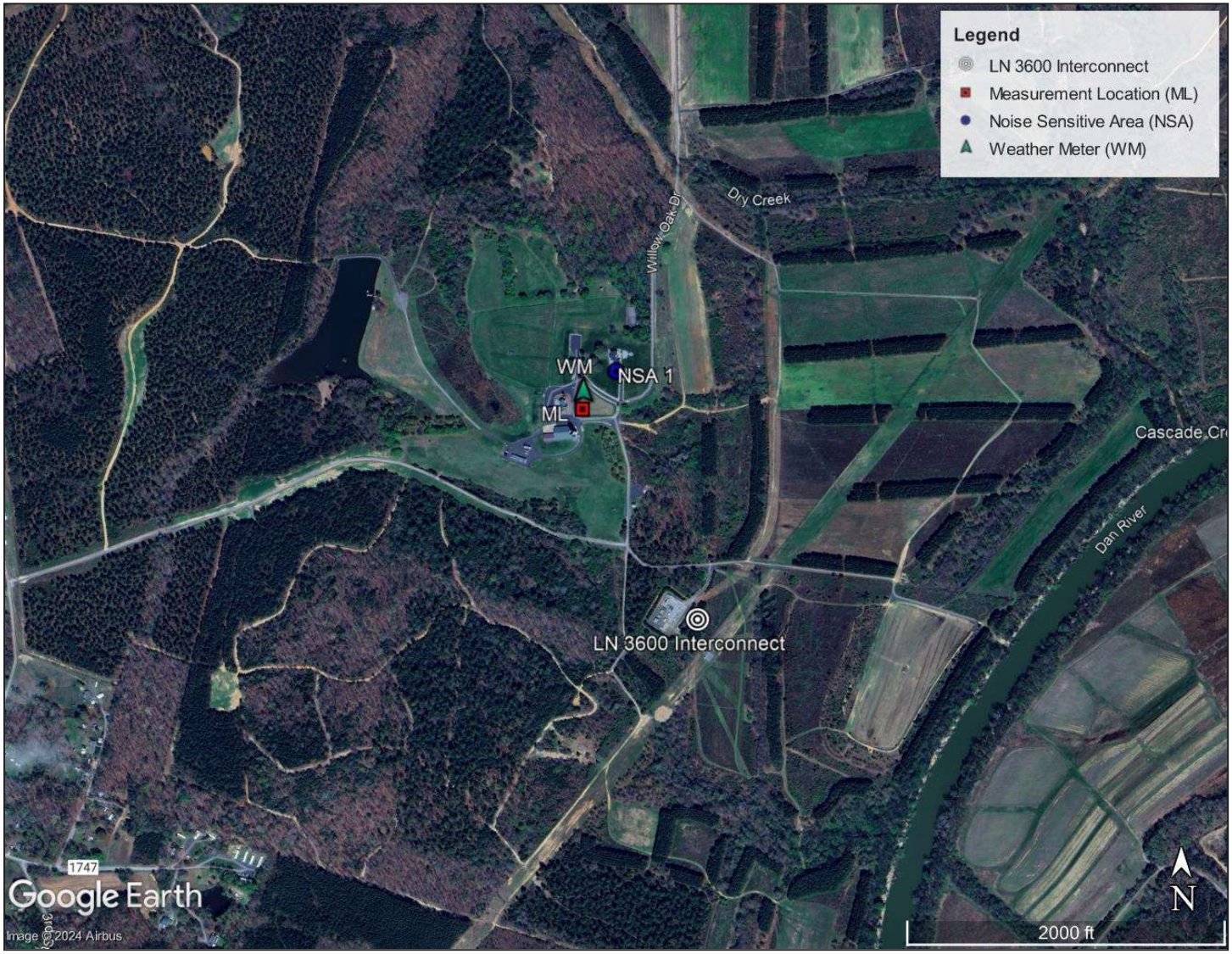


Figure 3: Dan River Interconnect 1 & 2 NSAs and Measurement Locations

Figure 4: Weather Data (Temperature and Relative Humidity) – August 14 to August 15, 2024

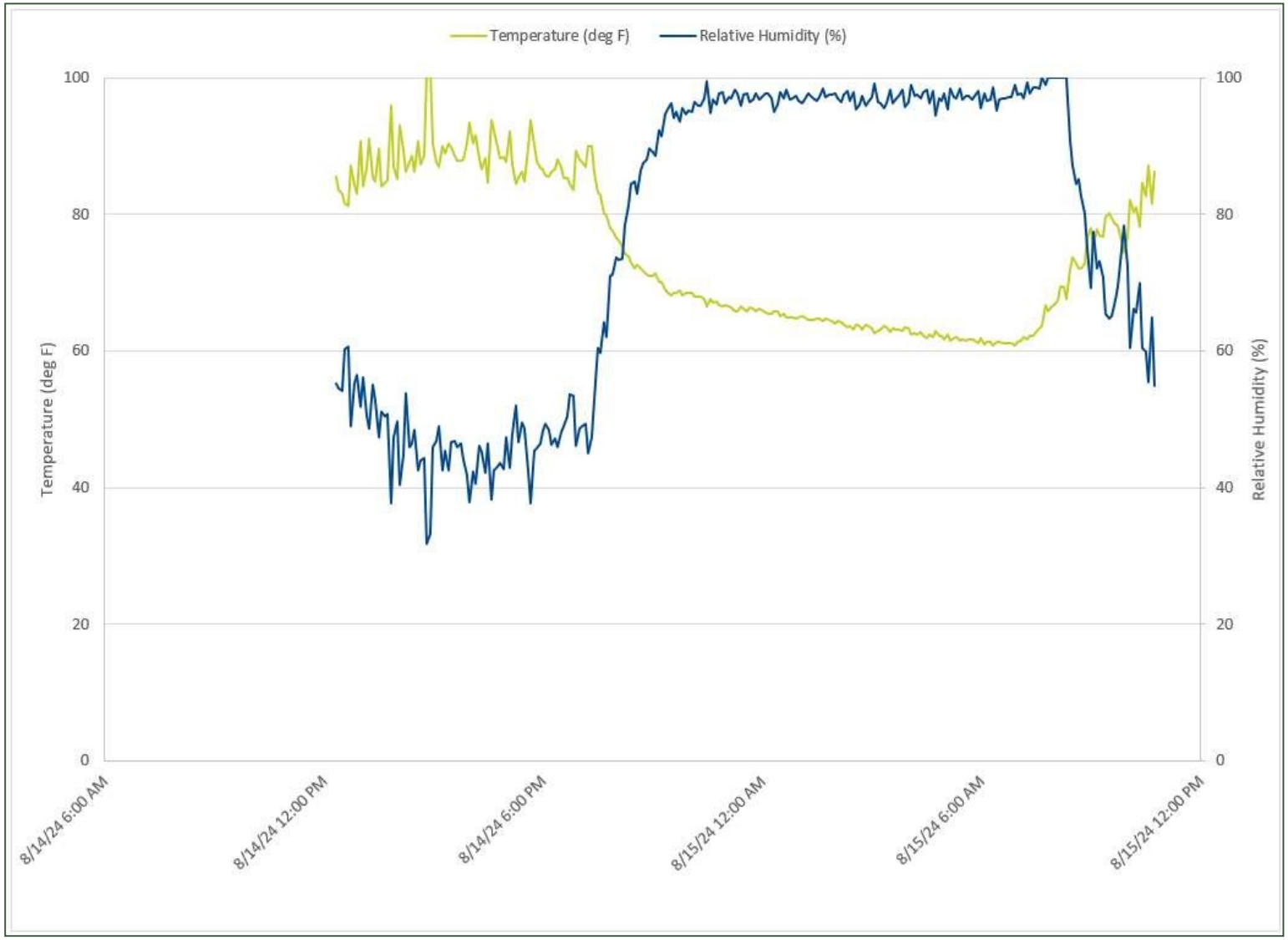


Figure 5: Weather Data (Wind Speed and Direction) – August 14 to August 15, 2024

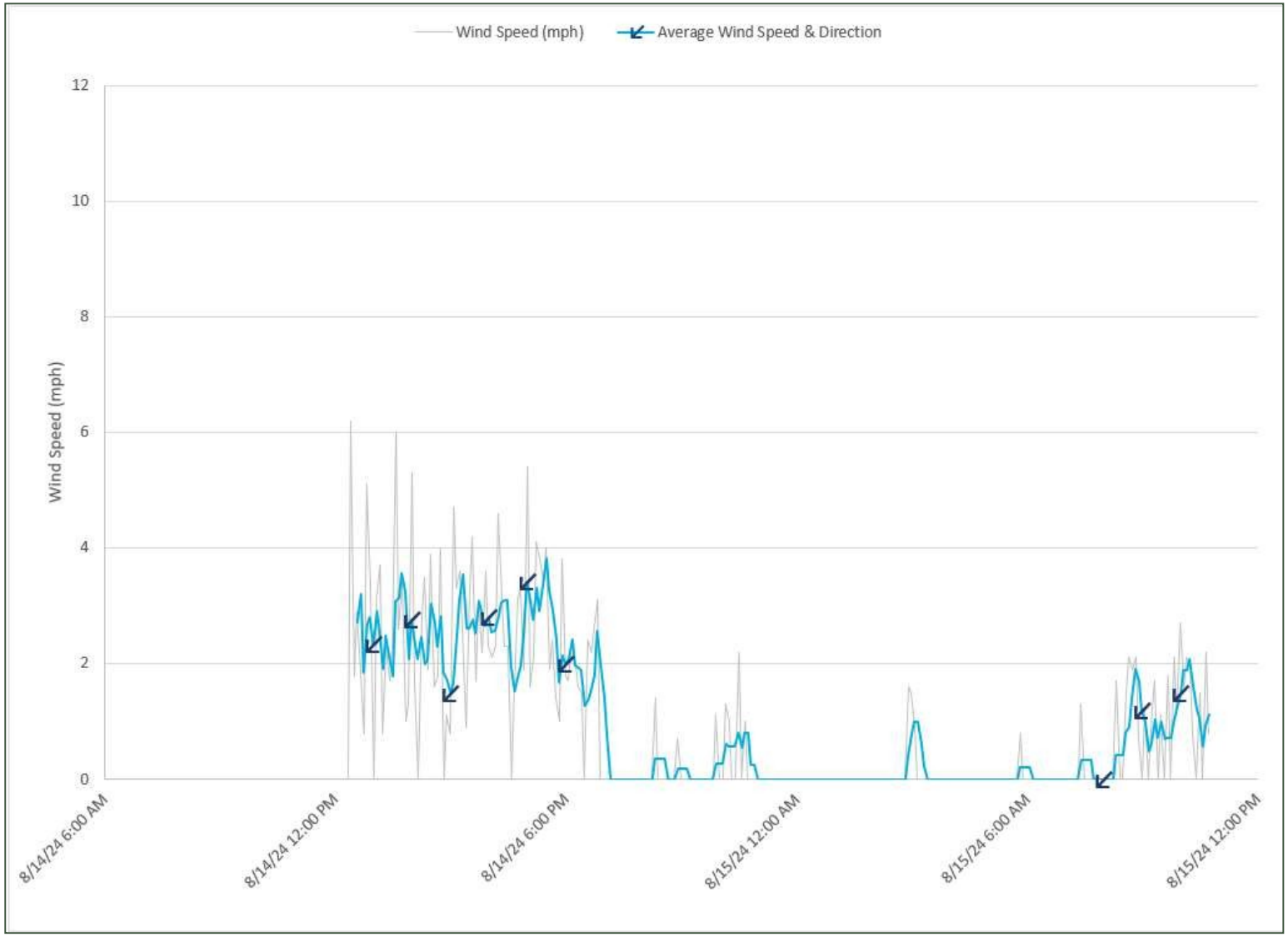


Figure 6: Predicted Unmitigated 48.6 dBA L_d Contour for Lambert Interconnect Daytime Construction

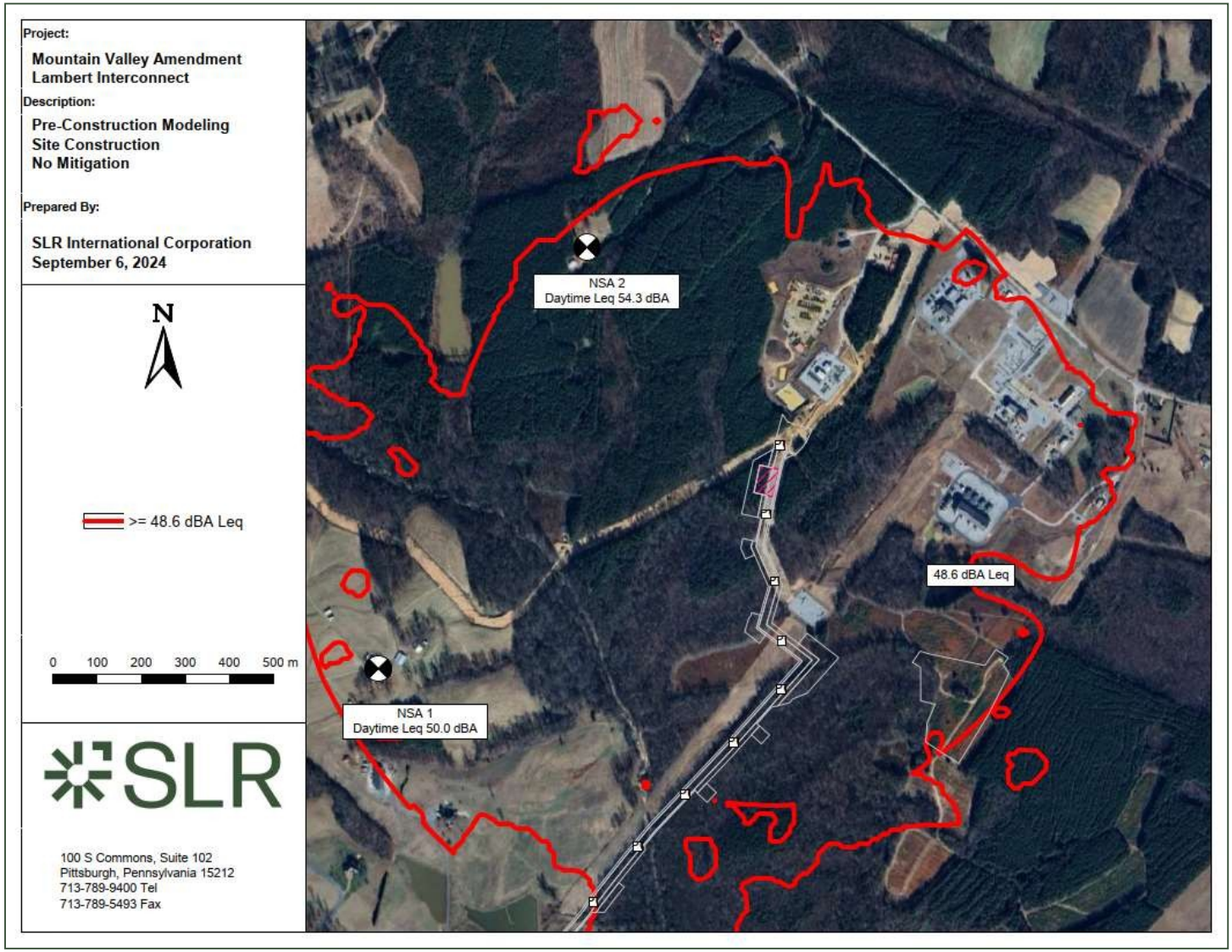


Figure 7: Predicted Unmitigated 48.6 dBA L_d Contour for LN 3600 Interconnect Daytime Construction

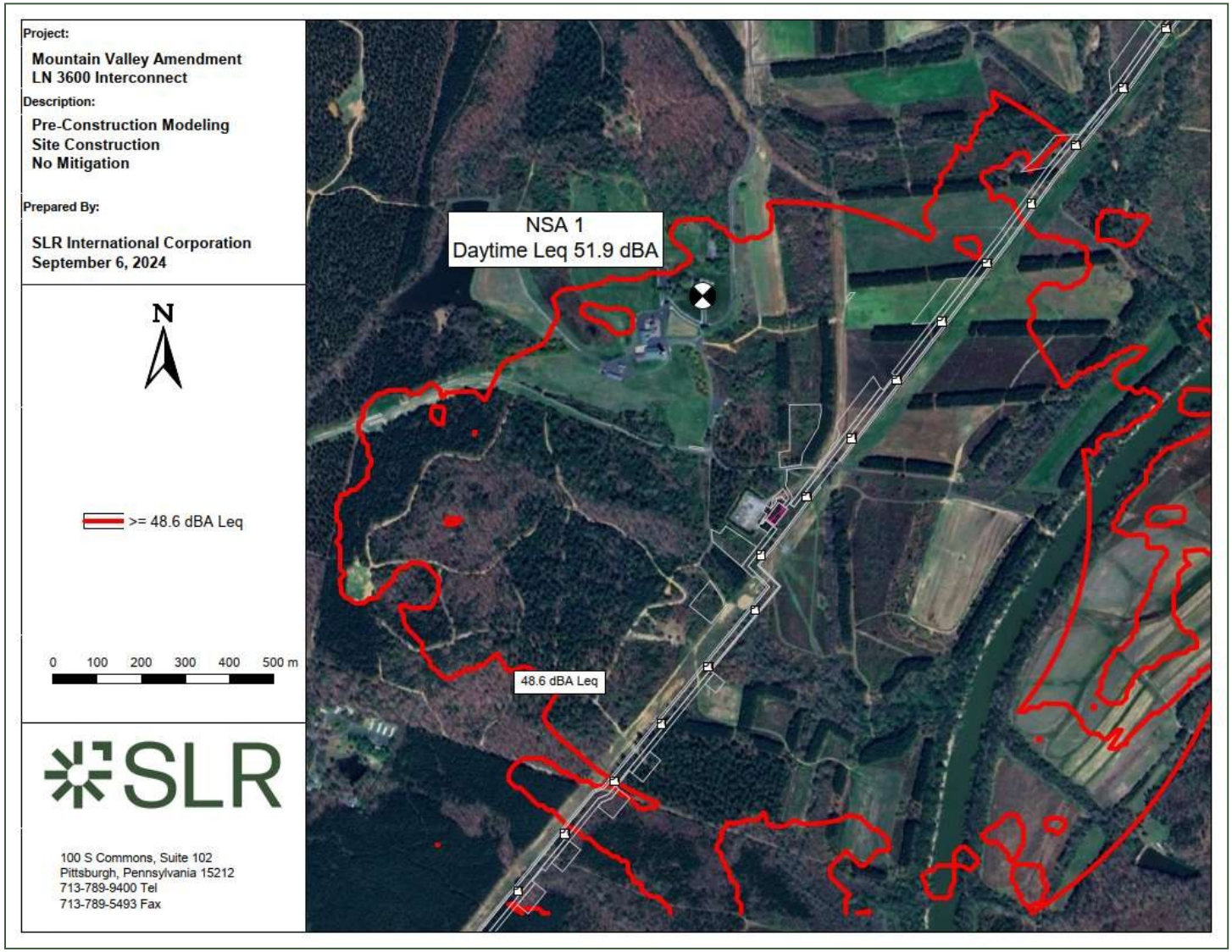


Figure 8: Predicted Unmitigated 48.6 dBA L_d Contour for Dan River Interconnect 1 Daytime Construction

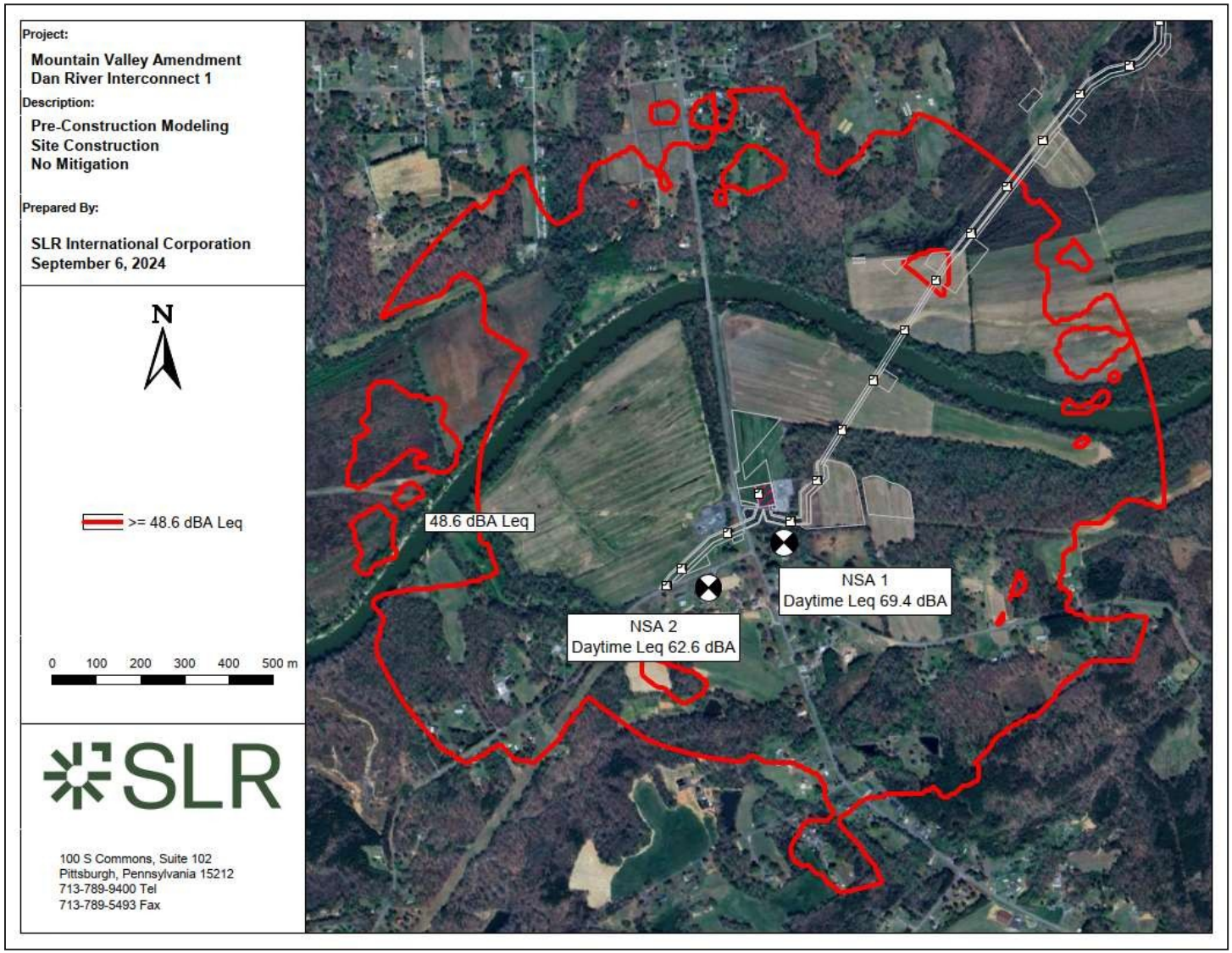


Figure 9: Predicted Unmitigated 48.6 dBA L_d Contour for Dan River Interconnect 2 Daytime Construction

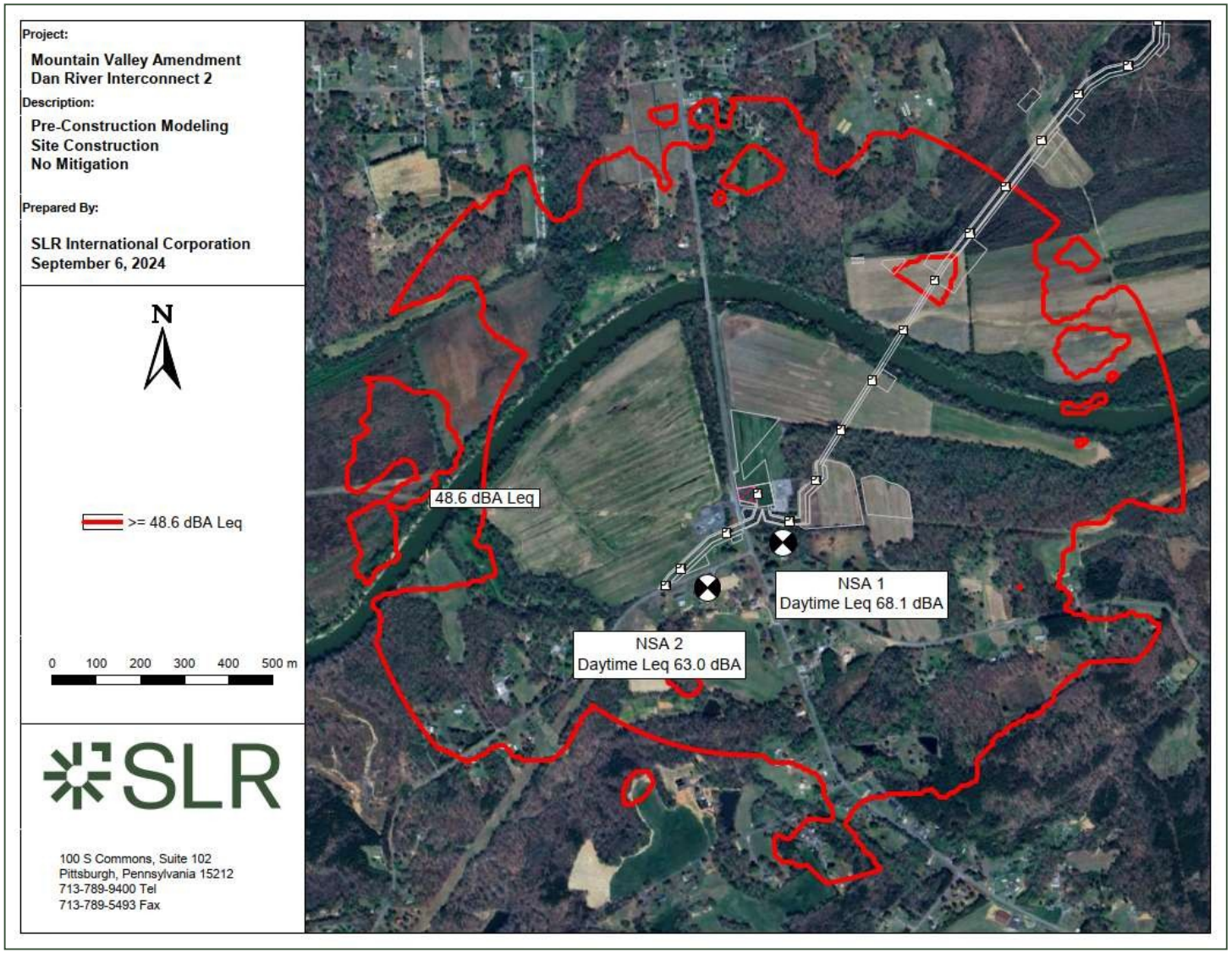


Figure 10: Predicted Unmitigated 48.6 dBA L_n Contour for Lambert Interconnect Normal Operation

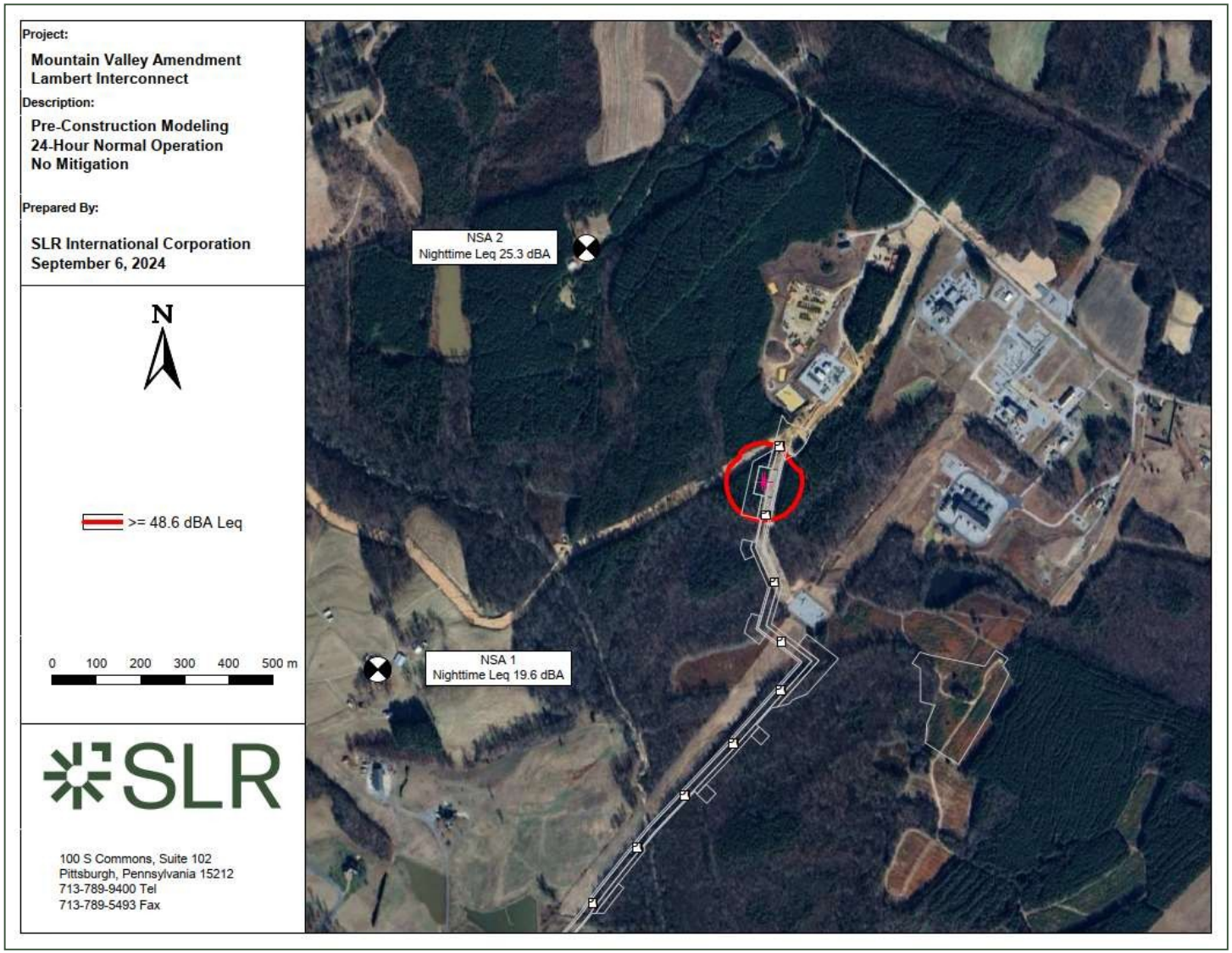


Figure 11: Predicted Unmitigated 48.6 dBA L_n Contour for LN 3600 Interconnect Normal Operation

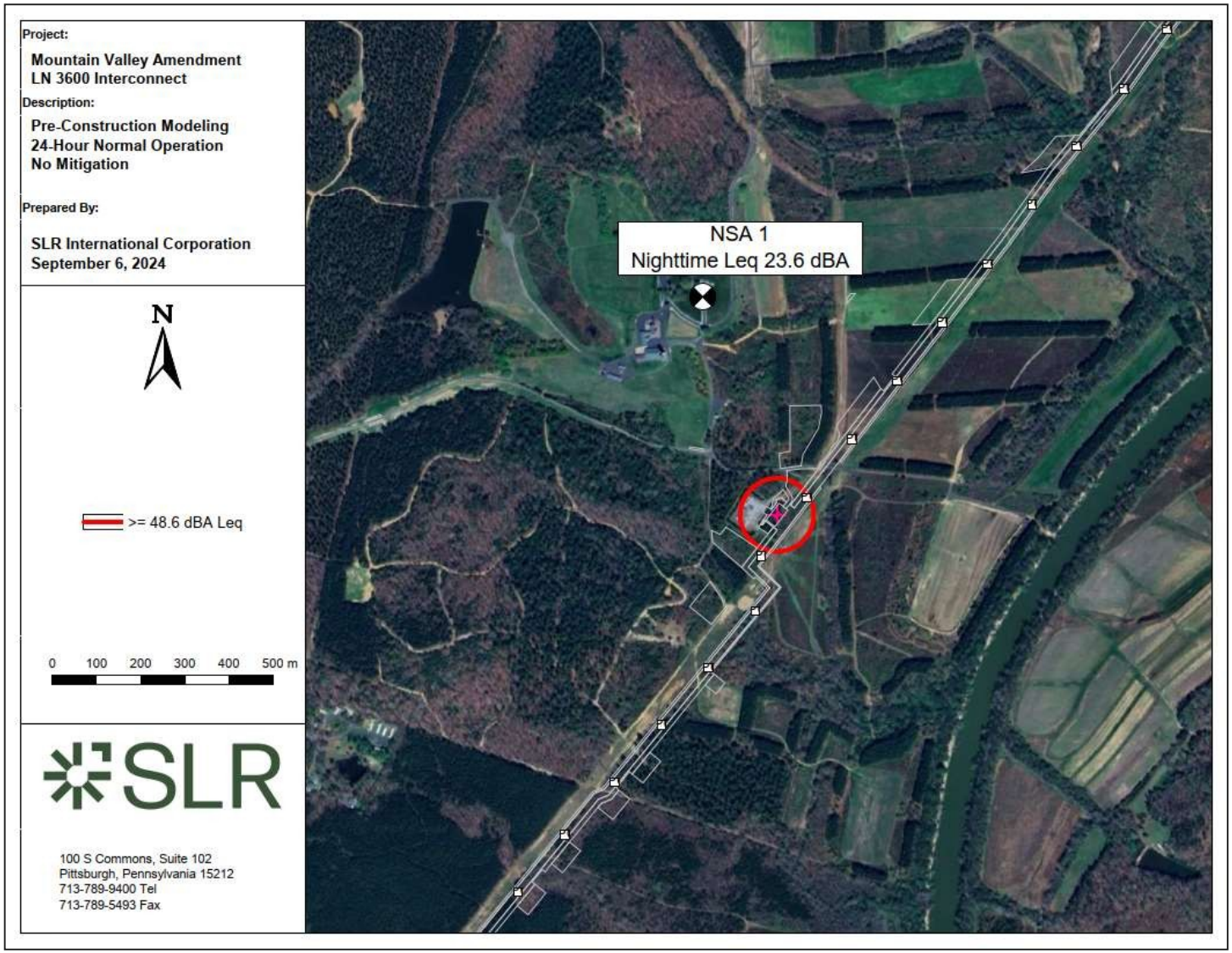


Figure 12: Predicted Unmitigated 48.6 dBA L_n Contour for Dan River Interconnect 1 Normal Operation

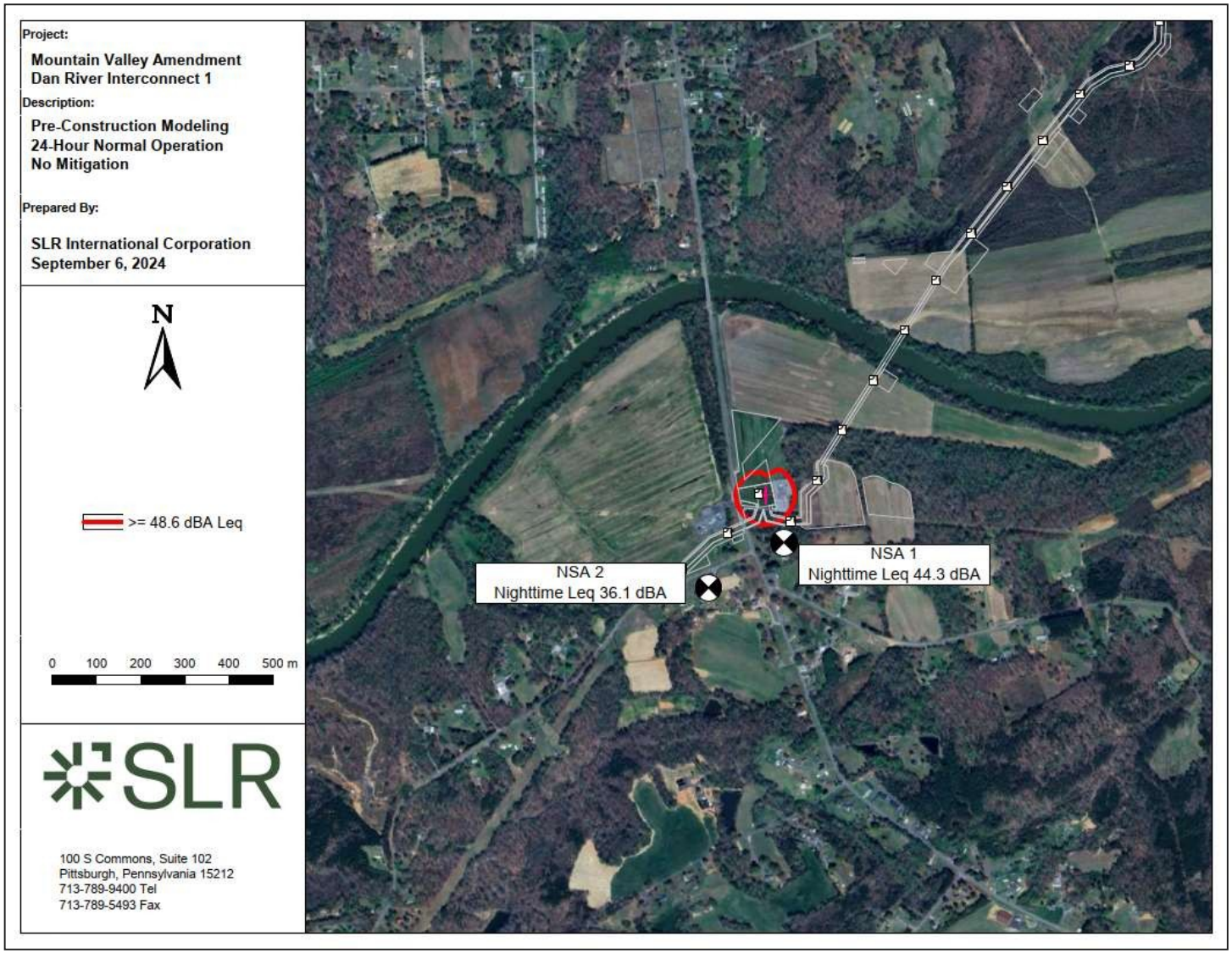
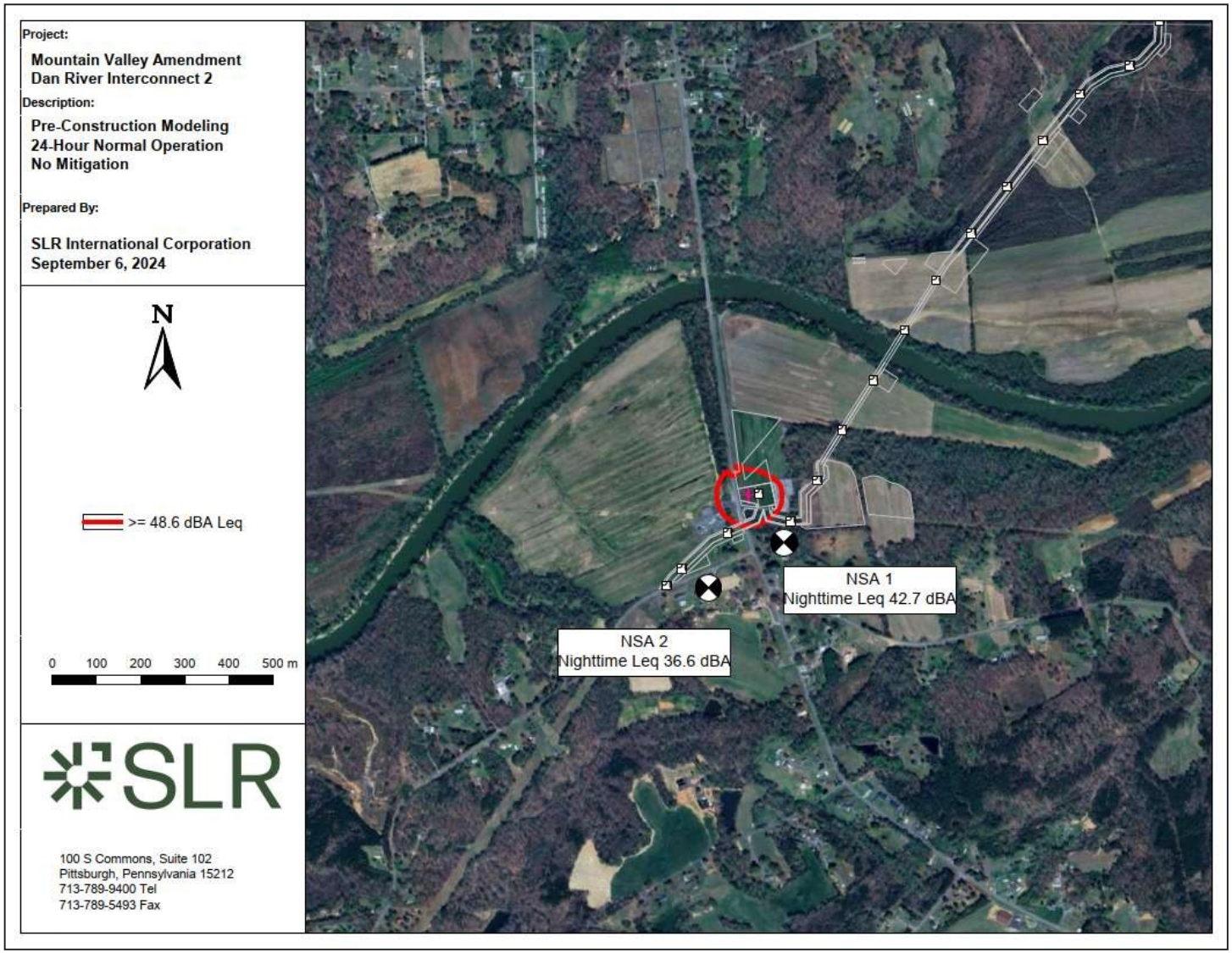


Figure 13: Predicted Unmitigated 48.6 dBA L_n Contour for Dan River Interconnect 2 Normal Operation



MVP Southgate Amendment Project

Docket No. CP25-XX-000

Resource Report 9

Appendix 9-D

Nighttime HDD Noise Assessment – HDD Crossings

SLR International Corporation
100 S Commons, Suite 102, Pittsburgh, PA 15212

November 19, 2024

Attention: James Sabol
Mountain Valley
2200 Energy Drive
Canonsburg, PA 15317

SLR Project No.: 135.000031.00001

RE: Nighttime HDD Noise Assessment – HDD Crossings – Rev. A
MVP Southgate Amendment Project

1.0 Introduction

Mountain Valley Pipeline, LLC (Mountain Valley) has requested that SLR International Corporation (SLR) modify the noise model for the proposed Horizontal Directional Drilling (HDD) sites along the MVP Southgate Amendment Project (Project). Mountain Valley is proposing to perform nighttime construction activities at the crossing work areas. SLR has updated the noise model with the additional nighttime activities and this report presents the results and impact assessment. Baseline sound level measurements were conducted on August 14 to August 15, 2024, and nighttime boring sound level impacts were predicted for the nearest noise sensitive areas (NSAs). Noise mitigation has been developed to reduce the sound levels due to nighttime HDD activities to 48.6 L_{eq} or less at the closest NSAs.

2.0 Environmental Sound Level Criteria

The Federal Energy Regulatory Commission (FERC) limits for noise from nighttime construction work are typically based on a goal of 55 dBA L_{dn}. The L_{dn} is essentially the logarithmic average of the sound levels during a 24-hour period, with a 10 dBA penalty added to the sound levels occurring during the more noise sensitive nighttime period from 10:00 p.m. to 7:00 a.m. Because of the nighttime penalty, a constant sound level at 48.6 dBA for 24-hours will result in an L_{dn} of 55 dBA.

As per the latest FERC guidance (FERC 2017) for the preparation of Resource Report 9, "Construction activity that would or may occur during nighttime hours should be performed with the goal that the activity contributes noise levels below 55 dBA L_{dn} and 48.6 L_{eq}, or no more than 10 dBA over background if ambient noise levels are above 55 dBA L_{dn}." If construction activities are limited to the daytime hours, with no significant noise production at night, then there is no specific sound level target for those activities.

These FERC noise limits apply at the nearest Noise Sensitive Areas (NSAs), which are typically residences, churches, schools, or hospitals. The FERC noise limits are not property-line limits – they apply at the NSA structure itself. As per the latest FERC guidance (FERC 2017) for the preparation of Resource Report 9, NSAs should be defined within 0.5 miles of the proposed HDD entry and exit sites.

Pittsylvania County, Virginia has a noise ordinance that applies at the property boundary of the noise source or at any point within any other affected property, rather than at the NSA structure,

so they cannot be directly compared to the FERC sound level requirements. The Pittsylvania County ordinance has an exemption for construction provided it takes place between 7:00 a.m. and 10:00 p.m. Pittsylvania County limits sound levels to 52 L_{eq} dBA at residential property boundaries during nighttime hours (10:00 p.m. to 7:00 a.m.). The Sandy River HDD site is located within Pittsylvania County and is subject to the nighttime limit of 52 L_{eq} dBA at the nearest property boundaries.

There are no other known state, county, or local regulations that would apply to these HDD sites.

3.0 Sound Level Survey

NSA(s) were identified by SLR using aerial imagery and field observations. Four NSAs were identified for the Sandy River HDD site and three NSAs for the Dan River HDD site. The NSAs consist of the closest residences. The NSAs are summarized in Table 3-1.

Table 3-1: Summary of Noise Sensitive Areas

HDD	Noise Sensitive Area	Description	Approximate Distance from Crossing, Feet	Direction to NSA from Crossing	NSA Coordinates	
					Lat	Long
Sandy River HDD	NSA 1	Residence	1,320	WSW	36.637136°	-79.543980°
	NSA 2	Residence	1,100	W	36.639264°	-79.540350°
	NSA 3	Residence	650	NNW	36.640120°	-79.538130°
	NSA 4	Residence	1,850	SW	36.635487°	-79.531551°
Dan River HDD	NSA 1	Residence	740	SSW	36.492462°	-79.679168°
	NSA 2	Residence	2,290	W	36.499735°	-79.682037°
	NSA 3	Residence	1,200	NNW	36.501900°	-79.676652°

3.1 Measurement Equipment

Sound level equipment used during the sound study included the following instruments:

- Larson Davis 831 SLM; Type 1; s/n 3220, 2443, 2572, 1708
- Larson Davis 831C SLM; Type 1; s/n 10403
- Larson Davis® CAL200 Calibrator; s/n 15533, 6266

A windscreen was used on the measurement microphones. The sound level meters were field-calibrated before and after the survey. All instruments have current laboratory certification that can be provided upon request. Measurements were conducted five feet above the ground.

3.2 Weather Conditions

Weather conditions were appropriate for a sound level study. A summary of the weather conditions is shown in Table 3-2.

Table 3-2: Summary of Weather Conditions

Date	August 14 – August 15, 2024
Temperature Range	61°F – 101.3°F
Relative Humidity Range	32% – 100 %
Wind Speed (Average)	0 mph – 6.2 mph
Wind From	NE
Sky Condition	Clear
Ground Condition	Dry

Complete weather data from the measurement survey were obtained from a Kestrel® weather station deployed while on site and are shown in Figure 3 and Figure 4.

3.3 Measurement Methodology

Sound levels were measured using the slow meter response and A-weighting. Data were collected in 1/3-octave bands and recorded using 10-second sampling period and 15-minute statistical intervals.

3.4 Environmental Sound Level Measurements

The sound study was performed on August 14 and 15, 2024 by Geoffrey Kulp and Rhianna Spong of SLR. Sound level measurements were conducted at three locations near Sandy River and two locations near Dan River selected to quantify ambient sound levels near the closest NSAs. Measurements were collected for one overnight period.

Figure 1 and Figure 2 show the measurement locations. Sound sources observed at the measurement locations are summarized in Table 3-3.

Table 3-3: Summary of Measurement Locations

HDD	NSA	Measurement Location (ML)	Measurement Start Time	Measurement Duration HH:MM:SS	Source Observations During Measurements
Sandy River HDD	NSA 1	ML 2	6:30 PM	15:20:59	Audible sounds included wildlife, insects, dog barks, local residence noise, and local traffic.
	NSA 2	ML 1	6:15 PM	15:26:08	Audible sounds included wildlife, insects, and local traffic.
	NSA 3				
	NSA 4	ML 3	6:00 PM	15:28:55	Audible sounds included insects, residence, foliage, bird caws, cows, wildlife
Dan River HDD	NSA 1	ML 2	9:30 AM	25:50:36	Audible sounds included wildlife, insects, foliage, small aircraft, nearby construction, and local traffic.
	NSA 2				
	NSA 3	ML 1	9:45 AM	25:10:03	Audible sounds included wildlife, leaves, insects, lawn equipment, and local traffic.

3.5 Measurement Results

The sound level measurement results are summarized in Table 3-4. The measured day, night, and day-night sound levels are shown. Due to significant insect activity during the survey, measurement results were filtered to remove noise from these environmental sources. This was completed by correcting all sound energy at and above the 1,600 Hz one-third (1/3) octave band in accordance with ANSI/ASA S3/SC1.100-2014[1]. Data are presented with and without the filtering applied.

[1] "Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas", ANSI/ASA S3/SC1.100-2014.

Table 3-4: Summary of Sound Level Measurements

HDD	NSA	Meas. Location (ML)	Dist. from HDD to NSA	Direction from HDD to NSA	Measured Sound Level, Unfiltered			Measured Sound Level, Filtered to Remove Noise from Birds and Insects			Noise Limit Based on Ambient Measurements
					dBA			dBA [a]			dBA
			Feet		L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_n
Sandy River HDD	NSA 1	ML 2	1,320	WSW	44.4	42.8	49.5	42.9	41.8	48.4	48.6
	NSA 2	ML 1	1,100	W	44.6	42.1	49.0	42.5	40.6	47.3	
	NSA 3		650	NNW	44.6	42.1	49.0	42.5	40.6	47.3	
	NSA 4	ML 3	1,850	SW	42.9	42.3	48.8	40.2	39.1	45.7	
Dan River HDD	NSA 1	ML2	1,850	SW	45.4	43.8	50.5	43.8	42.9	49.5	
	NSA 2		740	SSW	45.4	43.8	50.5	43.8	42.9	49.5	
	NSA 3	ML 1	2,290	W	43.0	41.7	48.3	40.4	39.2	45.8	

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.

The results in Table 3-4 show that the unfiltered ambient nighttime sound levels range from 42.1 to 42.8 dBA L_n at the Sandy River NSAs and from 41.7 to 43.8 dBA L_n near the Dan River NSAs. The main noise source at these locations are environmental noise sources such as wildlife, leaves, and insects. The overall measured sound levels are inclusive of all environmental noise sources and include noise from birds and insects. The filtered nighttime sound levels near the Sandy River NSAs ranged from 39.1 to 41.8 dBA L_n and 39.2 to 42.9 dBA L_n near the Dan River NSAs.

4.0 Site Description

The Sandy River and Dan River HDD milepost along the pipeline and coordinates are given in Table 4-1. Assumptions for Boring activity durations for each site are listed in Table 4-2.

Table 4-1: Site Location, Milepost, and Coordinates

Location Name	Milepost	Coordinates
Sandy River HDD	18.1	36.635683, -79.538034
Dan River HDD	30.8	36.497657, -79.675395

Table 4-2: Duration of Bore Pit Excavation and Boring Operations

Location Name	Boring Operation Duration (hrs/day, # of days)
Sandy River HDD	12 hrs/day, Site Prep, 6 days 24 hrs/day Pilot Hole, Ream (24” followed by 36”), and Pullback, 26 days
Dan River HDD	12 hrs/day, Site Prep, 6 days 24 hrs/day Pilot Hole, Ream (24” followed by 36”), and Pullback, 31 days

5.0 Sound Level Prediction

5.1 HDD Equipment

An HDD noise model was developed for the Amendment Project using US Federal Highway Administration (FHWA 2008) Roadway Construction Noise Model (RCNM) noise data for the expected construction equipment that will be used during the HDD. The RCNM manual was used in combination with an equipment schedule provided by Mountain Valley (Table 5-1) to obtain sound power levels during construction for both the Sandy River and Dan River HDD sites. The noise model was used to predict the HDD sound level contribution at the NSAs.

Construction equipment does not operate continuously, and typically is operating at maximum sound levels for only a small percentage of the overall period. The percentage of the work period during which the equipment operates at the listed sound level is termed the usage factor. The usage factor for each piece of equipment was obtained from the RCNM. Typical sound power levels (L_w) for peak HDD operations based on RCNM are shown in Table 5-2, below.

Table 5-1: HDD Operation Equipment List

Equipment	Quantity
Entry Work Area	
HDD Pilot/Reaming/Pullback Rig	1
P-750 Mud Pump	1
MCD-1000 Cleaning System	1
6" Dri Prime Pump	4
Cat 336 Excavator	2
Cat CTL- 299D3	1
Miller 500-amp Welder	2
3" Trash Pump	4
2" Trash Pump	1
Light Plants*	6
Generator- CAT - 100KW XQ125 T4F	1
Hydrovac Truck Peterbilt 548 or equiv.	5
Exit Work Area	
CAT 349 Excavator	1
CAT 583- Pipelayer	5
Grove RT890E Rough Terrain Crane, or equiv.	2
Light Plants*	2
*Used during nighttime only	

Crew Trucks were considered transient noise and were not included in calculations.

Table 5-2: Equipment Sound Power Levels (L_w) of HDD Equipment

Noise Source	Sound Power Level at Octave Band Center Frequency, dB									Total
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
HDD Entry Site	122	127	127	132	127	122	117	112	107	129
HDD Exit Site	108	113	113	118	113	108	103	98	93	115
Dan River HDD Entry Site Night L_w (with mitigation)	119	122	120	124	119	114	109	104	99	121
Sandy River HDD Entry Site Night L_w (with mitigation)	119	121	118	122	117	112	107	102	97	119

5.2 Prediction Methodology

A three-dimensional computer noise model was constructed to analyze the noise contributions expected from the proposed construction equipment. The model was developed using CadnaA, 2024, MR 1 version 205.5427, a commercial noise modeling package developed by DataKustik GmbH. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces and other sound propagation properties. The software is based on published engineering standards.

The ISO 9613-2 standard was used to calculate all propagation effects, including air and ground absorption, and spreading losses. Weather conditions used in the calculation were ISO 9613-2 default conditions. The default ISO conditions are representative of a moderate downwind condition under typical inversion conditions and are considered conservative as they will tend to overpredict sound levels in most cases.

Ground absorption for the entire Amendment Project area was conservatively set as 0.5, representing a mix of reflective and absorptive ground. This is a conservative assumption, as the majority of the Amendment Project area is undeveloped forests or fields, which are ground types that would typically be assigned a higher ground absorption coefficient of 1.0 (Kephalopoulos 2012).

To be conservative, foliage was not included in the model. The terrain was modeled based on USGS topographical data at a resolution of 10 by 10 meters. A temperature of 20 degrees Celsius and 70 percent relative humidity were used for the atmospheric absorption calculations. The ground was modeled as mixed, with a 0.5 absorption coefficient.

All construction equipment was arranged as an area source over the work area, six and a half feet above grade, as shown in Figure 3. This is appropriate because the site contains stationery and mobile equipment. The mobile equipment may move around the work area, as needed.

6.0 Sound Level Assessment

6.1 Base Model Results

Table 6-1 below shows results for the noise model calculations as the A-weighted equivalent unmitigated sound level, dBA $L_{eq,}$ for the construction activity period. If HDD activities take place during nighttime hours, then FERC guidance gives a sound level limit of 48.6 dBA L_{eq} for those nighttime activities.

Table 6-1: Predicted Temporary Sound Levels Due to Construction, 24-Hour Construction Activities – Base Unmitigated

HDD	NSA	Existing Ambient Sound Levels, dBA [a]			Predicted Sound Level 24-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} [b]	Night	L_{dn}	Night	L_{dn}
Sandy River	1	42.9	41.8	48.4	58.2	64.6	58.3	64.7	16.5	16.3
	2	42.5	40.6	47.3	60.3	66.7	60.3	66.7	19.7	19.4
	3	42.5	40.6	47.3	68.7	75.1	68.7	75.1	28.1	27.8
	4	40.2	39.1	45.7	60.5	66.9	60.5	66.9	21.4	21.2
Dan River	1	43.8	42.9	49.5	69.7	76.1	69.7	76.1	26.8	26.6
	2	43.8	42.9	49.5	57.3	63.7	57.5	63.9	14.6	14.4
	3	40.4	39.2	45.8	56.4	62.8	56.5	62.9	17.3	17.1

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. L_{dn} was obtained by adding 6.4 dB to the predicted sound levels due to nighttime construction.

Without mitigation, sound level modeling shows the sound levels during nighttime construction activities at several NSAs surrounding both Sandy River and Dan River HDD sites will exceed 48.6 dBA L_{eq}. Noise mitigation will be required to limit the nighttime construction sound level to less than 48.6 dBA L_{eq}.

6.2 Mitigated Model Results

Noise mitigation for the equipment will likely be necessary to achieve the noise goals. For noise mitigation on HDD or conventional bore equipment, engine exhaust and barrier treatments are typically used to reduce the sound level contribution to less than 48.6 dBA L_{eq}. Typically, all engines on power units, gensets, etc. would be fitted with residential-grade exhaust mufflers, and temporary barriers may be installed between the HDD bore site and the nearest NSAs. Secondary noise control treatments as specified in Section 7 may be required, depending on the actual equipment and site layout used.

Table 6-2 below shows results for the noise model calculations as the A-weighted equivalent mitigated sound level for the construction activity period.

Table 6-2: Predicted Sound Levels During Boring Operations 24-Hour Construction Activities - Mitigated

HDD	NSA	Existing Ambient Sound Levels, dBA [a]			Predicted Sound Level 24-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} [b]	Night	L_{dn}	Night	L_{dn}
Sandy River	1	42.9	41.8	48.4	46.1	52.5	47.5	53.9	5.7	5.5
	2	42.5	40.6	47.3	46.4	52.8	47.4	53.9	6.8	6.6
	3	42.5	40.6	47.3	48.0	54.4	48.7	55.2	8.1	7.9
	4	40.2	39.1	45.7	48.0	54.4	48.5	54.9	9.4	9.2
Dan River	1	43.8	42.9	49.5	48.1	54.5	49.2	55.7	6.3	6.2
	2	43.8	42.9	49.5	48.2	54.6	49.3	55.8	6.4	6.3
	3	40.4	39.2	45.8	48.4	54.8	48.9	55.3	9.7	9.5

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. L_{dn} was obtained by adding 6.4 dB to the predicted sound levels due to nighttime construction.

Property line sound levels were assessed at the Sandy River HDD location to compare to the Pittsylvania County, Virginia noise limit of 52 dBA L_{eq}. Mitigated model results indicate compliance with this limit, as sound levels range from 49.8 to 51.8 dBA L_{eq} during nighttime HDD activities.

7.0 Noise Control Treatments

The following noise control treatments have been evaluated in the noise model. With these noise control treatments, the noise models predict HDD sound levels lower than 48.6 dBA at all NSAs during nighttime HDD activities.

This is one potential set of noise control treatments. There are various combinations of noise control treatments that can effectively reduce the HDD activity sound levels. After an HDD contractor is selected the noise control treatments should be reevaluated and a site-specific noise control plan developed for each site.

7.1 Site Specific Noise Control Treatments

7.1.1 Sandy River Noise Control Treatments

- Entry Work Area:
  - Reduce vacuum truck activity at night from five to one
  - Install small enclosures constructed of mass-loaded vinyl or plywood over the drill rig engine(s), mud and trash pumps, generator, and the mud processing system during nighttime operations
  - A temporary barrier wall on the north (approximately 40 feet tall, 560 feet long) and south sides (approximately 30 feet tall, 340 feet long) of the entry work area
- Exit Work Area:
  - A temporary barrier wall on the north side of the exit pit (approximately 20 feet tall, 440 feet long)

Figure 11 and Figure 12 show examples of possible enclosure layouts and Figure 7 shows a close-up view of the HDD entry and exit barriers.

7.1.2 Dan River Noise Control Treatments

- Entry Work Area:
  - Reduce vacuum truck activity at night from five to one
  - Install small enclosures constructed of mass-loaded vinyl or plywood over the generator, drill rig engine(s), mud and trash pumps, and the mud processing system during nighttime operations
  - A temporary barrier wall on the north (approximately 16 feet tall, 210 feet long), west (20 feet tall, 215 feet long), and south sides (approximately 40 feet tall, 655 feet long) of the entry work area.
- Exit Work Area:
  - A temporary barrier wall on the north side of the exit pit (approximately 24 feet tall, 250 feet long)

Figure 11 and Figure 12 show examples of possible enclosure layouts Figure 10 shows a close up view of the HDD entry and exit barriers.

7.2 Barriers and Enclosures in General

For barriers and enclosures there are many suitable material choices. Typically, for short duration projects such as boring work, the best choices are either plywood or acoustical blankets.

For plywood enclosures or barriers, the plywood should be ¾″ thick at a minimum and the side facing the noise source should be faced with a layer of acoustically absorptive material. A widely available option would be 2 inches of medium-weight fiberglass board insulation such as Owens Corning 703 or Knauf Insulation Board (3 lb/cu.ft. density). Lightweight fiberglass batt insulation can also be used for short term uses. Batt insulation can be purchased with a thin plastic or paper facing that will offer some weather protection and will make installation easier.

Acoustical blankets should have a surface weight of greater than 1.5 pounds per square foot. The side facing the noise sources should be acoustically absorptive. Typically, this is accomplished with a quilted absorber material. Blankets should be installed with as few cracks and gaps as possible. Blankets can be applied directly to equipment skid supports, if desired, as long as there are no significant cracks or gaps between the blankets, and that there is no gap between the bottom of the blankets and the ground.

8.0 Conclusion

SLR has updated the noise models for the Sandy River HDD and Dan River HDD sites, a part of the Amendment Project, using an updated HDD equipment list provided by Mountain Valley. With the noise mitigation recommended in this report, the noise model predicts that sound levels will remain below the FERC criterion of 48.6 dBA, L_{eq} at all occupied NSAs at night during HDD activities, as shown in the rightmost column of Table 6-2. Property line sound levels were assessed at the Sandy River HDD location to compare to the Pittsylvania County, Virginia noise limit of 52 dBA L_{eq}. Mitigated model results indicate compliance with this limit, as sound levels range from 49.8 to 51.8 dBA L_{eq} during nighttime HDD activities. Due to the preliminary nature of the information presented in this report, results may change as the construction plan is finalized.

This concludes our Technical Report for the Mountain Valley Amendment HDD crossings.

Please contact us if you have any questions.

Regards,

SLR International Corporation

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9.0 References

ANSI/ASA S3/SC1.100-2014, Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas

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Kephalopoulos, Stylianos et al. (2012). Common Noise Assessment Methods in Europe (CNOSSUS-EU) European Commission Joint Research Centre, Institute for Health and Consumer Protection, TP 281 21027 – Ispra (VA), Italy.

ISO 9613-2 (1996) Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General method of calculation

Figure 1: Sandy River NSAs and Measurement Locations

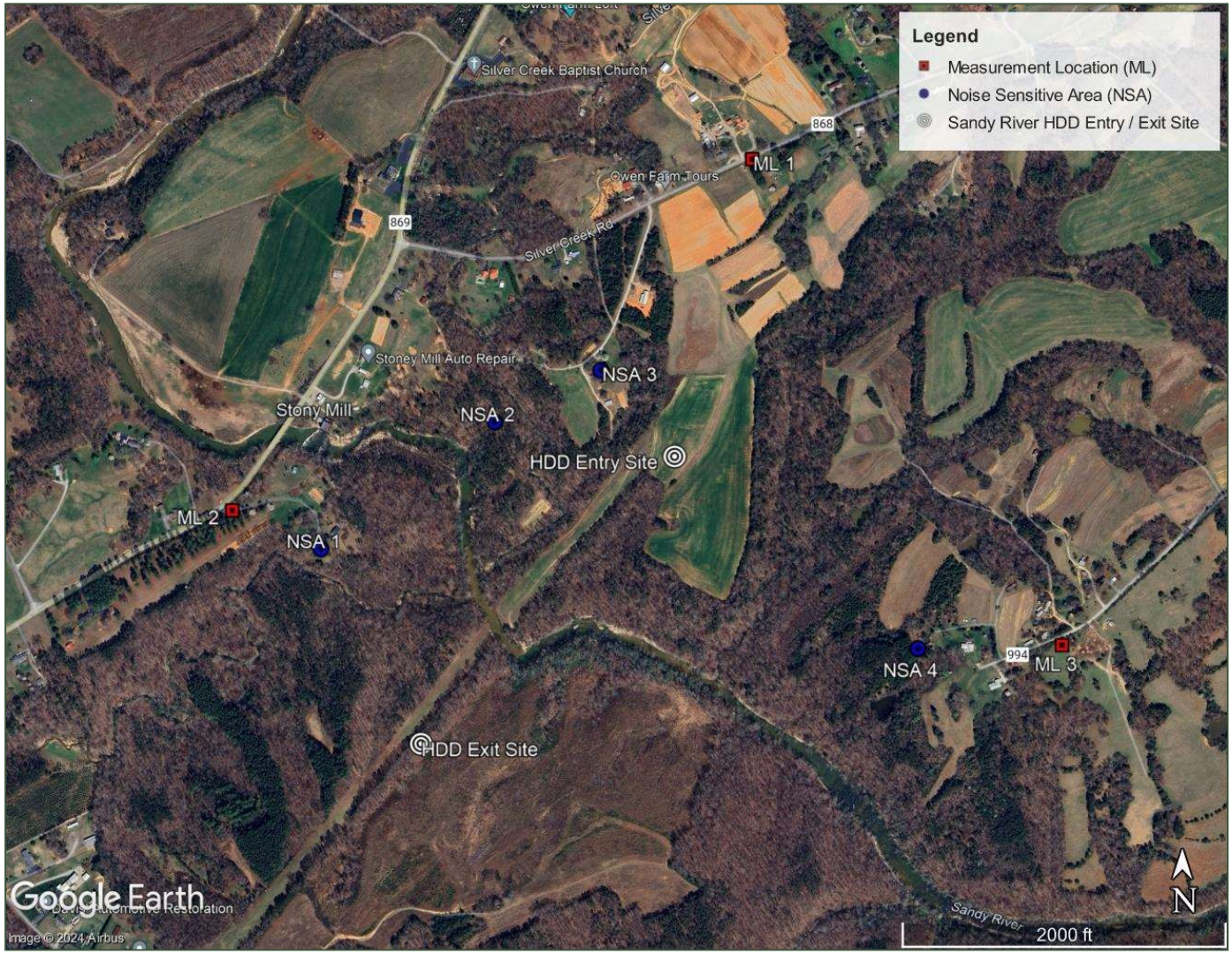


Figure 2: Dan River NSAs and Measurement Locations

Figure 3: Weather Data (Temperature and Relative Humidity) – August 14 to August 15, 2024

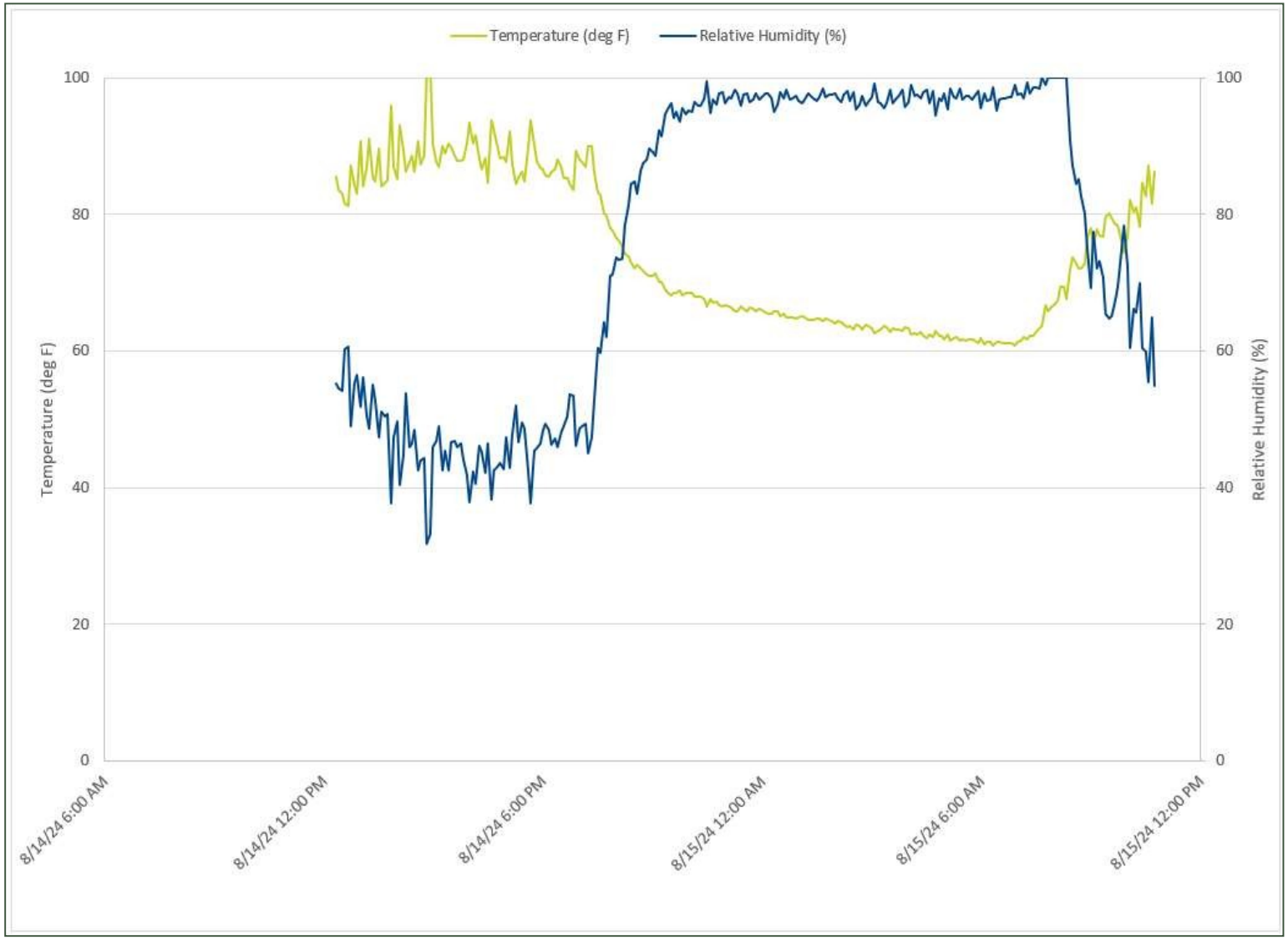


Figure 4: Weather Data (Wind Speed and Direction) – August 14 to August 15, 2024

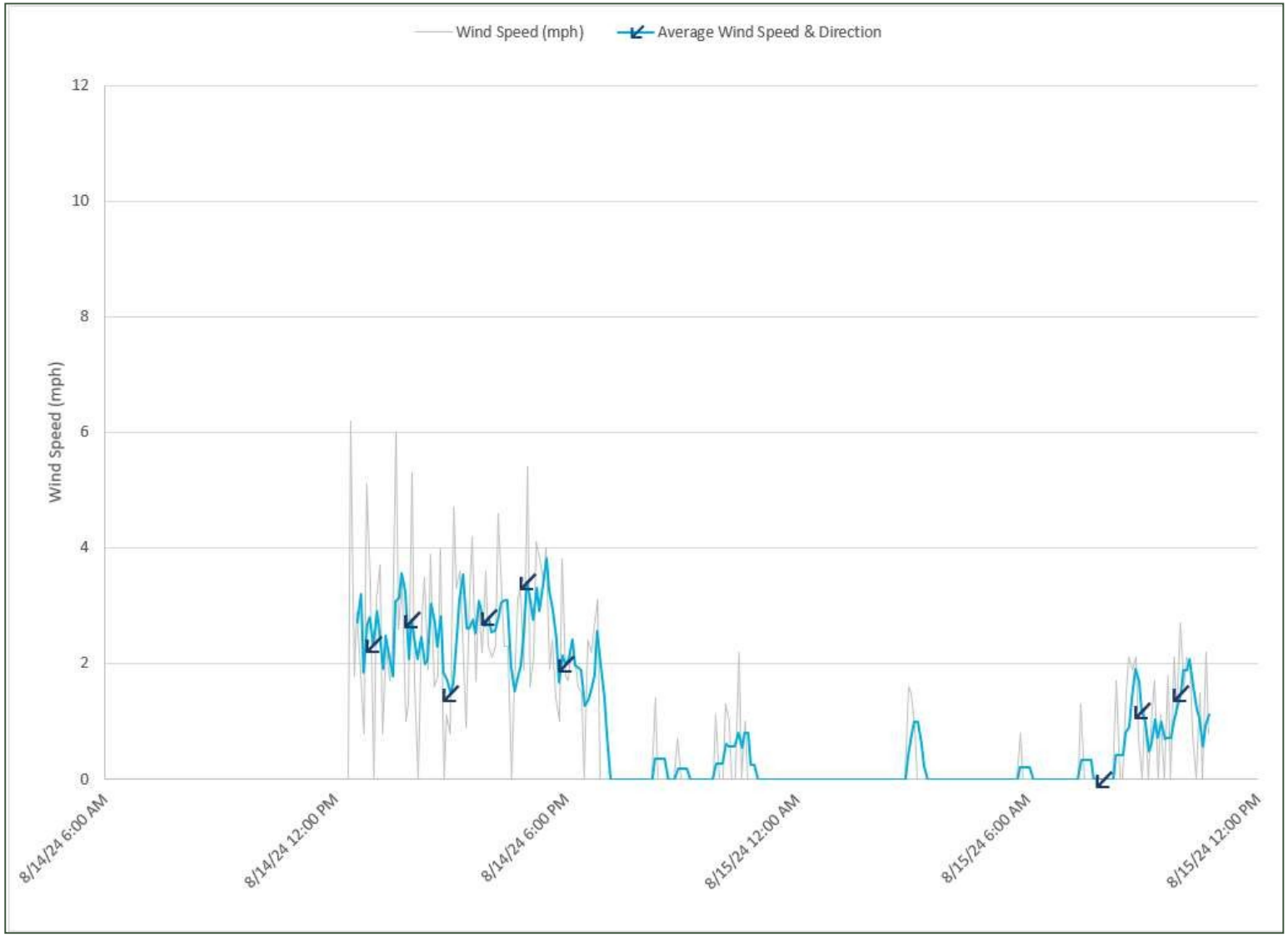


Figure 5: Predicted Unmitigated 48.6 dBA L_n Contour for Sandy River HDD

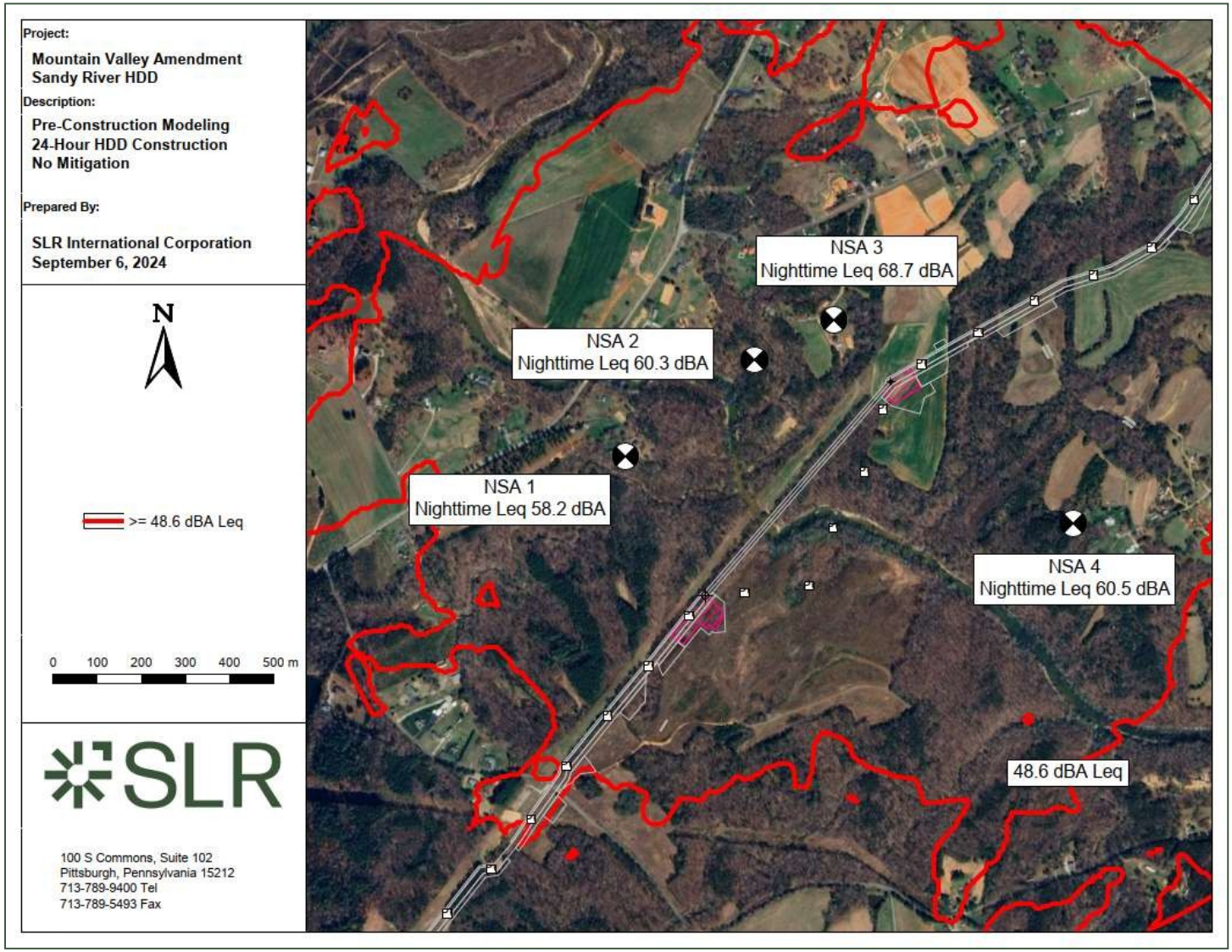


Figure 6: Predicted Mitigated 48.6 dBA L_n Contour for Sandy River HDD

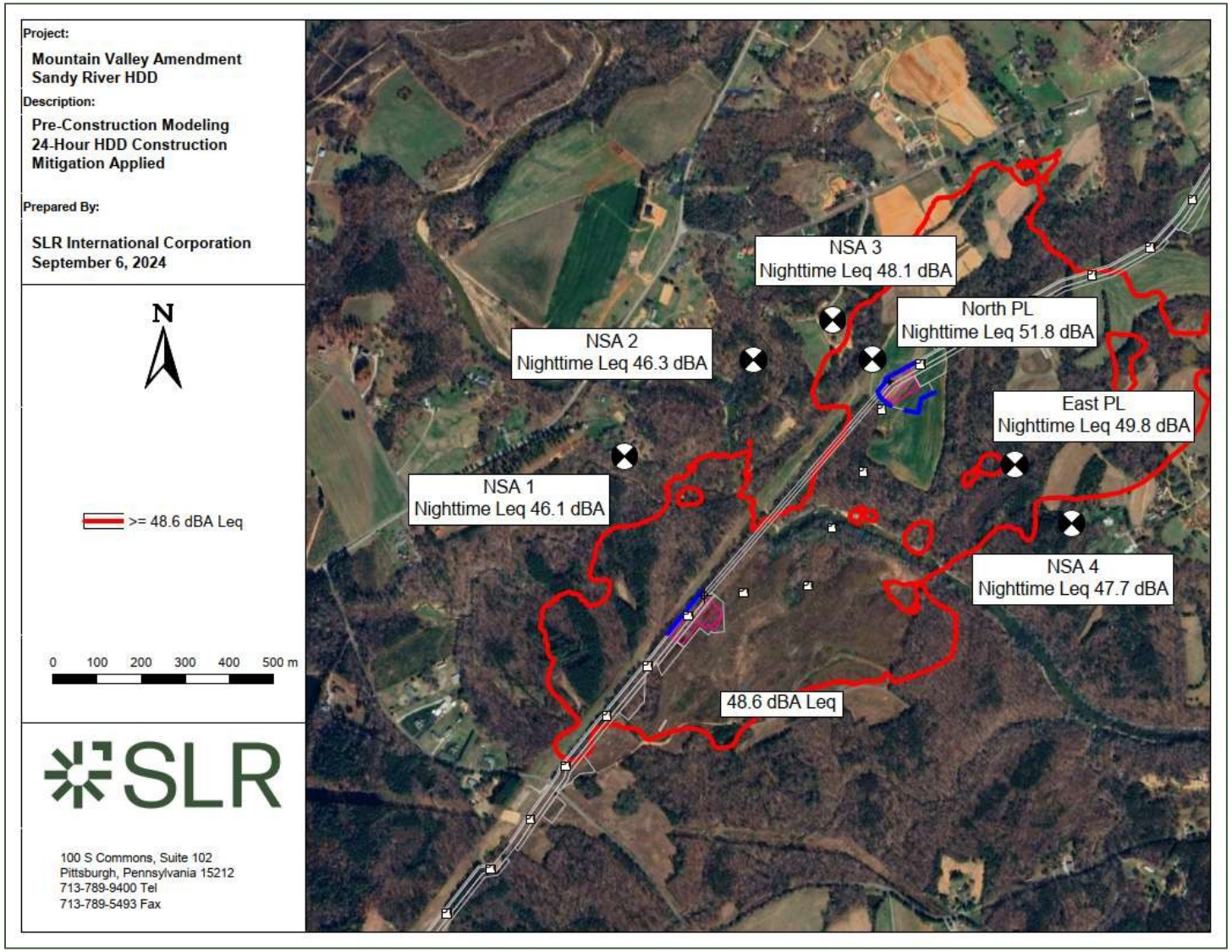


Figure 7: Sandy River HDD Barriers

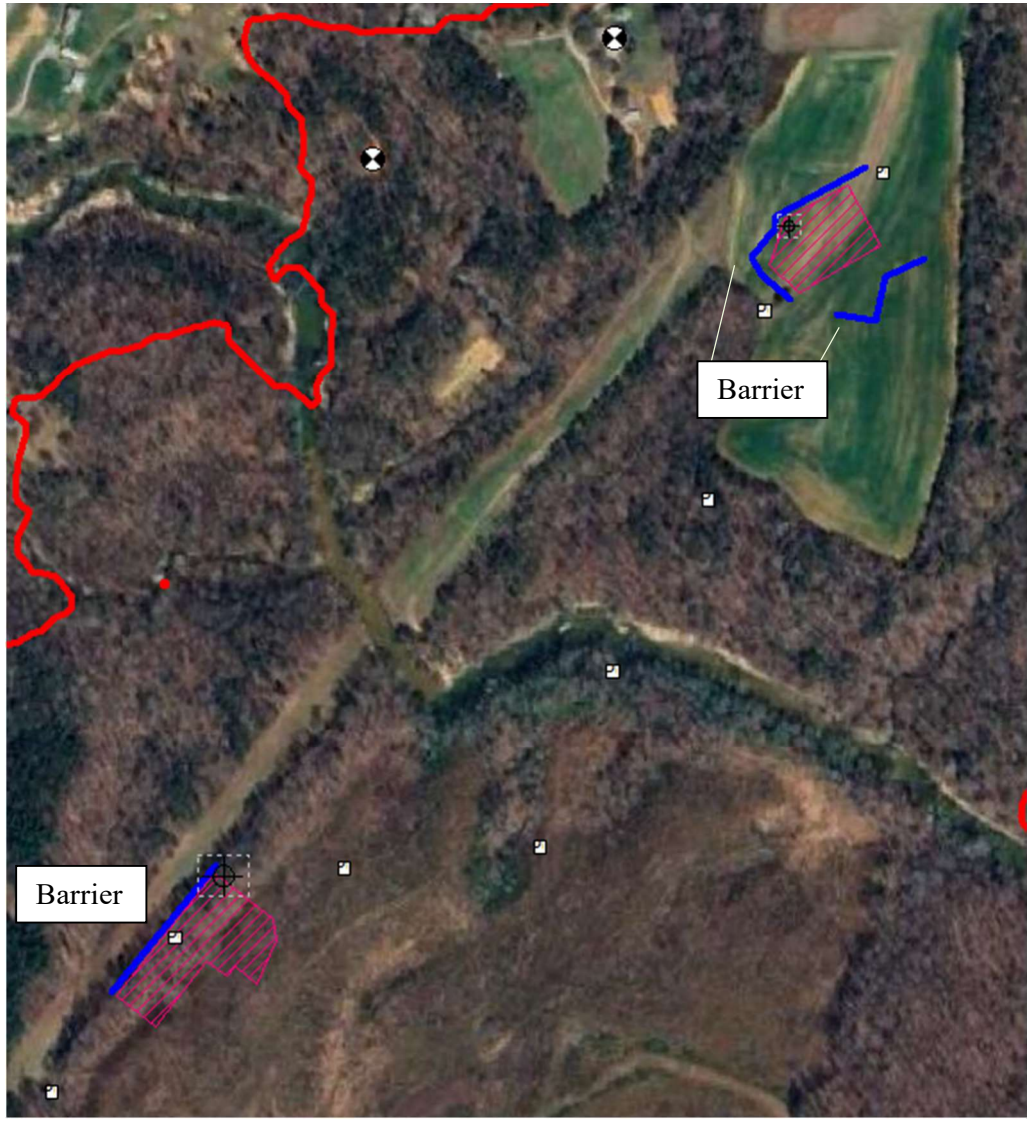


Figure 8: Predicted Unmitigated 48.6 dBA L_n Contour for Dan River HDD

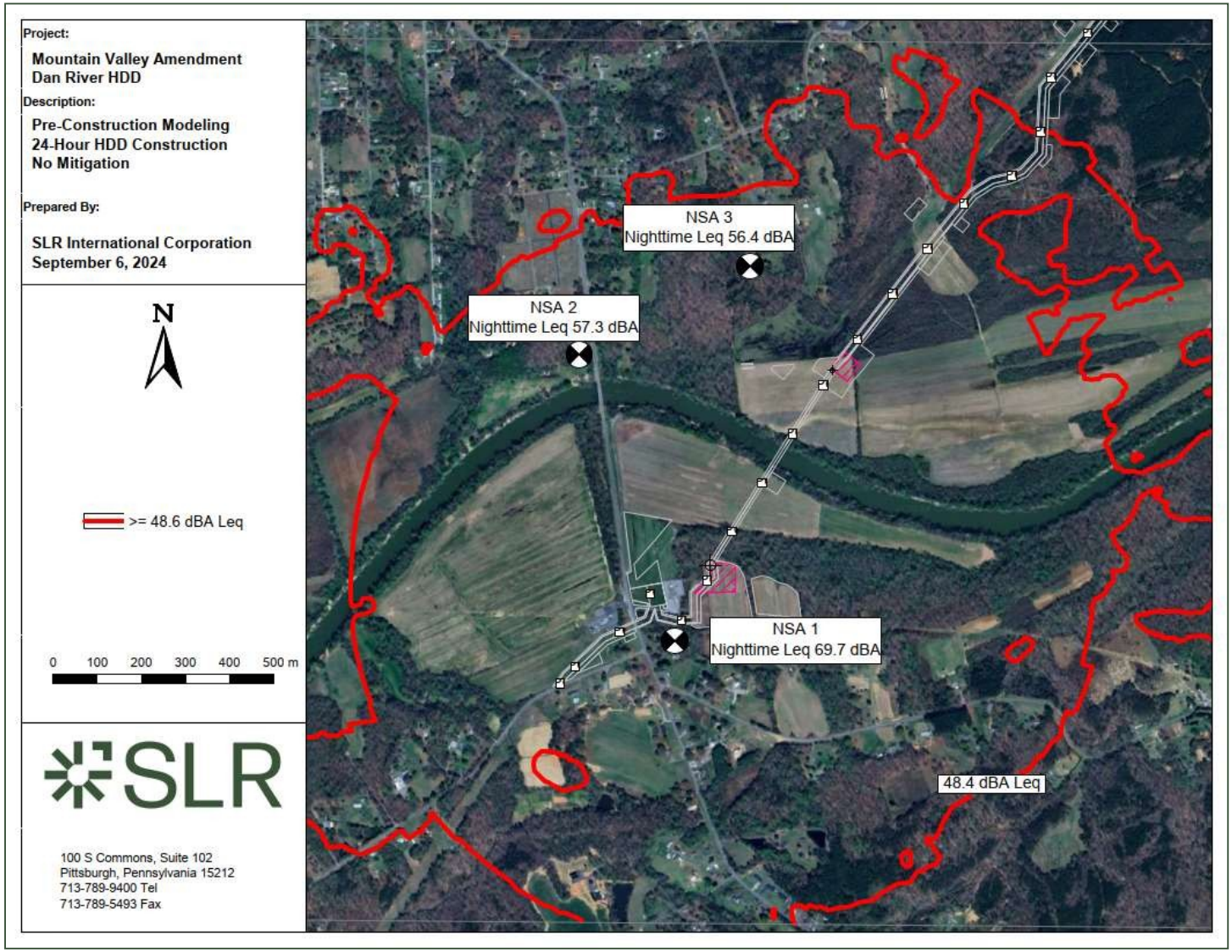


Figure 9: Predicted Mitigated 48.6 dBA L_n Contour for Dan River HDD

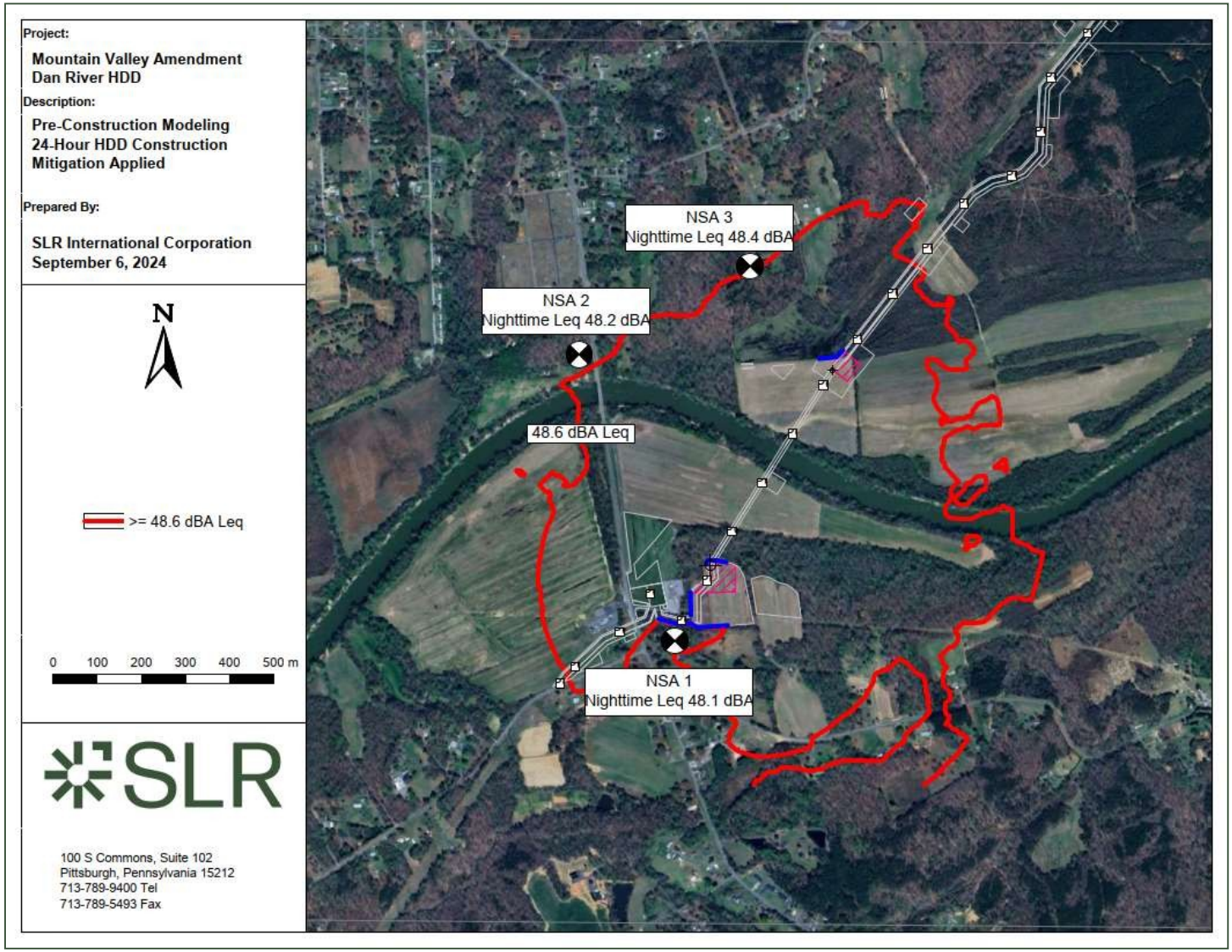


Figure 10: Dan River HDD Barriers

Figure 11: Typical Enclosure Layout for Diesel Powered Pump or Welder Equipment Axis Oriented North/South

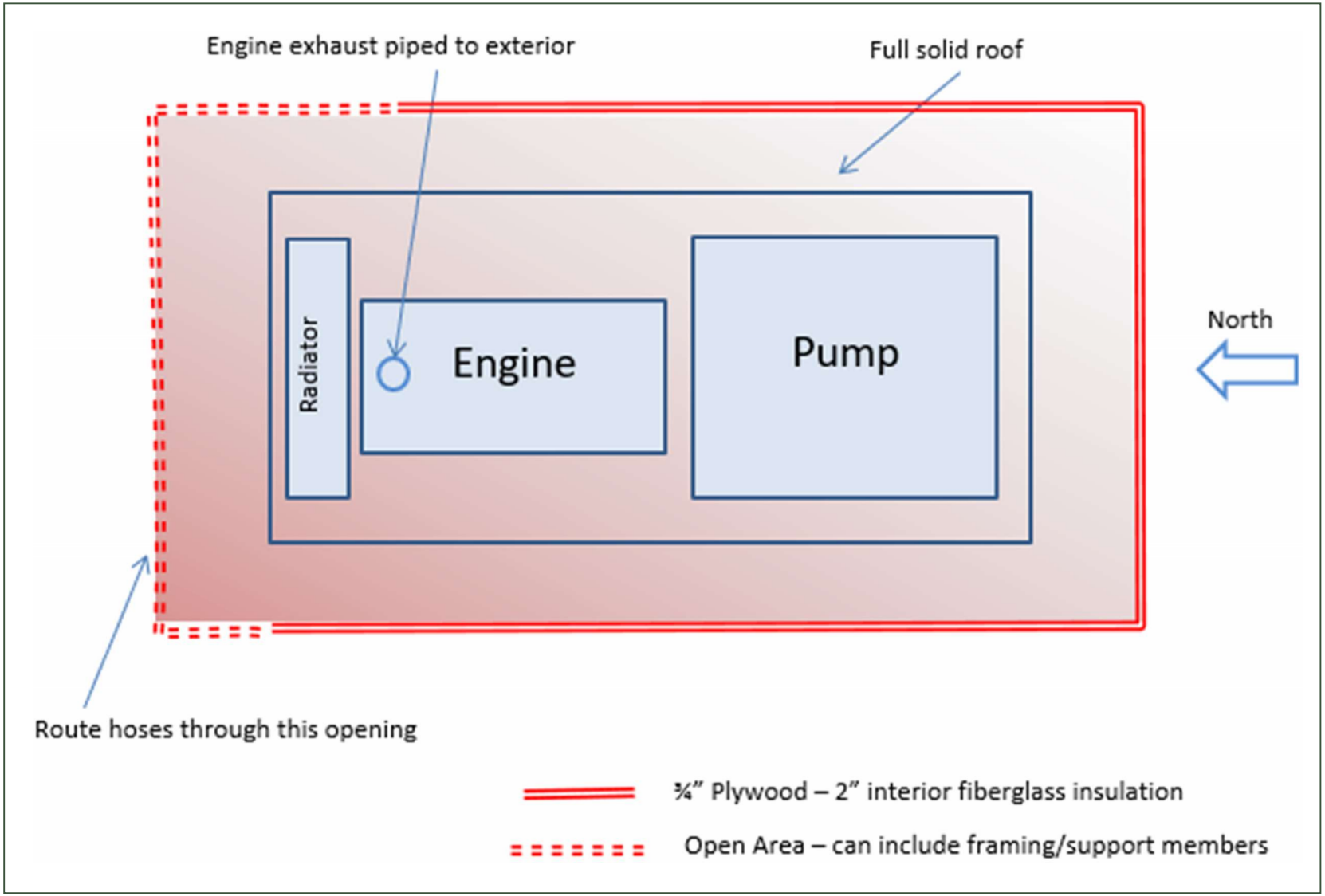
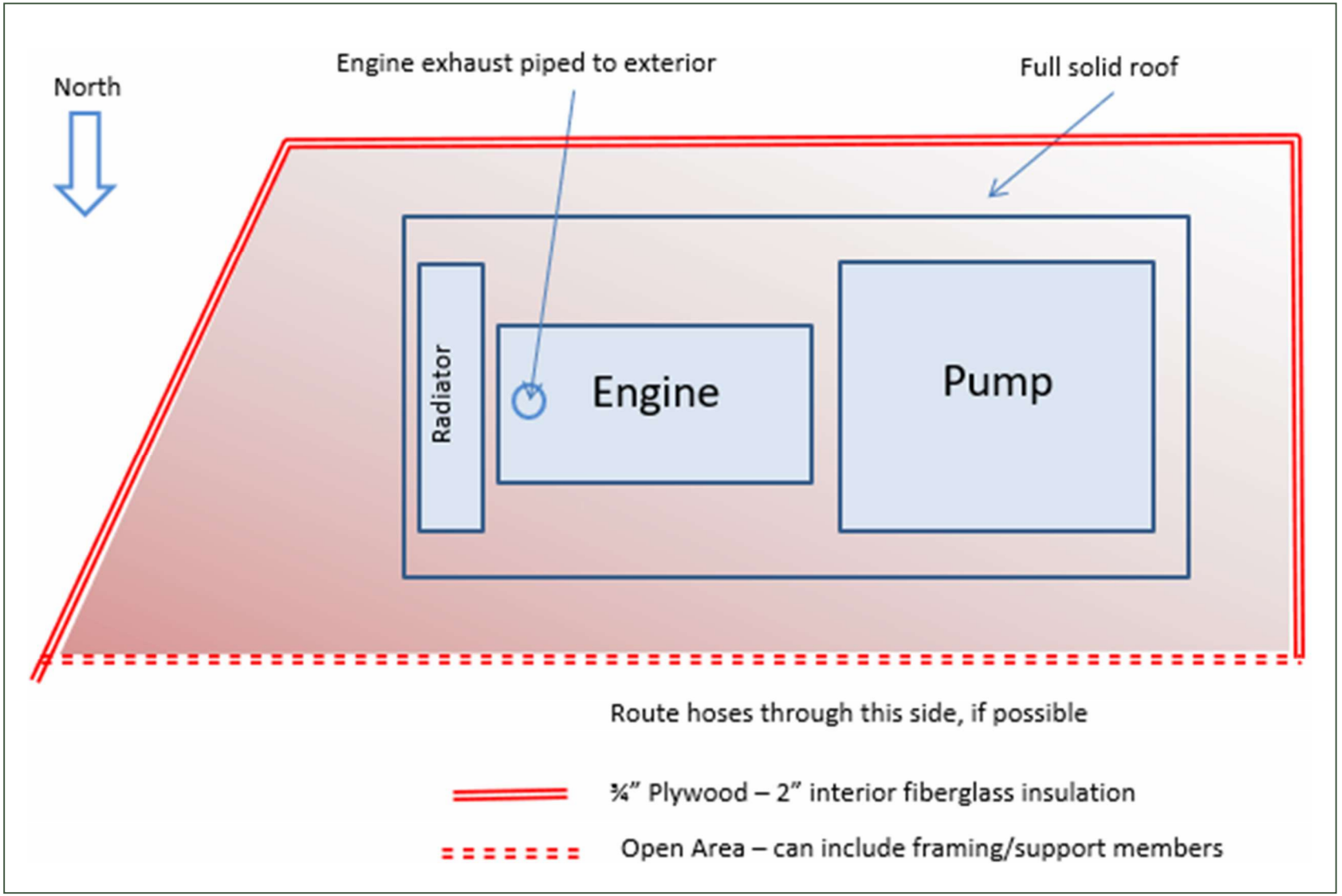


Figure 12: Typical Enclosure Layout for Diesel Powered Pump or Welder Equipment Axis Oriented East/West



MVP Southgate Amendment Project

Docket No. CP25-XX-000

Resource Report 9

Appendix 9-E

Nighttime Boring Noise Assessment – Railroad Crossings

SLR International Corporation
100 S Commons, Suite 102, Pittsburgh, PA 15212

November 19, 2024

Attention: James Sabol
Mountain Valley
2200 Energy Drive
Canonsburg, PA 15317

SLR Project No.: 135.000031.00001

RE: Nighttime Boring Noise Assessment – Railroad Crossings – Rev. 0
MVP Southgate Amendment

1.0 Introduction

Mountain Valley Pipeline, LLC (Mountain Valley) has requested that SLR International Corporation (SLR) modify the noise model for the proposed Railroad (RR) Crossing sites, a part of the MVP Southgate Amendment Project (Amendment Project). Mountain Valley is proposing to perform nighttime construction activities at the crossing work areas. SLR has updated the noise model with the additional nighttime activities and this report presents the results and impact assessment. Baseline sound level measurements were conducted on August 14 and August 15, 2024, and nighttime boring sound level impacts were predicted for the nearest noise sensitive areas (NSAs).

2.0 Environmental Sound Level Criteria

The Federal Energy Regulatory Commission (FERC) limits for noise from nighttime construction work are typically based on a goal of 55 dBA L_{dn}. The L_{dn} is essentially the logarithmic average of the sound levels during a 24-hour period, with a 10 dBA penalty added to the sound levels occurring during the more noise sensitive nighttime period from 10:00 p.m. to 7:00 a.m. Because of the nighttime penalty, a constant sound level at 48.6 dBA for 24-hours will result in an L_{dn} of 55 dBA.

As per the latest FERC guidance (FERC 2017) for the preparation of Resource Report 9, "Construction activity that would or may occur during nighttime hours should be performed with the goal that the activity contributes noise levels below 55 dBA L_{dn} and 48.6 L_{eq}, or no more than 10 dBA over background if ambient noise levels are above 55 dBA L_{dn}." If construction activities are limited to the daytime hours, with no significant noise production at night, then there is no specific sound level target for those activities.

These FERC noise limits apply at the nearest Noise Sensitive Areas (NSAs), which are typically residences, churches, schools, or hospitals. The FERC noise limits are not property-line limits – they apply at the NSA structure itself.

Pittsylvania County, Virginia has a noise ordinance (Section 41-6) that applies at the property boundary of the noise source or at any point within any other affected property, rather than at the NSA structure, so it cannot be directly compared to the FERC sound level requirements. The Pittsylvania County ordinance has an exemption for construction provided it takes place between 7:00 a.m. and 10:00 p.m. Pittsylvania County limits sound levels to 52 L_{eq} dBA at residential and agricultural property boundaries during nighttime hours (10:00 p.m. to 7:00 a.m.).

Both the MP 5.6 and MP 25.7 RR Crossing sites are located in Pittsylvania County and are subject to the nighttime limit of 52 L_{eq} dBA at the nearest property boundaries.

There are no other known state, county, or local regulations that would apply to these

3.0 Sound Level Survey

NSA(s) were identified by SLR using aerial imagery and field observations. No NSA(s) were identified within 0.5 miles of either the MP 5.6 nor MP 25.7 railroad crossing sites. The closest NSA(s), greater than 0.5 miles from the sites, were identified. The NSAs are summarized in Table 3-1.

Table 3-1: Summary of Noise Sensitive Areas

Crossing	Noise Sensitive Area	Description	Approximate Distance from Crossing, Feet	Direction to NSA from Crossing	Coordinates	
					Lat	Long
MP 5.6 Railroad Crossing	NSA 1	School	5,370	SW	36.761864°	-79.387580°
MP 25.7 Railroad Crossing	NSA 1	Residence	5,360	WNW	36.559075°	-79.637382°

3.1 Measurement Equipment

Sound level equipment used during the sound study included the following instruments:

- Larson Davis 831 SLM; Type 1; s/n 1737, A0335
- Larson Davis® CAL200 Calibrator; s/n 15533, 6266

A windscreen was used on the measurement microphone. The sound level meter was field-calibrated before and after the survey. All instruments have current laboratory certification that can be provided upon request. Measurements were conducted five feet above the ground.

3.2 Weather Conditions

Weather conditions were appropriate for a sound level study. A summary of the weather conditions is shown in Table 3-2.

Table 3-2: Summary of Weather Conditions

Date	August 14 – August 15, 2024
Temperature Range	61°F – 101.3°F
Relative Humidity Range	32% – 100 %
Wind Speed (Average)	0 mph – 6.2 mph
Wind From	NE
Sky Condition	Clear
Ground Condition	Dry

Complete weather data from the measurement survey were obtained from a Kestrel® weather station deployed while on site and are shown in Figure 4 and Figure 5.

3.3 Measurement Methodology

Sound levels were measured using the fast meter response and A-weighting. Data were collected in 1/3-octave bands and recorded using 1-second and 1-minute sampling periods for a 15-minute duration.

3.4 Environmental Sound Level Measurements

The sound study was performed on August 14-15, 2024 by Geoffrey Kulp and Rhianna Spong of SLR. Short term sound level measurements were conducted at one location near MP 5.6 and one location near MP 25.7. A single approximately 15-minute-long measurement was taken at each site. A reference location nearby was chosen to conduct an overnight measurement. The reference overnight location was conducted using 10 second sampling period and 15-minute statistical intervals.

Figure 1 and Figure 2 show the measurement locations. Sound sources observed at the measurement locations are summarized in Table 3-3.

Table 3-3: Summary of Measurement Locations

Crossing	NSA	Measurement Location (ML)	Meas. Start Time	Meas. Duration HH:MM:SS	Source Observations During Measurements
MP 5.6 Railroad Crossing	NSA 1	ML 1	1:51 PM	00:15:33	Audible sounds included wildlife, insects, foliage, and nearby landfill equipment.
MP 25.7 Railroad Crossing	NSA 1	ML 1	9:41 AM	00:18:31	Audible sounds included wildlife, insects, foliage, and local traffic.
Reference Overnight ML (Near MP 29.3)	N/A	Reference Overnight ML	11:50 AM	22:54:10	Audible sounds included wildlife, insects, and foliage.

3.5 Measurement Results

The sound level measurement results are summarized in Table 3-4. The measured day, night, and day-night sound levels are shown. Due to significant insect activity during the survey, measurement results were filtered to remove noise from these environmental sources. This was completed by correcting all sound energy at and above the 1,600 Hz one-third (1/3) octave band in accordance with ANSI/ASA S3/SC1.100-2014[1]. Data are presented with and without the filtering applied.

[1] "Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas", ANSI/ASA S3/SC1.100-2014.

Table 3-4: Summary of Sound Level Measurements

Measurement Location	Nearest NSA	Distance from Crossing to NSA	Direction from Crossing to NSA	Measured Sound Level, Unfiltered			Measured Sound Level, Filtered to Remove Noise from Birds and Insects			Noise Limit Based on Ambient Measurements
				dBA			dBA [a]			dBA
		Feet		L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_n
MP 5.6 ML 1	1	5,370	SW	40.0	44.0[b]	49.6	39.4	34.1[c]	41.8	48.6
MP 25.7 ML 1	1	5,360	WNW	41.7	45.3[b]	51.3	41.1	35.8[c]	43.5	
MP 29.3 Reference Overnight ML	N/A	N/A	N/A	48.2	51.8	57.8	37.6	32.3	40.0	N/A

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. The difference between the unfiltered MP 29.3 daytime and nighttime measurements was used to estimate the unfiltered L_n at the railroad crossings.
c. The difference between the filtered MP 29.3 daytime and nighttime was used to calculate the L_n measurements was used to estimate the filtered L_n at the railroad crossings.

No nighttime sound levels were measured at the railroad crossings, see Table 3-3. A reference overnight sound meter was placed near MP 29.3 in an area where the observed ambient sounds were similar to those observed at MP 5.6 and MP 25.7. The reference overnight measurement location is shown in Figure 3. The sound level difference between the daytime and nighttime levels at the reference overnight measurement location was subtracted from the L_d values measured at the railroad crossings to estimate their L_n values. The overall measured sound levels are inclusive of all environmental noise sources and includes noise from birds, insects, and foliage

The results in Table 3-4 show that the estimated unfiltered ambient nighttime sound levels are about 44.0 dBA L_n near MP 5.6 and about 45.3 dBA L_n near MP 25.7.

The filtered sound levels near MP 5.6 are about 34.1 dBA L_n and 35.8 dBA L_n near MP 25.7.

4.0 Site Description

The MP 5.6 and MP 25.7 RR Crossing milepost along the pipeline and coordinates are given in Table 4-1. Assumptions for boring activity durations for each site are listed in Table 4-2.

Table 4-1: Site Location, Milepost, and Coordinates

Location Name	Milepost	Coordinates
MP 5.6 Railroad Crossing	5.6	36.771209, -79.402705
MP 25.7 Railroad Crossing	25.7	36.554245, -79.620073

Table 4-2: Duration of Bore Pit Excavation and Boring Operations

Location Name	Boring Operation Duration (hrs/day, # of days)
MP 5.6 RR Crossing	10 hrs/day, Excavate and Shore Launch/Receiving Pit, 12 days 10 hrs/day, Gravel Base, Set Tracks, Install Bore Machine, 4 days 24 hrs/day, Bore Crossing – Sacrificial Pipe, 3 days 24 hrs/day, Bore Crossing – Production Pipe (Weld, Coat, Push), 3 days
MP 25.7 RR Crossing	10 hrs/day, Excavate and Shore Launch/Receiving Pit, 6 days 10 hrs/day, Gravel Base, Set Tracks, Install Bore Machine, 2 days 24 hrs/day, Bore Crossing – Sacrificial Pipe, 1 days 24 hrs/day, Bore Crossing – Production Pipe (Weld, Coat, Push), 2 days

5.0 Sound Level Prediction

5.1 Boring Equipment

A boring noise model was developed for the Amendment Project using US Federal Highway Administration (FHWA 2008) Roadway Construction Noise Model (RCNM) noise data for the expected construction equipment that will be used during boring. The RCNM manual was used in combination with an equipment schedule provided by Mountain Valley (Table 5-1) to obtain sound power levels during construction for both MP 5.6 and MP 25.7. The noise model was used to predict the boring sound level contribution at the NSAs.

Construction equipment does not operate continuously, and typically is operating at maximum sound levels for only a small percentage of the overall period. The percentage of the work period during which the equipment operates at the listed sound level is termed the usage factor. The usage factor for each piece of equipment was taken from the RCNM. Typical sound power levels (L_w) for peak boring operations based on RCNM are shown in Table 5-2, below.

Table 5-1: Boring Operation Equipment List

Equipment	Quantity
Entry Work Area	
Sideboom -CAT 583	2
Excavator - CAT 345 - CAT 352 / JD 470 or Comparable	1
Excavator - CAT 335 & 336 / JD 350 or Comparable	1
Excavator Attachment - 349 - Hammer 12,000 ft lb.	1
Dozer - D8T	1
Air Compressor - 185	1
Bore - Track Machine - w/ Push Plate, Head, Auger	1
Pump - Mud (TT Tech Bentonite Pump or Comparable)	1
Morooka - 3000 or Comparable	2
Welder - Engine Driven (Lincoln/Miller or Comparable)	2
Light Plant *	6
Exit Work Area	
Excavator - CAT 345 - CAT 352 / JD 470 or Comparable	1
Excavator - CAT 335 & 336 / JD 350 or Comparable	1
Pump - Mud (TT Tech Bentonite Pump or Comparable)	1
Light Plant *	2
*Used during nighttime only	

Crew Trucks were considered transient noise and were not included in calculations.

Table 5-2: Equipment Sound Power Levels (L_w) of Boring Equipment

Noise Source	Sound Power Level at Octave Band Center Frequency, dB									Total
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
RR Crossing Entry Site, dB	115	120	120	125	120	115	110	105	100	122
RR Crossing Exit Site, dB	110	115	115	120	115	110	105	100	95	116

5.2 Prediction Methodology

A three-dimensional computer noise model was constructed to analyze the noise contributions expected from the proposed construction equipment. The model was developed using CadnaA, 2024, MR 1 version 205.5427, a commercial noise modeling package developed by DataKustik GmbH. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces and other sound propagation properties. The software is based on published engineering standards.

The ISO 9613-2 standard was used to calculate all propagation effects, including air and ground absorption, and spreading losses. Weather conditions used in the calculation were ISO 9613-2 default conditions. The default ISO conditions are representative of a moderate downwind condition under typical inversion conditions and are considered conservative as they will tend to overpredict sound levels in most cases.

Ground absorption for the entire Amendment Project area was conservatively set as 0.5, representing a mix of reflective and absorptive ground. This is a conservative assumption, as the majority of the Amendment Project area is undeveloped forests or fields, which are ground types that would typically be assigned a higher ground absorption coefficient of 1.0 (Kephalopoulos 2012).

To be conservative, foliage was not included in the model. The terrain was modeled based on USGS topographical data at a resolution of 10 by 10 meters. A temperature of 20 degrees Celsius and 70 percent relative humidity were used for the atmospheric absorption calculations. The ground was modeled as mixed, with a 0.5 absorption coefficient.

All construction equipment was arranged as an area source over the work area, six and a half feet above grade. This is appropriate because the site contains stationery and mobile equipment. The mobile equipment may move around the work area, as needed.

6.0 Sound Level Assessment

6.1 Base Model Results

Table 6-1 below shows results for the noise model calculations as the A-weighted equivalent unmitigated sound level, dBA $L_{eq,}$ for the construction activity period. If HDD activities take place during nighttime hours, then FERC guidance gives a sound level limit of 48.6 dBA L_{eq} for those nighttime activities.

Table 6-1: Predicted Temporary Sound Levels at NSAs Due to Construction, 24-Hour Boring

Crossing	NSA	Existing Ambient Sound Levels, dBA [a]			Predicted Sound Level –24-Hour Construction, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn} [b]	Night	L_{dn}	Night	L_{dn}
MP 5.6 Railroad Crossing	1	39.4	34.1[c]	41.8	37.2	43.6	38.9	45.8	4.8	4.0
MP 25.7 Railroad Crossing	1	41.1	35.8[c]	43.5	36.5	42.9	39.2	46.2	3.4	2.7

a. Post-processed to remove noise from birds, insects, and passing vehicles in accordance with ANSI ANSI/ASA S3/SC1.100-2014.
b. L_{dn} was obtained by adding 6.4 dB to the predicted sound levels due to nighttime construction.

Sound level modeling shows that the sound levels at the NSAs during nighttime boring activities at both MP 5.6 and MP 25.7 will not exceed 48.6 dBA L_{eq}. Noise mitigation will not be required at the MP 5.6 and MP 25.7 railroad crossings to meet the FERC nighttime noise limit of 48.6 dBA L_{eq}. Noise contour plots for each railroad crossing showing the distance at which the sound levels are equal to the FERC nighttime noise limit are shown as Figure 6 and Figure 7.

Sound levels during 24-hour boring were also predicted at the nearest property lines to each railroad crossing to assess compliance with the Pittsylvania County noise limit.

At the MP 25.7 railroad crossing, the worst-case property line sound level is 52.1 dBA L_{eq} during nighttime boring activity. Sound levels from boring are not expected to exceed the Pittsylvania County limit at any location around the property line.

At the MP 5.6 railroad crossing, the worst-case property line sound level is 59.4 dBA L_{eq} at the current leased property boundary to the north at the MP 5.6 railroad crossing. This area is vacant wooded land with no visible structures (based on SLR's review of aerial imagery available at the time of writing this report). Sound levels at the closest property line with residential structures are 39.8 dBA L_{eq}, significantly lower than the ordinance. If it is determined that the sound levels need to be reduced below the Pittsylvania County limit at the northern property line, a nighttime construction noise plan will need to be developed to reduce sound levels to below the limit at the applicable property boundaries.

7.0 Conclusion

SLR has updated the noise models for the MP 5.6 and MP 25.7 railroad crossing sites, a part of the Mountain Valley Amendment Project, using an updated boring equipment list provided by Mountain Valley. The noise models predict that each site will be compliant with the FERC criterion of 48.6 dBA L_{eq} at all occupied NSAs during nighttime boring operations.

Property line sound levels were also assessed at each site to compare to the Pittsylvania County, Virginia noise limit of 52 dBA L_{eq} during nighttime hours. Model results predict compliance with this limit at MP 25.7 but predict maximum property line sound levels of 59.4 dBA L_{eq} at the north property line of the MP 5.6 crossing, 7.4 dBA higher than the 52 dBA limit. The MP 5.6 north property line is bordered by a vacant field/wooded area with no structures. Predicted sound levels at the closest property lines with residential structures are 39.8 dBA, significantly lower than the Pittsylvania County ordinance. If sound levels are to be reduced at the property line location at MP 5.6, a nighttime construction noise plan should be developed. Due to the preliminary nature of the information presented in this report, results may change as the construction plan is finalized.

This concludes our Technical Report for the Mountain Valley Amendment railroad crossings.

Please contact us if you have any questions.

Regards,

SLR International Corporation

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8.0 References

ANSI/ASA S3/SC1.100-2014, Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas

FERC (2017) Federal Energy Regulatory Commission, Office of Energy Projects "Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act." Volume 1, February 2017.

FHWA (2008) Roadway Construction Noise Model, Federal Highway Administration, US Department of Transportation. Version 1.1, December 8, 2008.

Kephalopoulos, Stylianos et al. (2012). Common Noise Assessment Methods in Europe (CNOSSUS-EU) European Commission Joint Research Centre, Institute for Health and Consumer Protection, TP 281 21027 – Ispra (VA), Italy.

ISO 9613-2 (1996) Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General method of calculation

Figure 1: MP 5.6 NSAs and Measurement Locations

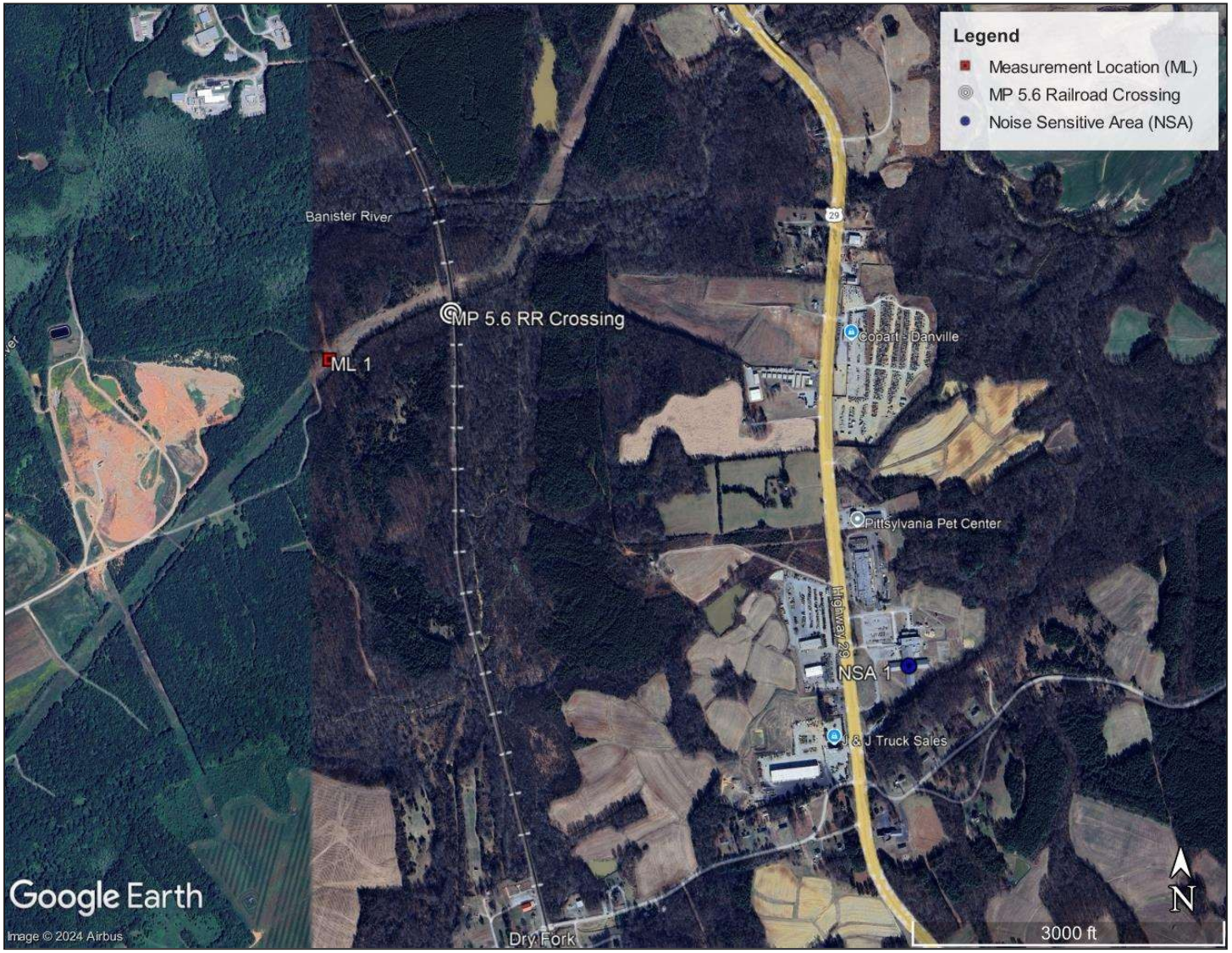

Figure 2: MP 25.7 NSAs and Measurement Locations

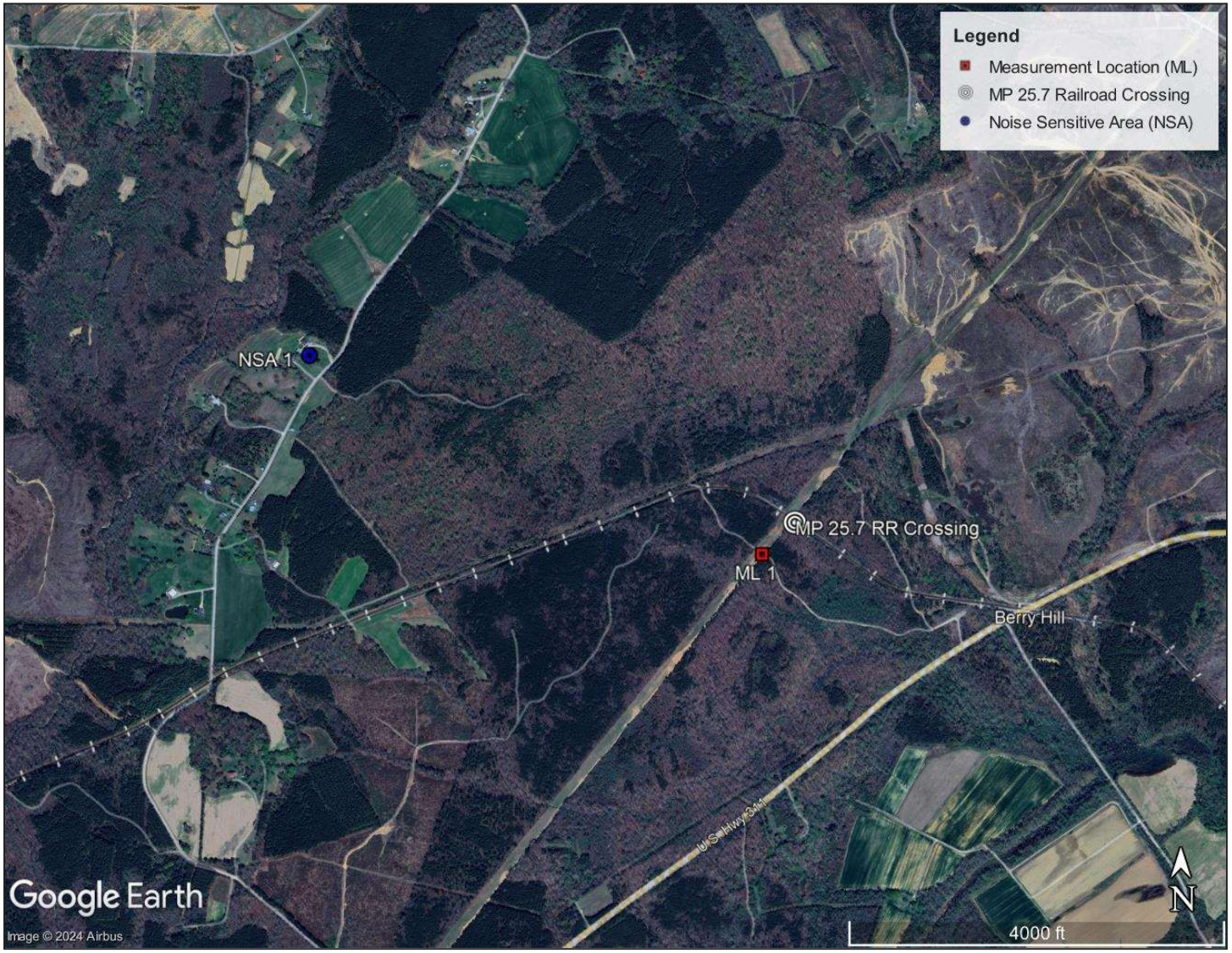

Figure 3: Reference Overnight Measurement Location

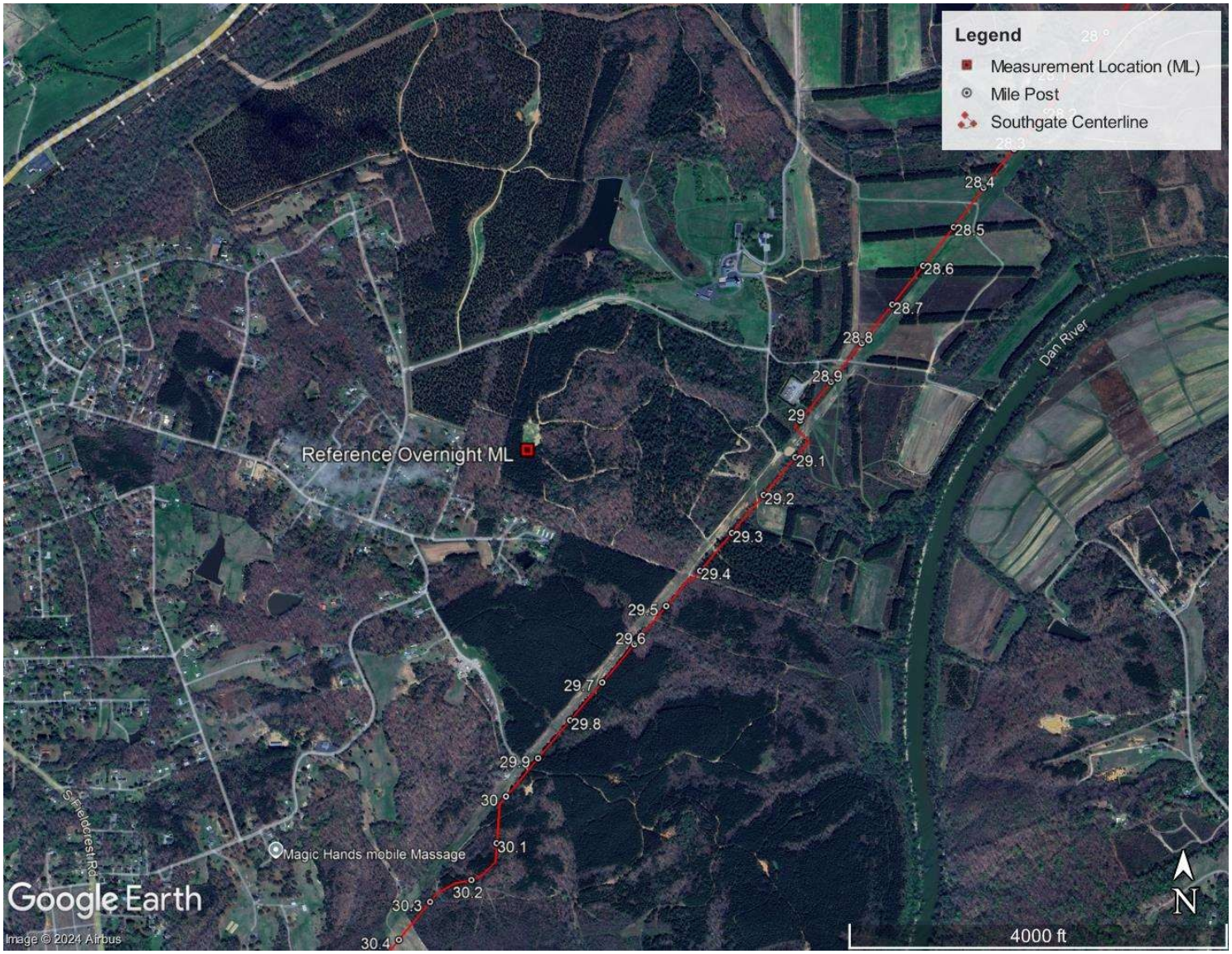

Figure 4: Weather Data (Temperature and Relative Humidity) – August 14 to August 15, 2024

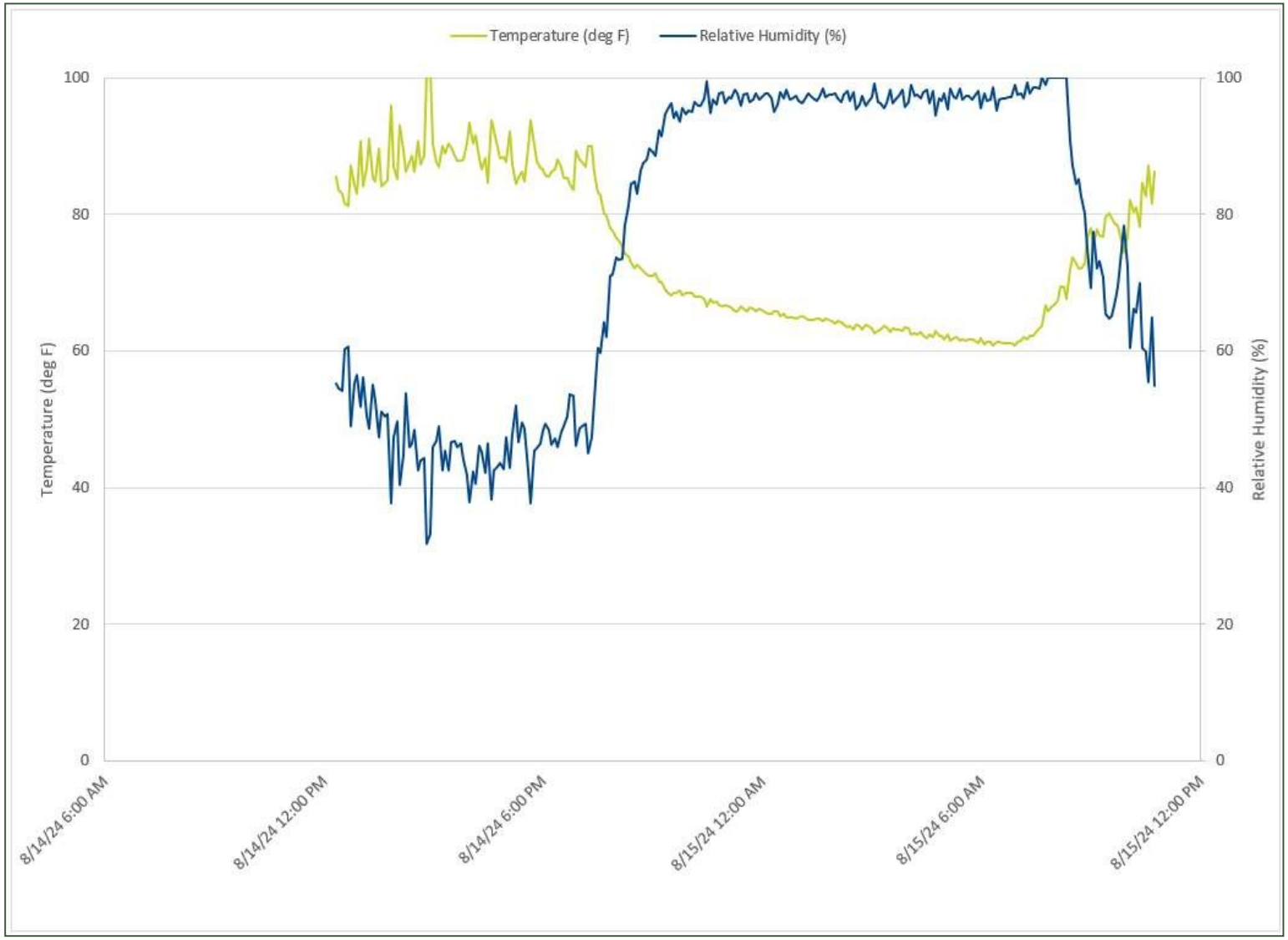

Figure 5: Weather Data (Wind Speed and Direction) – August 14 to August 15, 2024

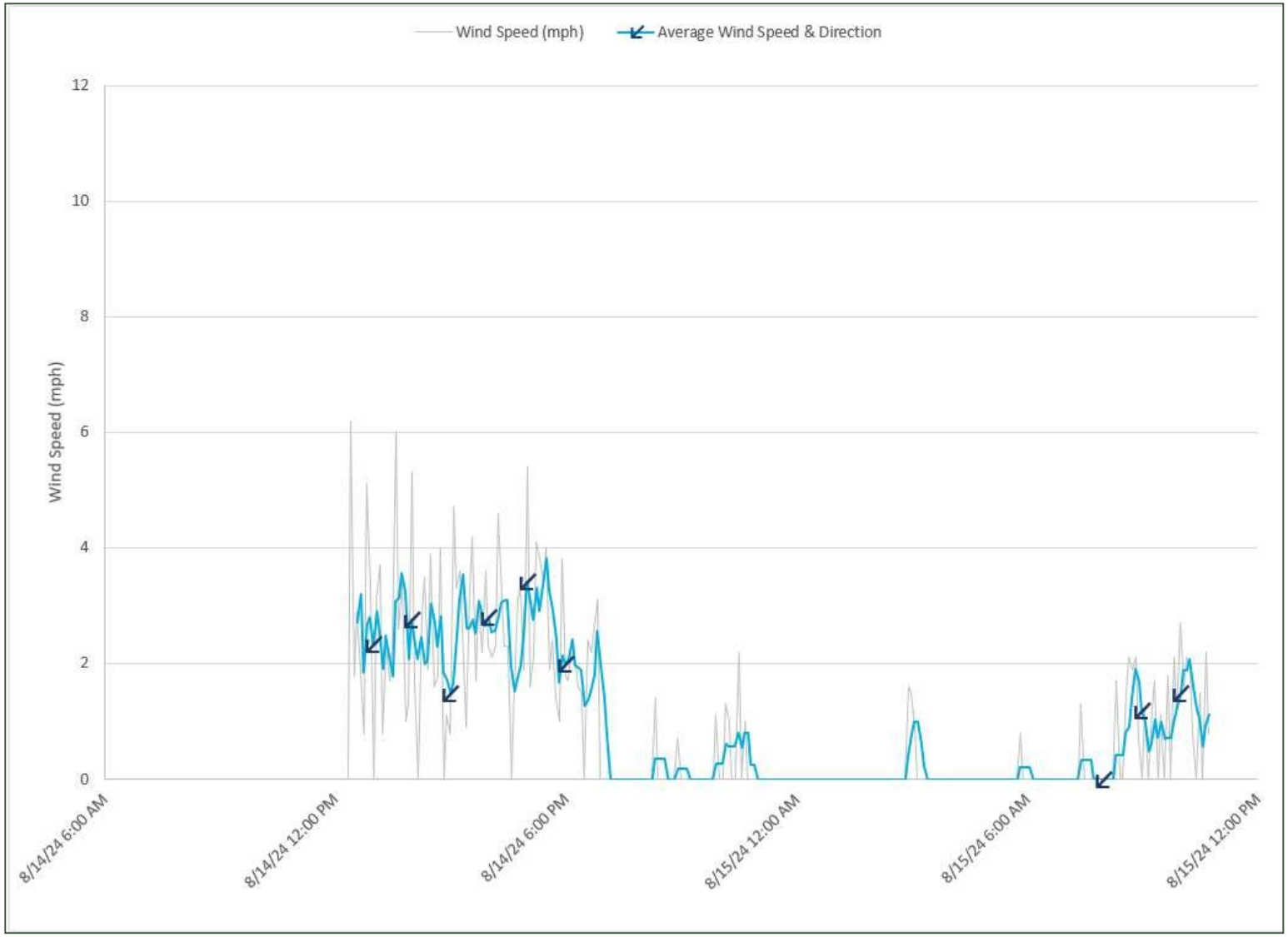

Figure 6: Predicted Unmitigated 48.6 dBA L_n Contour for MP 5.6 Railroad Crossing

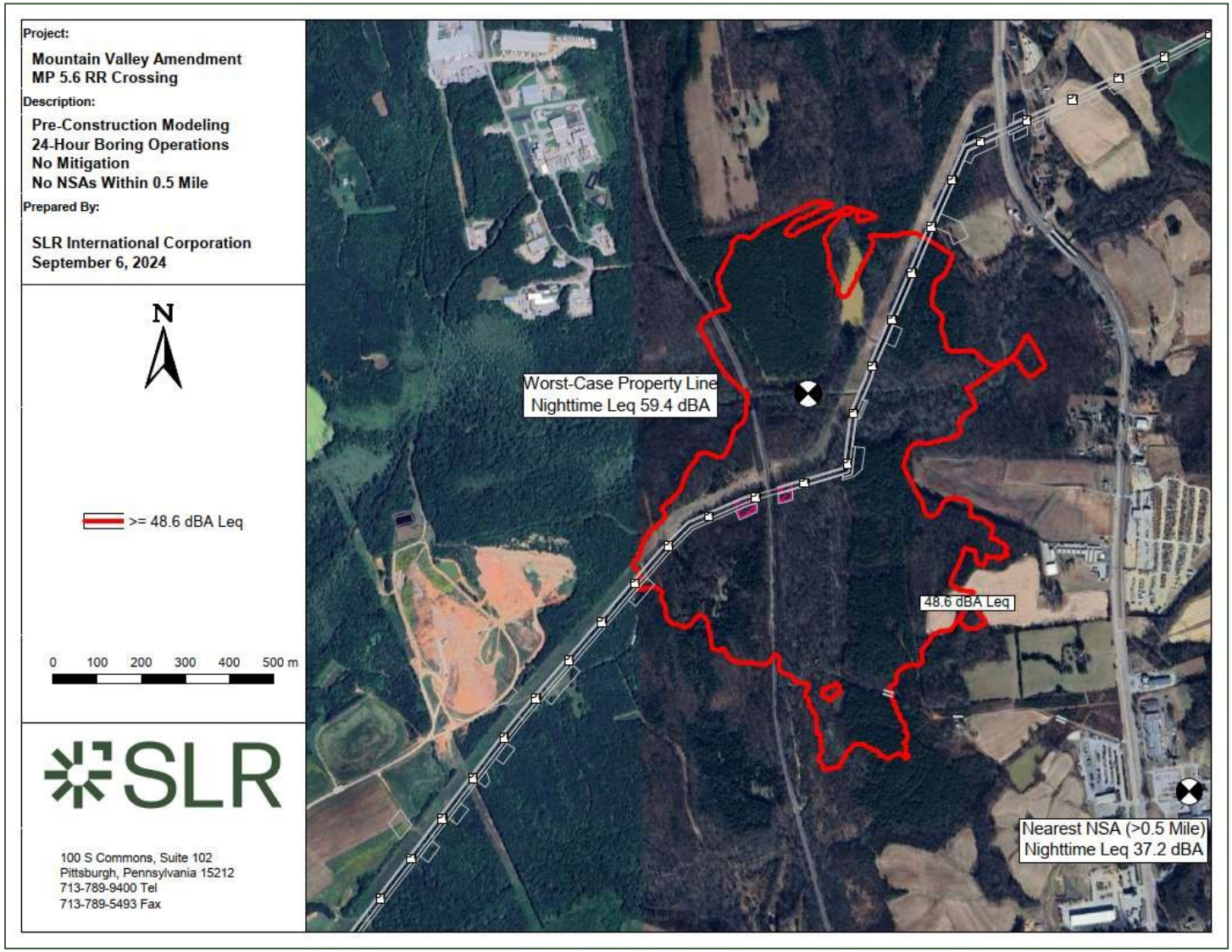

Figure 7: Predicted Unmitigated 48.6 dBA L_n Contour for MP 25.7 Railroad Crossing