BIOLOGICAL ASSESSMENT FOR THE MVP SOUTHGATE AMENDMENT PROJECT

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List of Abbreviations

Abbreviation	Term/Phrase/Name
2018 Guidelines	*Range-wide Indiana Bat Survey Guidelines*
2024 Guidelines	*Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines*
Amendment Project	MVP Southgate Amendment Project
Amendment Project Area	Amendment Project’s limit of disturbance
AMM	avoidance and minimization measures
ANSI	American National Standards Institute
ASA	Acoustical Society of America
ATWS	additional temporary workspace
BA	Biological Assessment
BMP	best management practice
Caltrans	California Department of Transportation
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
DAA	Draper Aden Associates
dB	decibel
dBA	A-weighted decibels
Duke Energy	Duke Energy Carolinas, LLC
E&SC	erosion and sediment control
EDGE	EDGE Engineering and Science, LLC
ESA	Endangered Species Act
ESI	Environmental Solutions & Innovations, Inc.
Fed. Reg.	Federal Register
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
Geosyntec	Geosyntec Consultants, Inc.
GIS	Geographic Information System
Guidelines	*Draft Freshwater Mussel Survey Guidelines for Virginia*
HDD	horizontal directional drill
HUC	Hydrologic Unit Code
IAQM	Institute of Air Quality Management

Abbreviation	Term/Phrase/Name
IPaC	Information for Planning and Conservation
ISEE	International Society of Explosives Engineers
ISO	International Organization for Standardization
LOD	limits of disturbance
Mainline Project	Mountain Valley Pipeline Project
Mountain Valley	Mountain Valley Pipeline, LLC
MP	milepost
MU	management unit
NA	Noise Area
n	sample size
NCDEQ	North Carolina Department of Environmental Quality
NCDOT	North Carolina Department of Transportation
NCNHP	North Carolina Natural Heritage Program
NCSU	North Carolina State University
NCWRC	North Carolina Wildlife Resources Commission
NHD	National Hydrography Dataset
NHDPlus	National Hydrography Dataset Plus
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Units
Original Certificated Project	MVP Southgate Project as authorized June 18, 2020
PBF	physical or biological feature
PCB	polychlorinated biphenyl
Planned Projects	future non-federal activities that are reasonably certain to occur in relevant proximity to the Amendment Project's Action Area
Procedures	*Wetland and Waterbody Construction and Mitigation Procedures*
PSNC	Public Service Company of North Carolina
RCNM	Roadway Construction Noise Model
ROW	right-of-way
RUSLE	Revised Universal Soil Loss Equation
RUSLE2	Revised Universal Soil Loss Equation Version 2
Sanders	Sanders Environmental, Inc.
SLR	SLR International Corporation
SPCC	Spill Prevention, Control, and Countermeasure

Abbreviation	Term/Phrase/Name
SSA	Species Status Assessment
SSC	suspended sediment concentration
Transco	Williams Company Transcontinental Gas Pipe Line Company, LLC
Transco Project	Transco Southeast Supply Enhancement Project
TSS	total suspended solids
U.S.	United States
USC	U.S. Code
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VADOE	Virginia Department of Energy
VDCR	Virginia Department of Conservation and Recreation
VDCR-DNH	Virginia Department of Conservation and Recreation's Division of Natural Heritage
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDOT	Virginia Department of Transportation
VDWR	Virginia Department of Wildlife Resources
WEST	Western Ecosystems Technology, Inc.
WNS	White-nose Syndrome

Executive Summary

The purpose of this Biological Assessment (BA) is to evaluate potential effects of Mountain Valley Pipeline, LLC's (Mountain Valley's), proposed MVP Southgate Amendment Project (Amendment Project) on species listed as threatened or endangered under the Endangered Species Act (ESA) and designated critical habitat.

The Amendment Project is a 31.3-mile, 30-inch-diameter natural gas pipeline between Pittsylvania County, Virginia, and Rockingham County, North Carolina, that will provide timely and affordable access to natural gas, which is in growing demand. The Amendment Project begins at the proposed Lambert Interconnect in Pittsylvania County, Virginia (milepost [MP] 0.0), extends to the proposed receipt interconnect point (LN 3600 Interconnect; MP 28.9) in Rockingham County, North Carolina, and ends at the proposed delivery interconnect points (Dan River Interconnect #1 and Dan River Interconnect #2; MP 31.3) in Rockingham County, North Carolina.

The Amendment Project crosses portions of the U.S. Fish and Wildlife Service (USFWS) Gloucester, Virginia, and Raleigh, North Carolina, field office service areas. Approximately 26.1 miles of the pipeline and 10.8 miles of access roads are sited within Virginia. Approximately 5.2 miles of the pipeline and 4.5 miles of access roads are sited within North Carolina.

This BA has been prepared on behalf of the Amendment Project proponent, Mountain Valley, and will be submitted to the Federal Energy Regulatory Commission in compliance with requirements of ESA Section 7. It evaluates potential effects of the Amendment Project on three species listed as threatened or endangered, including one mammal and two mussels. In particular, the BA evaluates potential effects to the northern long-eared bat (*Myotis septentrionalis*), Atlantic pigtoe (*Fusconaia masoni*), and James spinymussel (*Parvaspina collina*).[1] This BA also evaluates potential effects to designated critical habitat for Atlantic pigtoe.

<u>Potential Effects to Northern Long-eared Bats.</u>[2] The Amendment Project intersects the Current Range of the federally listed as endangered northern long-eared bat in Virginia. For purposes of evaluating the Amendment Project's potential to affect northern long-eared bats, Mountain Valley is relying on the best scientific and commercial information available, including data from USFWS and state agencies, habitat assessment surveys, and species surveys. [redacted] Mountain Valley will implement a variety of conservation measures, including seasonal tree clearing, to ensure that Amendment Project construction, operation, and maintenance will not adversely affect any northern long-eared bats. Thus, the Amendment Project May Affect – Is Not Likely to Adversely Affect the northern long-eared bat.

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[1] Although Roanoke logperch (*Percina rex*) was evaluated for the Original Certificated Project and was the subject of discussion and coordination between Mountain Valley, USFWS, and the state agencies in preparation for the forthcoming Section 7 consultation, Roanoke logperch is not analyzed in this BA due to USFWS's July 22, 2025 publication of its final decision to delist the Roanoke logperch as recovered under the ESA (USFWS 2025e). As stated in USFWS's notice regarding this final decision, the Roanoke logperch delisting will take effect August 21, 2025, at which time "Federal agencies will no longer be required to consult with us under section 7 of the Act in the event that activities they authorize, fund, or carry out may affect Roanoke logperch."

[2] Because the tricolored bat is only federally proposed to be listed as endangered, it will not be evaluated in this BA. As Mountain Valley has previewed to USFWS, it likely will address the tricolored bat separately in anticipation of a final listing decision in the future.

Potential Effects to Listed Freshwater Mussels and Critical Habitat.[3] The Amendment Project intersects the respective Current Ranges of the federally listed as threatened Atlantic pigtoe and the federally listed as endangered James spinymussel. For purposes of evaluating the Amendment Project's potential to affect listed mussels, Mountain Valley is relying on the best scientific and commercial information available, including data from USFWS and state agencies, habitat assessment surveys, species surveys, and a sedimentation analysis. [redacted] At USFWS's request, Mountain Valley completed mussel habitat suitability assessments and, where warranted, mussel surveys [redacted] did not recommend the Amendment Project conduct additional surveys in North Carolina.

Mountain Valley will avoid instream construction activities within all potential listed mussel streams by relying on trenchless crossing techniques. Together with implementing a variety of other conservation measures, this will avoid the potential for adverse effects to Atlantic pigtoe and James spinymussel individuals as well as the potential for adverse effects to Atlantic pigtoe critical habitat. Thus, the Amendment Project May Affect – Is Not Likely to Adversely Affect the Atlantic pigtoe and its critical habitat and May Affect – Is Not Likely to Adversely Affect the James spinymussel.

[3] Because the green floater (*Lasmigona subviridis*) is only federally proposed to be listed as threatened, it will not be evaluated in this BA. As Mountain Valley has previewed to USFWS, it likely will address the green floater separately in anticipation of a final listing decision in the future.

1. Introduction

On June 18, 2020, in Docket No. CP19-14-000, the Federal Energy Regulatory Commission (FERC) issued a Certificate of Public Convenience and Necessity (Certificate) 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 (Original Certificated Project).[4] A Final Environmental Impact Statement (FEIS) was issued by FERC on February 14, 2020.[5] The Original Certificated Project was placed on hold due to litigation-related delays with respect to the Mountain Valley Pipeline Project (Mainline Project). Construction of the Mainline Project subsequently was completed, and it was placed in service as of June 14, 2024. Mountain Valley is now seeking to amend the MVP Southgate Project (Amendment Project) by truncating the Original Certificated Project, incorporating certain route deviations, increasing the diameter of the pipeline, removing compression facilities, and modifying the proposed interconnects. As proposed, the Amendment Project is a 31.3-mile, 30-inch diameter natural gas pipeline between Pittsylvania County, Virginia, and Rockingham County, North Carolina (Figure 1-1). Mountain Valley filed its Amendment Application with FERC on February 3, 2025 (FERC Docket No. CP25-60-000). The purpose of this Biological Assessment (BA) is to evaluate potential effects of the proposed Amendment Project on species listed as threatened or endangered under the Endangered Species Act (ESA) to assist FERC and the U.S. Fish and Wildlife Service (USFWS) comply with their consultation obligations under Section 7 of the statute.[6]

The Amendment Project will provide additional firm natural gas transportation services via interconnections with the Mainline Project in southern Virginia and the interstate pipeline of East Tennessee Natural Gas Transmission, LLC, in North Carolina to two new delivery points in Rockingham County, North Carolina. The Amendment Project will provide timely, cost-effective access to new natural gas supplies to meet the growing needs of natural gas users in the southeastern United States, including for the Amendment Project's Foundation Shippers: Public Service Company of North Carolina, Inc. (d/b/a Enbridge Gas North Carolina; PSNC), a local natural gas distribution company serving customers in North Carolina (300,000 dekatherms per day), and Duke Energy Carolinas, LLC (Duke Energy), an electric utility in North Carolina (250,000 dekatherms per day).

[4] See FERC eLibrary Accession Number 20200618-3159.

[5] FERC. 2020. Southgate Project. Final Environmental Impact Statement. Mountain Valley Pipeline, LLC. FERC Docket No.: CP19-14-000. February 2020 (FERC eLibrary Accession Number 20200214-3010).

[6] Mountain Valley reserves all rights to amend, withdraw, or supplement the BA or any of its Attachments, and/or to object to, contest, or hold out as optional/unnecessary any permit, request, approval, opinion, certification, or assessment applied for, denied, or received pursuant to the BA or its Attachments, pursuant to any Presidential Executive Order or any governmental action taken as a result of or related to any Presidential Executive Order.

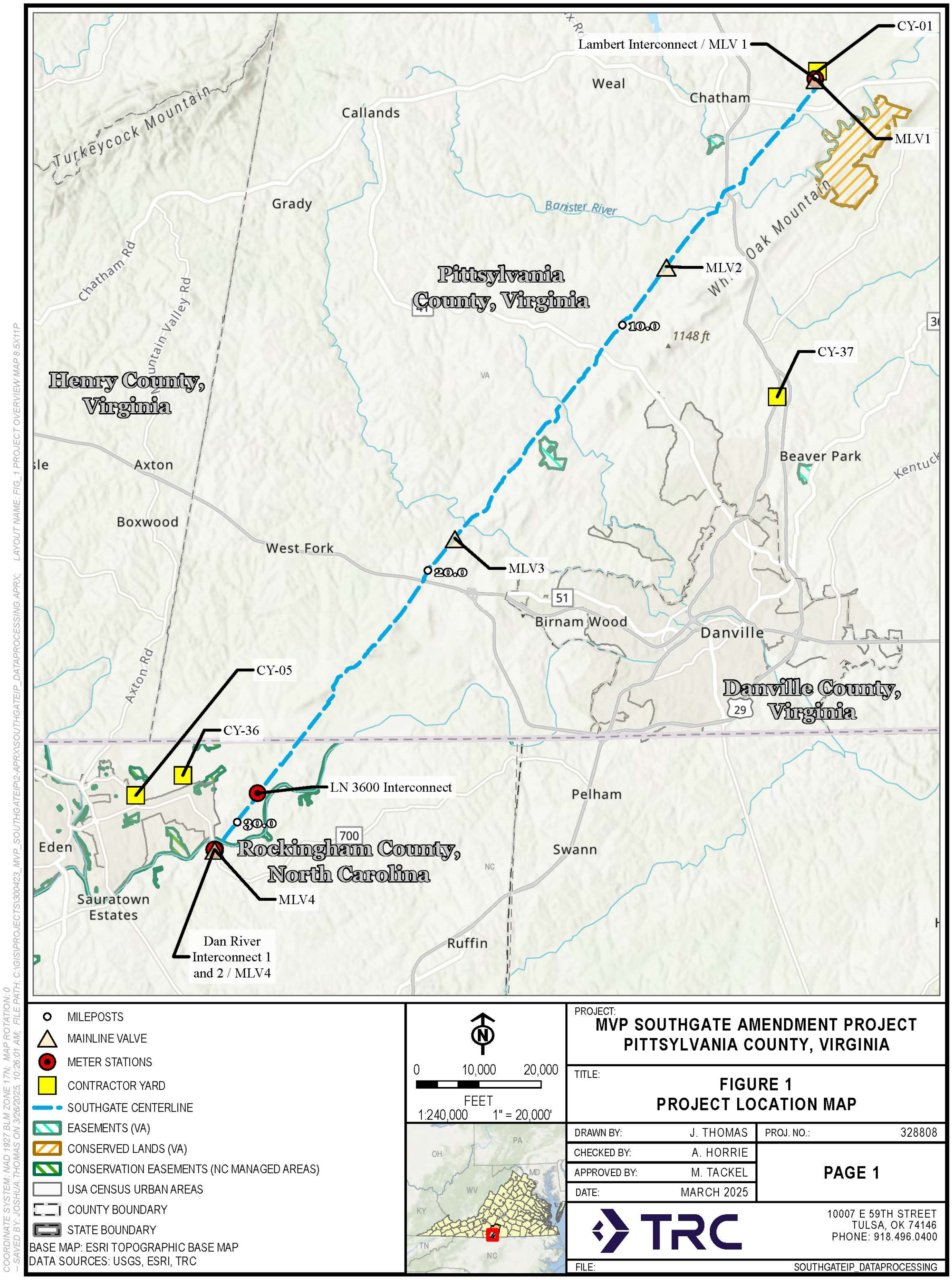

Figure 1-1: Amendment Project Location in Pittsylvania County, Virginia, and Rockingham County, North Carolina.

1.1. Regulatory Compliance

As described below, Mountain Valley is working with multiple entities to ensure compliance with state and federal environmental regulations. Efforts to address the following statutes have influenced the Amendment Project design as it relates to protected species:

- Section 7(c) of the Natural Gas Act (15 U.S. Code [USC] 717f(c))
- The National Environmental Policy Act (42 USC 4321-4347)
- The ESA (16 USC 1531-1544)
- Virginia Annotated Code Title 29.1 Chapter 5, Article 6: Endangered Animal Species
- North Carolina State Endangered Species Act (General Statutes 113-331 to 113-337)

Mountain Valley is also complying with additional state and local laws and regulations as required for the construction, operation, and maintenance of the Amendment Project.

1.2. Consultation History

On July 25, 2024, Mountain Valley submitted letters describing the Amendment Project to the North Carolina Wildlife Resources Commission (NCWRC) and the Virginia Department of Wildlife Resources (VDWR). On October 3, 2024, Mountain Valley held a videoconference call with the USFWS Virginia Field Office to describe the Amendment Project to the field office. Mountain Valley then sent letters requesting information and species data to USFWS on October 18, 2024. Additional teleconferences, including with the USFWS Raleigh Field Office, were conducted on November 21, 2024, January 29, 2025, May 14, 2025, June 27, 2025, and July 16, 2025. The purpose of the calls was to discuss the results of the Information for Planning and Consultation (IPaC) request and data request responses, analytical approaches, survey plans and results, the proposed components of this BA, and supporting studies, including the sedimentation analysis and the modeling on which it relies.

USFWS indicated the Amendment Project intersects the Current Range[7] of the federally endangered northern long-eared bat (*Myotis septentrionalis*) within Virginia and confirmed that the Amendment Project does not intersect the Current Range of any other federally listed bat species. [redacted]

[redacted]

Mountain Valley also requested natural heritage data from the North Carolina Natural Heritage Program (NCNHP) on August 8, 2024, and from the Virginia Department of Conservation and Recreation's Division of Natural Heritage (VDCR-DNH) on August 8, 2024. [redacted]

[7] Current Range is the geographic area where a species is currently known or suspected to occur.

[redacted]

[redacted]

1.3. Species Analyzed

Based on guidance from USFWS, as well as the best available information about possible listed species and/or critical habitat occurrence within the Amendment Project's Action Area (discussed in Section 4), this BA evaluates the following:

- Northern long-eared bat;
- Atlantic pigtoe (*Fusconaia masoni*) and designated critical habitat; and
- James spinymussel (*Parvaspina collina*).

1.4. Species Studies, Assessments, and Surveys Relevant to or Completed in Support of the Amendment Project

Qualified biologists completed species-specific studies, assessments, and surveys for federally listed species for the Original Certificated Project based on coordination with USFWS in 2018. The results of those efforts are summarized below with a focus on those that are relevant to the Amendment Project and its Action Area.

In addition, for purposes of the Amendment Project, USFWS recommended that Mountain Valley complete updated habitat assessments and species surveys or identify recent third-party assessments and surveys that are applicable to the Amendment Project's Action Area. As further described below, Mountain Valley has done both.

1.4.1. Bat Surveys for the Original Certificated Project

1.4.1.1. Summary

[redacted]

1.4.1.1.1. Mist-net Surveys[8]

[redacted]

[8] USFWS's survey guidance indicates that survey results typically are considered valid for a period of five years. Although the mist-net surveys for the Original Certificated Project were completed in 2018, the results of these surveys are summarized in this BA as relevant—though not conclusive—data.

[redacted]

[redacted]

1.4.1.1.2. Habitat Suitability Assessments

[redacted]

[redacted]

[redacted]

1.4.1.1.3. Portal Searches

[redacted]

[9] A net night is defined as a single mist-net set actively monitored for a minimum of five consecutive hours.

[redacted]

1.4.2. Current Bat Surveys Relevant to the Amendment Project

In its February 7, 2025, letter, USFWS recommended that, in lieu of assuming presence of northern long-eared bats for the Virginia portion of the Amendment Project, Mountain Valley could either complete additional surveys to update those completed in 2018 for the Original Certificated Project or identify recent third-party bat surveys with a scope sufficient to cover the Amendment Project Area. Mountain Valley has done both.

1.4.2.1. Mist-net Surveys

Consistent with USFWS's February 7, 2025, letter, [redacted]

1.4.2.2. Culvert, Bridge, and Structure Assessments

[redacted]

[redacted]

1.4.3. Williams Transco Project Surveys and Assessments

Consistent with USFWS's February 7, 2025, letter, [redacted]

1.4.3.1. Mist-net Surveys

[redacted]

1.4.3.2. Acoustic Surveys

[redacted]

1.4.3.3. Portal Searches

[redacted]

[redacted]

1.4.3.4. Culvert Surveys

[redacted]

1.4.3.5. Building and Structure Assessments

[redacted]

1.4.4. Bat Survey Conclusions

Because Mountain Valley's bat surveys for the Original Certificated Project were completed more than five years ago, USFWS recommended that Mountain Valley either (1) conduct additional bat presence/probable absence surveys in Virginia, (2) identify more recent bat surveys or other information that could apply to the Amendment Project's terrestrial Action Area, or (3) assume presence of northern long-eared bats in Virginia if Mountain Valley was unable to use one of the other two options (USFWS 2025b). Mountain Valley chose to conduct additional bat presence/probable absence surveys [redacted] Additionally, Mountain Valley identified [redacted]

1.4.5. Freshwater Mussel Surveys

The Amendment Project route traverses several perennial streams in Virginia and North Carolina that have areas of known occurrence of federally protected freshwater mussel species: James spinymussel and Atlantic pigtoe.

In Virginia, [redacted] The results of those updated efforts in Virginia [redacted]

In North Carolina, [redacted] However, to ensure this BA contains the best available scientific information, [redacted]

1.4.5.1. Virginia

For purposes of analyzing potential effects of the Original Certificated Project in Virginia, Virginia Department of Game and Inland Fisheries (VDGIF)[10] recommended [redacted] Mussel surveys followed USFWS and VDGIF Draft Freshwater Mussel Survey Guidelines for Virginia (Guidelines; VDGIF 2018) [redacted]

[redacted]

To supplement [redacted] As a result, on behalf of Mountain Valley, EDGE Engineering and Science, LLC (EDGE) assessed habitat suitability in [redacted] Four of the assessment areas [redacted]

[10] Virginia's Department of Game and Inland Fisheries became the Virginia Department of Wildlife Resources (VDWR), effective July 1, 2020. Previous coordination with VDGIF referenced in this BA, therefore, refers to coordination that occurred prior to 2020.

[redacted] EDGE, therefore, completed formal mussel surveys in the [redacted] The results of those surveys are as follows.

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

1.4.5.2. North Carolina

At the recommendation of NCWRC [redacted], Mountain Valley completed mussel surveys in [redacted] The Amendment Project does not occur [redacted]

[redacted]

[redacted]

Additionally in [redacted] The wetted width throughout the site averaged 68 meters. The [redacted] morphology is primarily composed of run habitat with a riffle [redacted]. Water depths averaged 1.9 meters with a max depth of 3 meters [redacted] along an outside bend. Velocities [redacted] averaged 61.3 centimeters per second with a maximum of 103.5 centimeters per second at [redacted]. Substrate composition in the [redacted] was dominated by sand (77.7 percent) with intermittent bedrock (8.1 percent) in the outside river bends and cobble (7.0 percent) in [redacted] Overall, [redacted]

[redacted]

[redacted] a mussel survey was completed in [redacted] Cumulatively, 20 hours of search effort were expended searching [redacted]

Additionally, during project-specific [redacted] completed within [redacted] was incidentally observed near [redacted] The live individual was photographed, georeferenced, and returned to the substrate at the point of discovery. [redacted] The finding was reported to [redacted] via email [redacted]

For purposes of the Amendment Project, as noted above, [redacted]

1.4.6. Comprehensive Environmental Baseline Evaluation

Mountain Valley's consultants performed a comprehensive review of the Amendment Project's terrestrial and aquatic Action Area to identify and characterize the activities and stressors that may contribute to the environmental baseline condition for each species and any designated critical habitat. This assessment was guided by USFWS's long-standing definition of "environmental baseline" as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action" (50 Code of Federal Regulations [CFR] § 402.02). This includes the past and present impacts of all federal, state, or private actions and other human activities, as well as natural factors, leading to the condition of each species, its local ecosystem, and its habitat. As discussed in greater detail below, to ensure that USFWS has all relevant information for its environmental baseline analyses, this BA identifies known stressors to each species and its environment as well as the past and present activities and natural factors that can cause or contribute to those stressors and therefore influence the condition of each species and its habitat in the Amendment Project's Action Area. It is important to recognize that Mountain Valley used a conservative approach for this review and analysis, including the components described below. Identification of stressors and activities for any particular location and summaries of stream assessments do not imply that a land area or stream is occupied by the subject species or that the location is within the Amendment Project's Action Area unless otherwise stated. The following briefly summarizes the key components of this baseline evaluation, and the results are incorporated into the analysis for each species presented in Section 5 of this BA.

1.4.6.1. Baseline Stream Assessments

Mountain Valley's consultants completed comprehensive assessments to help USFWS determine the Amendment Project's aquatic Action Area baseline conditions [redacted] In total, these assessments covered 48.7 stream kilometers of aquatic Action Area, including 46.2 stream kilometers in Virginia and 2.5 stream kilometers in North Carolina. The assessments included field evaluations of all publicly accessible areas in or near each stream, supplemented by drone surveys and aerial imagery reviews of any areas not publicly accessible. Information was amassed for the streams to aid in a larger overall understanding of external, existing, and contributing natural and third-party stressors and operations adjacent to the aquatic Action Area, including but not limited to mining, agriculture, timber management, urbanization, and commercial activities, developments, and facilities. Additional information related to existing natural and anthropogenic influences and water quality issues or impairments were also compiled to help inform a baseline stream characterization of each waterbody.

[redacted]

[redacted]

[redacted]

1.4.7. Species-Specific Climate Change Analyses

Mountain Valley compiled and summarized the best available science and information regarding current and anticipated future effects of climate change on each species within the Amendment Project Action Area. Due to the largely predictive nature of analyzing climate change effects, and because certain data may not yet exist, the climate change analyses recognize current scientific uncertainty but rely on the best available science and information to account for any reasonable climate change-related impacts. These analyses are presented for each species in Section 4 of this BA.

1.4.8. Comprehensive Cumulative Effects Survey

Mountain Valley's consultants submitted public records requests for permitting information and other data to non-federal agencies and other entities with jurisdiction over any portion of the terrestrial and aquatic Action Area and adjacent locations to identify any planned non-federal activities that could cause effects within the Amendment Project's Action Area. Permitting information and other data were requested from numerous local, regional, and state entities, [redacted] located in Pittsylvania County, Virginia, and Rockingham County, North Carolina. This information was then analyzed to determine if any future non-federal projects or other activities are planned to occur within or in relevant proximity to the Amendment Project's Action Area.

The results of this work are summarized in the relevant part in Section 6 of this BA.

1.5. Sediment Discharge and Turbidity

1.5.1. Sediment Loading Modeling Efforts

At the request of FERC and USFWS, Mountain Valley completed enhanced modeling to better understand the realistic potential effects of Amendment Project-related sediment on listed species. [redacted]

[redacted]

[redacted]

1.6. Listing, Recovery, and Critical Habitat Information

This BA provides information on the threats warranting the protection of species under the ESA (listing factors), the status of recovery efforts at reducing those threats, and information associated with designated critical habitat. This information is provided for the following species:

- Northern long-eared bat (Section 4.1)
- Atlantic pigtoe (Section 4.2)
- James spinymussel (Section 4.3)

1.6.1. Listing Factors

Additional information is provided for each species regarding the threats that USFWS identified for the species in its listing decision. At the time of listing, USFWS assessed the best scientific and commercial information available regarding past, present, and future threats to the species to complete the ESA's 5-factor analysis: present or threatened destruction, modification, or curtailment of its habitat or range; overutilization of the species for commercial, recreational, scientific, or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. This BA includes available information on the listing factors relative to current conditions.

1.6.2. Recovery Status

This BA includes relevant and current information on the progress of recovery efforts for each species. It summarizes recovery plan content (where available); describes recovery goals, objectives, and criteria; and identifies specific recovery actions that have been taken. This information helps provide a measure of success toward recovery. As appropriate, information from 5-Year Reviews and Species Status Assessments (SSA) has been included along with species recovery potential.

1.6.3. Critical Habitat

As relevant and appropriate, this BA includes information on critical habitat for listed species where it has been designated. As defined, critical habitat consists of:

- Specific areas within the geographical area occupied by the species at the time of listing that contain physical or biological features (PBFs) essential to the conservation of the species and that may require special management considerations or protection; and
- Specific areas outside the geographical area occupied by the species at the time of listing if the agency determines that such areas are essential to the conservation of the species.

This BA also addresses where the Action Area is located relative to designated critical habitat and appropriate physical and biological features.

1.7. Purpose of the Biological Assessment

The purpose of this BA is to evaluate potential effects to federally listed species and designated critical habitat associated with the development of the Amendment Project in Pittsylvania County, Virginia, and

Rockingham County, North Carolina. This BA has been prepared and submitted in compliance with standards and requirements of Section 7 of the ESA (16 USC 1536[c]) and its implementing regulations (50 CFR 402.12[f] and 402.14[c]) and in conjunction with requests for authorization from FERC to construct and operate the proposed pipeline under Section 7(c) of the Natural Gas Act and for other federal authorizations.

2. Proposed Action

2.1. Project Purpose and Location

The purpose of the Amendment Project is to transport natural gas from an interconnection point with the Mainline Project in southern Virginia to an interconnection point with the East Tennessee Natural Gas Transmission, LLC, system in North Carolina, and then to two new delivery points in Rockingham County, North Carolina, to meet the specific requests for natural gas transportation service of Foundation Shippers, PSNC and Duke Energy. The Amendment Project will enhance the diversity of gas supply and create additional pipeline capacity in the region.

The Amendment Project is expected to be fully in service by mid-2028. The Amendment Project is a separate project from the Mainline Project that began operation on June 14, 2024.

The proposed Amendment Project is a pipeline approximately 31.3 miles in length and 30 inches in diameter that will provide timely and affordable access to natural gas, which is in growing demand. The Amendment Project begins at the proposed Lambert Interconnect in Pittsylvania County, Virginia, and extends to the proposed delivery interconnect (Dan River Interconnect #1 and Dan River Interconnect #2) in Rockingham County, North Carolina (Figure 1-1). MPs and length (miles) of the Amendment Project in each county crossed are summarized in Table 2-1.

The Amendment Project Area consists of the temporary and permanent ROW established for the construction, operation, and maintenance of the pipeline, access roads, and aboveground facilities. The pipeline will require a 100-foot construction ROW and a 50-foot permanent, operational ROW. Mountain Valley will generally neck down to a 75-foot construction ROW at waterbodies and wetlands. Land required for the Amendment Project is summarized in Tables 2-2 and 2-3, below.

Tree clearing proposed for the Amendment Project is 242.7 acres. This total includes the acreage of known tree clearing identified as necessary.

Table 2-1: Length of Proposed Pipeline by County.

County, State	Milepost Range	Length (miles)
Pittsylvania, Virginia	0.0–26.8	26.8
Rockingham, North Carolina	26.8–31.3	4.5
Total		**31.3**

Table 2-2: Land Requirements for the Pipeline Facilities Associated with the Amendment Project.

Facility	Land Required for Construction (acres)	Land Required for Operation (acres)
H-650 Pipeline	355.77[1]	190.99[2]
Additional Temporary Workspace	134.63	0
Cathodic Protection[3]	1.15	1.15
Contractor Yards	43.07	0
Access Roads[4]	46.26	3.09
Amendment Project Total[5]	**580.87**	**195.23**

1. Based on a 100-foot-wide right-of-way (ROW), which includes the 50-foot-wide permanent ROW (which has been reduced to 3 feet in between trenchless crossing entry and exits), temporary workspace, and aboveground facility workspace.
2. Based on a 50-foot-wide permanent ROW.
3. The cathodic protection groundbeds are located within the limits of the pipeline permanent ROW; however, the acreages associated with those facilities were subtracted from the ROW acreage (i.e., cathodic protection groundbeds are listed as a separate line item within the table) and are therefore not double-counted within the total Amendment Project impacts.
4. Acreage based on a 25-foot-wide road width for temporary and permanent access roads.
5. Sums may not equal the total of addends due to rounding.

Table 2-3: Land Requirements for the Amendment Project Aboveground Facilities.

Facility Name	Approximate Milepost	Land Required for Construction (acres)	Land Required for Operation (acres)
Meter Stations			
Lambert Interconnect/MLV 1[1]	0.0	0.72	0.72
LN 3600 Interconnect	28.9	0.28	0.28
Dan River Interconnect #1/MLV 4[1]	31.3	0.68	0.68
Dan River Interconnect #2	31.3	0.47	0.47
Mainline Valves[2]			
MLVs 2 and 3	Various	0.04	0.04
Total[3]	---	**2.19**	**2.19**

Note: Impact calculations do not include associated facility access roads.

1. Pig launcher/receiver will be within the aboveground facility sites (i.e., the Lambert Interconnect and Dan River Interconnect #1); therefore, acreage calculations for the pig launcher and receiver are included with those facilities.
2. Mainline valves (MLVs) contained within the fence line of a proposed meter station (MLV 1 at the Lambert Interconnect and MLV 4 at the Dan River Interconnect #1) will not require any additional land disturbance. MLVs 2 and 3 are within the pipeline permanent ROW; however, the acreages associated with those facilities have been excluded from the ROW acreage (i.e., MLV sites are not double counted within the total Amendment Project impacts).
3. Sums may not equal the total of addends due to rounding.

2.2. Construction Timeline

The Amendment Project schedule is dependent upon obtaining all necessary authorizations, which will then dictate when Amendment Project activities can begin. Mountain Valley will begin tree-clearing activities as soon as allowed, subject to its tree clearing avoidance and minimization measures (AMMs). In general, construction activities will occur six days per week from 7:00 a.m. to 7:00 p.m. or daylight hours, except where the pipeline would be installed using horizontal directional drill (HDD) and conventional bore methods, which require around-the-clock operations and typically will last a few days to a few weeks. In spring, summer, and fall, when sunset occurs later in the evening, construction activities may continue after 7:00 p.m. but will be limited to daylight hours.

Restoration will begin immediately following pipeline installation throughout the construction process and continue until vegetation is successfully established.

2.3. Life of the Project

The Amendment Project currently has no plans for either future expansion or abandonment of the facilities. Market forces will determine the timing and need of any expansions that may be warranted in the future.

2.3.1. Route Selection

Several criteria were used to select the proposed pipeline route, including the following:

- Avoiding or minimizing potential impacts to sensitive biological and cultural resources, protected lands, wetlands and waterbodies, floodplains, sensitive soils, mineral resources, environmental hazards (e.g., hazardous landfills), and geologic/topographic hazards to the extent possible;
- Avoiding, when possible, residential or high-density population areas;
- Existing ROWs available for co-location; avoiding or minimizing impacts to existing transportation features and utility crossings; land uses (i.e., both existing and potential future); potential impacts (i.e., both positive and negative) to local communities and landowners (e.g., increase tax revenue, short-term disruptions due to construction activities); and
- Engineering, construction, and cost feasibility (e.g., including route length, topography implications, side slopes, and trenchless crossing location[s]).

2.4. Facilities and Infrastructure

This section provides an overview of the typical and specialized construction methods that will be implemented on the Amendment Project.

2.4.1. Pipeline Construction

As proposed, the pipeline will be constructed of high-strength carbon steel pipe and manufactured in accordance with the American Petroleum Institute's Specification for Line Pipe (API 5L PSL2). The pipe will be protected from corrosion by a fusion-bonded epoxy coating and an impressed current cathodic protection system during operations.

Construction of the pipeline and associated facilities will occur within one construction season and will be undertaken in at least one construction spread using a combination of conventional open-cut and trenchless crossing methods at aquatic and sensitive resource areas. A pipeline construction spread operates as a moving assembly line performing specialized procedures in an efficient, planned sequence. Elements of a construction spread vary depending on the selected contractor and execution plan.

Portions of the Amendment Project primarily in upland terrain will employ conventional overland construction techniques for large-diameter pipelines. In the typical pipeline construction scenario the construction contractor will construct the pipeline along the ROW within the spread using sequential construction techniques, including survey, staking, and fence crossing; clearing and grading; trenching; pipe stringing, bending, and welding; lowering-in and backfilling; hydrostatic testing; clean-up and restoration; and commissioning.

2.4.1.1. Surveying and Staking

The initial step in preparing the ROW for construction is the civil survey. Engineers and land survey crews will stake the outside limits of the construction ROW, the centerline of the proposed trench, additional temporary workspaces (ATWSs), and other approved work areas. Approved access roads will be marked using temporary signs or flagging, as well as the limits of approved disturbance on any access road requiring widening. Any identified environmentally sensitive areas (e.g., waterbodies and wetlands, special-status species habitat, and historic properties) will be fenced off to constrict the construction ROW as necessary to avoid these features. The "One Call" system of each state will be contacted, and underground utilities (e.g., cables, conduits, and pipelines) will be located and flagged. Affected landowners will be notified prior to surveying and staking of the proposed route, following applicable state/federal guidelines.

2.4.1.2. Clearing and Grading

After the ROW has been surveyed and easements secured, a combination of heavy equipment and sawyers will be used to clear the ROW of any obstructions (e.g., trees and stumps, brush, logs, and large rocks). Ground cover may remain until grading is required. All merchantable timber will be cut into lengths and stacked off the edge of the ROW. Timber ranging from four to eight inches in diameter at the butt end, suitable for fence posts or other uses, will be cut into usable lengths. If the landowner does not wish to use timber products or any other tree material, it will be windrowed, no taller than 4 feet, with wildlife breaks/openings every 200 feet.

Brush and slash will be handled according to local permitting and landowner requests. [redacted] Open burning of brush will be conducted on a site-specific basis, in accordance with applicable state and local regulations. Except in [redacted] the chipped brush will be blown on the ROW only or as allowed by the appropriate regulatory agencies.

Once the ROW is cleared of timber and brush, rough grading will be conducted as necessary using bulldozers and backhoes to allow for a reasonably level work surface, the passage of equipment, and the preparation of a work area for pipeline installation activities. Displaced soils will be stockpiled along the construction ROW to minimize the need and potential impact of additional haul vehicles. In residential and agricultural areas, at minimum, the top 12 inches of topsoil will be segregated from subsoil. The entire topsoil layer will be segregated in soils with less than 12 inches of topsoil.

The FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (2013) and the Amendment Project E&SC Plans will be implemented along the construction ROW. Temporary erosion controls (e.g., mulching, silt fences, compost filter socks) will be installed prior to soil disturbance and will be maintained throughout the construction phases of the Amendment Project until permanent erosion controls (e.g., waterbars, slope breakers) are installed or restoration is completed. Environmental Inspectors will be present at each construction spread and will aid in determining if erosion controls are properly installed and maintained or if additional measures are necessary.

2.4.1.3. Trenching

To bury the pipeline underground, it will be necessary to excavate a trench by removing all soil and bedrock using a track-mounted excavator/backhoe or similar equipment. Excavated soils will be stockpiled along the ROW on the side of the trench opposite construction traffic (commonly referred to as the "spoil side"). As previously discussed, subsoil will not be allowed to mix with stockpiled topsoil. Where the route is co-located adjacent to existing infrastructure, the spoil generally will be placed on the same side of the trench as the existing infrastructure. Bedrock will be fractured prior to excavation using tractor-mounted mechanical rippers or rock trenchers. Explosives will be used only when necessary, in areas where rock substrates are found at depths that interfere with conventional excavation or rock-trenching methods. The amount of blasting will be minimized to the extent practical but may be required in areas of shallow bedrock. Blasting is more fully discussed in Section 2.4.2.4.

The trench will generally be excavated to a width at least 12 inches greater than the diameter of the pipeline. It will typically be excavated to a depth of approximately six feet to allow for at least three feet of soil cover between the top of the pipe and the final land surface after backfilling, in accordance with U.S. Department of Transportation (USDOT) standards at 49 CFR 192.327. In certain situations where consolidated rock is encountered, trench depth may be reduced to approximately 4.5 feet to provide the minimum required cover of 1.5 feet in Class 1 locations, as permitted by the same regulation.

Where necessary to install the pipeline below the potential scour depth of a waterbody, the pipeline will be buried deeper than the USDOT minimum standard to prevent potential exposure. At railroad crossings, uncased pipeline will be installed with a minimum cover of 10.0 feet, while cased pipe will have at least 5.5 feet of cover.

Trench width can vary significantly depending on trench depth, soil conditions, and site-specific safety requirements. In areas with unstable or loose soils, the trench sides may need to be sloped or benched for stability, potentially resulting in a top-of-trench width of 21.5 feet or more. In contrast, where consolidated rock is present, the top-of-trench width may be as narrow as 3.5 feet.

2.4.1.4. Pipe Stringing, Bending, Welding, and Coating

Steel pipe will be procured in nominal double random and/or triple random lengths (also referred to as "joints") typically between 40 and 60 feet long and protected with a fusion-bonded epoxy coating applied at the factory or a coating yard. The coating inhibits corrosion by preventing moisture from coming into direct contact with the steel. These joints will be shipped to pre-determined and strategically located materials storage areas. The individual joints will be transported to the ROW by truck and placed along the excavated trench in a single, continuous line, making them easily accessible to the construction personnel on the working side of the trench. This allows subsequent lineup and welding operations to proceed efficiently. At stream crossings, the amount of pipe required to span the stream will be stockpiled in the ATWS on one or both sides of the stream.

The pipe will be delivered to the job site in straight joints. The use of field-controlled internal diameter fittings, in addition to the bending of pipe, will be required to allow the pipeline to follow natural grade changes and directional changes of the ROW. Prior to welding, selected joints will be bent in the field by track-mounted hydraulic bending machines. After pipes are bent, they will be aligned, welded together into a long segment by qualified welders, and placed on temporary supports at the edge of the excavated trench. All welds will be inspected to determine quality using radiographic or other approved methods. Radiographic examination is a non-destructive method of inspecting the inner structure of welds and determining the presence of defects. Defective welds not meeting regulatory standards will be repaired or removed.

The bare pipe around approved welds will be thoroughly cleaned with a power wire brush or sandblasting machine to remove dirt, mill scale, and debris before a coating crew recoats the weld and the area around it. After the coat has dried, the pipeline will be inspected electronically for faults or voids in the coating and visually inspected for scratches or other defects. Any detected damage will be repaired before the assembled pipe is lowered into the trench.

2.4.1.5. Lowering-in and Backfilling

Prior to lowering the pipeline, the bottom and sides of the trench will be checked for sharp rocks that could damage the pipe and/or its coating during installation. Any questionable rocks will be removed prior to trench installation. In rocky areas where the bottom of the trench is not smooth, a layer of soil or sand may be placed on the bottom to protect the pipe by using a padding machine or excavator with a “shaker bucket,” which will separate rocks from satisfactory padding materials. Concrete-coated pipe or aggregate-filled sacks will be used if required for negative buoyancy in areas of saturated soils. Excess water from the trench line may need to be removed during periods of heavy precipitation or due to a high water table. Dewatering activities will be performed in well-vegetated upland areas and in a manner that does not cause erosion or discharge directly to streams or wetlands.

The completed section of pipe will be lifted off the temporary supports and lowered into the trench by side-boom tractors or similar equipment. After the pipe is lowered into the trench, the trench will be backfilled. Previously excavated materials will be pushed back into the trench using backhoes or similar equipment. In areas where excavated material contains large rocks or other material that could cause damage to the pipe or coating, clean fill will be used instead. Clean fill will include limestone dust or sand, which is typically basic and will often aid in the cathodic protection of the pipeline. Fly ash will not be used due to concerns about the acidity of this material and the potential impacts on cathodic protection.

Clean fill free of rocks will be used in the first 12 inches above the top of the pipe. The remainder of the trench will be filled using an aggregate of material removed during the time of excavation. Topsoil will be segregated and will be placed after backfilling the trench above the subsoil. In agricultural land, grassland, or open land, a small crown may be left to account for any future settling of the soil that may occur following backfilling of the trench. In wetlands, a crown will not be left in order to restore the hydrology to pre-construction conditions. Excess soils will be distributed evenly on upland areas of the ROW, while maintaining preexisting contours.

2.4.1.6. Hydrostatic Testing and Final Tie-In

Following the backfilling of the trench, the pipeline will be hydrostatically tested to ensure it is capable of safe operation at the designated pressure. Hydrostatic testing involves filling the pipeline with water to a designated test pressure and maintaining that pressure for approximately eight hours (Table 2-4).

Table 2-4: Hydrostatic Test Water Sources and Discharge Locations for the Amendment Project

Proposed Hydrostatic Test Water Use Summary											
Anticipated Construction Year	Test Segment	Beginning MP[2]	Ending MP[2]	Length of Section (feet)	Required Water (gallons)	Proposed Water Source			Proposed Test Water Discharge Location[1]		
						MP[2]	Water Source	Watershed	MP[2]	Watershed	Volume
2026 (Test 2027)	1	[redacted]	[redacted]	[redacted]	3,300,000	[redacted]	[redacted] (primary)/ Municipal (secondary)	[redacted]	[redacted]	[redacted]	3,300,000
	2	[redacted]	[redacted]	[redacted]	2,600,000						
Hydrostatic Test Water Total					**3,300,000[3]**						

1. Test water will be filtered through a dewatering structure in a well-vegetated upland area; released at a low flow rate; and monitored to prevent flooding/erosion.
2. Milepost (MP) is approximate.
3. The total volume of water used for hydrostatic testing is proposed to be approximately 3,300,000 gallons. The construction spread would be broken down into smaller test sections and would transfer test water from one test section to the next to reduce the total amount of water needed for testing.

Mountain Valley anticipates using a total of 3.3 million gallons of water for hydrostatic test water. [redacted] Baseline water samples will be taken at the withdrawal source prior to release. Mountain Valley will store the test water in tanks prior to pumping it into the pipe. To reduce the total amount of water needed for testing, Mountain Valley intends to transfer test water from one test section to the next. After hydrostatic testing is complete, Mountain Valley plans to release the water into well-vegetated upland locations using energy-dissipating devices.

[redacted] Mountain Valley has incorporated into the proposed water withdrawal process a suite of conservation measures (Section 2.5).

The hydrostatic test water will contact only new or cleaned and certified PCB-free pipe. If chemical methods are used to clean pipes, chemical-laden water would be collected and disposed of at an approved waste facility. Mountain Valley will adhere with the sampling and monitoring requirements of the (1) General Virginia Pollutant Discharge Elimination System Permit for Discharges from Petroleum Contaminated Sites, Groundwater Remediation, and Hydrostatic Tests as applicable to discharges of hydrostatic test water and (2) representative North Carolina NPDES individual permits that include provisions addressing hydrostatic test water discharges. This includes sampling the water for Total Petroleum Hydrocarbons, Oil and Grease, Total Organic Carbon, Total Suspended Solids, pH, Turbidity, and Total Residual Chlorine prior to discharge. Prior to construction, Mountain Valley will apply for any permits required to discharge hydrostatic test water.

2.4.1.7. Cleanup and Restoration

Construction debris, temporary construction structures, and equipment will be removed at the end of construction. The construction ROW and other areas disturbed by construction activities will be restored to pre-existing contours and hydraulic regimes. In agricultural areas, the segregated topsoil will be returned to its original horizon. Final restoration typically occurs within five to seven days of rough backfilling, weather permitting.

Permanent stormwater controls will be installed where required, and the construction ROW will be re-seeded and/or mulched according to permit requirements and landowner agreements. Private and public property, such as fences, gates, driveways, and roads that have been disturbed by the pipeline construction, will be restored to their original or better condition. Where required by applicable regulations or permits, temporary E&SCs will be left in place and maintained until mature vegetative cover is reestablished on the construction ROW.

2.4.2. Specialized Construction Methods and Crossings

Special construction methods and crossings are likely to occur throughout the construction phases. These special methods are in addition to the aforementioned standard construction practices for the pipeline. Aquatic resource crossings are evaluated to reduce the LOD and establish setbacks where feasible. ROW crossing widths are reduced from 100 feet to 75 feet at most stream and wetland crossings. Exceptions preventing the appropriate neck-down at resource crossings are discussed below. These exceptions include small aquatic resources completely contained within the LOD, adjacent temporary workspaces necessary to accommodate construction equipment, and a road crossing at the same location waterbody/wetland crossing.

2.4.2.1. Waterbody Crossings

The Amendment Project crosses[11] 101 waterbodies and 141 wetlands in North Carolina and Virginia. As discussed below, [redacted]

Where trenchless methods are used to cross waterbodies, construction will be performed as a continuous to minimize the duration that trenches for pipeline crossings are left open. The typical trenching operation, as described above, will skip the waterbody crossing, stopping on each side near the top of the bank. Where feasible, a 50-foot buffer will be maintained between the aquatic resource and LOD immediately prior to stream crossings. In general, waterbody and wetland crossings will be conducted by specialized construction crews separate from the upland construction activity. Typically, the pipe will be pre-assembled prior to initiating trench excavation of the waterbody. Waterbody crossings are conducted as a single and complete project, such that waterbody buffers are restored immediately following completion of the crossing. All ATWSs necessary for waterbody crossings would be placed a minimum of 50 feet from the waterbody edge, and the setback will be maintained unless site-specific approval for a reduced setback is granted by FERC or other jurisdictional agencies. All appropriate staging, storage, and fueling setbacks will be maintained throughout the Amendment Project Area.

Temporary equipment bridges will be installed to prevent sedimentation caused by construction equipment traffic crossing the waterbodies. Bridges will be maintained throughout construction, and types may include clean rock fill over culverts, equipment pads, wooden mats, and free-spanning bridges. Each bridge will be designed to accommodate normal to high streamflow (storm events), prevent soil from entering the waterbody, and prevent restriction of flow when in use.

Sediment barriers, such as silt fence and erosion control sock, will be installed prior to initial disturbance to the waterbody and adjacent upland area. Sediment barriers will be properly maintained throughout construction until replaced with permanent erosion controls (e.g., waterbars, slope breakers) or restoration of adjacent upland areas is complete, and revegetation has stabilized the disturbed areas. Trench plugs, consisting of compacted earth or similar low-permeability material, will be installed at the entry and exit points of the waterbodies to prevent water from the stream from moving along the trench. After backfilling, streambanks will be re-established to approximate pre-construction contours and stabilized.

Prior to installation of the pipeline across a wetland or waterbody, the pipeline will be welded, non-destructively tested, and coated in an upland area. Once the pipeline is fully prepared for installation, the contractor will excavate the trench in the wetland/waterbody, and the pipeline section will be transported via sidebooms and installed in the excavated trench. The trench will then be backfilled to its original contour. If the wetland/waterbody can support the use of skids and pipe, the process would generally be the same. However, the pipeline will be welded, non-destructively tested, and coated in the wetland/waterbody area.

Trench spoil will be placed on the banks above the high water mark for use during backfilling. Proposed waterbody construction methods include dry-ditch open-cut (flume or dam/pump) and trenchless (conventional bore or HDD) methods, each of which is discussed in more detail below.

[11] The number of waterbody and wetland crossings identified here accounts for the resources that will experience temporary or permanent discharge of fill material (i.e., open-cut crossings, timber mat crossings, culverts, access roads, and ATWS) [redacted]

2.4.2.1.1. Dry-Ditch Open-Cut Crossing Methods

Dry-ditch open-cut crossings combine traditional trench construction techniques with E&SC Plan best management practices (BMPs; e.g., silt fence, compost filter socks, turbidity curtains, pumped water filter bags) and water management techniques/diversion structure (e.g., cofferdam, flume pipe, and dam-and-pump) to install pipeline across waterways. This method involves isolating the work area from the stream so construction can be performed in a controlled, "dry" condition.

Dry-ditch stream crossings require the use of pumps to remove water from within an isolated, instream workspace and for trench dewatering. Dewatering operations within isolated, instream workspaces involve the use of a screened intake pump.

During construction, the section (or sections) of pipe to be installed in the waterway will be prepared and readied for installation. After the flow is diverted around the crossing area, the work area will be dewatered by pumping standing water into an energy-dissipating dewatering structure (including filter bags, where necessary) in a well-vegetated upland area to minimize erosion and sedimentation, as required by the E&SC Plan. The trench will then be prepared to receive the pipe. The 12 inches of streambed substrate will be segregated and stockpiled to prevent mixing with other materials and to be used during restoration.

The pipe will be placed in the trench to a length of at least 10 feet beyond the high bank of the stream and will be installed to provide a minimum of 3 feet of cover from the waterbody bottom to the top of the pipeline. In areas of consolidated rock, Mountain Valley will excavate rock using hydraulic hammers (to the extent feasible) or blasting (only when necessary) to maintain the minimum depth of cover at two feet at waterbody crossings.[12]

Stream impacts within the pipeline LOD using the dry-ditch open-cut method will be temporary and occur during pipeline construction activities only.[13] With the use of diversion structures, the risk of increased levels of sediment and turbidity is largely reduced and limited to the work associated with installing and removing the cofferdam or other diversion structure, which is the only time work within the flowing stream is necessary. Once installed, the presence of a diversion structure within a stream does not materially cause ongoing sediment or turbidity increases downstream of the crossing—meaning there is little difference in potential water quality impact regardless of the temporary diversion's duration. While the diversion structure is in place, the excavation, installation, backfilling, and streambed restoration are isolated from the flowing river and performed under dry conditions. Temporary stream crossings will result in only temporary impact to water quality, physical habitat, or aquatic species within the Amendment Project Area due to the short duration of stream-crossing construction activities and the implementation of the E&SC Plan BMPs.

[12] In addition to observing the general minimum depth-of-cover requirements, Mountain Valley will implement any scour mitigation requirements detailed in the FERC FEIS.

[13] See Reid et al. 2008.

2.4.2.1.2. Trenchless Crossing Methods

[redacted]

HDD is a method that allows for trenchless construction across an area by pre-drilling a pilot (or guide) hole below the depth of a conventional pipeline lay and then pulling the pipeline through the pre-drilled borehole. The primary advantage of the HDD method is that there is minimal planned disturbance of the surface between the entry and exit points of the HDD. Although the HDD method is a proven technology for pipe installation, the potential exists for an HDD installation to fail. Reasons for failure include encountering soil conditions not conducive to boring, caving of the borehole, loss of the drill string in the borehole, loss of drilling fluid return or inadvertent return to the surface of drilling fluid, and pullback refusal. Specific geology, such as karst, fractures, or fissures, and the presence of underground waterways can increase the potential of an inadvertent return. Proximity to public drinking water sources, private wells, and mining activities (both active and abandoned), as well as the maximum bend radius of the pipe, should be considered during the HDD feasibility analysis. Other considerations include the volume of drilling muds and fluids that must be managed onsite, increased volume of spoil that must be managed onsite, additional collected surface water from precipitation that must be managed, significantly more support area (1–3 acres) than an open-trench crossing, and the possibility for an inadvertent return to occur.

Conventional boring is a collection of techniques that allows for trenchless construction across an area. To complete a conventional bore, two pits will be excavated, one on each side of the feature to be bored. These pits are typically much closer to the feature being crossed than they would be for an HDD due to design length constraints for a conventional bore. A boring machine will be lowered into one pit, and a horizontal hole (or series of holes with increasing diameter) will be bored at the depth of the pipeline installation. The pipeline section and/or casing will then be pushed through the bore to the opposite pit. Like HDD, the primary advantage of the conventional bore method is that there is minimal planned disturbance of the surface between the entry and exit points. Potential issues that must be considered during the evaluation of conventional bore include an increased volume of spoil that must be managed onsite, significantly more support area (up to one acre) than an open-trench crossing, additional groundwater that must be managed, geology that may hinder or eliminate the potential use of conventional boring due to the hardness of rock encountered, the presence of varying different materials in the bore path (e.g., large boulders in sand and gravel), and changes in bedding thickness.

2.4.2.2. Wetland Crossing

The crossings of jurisdictional wetlands will be completed in accordance with state and federal permits and the FERC *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures). However, specific site conditions may require Mountain Valley to request variances from the Procedures that will require approval by FERC prior to construction in these areas. As proposed, the pipeline is expected to cross 87 wetlands, and other Amendment Project components (e.g., access roads) would cross 63 wetlands.

Generally, a maximum construction ROW width of 75 feet in wetlands will be utilized, and operation of construction equipment will be limited to that which is needed to clear the ROW, dig the trench, fabricate the pipe, install the pipe, backfill the trench, and restore the ROW. Exceptions to the maximum construction ROW of 75 feet will be required at one wetland in North Carolina. Fuel will not be stored within 100 feet of wetlands or waterbodies. Topsoil will be segregated up to one foot in depth within wetlands where hydrologic conditions permit and placed into the trench following subsoil backfilling. The restoration and monitoring of wetland crossings will be conducted in accordance with FERC Procedures. The conventional dry-ditch open-cut method will be used most frequently when installing pipeline in wetlands. Construction methods for crossing saturated and unsaturated wetlands are briefly described in the sections below.

Wetland impacts within the pipeline LOD using the dry-ditch open-cut method will mostly be temporary impacts to palustrine emergent wetlands that would occur during pipeline construction activities only. However, the dry-ditch open-cut crossing method will result in some permanent conversion of palustrine forested and palustrine scrub-shrub wetlands to palustrine emergent wetlands within the permanent pipeline easement.

2.4.2.2.1. Unsaturated Wetland Crossings

In wetlands without standing water or saturated soils (i.e., unsaturated wetlands), construction will be similar to the typical upland construction described in Section 2.4.1, with some exceptions, including restricting construction equipment to one traffic lane instead of two. If the use of normal construction equipment leads to rutting or mixture of wetland topsoil and subsoil, crews will switch to low-ground-pressure equipment, or temporary equipment mats will be installed to allow passage of equipment with minimal disturbance to the surface and vegetation.

Trees within the construction ROW will be cut to grade, but stumps will only be removed within 15 feet of the pipeline trench unless safety dictates otherwise. Topsoil over the trench will be segregated from the underlying subsoils, and a vegetation buffer zone will be retained between the wetland and adjacent upland construction areas outside of the pipe trench and travel lane. Erosion control measures such as silt fences and erosion control socks will be installed and maintained to minimize sedimentation within the wetland, and trench plugs will be installed where necessary to prevent unintentional draining of water out of the wetland. The construction ROW will be restored upon completion of pipe installation, and a 10-foot-wide strip centered on the pipeline will be maintained in an herbaceous state.

2.4.2.3. Trench Dewatering

In most cases, trench dewatering will be limited to the removal of stormwater in the pipe trench excavated in upland locations. In saturated wetlands, it will not be practical to attempt to dewater the trench since the groundwater level is at or near the ground surface. In those locations, the pipe may be concrete-coated or weighted with aggregate-filled sacks to overcome buoyancy in the flooded trench. In uplands, stormwater will typically be removed from the trench prior to lowering the pipe into place. The stormwater will be pumped from the trench to a location downgradient of the trench. The trench will be dewatered in a manner that does not cause erosion and does not result in heavily silt-laden water flowing into any waterbody or wetland. The stormwater will be discharged to an energy-dissipation/filtration dewatering device, such as a hay bale structure. Heavily silt-laden water may first be passed through a filter bag. The dewatering structure will be removed as soon as possible after completion of the dewatering activities. Trench breakers (ditch plugs) will be used where necessary to separate the upland trench from adjacent wetlands or waterbodies to prevent the inadvertent draining of the wetland or diversion of water from the waterbody into the pipe trench.

2.4.2.4. Blasting

All blasting will be conducted in accordance with the Amendment Project General Blasting Plan. Pre- and post-blasting structural surveys will be conducted of occupied structures, water supply wells, and water supply springs that will be specified in the prepared General Blasting Plan. At this time, the extent of blasting for the Amendment Project is unknown. Mountain Valley will minimize the amount of blasting required to the extent practicable. Where unrippable subsurface rock is encountered, blasting for ditch excavation may be necessary. In these areas, Mountain Valley will take measures to prevent damage to underground structures (e.g., cables, conduits, and pipelines) or to springs, water wells, or other water sources, [redacted] Blasting mats or padding will be used as necessary to prevent the scattering of loose rock. [redacted] All blasting will be conducted during daylight hours and will not begin until occupants of nearby buildings, stores, residences, places of business, and farms have been notified. Where competent sandstone bedrock occurs in the stream bed, blasting may be used to reduce bedrock so that the trench can be excavated, though this is not anticipated [redacted]

2.4.3. Aboveground Facilities

Three meter (interconnect) stations will be constructed for the receipt and delivery of natural gas with other pipelines, two of which will include pig launcher and receiver sites. Locations and descriptions of aboveground facilities are summarized in Table 2-5.

Table 2-5: MVP Southgate Amendment Project Aboveground Facilities

Facility	Approximate Milepost	County, State
Interconnections		
Lambert Interconnect (receipt with MLV 1, with pig launcher)	0.0	Pittsylvania, VA
LN 3600 Interconnect	28.9	Rockingham, NC
Dan River Interconnect #1 (with pig receiver)	31.3	Rockingham, NC
Dan River Interconnect #2 (delivery with MLV 4)	31.3	Rockingham, NC
Mainline Valves (MLV)		
MLV 2	7.7	Pittsylvania, VA
MLV 3	18.7	Pittsylvania, VA

2.4.4. Access Roads

The Amendment Project will require a combination of both temporary and permanent access roads to provide access to the pipeline facilities. Temporary access roads will be obtained for the purpose of constructing the pipeline facilities only and will be restored to pre-construction conditions upon completion. Permanent access roads will be secured to support both the initial construction as well as regular operational activities after the pipeline is placed in-service. To the extent practicable, Mountain Valley will use existing access roads and maintain and/or improve them as needed to minimize land disturbance for the Amendment Project. Minor maintenance and upgrades to existing access roads may include grading, tree trimming, environmental controls, and the installation of Geotech fabric and gravel, depending on the condition of the existing road. If the road is not existing, Mountain Valley will build the road in a similar manner, including potential grading, tree trimming and/or clearing, environmental controls, and the installation of Geotech fabric and gravel. Mountain Valley will maintain permanent access roads throughout construction, and once the Amendment Project is completed, the permanent access roads will be used during typical operational and maintenance activities. Temporary access roads will be restored to pre-construction conditions.

2.4.5. Additional Temporary Workspace

ATWSs will be necessary for construction activities requiring space beyond the 100-foot construction ROW. Example construction activities or situations that may require ATWS include road and railroad crossings, winch hills/steep slopes, wetlands and waterbody crossings, foreign utility and pipeline crossings, interconnects, difficult terrain, truck turnarounds, fabrication and staging areas, and hydrostatic test water withdrawal and discharge locations.

2.4.6. Pipe Storage and Contractor Yards

Pipe storage and contractor staging yards for temporary use during construction have been selected and designed to avoid streams, wetlands, and other sensitive habitats. To the maximum extent practicable, Mountain Valley avoided locating storage and contractor yards in forested tracts to minimize impacts to forested areas. Depending on the current condition and use of these yards, minor surface work, drainage improvements, placement of surface material (e.g., gravel), and internal roadways may be required. Upon completion of construction, all facilities and equipment will be removed from the pipe storage and contractor yards. Each yard will be restored to original contours and returned to its original use.

Significant grading is not anticipated at pipe storage and contractor yards. If necessary, the topsoil may be segregated and stockpiled within pipe storage and contractor yards to provide a level base for gravel or matting. Impacts to aquatic resources are not anticipated at any yards. The appropriate E&SC BMPs will also be installed around yards to provide additional protection to potential resources.

2.4.7. Operation and Maintenance

Operational activity for the Amendment Project will be limited to maintenance of the permanent ROW and inspection, repair, and cleaning of the pipeline. Inspections at highway and railroad crossings will be conducted at least twice a year, with inspections occurring at least once a year at other pipeline locations. Pipeline inspections are completed at varying frequencies based on USDOT requirements. During the process, inspectors will look for any sign of encroachment or downed trees on the ROW. Additionally, they will look for any abnormal ground conditions, physical damage in the area, and missing or damaged line markers. They also will conduct a leak inspection and ensure that required emergency contact information is posted and accurate on all line markers and fenced enclosures.

Regular cleaning will be conducted at established pig launcher/receiver sites. Emergency spill kits will be on site and accessible during pigging operations. Temporary containment will be installed prior to pig removal. All contaminated material will be collected and disposed of by a qualified vendor, and temporary containment will be removed when all work is complete.

The permanent ROW will be allowed to revegetate and will be maintained by periodic mechanical mowing, cutting, and trimming. Routine mowing in the ROW will not occur more frequently than every three years (per FERC Procedures) and not from April 15 – August 1. Large brush and trees will not be permitted to grow within the permanent ROW. Vegetation maintenance is not expected to be required in agricultural areas or within wetlands.

Site personnel at aboveground facilities will perform routine checks of the facilities, including calibration of equipment and instrumentation, inspection of critical components, and scheduled and preventative maintenance of equipment. The surface of permanent access roads to these stations will be properly maintained, and appropriate E&SC measures will be employed. Permanent E&SC measures will be installed, including culverts, drainage ditches, water breaks, sumps, and filter socks if necessary. Also, the road surface will be maintained with the placement of gravel when needed.

2.5. Project Design Features to Avoid and Minimize Impacts

Mountain Valley designed the Amendment Project to avoid and minimize impacts to the natural environment, especially including federally listed species and their habitats, by selecting a route that avoids to the extent possible critical or sensitive habitats, national wildlife refuges, sensitive soils, disruption to mineral resources, environmental hazards, and geologic/topographic hazards to the extent possible.

In addition to route selection, Mountain Valley is implementing BMPs for [redacted] These practices serve to avoid and minimize potential adverse effects [redacted] BMPs and Amendment Project-wide conservation measures for the Amendment Project are listed in the following sections.

2.5.1. Wetlands and Waterbody-Related Conservation Measures

Mountain Valley will use a variety of mitigation measures to minimize potential adverse impacts [redacted]

Measures Mountain Valley will implement to avoid or minimize potential impacts to [redacted]

- Reducing the construction ROW width from 100 to 75 feet at stream and wetland crossings.
- Clearly marking wetland boundaries and buffers to be avoided in the field with signs and/or highly visible flagging until construction-related ground-disturbing activities are complete.
- Avoiding removal of riparian canopy or stabilizing vegetation, if possible.
- Preferring crushing or shearing streamside woody vegetation to complete removal.
- Stabilizing waterbody banks and installing sediment barriers (i.e., silt fence, compost filter sock) upon completing in-stream construction activities. Sediment barriers will be left in place until the site has been stabilized with perennial vegetation (typically one full growing season after construction).
- Aligning crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions allow.
- Attempting to maintain, at minimum, a 15-foot section of undisturbed vegetation between the waterbody and construction ROW where the pipeline parallels a waterbody.
- Conducting construction at stream crossings during low-flow conditions to the maximum extent possible.
- Crossing streams using open-cut dry-ditch crossing methods by pumping or fluming water around if water is flowing at the time of construction.

- Conducting pipeline assembly in upland areas unless the wetland is dry enough to support skids and pipe adequately and using timber mats to cross wetlands.
- Minimizing the length of time that the trench is open, to the maximum extent practicable, especially within wetlands.
- Minimizing the amount of necessary construction equipment traffic to that which is needed to clear and grade the ROW, excavate the trench, install the pipeline, backfill the trench, and restore the construction ROW.
- Prohibiting construction equipment, vehicles, hazardous materials, chemicals, fuels, lubricating oils, and petroleum products from being parked, stored, or serviced within a 100-foot radius of any wetland or waterbody. All equipment will be inspected for leaks by an inspector at the beginning of the day. The operation will not commence or will cease until the spill is contained, cleaned up, and collected before operations continue. Leaking equipment will be removed or repaired on the same day.
- Locating as many ATWSs as possible at least 50 feet away from the water's edge.
- Storing trench spoil excavated from within a stream at least 10 feet from the top of the bank to minimize turbidity caused by erosion.
- Avoiding the use of herbicides and pesticides to maintain any portion of the Amendment Project ROW or aboveground facilities except as specified below.
- Installing temporary equipment bridges within the ROW to reduce turbidity and sedimentation caused by construction and vehicular traffic.
- Minimizing crossing of the pipeline through forested wetlands to the maximum extent practicable. When forested wetlands are crossed, Mountain Valley will maintain no more than a 10-foot-wide herbaceous strip centered over the pipeline and only remove woody vegetation within a 30-foot-wide strip centered over the pipeline.
- Allowing vegetation in wetlands to recover more rapidly by only removing tree stumps located directly over the trench line or where safety is a concern.
- Restoring each waterbody to its original configuration and contour. Permanent stabilization of the banks of the waterbody and adjacent areas using erosion control measures and vegetative cover will occur as soon as possible after construction.
- Using segregated streambed substrate and, where necessary, native stone to the extent possible during stream bed restoration and stabilization.
- Promptly removing construction materials and related crossing structures from each waterbody after construction.
- Avoiding the use of freshwater withdrawals in Virginia for hydrostatic testing. Municipal source waters may also be used.
- Implementing sustainable water-use practices to ensure water resources and environmentally responsible streamflows are maintained during water withdrawal activities. All water withdrawals will be performed in accordance with local, state, and/or federal regulations to prevent the localized and downstream dewatering of streams. [redacted]
- Discharging hydrostatic test water to the ground in an upland, well-vegetated area, using energy-dissipating devices, and not directly to surface waters.
- Dewatering upland trenches into well-vegetated upland areas that minimize erosion and discharge to waters.

2.5.2. Federally Listed Bat Conservation Measures

Mountain Valley will [redacted] as follows.

- Clearly mark the Amendment Project construction ROW to help ensure that contractors do not [redacted]
- [redacted] Mountain Valley will coordinate with USFWS and FERC in the event that emergency circumstances arise [redacted] to identify additional measures to implement that would ensure such activities are not likely to adversely affect listed bat species.
- [redacted] to avoid the potential for adverse effects.
- [redacted]
- Minimize the potential for lighting impacts on bats by instituting a 7:00 a.m. to 7:00 p.m. workday, 6 days per week, except as mandated by safety standards, with the exception of 24-hour construction areas for trenchless crossings, hydrostatic testing, pig runs, and tie-in welds. In spring, summer, and fall, when sunset occurs later in the evening, construction activities may continue after 7:00 p.m. but will be limited to daylight hours. The directional luminous intensity of lighting structures used during construction will be proportional to work area required to complete the task. Fully shielded, "full cut-off" type lighting fixtures will be used to minimize objectionable light from upland facilities. "Full cut-off" means no direct upward lighting is emitted above the horizontal plane and, therefore, provides the maximum possible shielding to prevent unintentional lighting of surrounding areas.
- [redacted]
- Adhere to measures specified in the Amendment Project-specific Spill Prevention, Control, and Countermeasure (SPCC) Plan and the E&SC Plan to manage the risk of a potential spill or release of oil or hazardous material during construction. [measure also beneficial to aquatic species]
- Site equipment servicing and maintenance areas at least 100 feet away from streams. [measure also beneficial to aquatic species]
- Implement sediment and erosion control measures, ensure restoration of pre-existing topographic contours after any ground disturbance, and restore native vegetation (where possible). [measure also beneficial to aquatic species]

[14] If USFWS [redacted], in coordination with USFWS.

- Control erosion and sediment by using appropriate BMPs. Environmental Inspectors will be present onsite during construction, and until stabilization after construction. Any erosion and sedimentation issues would be addressed immediately. [measure also beneficial to aquatic species]
- Use water trucks to dampen the area and control fugitive dust to minimize [redacted]
- Maintain areas that must be kept open for pipeline operation and safety by conducting routine maintenance mowing at the maximum time interval required to prevent woody encroachment (e.g., every three years) and late in the growing season of any year (after August 1).
- [redacted]
- Avoid the use of herbicides and pesticides to maintain any portion of the Amendment Project ROW or aboveground facilities, unless requested by a landowner or land management agency or needed to spot treat exotic/invasive species posing a safety risk or to treat pest species that threaten the integrity of stabilizing revegetation when fall mowing is unsuitable to treat the pest species. [measure also beneficial to aquatic species]
    - When mowing treatment is unsuitable to address a localized pest outbreak, use an appropriate pesticide product, on a limited basis, in the specific and discrete areas of outbreak occurrence, in strict compliance with the product label requirements identified by federal and state regulators and the manufacturer, and in direct response to an identified outbreak that jeopardizes the integrity of a revegetated area. [measure also beneficial to aquatic species]
    - Upon discovery of a pest infestation or outbreak that may require management, and with direction from Mountain Valley, a Licensed Insecticide Applicator will review potential treatment options, give recommendations, and select a commercially available, EPA-approved pesticide or other treatment product that is appropriate for the specific location and circumstances and that:
        - Has shown effectiveness in treating the pest,
        - Is approved for treating the pest in the state where it will be applied, and
        - Is approved for treating infestations occurring in turf/grasses (if relevant). [measure also beneficial to aquatic species]
    - Apply pesticide (insecticide or herbicide) spot treatments by hand or using equipment approved for precise, localized product application; aerial application will not be used. [measure also beneficial to aquatic species]
    - Avoid pesticide application during or within 12 hours of measurable rainfall, and, unless a greater setback distance is identified on the product label (EPA-approved conditions), adhere to a minimum of 150-foot horizontal buffer around the following features:
        - Pastures and other livestock grazing areas;
        - Buildings and yards;
        - Streams, wetlands, and ponds;
        - “No Spray” property lines; and
        - Drains, culverts, and storm sewer inlets. [measure also beneficial to aquatic species]
- Allow natural woodland regeneration of temporary and additional workspaces.

- Native species will be included in seed mixes intended for permanent ROW restoration. Portions of the ROW not considered steep slope will incorporate herbaceous species preferable to native pollinators within the Upland Meadow Pollinator seed mix that contains herbaceous species considered superfoods or immune builders for native pollinators.
- Prepare and distribute information for the training of construction personnel that provides information about biology of northern long-eared bats, activities that may affect bat behavior, ways to avoid and minimize these effects, and appropriate procedures to follow as they relate to Amendment Project-specific conservation measures.

2.5.3. Federally Listed Aquatic Species and Habitat Conservation Measures

In addition to the conservation measures described above, Mountain Valley will implement the following additional conservation measures to further avoid and minimize potential adverse effects to federally listed aquatic species and critical habitat[15] from the Amendment Project:

- [redacted]
- Implementing the following measures [redacted]
  - [redacted]
  - o [redacted]
  - [redacted]
  - o [redacted]
  - [redacted]
  - o Removing only the minimum riparian vegetation (i.e., understory) [redacted]
    - [redacted] but rather released in a well-vegetated upland location in accordance with state regulatory procedures.

[15] If USFWS finalizes its proposed listing decision and critical habitat designation for green floater, Mountain Valley will update these conservation measures as appropriate to avoid potential adverse effects.

- Employing open-cut, dry-ditch construction methods for trenched crossings (as opposed to open-cut, wet-ditch methods) and commencing crossings when streamflow is low or absent to minimize instream disturbances and downstream transport of sediment.
- Implementing the following additional AMMs within [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]

3. Action Area

In Section 7 consultation, the action area is the area that may be affected directly or indirectly by the proposed federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area includes the geographic extent of environmental changes (i.e., physical, chemical, and biotic effects) that result from the action. The action area is defined by measurable or detectable changes in land, air, and water quality. Accordingly, in addition to the immediate area of planned disturbance, the Amendment Project's Action Area includes any location where impacts of the proposed activities can occur, even outside of the Amendment Project's LOD. The Action Area, therefore, encompasses both effects within the LOD and those locations beyond the LOD expected to experience effects from dust, light, noise (air or substrate-born sound or vibration), and water quality alteration from sediment loss. Toward that end, in the sections below, (1) the respective areas of potential environmental reach of Amendment Project-related dust, light, and noise are identified and used to define the scope of the terrestrial Action Area; and (2) the potential aquatic environment reach of Amendment Project-related sediment is described and used to define the scope of the aquatic Action Area. Finally, the scope of the Amendment Project's overall Action Area used in this BA, which consists of the terrestrial Action Area component and the aquatic Action Area component, is summarized.

3.1. Dust

Dust created during Amendment Project activities can travel from the point of origin to more remote locations where it can settle on natural and anthropogenic surfaces. As a result, dust produced during the construction and operation of the Amendment Project, and the estimated distance dust can travel from the point of origin are accounted for in defining the Amendment Project's Action Area.

Crystalline silica is one of the most abundant naturally occurring compounds on earth and is a common component of dust at construction sites. Quartz is the most common form of crystalline silica, and it is the second most common surface material, accounting for almost 12 percent by volume of the earth's crust. Crystalline silica is a common component of sand, rock/stone, clay, concrete, and masonry, and is found in soils. Activities that involve the cutting, breaking, crushing, drilling, grinding, or blasting of these materials may produce fine silica dust.

In the context of project development and operation, dust creation and dissemination are greatest during land preparation (e.g., demolition, land clearing, grubbing, earth moving, and grading) and construction. Empirical data describing the distance over which dust impacts may occur are limited. Nevertheless, the latest Institute of Air Quality Management (IAQM) guidance identifies 50 meters as the farthest distance for analyzing dust emissions from the point of origin for assessing potential effects to ecological receptors (IAQM 2024). That 50-meter distance conservatively does not account for site-specific conditions or implementation of suppression measures during construction activities that can reduce dispersal distances. Dust emissions from construction are positively correlated with the silt content of the soil and the speed and weight of vehicles, while they are negatively correlated with soil moisture. Thus, the scope of dust generation and distribution typically depends on whether dust suppression measures are implemented. With this in mind, Mountain Valley will implement measures to significantly reduce dust generation and control dust emission through the use of wet suppression (water application) in disturbed areas and suppression of dust emission on paved surfaces using a combination of water trucks, power washers, sweeping, and/or vacuuming.

Accordingly, for purposes of accounting for possible dust generation and dispersal in scoping the Amendment Project's Action Area, the potential distance that dust from construction, maintenance, and operation activities could travel will be less than 50 meters. Thus, a maximum of 50 meters is the furthest extent of expected Amendment Project dust impacts that is used below to help determine the scope of the Amendment Project's terrestrial Action Area.

3.2. Light

Though limited, as discussed in Section 2, artificial lighting may be used during construction when the completion of particular Amendment Project activities warrants continued work outside normal daylight operating hours due to agency requirements that limit the time allowed for such tasks, or to temporarily extend workable hours during the construction phase. This practice will be most common when completing stream crossings and during the hydrostatic testing phase. The distance that artificial lighting travels will vary by the type (wavelength), duration, and intensity of emitted light, the environment in which it occurs, the size of the lighted work area required to complete an activity, and any minimization measures implemented.

According to Gaston et al. (2015), there is little empirical evidence describing the environmental impacts of light generation type, quantity, intensity, distance, and direction because the mechanisms influencing each of these are not understood well enough to be quantified. Like most other energy waves, light follows a line-of-sight transmission pattern, degrades over distance, and can be blocked or altered by the presence of an object. Light is most visible in open areas and is often blocked by trees and woodlands. Thus, light travels the farthest across open areas, but it becomes confined and far more attenuated in areas that remain forested or have topographical or other impediments that block transmission.

For purposes of accounting for light in the Amendment Project's Action Area, it is assumed, based on the specifications of typical lighting equipment used for pipeline construction, that light sources will be less than the height of typical woodland trees. Therefore, given line-of-sight transmission, lighting associated with the Amendment Project is expected to be at least partially obscured by surrounding woody vegetation, with the level of light attenuation influenced by the density of vegetation in both the canopy and subcanopy of the surrounding forest. Pocock and Lawrence (2005) found that car lights penetrate forest a distance of 360 meters in flat terrain, 450 meters down gullies, and 260.3 meters across ridges. The overall mean distance for light penetration was 360 meters when the light is directed horizontally from its source. Therefore, any light directed horizontally from the Amendment Project would not be expected to travel more than 365 meters in areas with obscuring vegetation if Mountain Valley (1) directed light horizontally, and (2) did not implement any light attenuation-focused conservation measures. However, Mountain Valley will not direct light horizontally from the Amendment Project. As discussed in Section 2, Mountain Valley will implement specific conservation measures to limit light generation from the Amendment Project and the distance that the minimal light generated may travel from the isolated locations lighting is used, including workday schedule restrictions, light directional shielding, and reliance on full cut-off type lighting fixtures.

Nevertheless, numerous variables, both static and dynamic, affect the scope of light transmission, including atmospheric conditions (moisture, cloud, rain, dust); site topography (hills, sand dunes, beach orientation, vegetation, buildings); natural sources of light (moon and stars); other artificial sources of light; the spectral output of luminaires; and the distance, elevation and viewing angle of receptors (Department of Climate Change, Energy, the Environment and Water 2023). This variability makes it impossible to identify a specific distance that potential light effects could extend from the Amendment Project. As a result, while it is reasonable to expect that the maximum distance that the limited light used at the Amendment Project would travel will be less than 150 meters, for purposes of this BA, it is conservatively assumed that Amendment Project light could extend up to the distance from the Amendment Project that noise could extend.

3.3. Noise

Energy transmitted by pressure waves through media such as air or water creates sound. When sound becomes excessive, annoying, or otherwise unwanted, it is referred to as noise (USDOT 2006). A decibel (dB) is a unit of sound pressure used to express the level of perceived noise and is quantified in terms of base-10 logarithmic units of ratios of the sound pressure being measured to a reference pressure squared (termed “bel”) multiplied by 10 to get “deci-bel.” A-weighted sound level (dBA) is used to characterize the effects of noise on people and is based on the dB unit but emphasizes frequencies in the range humans hear best. Sound levels decrease with distance from a sound source at a rate of six dBA and three dBA with every doubling of distance from a point source and line source, respectively, when unobstructed by topography or vegetation and when atmospheric conditions (e.g., temperature and humidity) are not considered.

Ambient or background sound levels are those emanating from natural or artificial sources that currently exist on a given landscape and are often referred to as baseline noise levels. The magnitude and frequency of ambient noise will vary over a 24-hour period and throughout the year due to weather conditions, vegetative cover, wildlife, and human activity. Noise impacts are determined by quantifying increases over ambient levels caused by a given activity. Humans cannot discern less than a 3 dBA increase, an increase of 5 dBA is considered clearly noticeable, and increases of 10 dBA are perceived as a doubling of noise or becoming twice as loud.

To account for noise from the Amendment Project in scoping the Action Area, Mountain Valley [redacted]

[redacted]

3.3.1. Sources of Noise

The Amendment Project will generate noise during both construction and operation. Noise during the construction phase will result from the construction of the pipeline and the construction of the facilities.

Pipeline construction generates noise along the entire length of the Amendment Project, with prevalent noise sources coming from internal combustion engines of construction equipment used during the earthmoving phase. On average, noise levels emitted from construction equipment measure approximately 85 dBA at 50 feet when operating at full capacity during daytime hours (FHWA 2006). Nighttime construction is not anticipated except where noted in the following paragraphs.

Blasting in limited areas may be necessary but will not occur at night. Sound levels produced during a blasting event are instantaneous and vary based on the type and amount of explosive used, below-ground depth of detonation, and any noise mitigation applied. An average conservative estimate (i.e., assuming no noise shield or barrier between noise source and receptor is used) of blasting operation noise level is approximately 94 dBA at a distance of 50 feet (FHWA 2006).

Crossings of [redacted] The highest estimated combined noise level for all equipment used [redacted] The highest noise level emitted from the pump/generator combination is estimated at 81 dBA at 50 feet (FHWA 2006).

3.3.2. Noise Production and Movement Distance

Sounds generated by Amendment Project construction activities may cause a short-term increase in localized environmental sound levels. These increases will be present for short periods of time at any given location while construction activities progress along the Amendment Project Area. The NA extends from the Amendment Project Area to where sound levels from construction are equal to the ambient sound levels without construction noise contributions.

[redacted]

[redacted]

3.3.2.1. Ambient Noise Levels

Ambient sound levels vary over time and are influenced by local area sound sources, both natural and human created. [redacted]

[redacted]

3.3.2.2. Traffic Noise Levels

[redacted]

3.3.2.3. General Construction Equipment and Activities

To assess general construction noise, [redacted] The source sound levels will be temporary and mobile and will vary depending on the specific locations and concentrations of activities.

The following construction activities [redacted]

- General pipeline construction
- HDDs
- Railroad bores
- Interconnect construction

[redacted]

General pipeline construction sound levels were calculated using the following methodology:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

16 [redacted]

3.3.2.4. Blasting

Blasting during construction may be required during construction activities along the Amendment Project route, depending on the ground conditions encountered onsite. To assess the impact of potential blasting for the Amendment Project, [redacted]

[redacted]

Blasting sound levels were calculated using the following methodology:

- [redacted]
- [redacted]
- [redacted]

[redacted]

3.3.3. Noise Areas

Figures 3-1, 3-2, and 3-3 show the extent of the daytime, nighttime, and blasting NAs. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.3.4. Terrestrial Action Area

For the Amendment Project, the terrestrial Action Area is defined as the Amendment Project Area plus the distance or location where:

- Meaningful concentrations of dust will travel outside the Amendment Project Area, estimated to be less than 50 meters;
- Emitted nighttime light will travel from the Amendment Project Area, estimated to be within the distance that sound will travel; and
- Air- or substrate-borne sound or vibration will travel.

[redacted]

[redacted]

3.3.5. Changes in Water Quality from Sediment

3.3.5.1. [redacted]

For purposes of delineating the scope of the Amendment Project's Action Area in the aquatic environment, Mountain Valley [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.3.5.2. Delineation of Aquatic Action Area

The aquatic Action Area accounts for the expected and reasonable extent of direct and indirect effects to the aquatic environment from the Amendment Project. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.4. Summary of Action Area

As used in this BA, the Action Area is defined as the Amendment Project Area plus any location within the terrestrial Action Area or aquatic Action Area.

The terrestrial Action Area encompasses the entirety of the Amendment Project Area, along with all locations in which:

- Meaningful concentrations of dust will travel outside the Amendment Project Area;
- Light will travel from the Amendment Project Area; and
- Air- or substrate-borne sound or vibration will travel from the Amendment Project Area.

[redacted]

The aquatic Action Area encompasses:

- [redacted]
- [redacted]

In other words, the aquatic Action Area is [redacted]

In sum, the Action Area for the Amendment Project consists of [redacted]

[redacted]

4. Species within the Action Area

4.1. Northern Long-Eared Bat

Northern long-eared bats are characterized by relatively long ears (1.8 centimeters), which extend past the muzzle when laid forward, as well as a long, pointed and narrow tragus (part of the ear; 10.2 millimeters; Whitaker and Mumford 2009). Northern long-eared bats are typically medium to dark brown on the dorsal side and light brown on the ventral side (Caceres and Barclay 2000, Whitaker and Mumford 2009). Ears and wing membranes are usually dark brown (USFWS 2022b). Northern long-eared bats weigh approximately 5 to 8 grams at maturity, and forearms measure approximately 33 to 39 millimeters (USFWS 2022b). The wing membrane connects to the foot at the base of the first toe (Schmidt et al. 2021). Female northern long-eared bats give birth to one young per year and can live as long as 18 years or more (USFWS 2022b).

Northern long-eared bats occur throughout most of the east and north-central US and eastern and central Canada (USFWS 2022b, 2024a, 2025c; Figure 4-1). In 2016, there were an estimated 6.5 million adult northern long-eared bats range-wide (USFWS 2016b). However, white-nose syndrome (WNS)[24] as caused estimated population declines of 97 to 100 percent across 79 percent of the species' range (Cheng et al. 2021), making WNS the most severe threat facing this species (USFWS 2022b). In 2023, the estimated range-wide population of northern long-eared bats was 201,266 adults (USFWS 2023a). In 2024, the estimated summer population of northern long-eared bats was 14,664 individuals (adults and pups) in Virginia and 59,358 individuals (adults and pups) in North Carolina (USFWS 2024a).

[redacted]

Northern long-eared bats typically roost in trees in summer and hibernate in caves or mines in winter. The annual life cycle of northern long-eared bats (Figure 4-2) includes the use of multiple habitats:

- Winter habitat (hibernation)
- Staging/swarming habitat (spring staging and fall swarming)
- Migration habitat (spring and fall migration)
- Summer habitat[25] (summer activity[26])

[24] WNS is a disease caused by the fungus *Pseudogymnoascus destructans* that affects hibernating bats and often leads to mortality (USFWS 2022b).

[25] Summer habitat includes maternity roosts, non-reproductive female and male roosts, roosts after the pups start to fly, and foraging habitat.

[26] Summer activity includes maternity, pup rearing, non-reproductive female and male roosting activity, and foraging.

[redacted]

	January	February	March	April	May	June	July	August	September	October	November	December
Life [1,2] Stage		hibernation		spring staging	pup season				fall swarming		hibernation	
				spring migration		summer occupancy			fall migration			

[1] Dates based on U.S. Fish and Wildlife Service (USFWS) *Northern Long-eared Bat and Tricolored Bat Voluntary Environmental Review Process for Development Projects* (Version 1.1; USFWS 2025c).

[2] Dates may vary by location and year but generally show when northern long-eared bats are most likely to be engaging in each seasonal activity.

Figure 4-2: Annual Life History Diagram for Northern Long-eared Bats.

4.1.1. Listing

On April 2, 2015, USFWS published a final rule to list northern long-eared bats as a threatened species and an interim 4(d) rule to provide measures that are necessary and advisable to provide for the conservation of the species (USFWS 2015b). At the time of listing, USFWS determined that issuance of a

[27] [redacted]

[28] The USFWS [redacted]

4(d) rule[29] was the most appropriate regulatory action it could take for the species, which helped ensure northern long-eared bats were adequately protected when they are most vulnerable (e.g., from birth to flight and when in and around hibernacula), and acknowledged WNS reduction as the primary measure to arrest and reverse the decline of the species. USFWS identified other factors that affect the species but acknowledged WNS was the most severe and immediate threat and the primary reason the species is facing dramatic declines (USFWS 2015b).

On March 23, 2022, USFWS issued a proposed rule to uplist northern long-eared bats from threatened to endangered status (USFWS 2022a). This rule went into effect on March 31, 2023, elevating northern long-eared bats to endangered status and nullifying the 4(d) rule, which means that unauthorized incidental take is prohibited throughout the species' range (USFWS 2022c, 2023b).

4.1.2. Critical Habitat Designation

No northern long-eared bat critical habitat has been designated. At the time of the northern long-eared bat listing as a threatened species in 2015, USFWS concluded that critical habitat was not determinable, although USFWS indicated a determination would be prudent. On April 27, 2016, USFWS reassessed its initial conclusion and found that the designation of critical habitat was not prudent (USFWS 2016a). USFWS indicated that northern long-eared bat summer habitat and summer roost selection are too diverse to qualify for a critical habitat designation. Further, it indicated that the designation of winter habitat would result in cave locations being made public, which could allow public access to the species, resulting in more harm than good (USFWS 2016a).

4.1.3. Environmental Baseline and Stressors

In the final rule to list northern long-eared bats as endangered in 2022 and the *Species Status Assessment Report for the Northern long-eared bat (Myotis septentrionalis)*, Version 1.2, USFWS recognized that WNS was the predominant threat to the species (USFWS 2022b, 2022c). In the 2015 rule to list northern long-eared bats as threatened with a 4(d) rule and the 2024 *Standing Analysis and Implementation Plan-Northern Long-eared Bat and Tricolored Bat Assisted Determination Key*, USFWS also discussed other stressors that influence northern long-eared bat population stability to a lesser extent than WNS (USFWS 2015b, 2024d). Many of the existing local populations continue to face the effects of less impactful past and ongoing stressors. These stressors include impacts to the integrity of bat hibernacula, cave commercialization and other sources of disturbance to hibernating bats, land-use changes and development, forest conversion and management (including prescribed burning), other diseases, scientific collection, predation, wind energy development, climate change, and pesticides (USFWS 2015b, 2024d). These stressors have occurred and continue to occur in areas across the northern long-eared bat range. Impacts associated with climate change (discussed in Section 4.1.4) are also expected to occur across the northern long-eared bat range and continue into the future.

- Disease and Predation: WNS is the foremost stressor to northern long-eared bats (USFWS 2022b). WNS invades the bats' skin and increases the frequency and duration of arousals during hibernation, eventually depleting fat reserves, often resulting in mortality (USFWS 2022b). WNS has caused around 97 to 100 percent population declines across 79 percent of the species' range (USFWS 2022b). Other diseases affect the species, such as rabies, histoplasmosis, St. Louis encephalitis, and Venezuelan equine encephalitis, but to a much lesser extent (USFWS 2015b). Rabies can lead to mortality but is not known to have an appreciable effect on the population (USFWS 2015b). There is

[29] USFWS issued a final 4(d) rule for the species on January 14, 2016. The final 4(d) rule prohibited purposeful take of northern long-eared bats throughout the species' range, except in certain limited instances. It also prohibited incidental take for a limited number of activities in the WNS zone.

limited information on histoplasmosis, St. Louis encephalitis, and Venezuelan equine encephalitis, but no population declines have been associated with these other diseases (USFWS 2015b). The species is known to carry a variety of pests, including chiggers, mites, and bat bugs, but the level of mortality caused by WNS far exceeds any mortality from pests (USFWS 2015b). Animals including owls, hawks, raccoons (*Procyon lotor*), skunks, and snakes prey upon bats; however, information about northern long-eared bat predation is limited and predation does not appear to be a population-changing cause of mortality (USFWS 2015b).

- Wind Energy Development: Wind-energy-related mortality is considered a consequential stressor at local and regional levels (USFWS 2022b). Most bat mortality is caused by collision with moving turbine blades, and wind energy projects kill an estimated 122 individual northern long-eared bats annually (USFWS 2022b). Bats may also collide with turbine towers (USFWS 2015b). If wind projects are sited in forested habitat, effects from wind energy development may include tree clearing associated with turbine placement, road construction, turbine lay-down areas, transmission lines, and substations (USFWS 2015b). Wind energy development continues to increase throughout the northern long-eared bat range. There is, however, no evidence that wind energy development has led to population-level declines. Nevertheless, sustained annual mortality of northern long-eared bats could result in negative impacts to local populations (USFWS 2015b).
- Habitat Loss: Habitat loss includes loss or degradation of suitable roosting or foraging habitat, including fragmentation of maternity colony networks and loss or modification of winter roosts (USFWS 2022b). While forest land cover acreage throughout the species range has been fairly stable, deciduous forest land cover decreased by 1.4 million acres from 2006 – 2016 (USFWS 2022b). Other land cover types that provide foraging habitat, such as emergent wetlands, have also decreased across the species' range (USFWS 2022b). As for winter roosts, modifications to bat hibernacula, including placement of physical barriers to control cave and mine access, intentional or accidental filling or sealing of entries, or creation of new openings, can alter the species' ability to access the site and/or can affect the airflow and microclimate needed for successful hibernation (USFWS 2015b, 2022b). Human entry or other disturbance during hibernation can also impact the species (USFWS 2015b, 2022b). Mining operations, mine passage collapse, and mine reclamation activities can also affect bats (USFWS 2015b). Loss of potential winter habitat through mine closures is a concern in Virginia (USFWS 2015b). Generally, these threats to integrity of bat hibernacula for all species have decreased since USFWS listed the Indiana bat as endangered in 1967 (USFWS 2015b).
- Human Disturbance: The primary forms of human disturbance to northern long-eared bats include cave commercialization such as tours, recreational caving, vandalism, and research-related activities (USFWS 2015b). Changes in light and sound exposure above baseline conditions can cause bats to arouse more frequently during hibernation, resulting in premature depletion of energy stores and starvation (USFWS 2015b, 2024d). Artificial lighting may also cause bats to avoid the area or change established flight or commuting routes resulting in increased energy expenditure and reduced foraging (USFWS 2024d). Northern long-eared bats may avoid vehicle noise on roads, resulting in roads becoming a barrier for commuting and foraging (USFWS 2024d). Roads may also create a collision risk for northern long-eared bats (USFWS 2024d). There have been isolated instances of intentional killing, but there is no evidence that this occurs on a scale large enough to have population-level effects (USFWS 2015b).
- Land-Use Changes: Forest conversion, the loss of forest to another land cover type, may result in loss of suitable roosting and/or foraging habitat, habitat fragmentation, removal or creation of travel corridors, and injury or mortality during clearing activities (USFWS 2015b). The rate of forest conversion across the species' range is fairly stable (USFWS 2015b). Development, such as wind energy projects discussed above and surface coal mining, contributes to the loss of forest habitat

(USFWS 2015b). Surface coal mining is a driver of land change and may destroy forest habitat (USFWS 2015b). In addition, urban development, energy production and transmission, and natural gas extraction are expanding and may affect habitat necessary for establishing maternity colonies and foraging, thereby reducing the amount of forest habitat available to the species (USFWS 2015b). Tree removal for these land-use changes may result in longer flights to find alternative suitable habitat and colony disruption from the removal of roosting or foraging habitat (USFWS 2015b). Depending on the degree of forestation, the impact of tree clearing would change; impacts in areas with little forest or highly fragmented forest would be disproportionately greater than similar-sized losses in heavily forested areas like the Appalachians (USFWS 2015b). Tree-removal activities outside the species' summer home range or away from hibernacula, however, would not likely impact northern long-eared bats (USFWS 2015b).

- Forest Management: Timber harvesting is the primary forest management stressor on the species (USFWS 2015b). Impacts from forest management would vary depending on the timing, location, and extent of tree removal (USFWS 2015b). Forest management activities outside the summer home ranges or away from hibernacula should not result in species impacts (USFWS 2015b). Prescribed burning generally has a beneficial effect on bat habitat, making trees vulnerable to pathogens, thereby providing roosting habitat and opening the tree canopy, facilitating faster juvenile development (USFWS 2015b). Vegetation growth stimulated by prescribed burns has been shown to increase the abundance of insect prey for northern long-eared bats (USFWS 2024d). Prescribed burns may directly expose bats to heat, smoke and gases, but carbon monoxide levels do not reach critical thresholds that could harm bats during low intensity burns (USFWS 2024d). Heat exposure could cause injury but can be avoided through appropriate management practices (USFWS 2024d). There is no evidence that prescribed burns have a significant population-level effect on the species (USFWS 2015b).
- Dust and Contaminants: Fugitive dust generation, such as that produced during site preparation, infrastructure construction, and access road use, can accumulate and coat natural and anthropogenic surfaces, which could damage plants and affect the diversity of ecosystems. This damage could in turn lead to a decrease in food supply (i.e., insects) for northern long-eared bats. Dust accumulation could also adversely affect water quality, which could decrease the availability of clean drinking water and aquatic insects. As a result, northern long-eared bats may have to travel further than otherwise necessary to find clean water and food, which could result in increased energy expenditure (USFWS 2015b). Contaminants of exposure concern include organochlorine pesticides, organophosphates, carbamates, neonicotinoid insecticides, polychlorinated biphenyls, polybrominated diphenyl ethers, pyrethroid insecticides, and inorganic contaminants such as mercury (USFWS 2015b). Bats typically are exposed to these contaminants through consumption of prey and water (USFWS 2015b). Increased sedimentation from construction activities could degrade water quality and result in reduced abundance of aquatic insects that bats consume (USFWS 2024d). There is no evidence of population declines associated with contaminant exposures (USFWS 2015b).
- Synergistic Effects: The above stressors may act synergistically and additively on the species, and exposure to a combination of multiple stressors may be more harmful than a single stressor acting alone (USFWS 2015b).

Specific information was not available regarding activities or land uses that have resulted in these stressors occurring within the counties the Amendment Project crosses or within the terrestrial Action Area. As a result, Mountain Valley [redacted]

[redacted]

4.1.3.1. Land Cover in the Terrestrial Action Area

4.1.3.1.1. Physiography

The Amendment Project traverses the Piedmont physiographic province. The Piedmont is characterized by low, rounded hills with gentle slopes and a few isolated ridges. Bedrock is composed of igneous and metamorphic rocks typically buried under a thick (1.8 to 19.8 meters) blanket of weathered rock responsible for the area's clay-rich soils. Outcrops are typically restricted to stream valleys where erosion has removed the soil layer.

4.1.3.1.2. Land Cover Types

[redacted]

- Deciduous Forest: These are areas dominated by trees that are generally greater than 5 meters tall and comprise greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage in response to seasonal change.
- Evergreen Forest: These are areas dominated by trees that are generally greater than 5 meters tall and comprise greater than 20 percent of total vegetative cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
- Mixed Forest: These are areas dominated by trees that are generally greater than 5 meters tall and comprise greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
- Woody Wetlands: These are areas where forest or scrubland vegetation accounts for greater than 20 percent of vegetative cover, and the soil or substrate is periodically saturated with or covered by water. [redacted]
- Developed Open Space: These are areas with a mixture of some constructed materials but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- Developed, Low Intensity: These are areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas most commonly include single-family housing units.
- Developed, Medium Intensity: These include areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover. These areas most commonly include single-family housing units.
- Developed, High Intensity: Developed, high intensity includes highly developed areas where people reside or work in high numbers. Apartment complexes, row houses, and commercial/industrial

represent examples of developed, high-intensity land use. Impervious surfaces account for 80 to 100 percent of the total cover.

- Shrub/Scrub: Shrub/scrub includes areas dominated by shrubs that are less than 5 meters tall, with a shrub canopy typically greater than 20 percent of total vegetation. [redacted] includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
- Emergent Herbaceous Wetlands: Emergent herbaceous wetlands are defined by areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover, and the soil or substrate is periodically saturated with or covered by water. [redacted]
- Cultivated Crops: Cultivated crops include areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and perennial woody crops, such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. [redacted] includes all land actively tilled.
- Pasture/Hay: Pasture/hay includes areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
- Grassland/Herbaceous: Grassland/herbaceous comprises areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management, such as tilling, but can be used for grazing.
- Open Water: Open water land use includes all areas of open water, generally with less than 25 percent cover of vegetation or soil.
- Barren Land: Barren land includes areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover.

[redacted] Land use types along the Project route are herein classified into the following eight classifications based on predominant land uses:

- Upland Forest/Woodland: Upland forest not being used for specific commercial purposes.
- Upland Open Land: Utility ROWs, open field, vacant land, herbaceous and scrub uplands, non-forested lands, golf courses, and municipal land.
- Agricultural: Cultivated land (e.g., tobacco, soybeans, hay, corn).
- Commercial/Industrial: Manufacturing or industrial plants, paved areas, landfills, mines, quarries electric power or natural gas utility facilities; developed areas, roads, railroads and railroad yards, and commercial or retail facilities.
- Wetland: Palustrine forested, palustrine scrub-shrub, and palustrine emergent wetlands.
- Silviculture: Wooded lands being managed for forest products (i.e., pine plantations).

- Residential: Existing developed residential areas and planned residential developments. This may include large developments, low-, medium-, and high-density residential neighborhoods, urban and suburban residential, multi-family residences, ethnic villages, residentially zoned areas that have been developed or short segments of the route at road crossings with homes near the route alignment.
- Open Water: Field delineated waterbodies with a bank width of greater than six feet, and waterbodies visible on aerial photography where field delineation has not been completed. Major waterbody crossings greater than 100 feet wide are discussed in detail in Resource Report 2.

[redacted]

[redacted]

4.1.4. Climate Change

Although there may be some benefit to northern long-eared bats from a changing climate, overall negative impacts are anticipated, especially at local levels (USFWS 2022b). According to USFWS, although any climate change effects to northern long-eared bats to date are considered “low,” there is growing concern about impacts to bat populations overall due to climate change (USFWS 2022b).

Researchers have identified several climate change factors that may impact bats, including changes in hibernation; mortality from extreme drought, cold, or excessive rainfall; cyclones; loss of roosts from sea-level rise; and impacts from human responses to climate change (e.g., wind turbines; USFWS 2022b). Climate change may also influence disease dynamics such as temperature, humidity, phenology, and other factors which may affect the interactions between WNS and hibernating bats (USFWS 2022b). In addition, climate change could result in a phenological mismatch (e.g., timing of various insect hatches not aligning with key life-history periods of spring emergence, pregnancy, lactation, or fall swarming) and cause shifts in the distribution of forest communities, invasive plants, invasive forest pest species, or insect prey (USFWS 2022b). USFWS further recognizes that changes in temperature and precipitation likely will influence northern long-eared bat resource needs, such as suitable roosting habitat for all seasons, foraging habitat, and prey availability (USFWS 2022b).

USFWS has cautioned that northern long-eared bats' risk of exposure to climate change is range-wide (USFWS 2022b). However, the magnitude, direction, and seasonality of climate variable changes may not be consistent range-wide. In addition, the resiliency of populations and inherent differences among populations (e.g., genetics, summer roost microclimates) may result in differing ability for the species to respond to the same types of changes across the range. While researchers have not observed these impacts in northern long-eared bats to date, based on studies of other insectivorous bat species, USFWS has identified the following potential future risks: reduced reproduction due to drought conditions leading to decreased availability of drinking water and reduced adult survival during dry years; decreased insect availability and reduced echolocation effectiveness resulting in decreased foraging success during heavy precipitation events (Geipel et al. 2019); and reduced reproduction during cooler, wetter springs (USFWS 2022b). As a result, USFWS predicts a "medium impact" to northern long-eared bats from climate change in the future (Somerville 2022, USFWS 2022b).

4.1.5. Recovery Status and Efforts

USFWS has not prepared a recovery plan for northern long-eared bats. Information associated with updates to conservation measures and recovery efforts have been primarily documented in biological opinions issued since the initial 2015 threatened listing (USFWS 2015b), the subsequent uplisting to endangered in 2022, which went into effect March 31, 2023 (USFWS 2023b), and the 2022 SSA (USFWS 2022b). The *Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat* (USFWS 2018a) provided some updates about the species related to recent research (e.g., documented habitat use) and stressors, identifying the additional stressors of vibration, lighting, alteration of clean drinking water, foraging habitat, and composition of insect prey base. The 2022 SSA (USFWS 2022b) and endangered listing (USFWS 2022a) also largely restate information related to conservation measures associated with WNS reduction efforts, wind energy production, and habitat loss.

To address the threat from WNS, USFWS has been working with state and federal agencies, tribes, conservation organizations, institutions, and individuals on management strategies to control the spread of WNS and to minimize the impact WNS is having on northern long-eared bats (USFWS 2014a, 2022b). Since the species' original threatened listing, the agencies responsible for many state and federal forests have proactively closed caves to the public to control the spread of WNS. Many private landowners and private parties, including Mountain Valley, have installed "bat friendly" gates on their caves to control public access and the possible spread of WNS (USFWS 2020b). USFWS has funded WNS-related research and coordinates the WNS National Response Team (USFWS 2025d). Many state and federal agencies, as well as universities and other organizations are also undertaking research and monitoring efforts to gain more information about habitat needs of and use by northern long-eared bats (USFWS 2015c, 2025d).

4.1.6. Species-Specific Information

4.1.6.1. Habitat

4.1.6.1.1. Summer Habitat

During the summer season, reproductive female northern long-eared bats congregate in maternity colonies[30] to raise their young (USFWS 2022b). Maternity colonies are typically found in mature-growth forests with dead/decaying trees and/or live trees with cavities or exfoliating bark, although they may also use bat houses, buildings, bridges, culverts, and other anthropogenic structures during the summer in some locations (Foster and Kurta 1999, Lacki and Schwierjohann 2001, Amelon and Burhans 2006, Ford et al. 2006, USFWS 2022b). Northern long-eared bats use multiple types of trees for roosts throughout their range, including different species of oak (*Quercus* spp.), maple (*Acer* spp.), and even pine (*Pinus* spp.) trees (Foster and Kurta 1999, Caceres and Barclay 2000, Carter and Feldhamer 2005, Perry and Thill 2007). Since the arrival of WNS, maternity colonies typically consist of 1 to 11 individuals (Gorman et al. 2023), while they typically consisted of 30 to 60 individuals before the arrival of WNS (Whitaker and Mumford 2009). Pups are born as early as late May or early June but may be born as late as mid-July (Whitaker and Mumford 2009). Pups usually become volant (able to fly) by 21 days of age (Kunz 1971, Krochmal and Sparks 2007). The number of bats per maternity roost declines from pregnancy to post-lactation (Lacki and Schwierjohann 2001, Sparks et al. 2004).

Canopy coverage surrounding a northern long-eared bat summer roost tree can range from approximately 50 percent to more than 80 percent (Sasse and Pekins 1996, Lacki and Schwierjohann 2001, Perry and Thill 2007, Timpone et al. 2010). Within a given tree stand, maternity colonies are typically located in larger-diameter trees, relatively open areas, and on upper and middle slopes. Larger trees and open areas are likely to increase sun exposure, which aids in the development of young bats (Perry and Thill 2007, Taylor et al. 2020). Locations with fewer trees surrounding maternity roosts may also present fewer obstacles and thereby benefit juvenile bats that are learning to fly (Perry and Thill 2007).

Unlike the communally roosting reproductive females, male northern long-eared bats usually select solitary roosts (Caceres and Barclay 2000). Both non-reproductive females and males often roost in live tree cavities (Caceres and Barclay 2000, Lacki and Schwierjohann 2001, Broders and Forbes 2004) and occasionally in caves and mines (Barbour and Davis 1969). Structurally, summer roosts used by males are similar to those used by maternity colonies, although trees used by males may be smaller diameter than those used by maternity colonies (Perry and Thill 2007).

Northern long-eared bats demonstrate site fidelity to summer habitat and switch between multiple roost trees within the summer habitat every one to three days (Foster and Kurta 1999, Arnold 2007, Timpone et al. 2010). Between roost trees, females may move up to approximately 2,000 meters and males up to approximately 1,000 meters (Broders et al. 2006). Bats switch roosts for a variety of reasons, including temperature, precipitation, predation, parasitism, and roost trees falling (Carter and Feldhamer 2005).

Roost trees may be habitable for one to several years, depending on the species and condition of the tree (Perry and Thill 2007). The many different species used as roosts suggest that tree form, not species, is most important for choosing roost locations (Foster and Kurta 1999). Northern long-eared bats often form groups nested within networks of roost trees that contain a central, primary roost tree (Johnson et al.

[30] Groups of roosting reproductive females and their pups (young bats) born that year (USFWS 2022b).

2012a). Northern long-eared bats may roost singly or in small groups among networks of 1 to 16 roost trees spread over areas ranging from less than 1 acre to 85 acres (Henderson and Broders 2008, Johnson et al. 2012a).

4.1.6.1.2. Winter Hibernation, Spring Staging and Fall Swarming Habitat

In Virginia, northern long-eared bats hibernate from mid-November to late-March (USFWS 2025c). For hibernation, northern long-eared bats require areas in caves or mines with constant winter temperatures, high humidity, and no air currents (Griffin 1940, Whitaker and Winter 1977, Stones 1981). Within hibernacula, the bats are most often located in small crevices or cracks, often with only the nose and ears protruding (USFWS 2015a). Especially in areas where caves or mines are not present, northern long-eared bats may use non-traditional hibernacula, such as buildings or bridges, or atypical hibernacula, such as talus slopes, rock shelters, or rock crevices/outcroppings (USFWS 2022b, 2024b). However, northern long-eared bats have not been documented hibernating in atypical hibernacula, bridges, or culverts in Virginia (USFWS 2024d); therefore, they are not being evaluated as hibernacula in this assessment. While northern long-eared bats generally exhibit strong philopatry to a hibernaculum, they have been documented moving between hibernacula during the winter (Whitaker and Rissler 1992; USFWS 2014b, 2024b). Northern long-eared bats hibernate as individuals or in small groups, with hibernating population sizes ranging from a few individuals to rarely more than 100 within a hibernaculum (Barbour and Davis 1969, Caire et al. 1979, USFWS 2024b).

Spring staging occurs after northern long-eared bats emerge from hibernation and before migrating to summer habitat. Fall swarming occurs after migration from summer habitat and before winter hibernation. During staging and swarming, bats use the area around hibernacula for roosting and foraging, and for mating in fall (USFWS 2024a). During swarming and staging, northern long-eared bats were found to use roost trees up to 4.5 miles from hibernacula in fall and up to 1.2 miles from hibernacula in spring (USFWS 2024a).

4.1.6.1.3. Migration Habitat

Spring migration in Virginia typically occurs from April to mid-May (USFWS 2025c). During this period, northern long-eared bats leave spring staging habitat near their winter hibernacula to move to summer habitat to establish maternity roosts. Fall migration, when the bats leave summer maternity habitat to move to fall swarming habitat near hibernacula, typically occurs from mid-August to mid-November in Virginia (USFWS 2025c). While little is known about northern long-eared bat behavior during migration, short regional migratory movements have been documented between summer roost and winter hibernacula (USFWS 2022b). Flights vary in duration depending on the distance between these habitats, and migration distances up to 55 miles have been documented for northern long-eared bats (USFWS 2022b).

Northern long-eared bats may use day roosts and temporary night roosts to rest during migration throughout their range (USFWS 2022b). Lewis et al. (2022) found that northern long-eared bats occupied the same roost trees in fall that were used as maternity roosts during the summer, indicating habitat use characteristics are similar between seasons. Similarly, during migration, northern long-eared bats may use human-made structures that are used during the summer maternity season such as buildings, bridges, and bat houses (USFWS 2022b; Section 4.1.6.1.1). Many bat species, including northern long-eared bats, select edge habitat for foraging and as travel corridors and may use edge habitat as migration travel corridors (USFWS 2022b).

4.1.7. Occurrence

4.1.7.1. Summer Occurrence

[redacted]

[redacted]

4.1.7.2. Winter Hibernation, Spring Staging and Fall Swarming Occurrence

[redacted]

4.1.7.3. Migration Occurrence

[redacted]

4.2. Atlantic Pigtoe

Atlantic pigtoe is a small freshwater mussel within the Unionidae family that is endemic to portions of Virginia and North Carolina. It is typically encountered at lengths of 1.0–1.5 inches and rarely exceeds 2.0 inches in shell length (USFWS 2022f). Atlantic pigtoe has a thin but solid sub-rhomboid-shaped shell that is boxy and tall relative to its length (Fuller 1973, Wisniewski 2008). The shell's periostracum (outer layer) is yellowish brown, though juveniles may have green rays across the entirety of the shell. Additionally, the umbo is raised slightly above the hinge line, and the posterior ridge is prominent. Internally, shells feature medium-sized lateral teeth, a deep beak cavity, and nacre that is predominantly white and salmon with iridescent posterior margins (Fuller 1973, Wisniewski 2008). Atlantic pigtoe has an affinity for coarse sand and gravel substrates ranging from small creeks to larger rivers (USFWS 2021a). This species is associated with high water quality along with clean, moderately flowing water that is able to maintain silt-free substrates (86 Federal Register [Fed. Reg.] 64000).

Range-wide, Atlantic pigtoe has exhibited marked declines in populations for various reasons including habitat fragmentation, water quality degradation, and sedimentation (USFWS 2021a). Historically distributed across 12 major Atlantic Slope river basins from Virginia to Georgia, the species is currently structured within 7 populations that are assigned to 14 management units (MUs). Referring to extant populations at the MU scale, which represents a less-coarse scale than at a river-basin scale, helps define the smaller, isolated populations. Despite an overall 41.6 percent reduction in population representation (5/12 = 41.6 percent), extant populations—particularly in isolated, upper basin tributaries—retain the ecological characteristics necessary to support long-term persistence (USFWS 2021a).

[redacted]

[redacted]

4.2.1. Activity Patterns and Habitat

Atlantic pigtoe is found in small streams and rivers with high dissolved oxygen content and sufficient flow to maintain clean and silt-free substrate (USFWS 2021a). The preferred habitat of Atlantic pigtoe is coarse sand and gravel near downstream edge of riffles. Less commonly, it is found in cobble, silt, or sand detritus mixtures (Bogan and Alderman 2008). This species typically occurs near the headwaters of rural watersheds and [redacted]

Most freshwater mussels, including Atlantic pigtoe, are found in aggregations (mussel beds) that vary in size and are often separated by stream reaches in which mussels are absent or rare (Vaughn 2012). Genetic exchange occurs between and among mussel beds via sperm drift, host fish movement, and movement of mussels during high-flow events. Nevertheless, as discussed below, the contemporary distribution of Atlantic pigtoe is patchy, resulting in largely isolated populations and, in turn, potentially limited genetic exchange.

Atlantic pigtoe is a short-term, tachytictic (i.e., short-term) brooder, meaning it has a short-term breeding cycle (USFWS 2021a). Spawning has been observed in early spring, with release of semi-buoyant white-to pink-colored conglutinates in the late spring to early summer (C. Eads, North Carolina State University [NCSU], email to S. McRae, USFWS, on January 13, 2016; Alderman and Alderman 2014b).The conglutinates are tubular, and the color varies from white to pink to red depending on the percentage of fertilization, with less fertilization being more red (unfertilized eggs are red; C. Eads, NCSU, email to S. McRae, USFWS, on January 13, 2016). Once the glochidia attaches, depending on the host fish, it could take 30–60 days to develop before dropping in the substrate to reside as a juvenile. Like many freshwater mussels, Atlantic pigtoe relies on fish hosts for successful reproduction. Hosts for the Atlantic pigtoe include rosefin shiner (*Lythrurus ardens*), creek chub *(Semotilus atromaculatus*), longnose dace (*Rhynichthys cataractae*), white shiner (*Luxilus albeolus*), satinfin shiner (*Cyprinella analostana*), bluehead chub (*Nocomis leptocephalus*), rosyside dace (*Clinostomus funduloides*), pinewoods shiner (*Lythrurus matutinus*), swallowtail shiner (*Notropis procne*), mountain redbelly dace (*Chrosomus oreas*), bluegill (*Lepomis macrochirus*), redbreast sunfish (*Lepomis auritus*), Roanoke darter (*Percina roanoka*), shield darter (*Percina peltata*), and fallfish (*Semotilus corporalis;* O'Dee and Watters 2000, Johnson et al. 2012b, Wolf 2012). Atlantic pigtoe can live up to 58 years with an average lifespan of 30 years, but it reaches reproductive maturity in about 3 years (Eads and Levine 2011, Johnson et al. 2012b; 86 Fed. Reg. 64000). The slow growth, delayed reproductive maturity, and low fecundity of this species limit its adaptability to a changing environment (USFWS 2022f).

Atlantic pigtoe, like many freshwater mussels, specifically require clean, highly oxygenated, and flowing water to maintain uncompacted stream bed habitat conducive to their life history characteristics. Since this species is primarily anchored into the substrate, it also relies on high water flow to deliver nutrients and oxygen while also filtering microscopic particulate matter such as phytoplankton and dissolved organic matter for sustenance (86. Fed. Reg. 64000).

Mussel behaviors (e.g., siphoning, reproductive displaying) have been documented to change in response to high levels of suspended solids (Aldridge et al. 1987, Corey et al. 2006). Although mussels may continue to actively filter and exhibit reproductive displays during periods of elevated turbidity, these behaviors often diminish with prolonged exposure. Mussel displays have been documented to decrease in frequency and duration or cease altogether during sustained turbid conditions (Corey et al. 2006). The effectiveness of mussel displays may be reduced due to the limited visibility of host organisms. In addition, turbid water conditions have been documented to reduce feeding rates and efficiency as well as alter physiological energetics in the form of reduced oxygen uptake and increased nitrogenous excretions (Aldridge et al. 1987).

4.2.2. Site-Specific Data

[redacted]

The Amendment Project and its aquatic Action Area [redacted]

4.2.2.1. Virginia

[redacted] Mountain Valley will share with USFWS any information that it may receive in the future. [redacted]

In response to USFWS's recommendation, [redacted]

31 [redacted]

[redacted]

[redacted]

In summary, the Amendment Project's aquatic Action Area [redacted]

4.2.2.2. North Carolina

[redacted]

[redacted]

[redacted]

Finally, Mountain Valley [redacted]

32 [redacted]

[redacted]

As discussed in Section 1.4.5, [redacted]

[redacted]

[redacted]

[redacted]

4.2.2.3. Environmental Baseline and Stressors

When USFWS listed Atlantic pigtoe as threatened in 2021, it identified water quality degradation, water quantity fluctuation, instream habitat and substrate degradation, and habitat fragmentation as the primary stressors for the species (86 Fed. Reg. 64000). The sources of these issues may include but are not limited to development, agricultural and silvicultural practices, invasive species, and dams and barriers (86 Fed. Reg. 64000). The following provides further information about stressors on Atlantic pigtoe based

33 [redacted]

on the best scientific and commercial information available, including USFWS's listing decision and the 2021 Updated SSA. Impacts to Atlantic pigtoe from climate change are discussed in Section 4.2.3.

- Development and Urbanization: Development and urbanization threaten Atlantic pigtoe throughout its range. Associated activities include (1) land conversion for residential, commercial, and industrial uses; (2) water infrastructure, which results in pollution point discharges; (3) utility crossings and ROW maintenance, which may cause direct exposure and crushing of individuals, sedimentation, habitat disturbance, direct runoff, increased stream temperature, and promotion of the use of off-road vehicles that may erode banks; and (4) anthropogenic activities, which may lower water tables and make the species more susceptible to depressed flow levels, may result in point discharges, and may cause secondary impacts such as increased contaminant introduction, utilization of barriers and impervious surfaces, and forest conversion. Addition of impervious surfaces causes water to enter streams faster than would occur naturally, leading to stressed or displaced populations. Pollutants and contaminants from development can also directly negatively impact water quality. The resulting stormwater runoff from some types of development affects water quality parameters such as temperature, pH, dissolved oxygen, and salinity, which in turn alters the water chemistry potentially making it inhospitable for aquatic biota. High turbidity and poor water quality both directly negatively affect the filter feeder, Atlantic pigtoe. Urbanization can also alter stream habitat directly by channelization or clearing of riparian areas (USFWS 2021a).
- Transportation: Road development increases impervious surfaces, land clearing, and habitat fragmentation. Roads are also associated with changes in surface water temperatures, patterns of runoff, changes in sedimentation, and increased heavy metals, salts, organics, and nutrients to stream systems. Salts used in the road deicing process are also toxic to mussels if they enter the water. Improperly constructed culverts that accompany road construction can act as barriers if flow through the culvert varies significantly from the rest of the stream or if the culvert becomes perched such that host fish cannot pass through. Further, dredging and channelization have altered river habitats by accelerating erosion, increasing bed load, reducing depth, decreasing habitat diversity, causing geomorphic instability, and causing riparian canopy loss (USFWS 2021a).
- Agricultural Activities: Row-crop agricultural practices, nutrient enrichment, water withdrawals, and chemical control using pesticides, herbicides, fungicides, and insecticides are all threats to freshwater mussels. Waste from confined animal feeding and commercial livestock operations is another potential source of contaminants. Nutrient pollution (from livestock and fertilizers) can leach into nearby waters, causing algal blooms and lowering dissolved oxygen in potentially suitable streams for Atlantic pigtoe. Irrigation is commonly accomplished by pumping from local streams and rivers, which would impact mussel species by adjusting typical flow levels, subjecting them to desiccation or predation from terrestrial predators.
- Silvicultural Activities: Silvicultural activities, if performed according to guidelines or BMPs, can retain adequate conditions for aquatic ecosystems. If these best practices are not followed, however, lost shade and canopy cover and increases in surface runoff can lead to increased evapotranspiration, changing water levels, and poor water quality (USFWS 2021a). Further, cleared forest areas can lead to increased sediment runoff. Mussels and fishes are potentially affected by changes in bed material load, changes in bed sediment composition, changes in channel formation, stream crossings, and inadequately buffered clear-cut areas, all of which can be sources of sediment entering streams (USFWS 2021a). Siltation and erosion from conversion of natural forest to monoculture is a well-documented stressor to aquatic systems.
- Invasive Species: Many invasive species affect freshwater mussels like Atlantic pigtoe, such as the Asian clam (*Corbicula fluminea*) and flathead catfish (*Pylodictus olivaris*). The Asian clam affects benthic substrates, competes with native species for resources, and causes an ammonia spike in surrounding water when they die off in mass (Scheller 1997). A recent study demonstrated that native

mussel growth was negatively associated with Asian clam abundance, indicating invasive clams may be a pervasive stressor to native species (Haag et al. 2021). Flathead catfish are invasive in many Atlantic Slope rivers, including documented occurrences in most of Atlantic pigtoe's range (Fuller et al. 2025). They are voracious predators that may impact host fish communities and mussel-host interactions that are essential to support development and dispersal of Atlantic pigtoe.

- Dams and Impoundments: Extinction/extirpation of North American freshwater mussels can be traced to impoundment and inundation of riffle habitats in all major river basins of the central and eastern United States (North Carolina Aquatic Nuisance Species Management Plan Committee 2015). Dams can also lead to habitat fragmentation, genetic isolation, buildup of sediments, dissolved oxygen depletion, and changes in water temperatures (USFWS 2021a).
    - o [redacted]
- Synergistic Effects: The combination of factors listed above, including but not limited to dams and impoundments, invasive species, development, and urbanization, is more likely harmful to Atlantic pigtoe rather than a single stressor alone (USFWS 2021a).

[redacted]

[redacted]

The best available science indicates that the stressors listed above have occurred and continue to occur in areas across the Atlantic pigtoe's range, including [redacted]

4.2.2.3.1. Land Cover Baseline Assessment

To help USFWS evaluate the environmental baseline conditions for Atlantic pigtoe within the Amendment Project's aquatic Action Area, Mountain Valley [redacted]

Table 4-2: [redacted] **for Environmental Baseline for Atlantic Pigtoe Analysis.**

[redacted]	Bare Soil/Rocks/Sand	Cultivated Crops	Deciduous Forest	Developed, High Intensity	Developed, Low Intensity	Developed, Medium Intensity	Developed, Open Space	Emergent Herbaceous Wetlands	Evergreen Forest	Grassland/Herbaceous	Mixed Forest	Open Water	Pasture/Hay	Shrub/Scrub	Woody Wetlands	Total (acres)
[redacted]	4	315	8,894	170	1,223	388	2,354	2	1,816	528	2,437	254	3,356	706	70	**22,717**
[redacted]	2	897	8,083	9	625	63	1,507	2	4,686	1,905	3,593	339	4,283	1,481	316	**27,790**

4.2.2.3.2. Baseline Stream Assessments

[redacted]

[redacted]

[redacted] Substrates are dominated by sand and episodic occurrences of heterogeneous substrates such as boulder, cobble, and gravel with expanses of uplifted (exposed) bedrock. Land in the vicinity of the Amendment Project [redacted] largely is privately owned, and forestry and agricultural activities are relatively common land use. These land uses [redacted] contribute to the presence of irregular-sized riparian buffers. [redacted] also receives elevated levels of sedimentation and, therefore, exhibits relatively high embeddedness of coarse substrates. Riffle habitats [redacted] are generally short and infrequent. Pool habitats are most common in [redacted] and the relatively low water velocities facilitate deposition of non-coarse substrates. Additionally, woody debris is abundant, particularly along the stream margins.

[redacted] further inform a characterization of the baseline conditions. Abiotic habitat information was recorded along 1,020 meters of stream reach. The wetted width throughout the site [redacted] morphology is primarily composed of a deep run habitat with a riffle [redacted] Water depths averaged 1.9 meters with a max depth of 3.0 meters in [redacted] Velocities [redacted] averaged 61.3 centimeters per second with a maximum of 103.5 centimeters per second at the head of the riffle. Substrate composition was dominated by sand (77.7 percent) with intermittent bedrock (8.1 percent) in the outside river bends and cobble (7.0 percent) in a short riffle habitat [redacted]

Sources of anthropogenic influences within the aquatic Action Area included unstable slopes, boat ramps, rip rap, bridges, and pipeline crossings unrelated to the Amendment Project.

4.2.3. Climate Change

Based on a review of the best available science, the effects of climate change such as droughts and increases in temperature have been seen in the range of Atlantic pigtoe and may contribute to habitat degradation (USFWS 2021a). Additionally, water quality, water quantity, instream habitat occurrence and quality, and habitat connectivity have and will continue to be influenced by climate change. However, more general impacts from climate change to aquatic systems, like the ones that Atlantic pigtoe occupies, include the following:

- Increases in water temperatures that may alter fundamental ecological processes, thermal suitability of aquatic habitats for resident species, as well as the geographic distribution. Adaptation by movement to suitable habitat might be possible; however, human alteration of dispersal corridors may limit the ability of species to relocate, thus increasing the likelihood of species extinction and loss of biodiversity.
- Changes and shifts in seasonal patterns of precipitation and runoff will alter the hydrology of stream systems, affecting species composition and ecosystem productivity. Aquatic organisms are sensitive

to changes in frequency, duration, and timing of extreme precipitation events such as floods or droughts, potentially resulting in interference of reproduction. Further, increased water temperatures and seasonally reduced streamflows will alter many ecosystem processes, including increases in nuisance algal blooms.

- Climate change is an additional stressor to sensitive freshwater systems, which are already adversely affected by a variety of other human impacts, such as altered flow regimes and deterioration of water quality.
- As mentioned by Poff et al. (2002), aquatic ecosystems have a limited ability to adapt to climate change. Reducing the likelihood of significant impacts will largely depend on human activities that reduce other sources of ecosystem stress to ultimately enhance adaptive capacity; these include maintaining riparian forests, reducing nutrient loading, restoring damaged ecosystems, minimizing groundwater (and stream) withdrawal, and strategically placing any new reservoirs to minimize adverse effects.
- Specific ecological responses to climate change cannot be easily predicted because new combinations of native and non-native species will interact in novel situations.
- Since sedentary freshwater mussels have limited refugia from disturbances such as droughts and floods, and since they are thermo-conformers whose physiological processes are constrained by water temperature within species-specific thermal preferences, climate-induced changes in water temperature can lead to shifts in mussel community structure (Galbraith et al. 2010).

4.2.4. Listing

On December 16, 2021, USFWS published a final rule listing the Atlantic pigtoe as threatened under the ESA, along with a special rule under Section 4(d) of the statute that provides exceptions for species restoration efforts by state wildlife agencies, channel restoration projects, bank stabilization projects, and silvicultural practices and forest management activities (USFWS 2021b).

[redacted]

Decline in range and population is correlated with habitat degradation, water quality decline, sedimentation, urban development, dam construction, and habitat fragmentation (86 Fed. Reg. 64000). Those factors may also inhibit the ability of Atlantic pigtoe host fish (e.g., rosefin shiner, creek chub, longnose dace, white shiner, satinfin shiner, bluehead chub) to thrive, ultimately affecting the reproduction rates and longevity of the mussel population (USFWS 2021b). Furthermore, the species may suffer from competition with invasive or introduced species, such as the Asian clam, which is present throughout the watersheds across the range of Atlantic pigtoe (Foster et al. 2017, Ferreira-Rodríguez et al. 2018; 86 Fed. Reg. 64000).

4.2.5. Critical Habitat Designation

USFWS designated final critical habitat for Atlantic pigtoe on December 16, 2021. [redacted]

[redacted]

USFWS's critical habitat designation for Atlantic pigtoe identified four specific PBFs essential to key life-history functions and the species' conservation: (1) Stable Substrates and Connected Instream Habitats, (2) Adequate Hydrologic Flow Regimes, (3) Water and Sediment Quality, and (4) Presence of Suitable Fish Hosts. [redacted]

4.2.6. Recovery Status

In February 2022, USFWS created an initial Recovery Outline for Atlantic pigtoe until a comprehensive recovery plan for the species is approved in the future (USFWS 2022f). Overall, Atlantic pigtoe received a threatened listing status because it has declined in abundance and distribution and many of the remaining populations are fragmented, leaving the species with low resiliency, substantially diminished redundancy, and low adaptive potential, as indicated by its severely reduced representation (USFWS 2022f).

While USFWS has not issued a formal Recovery Plan, it included an Action Plan in its February 2022 Recovery Outline. Recovery actions focus on surveying and monitoring current and historical Atlantic pigtoe populations, protecting high-quality habitats in occupied areas, reducing threats to extant populations, and improving population resiliency (USFWS, 2022f). USFWS recommends the following actions to address Atlantic pigtoe's needs.

- Protect key habitats and riparian lands in high-priority watersheds (watersheds that currently support Atlantic pigtoe populations with high or moderate resiliency) by leveraging partnerships with state and federal agencies.
- Develop a species propagation, augmentation, and reintroduction plan that will improve resiliency, redundancy, and representation across Atlantic pigtoe range.
- Continue and expand captive propagation efforts to support augmentation and reintroduction efforts across Atlantic pigtoe's historical and Current Range.
- Study Atlantic pigtoe genetics and genomic parameters that will aid in recovery planning.
- Devote resources to Atlantic pigtoe populations in all seven extant watersheds, including resources to host fish monitoring and habitat protection.
- Develop a range-wide species distribution model.
- Expand Atlantic pigtoe surveys to include historically occupied watersheds.
- Educate local communities within the range of Atlantic pigtoe to increase public awareness about the species needs and the contribution of anthropogenic stressors.
- Research sedimentation factors in the Current Range of Atlantic pigtoe to determine the severity and contribution of this stressor.
- Evaluate the physico-chemical water quality parameters to the presence, abundance, and or recruitment of Atlantic pigtoe to understand and help alleviate water quality stressors.
- Investigate invasive species such as the Asian clam and flathead catfish and their role in the decline of Atlantic pigtoe, specifically in designated critical habitat.
- Identify physical barriers that impact gene flow and dispersal in Atlantic pigtoe and host fish in designated critical habitat.

- Address synergistic stressors such as water quality, predation, connectivity, and global warming, to then identify the most influential stressor in each population MU.

Notwithstanding the absence of a formal recovery plan for the species, USFWS and state wildlife agencies already have been working to conserve Atlantic pigtoe. The following conservation actions were underway to support the needs of the species at the time USFWS prepared the Recovery Outline (USFWS 2022f).

- NCSU and the NCWRC began a captive propagation program for Atlantic pigtoe in 2012. In-vitro methods have started to be used to support the development of these species with no host fish. The overall goals of this program are to have successful captive breeding, augmentation of wild populations, and then reintroduction into Atlantic pigtoe habitat that has been historically occupied.
- NCWRC and the Virginia Fisheries and Aquatic Wildlife Center have been working on propagation and culture technology for reared juvenile Atlantic pigtoe mussels.
- NCWRC teamed up with Georgia Southern University to develop genomic markers and study the genetic diversity of several at-risk mussel species, including Atlantic pigtoe.
- [redacted] The surveys are funded by USFWS through Section 6 of the ESA.
- In the Atlantic pigtoe final listing rule, USFWS included specific exemptions to incidental take prohibitions under Section 4(d) of the ESA. These exemptions apply to efforts aimed at species restoration, channel restoration, bank stabilization, and certain forest management activities that are expected to have overall conservation benefits for the species.
- USFWS and NCWRC have developed a programmatic Safe Harbor Agreement that covers 21 aquatic species including Atlantic pigtoe. This agreement is designed to support species restoration efforts in their historical habitat and other suitable habitat in North Carolina. USFWS has partnered with North Carolina Forest Service to launch “Foresters for Healthy Waters.” This program provides additional conservation support to landowners interested in improving aquatic habitat protection for rare and at-risk species. This program is currently active in the range of Atlantic pigtoe.
- NCDOT has agreed to commit millions of dollars to multiple conservation partners that support the research, propagation, and management of imperiled aquatic species, including Atlantic pigtoe.

4.3. James Spinymussel

James spinymussel is a small freshwater mussel, or bivalve mollusk, of the family Unionidae. James spinymussel valves (the two shell parts) are moderately heavy and sub-rhomboid, averaging approximately 5.1 centimeters in length and a maximum length typically not exceeding 7.6 centimeters (USFWS 1990, Hove and Neves 1994). Although absent from most specimens, individuals can have two to three short spines on each valve, [redacted] More commonly found on juveniles, the spines are typically eroded by adulthood. The shell’s periostracum (outer layer) is yellow to dark brown and shiny with dark concentric rings. Internally, shells feature medium-sized lateral teeth, a shallow beak cavity, and nacre that is typically white but can exhibit pink or blue hues (Clarke and Neves 1984, USFWS 1990).

James spinymussel is endemic [redacted] However, James spinymussel is now predominantly confined to small and medium rivers characterized by clean, unimpacted waters and stable sand and gravel substrates (Clarke and Neves 1984, Hove and Neves 1994). [redacted]

[redacted]

Range-wide, James spinymussel populations have experienced substantial declines due to a suite of anthropogenic stressors including sedimentation, agriculture and silviculture, water pollution, impoundments, and habitat fragmentation (USFWS 1988, 1990). [redacted] Remaining populations are isolated and fragmented and show signs of continued decline, with the species currently federally classified as endangered according to USFWS and state listed as endangered in both Virginia and North Carolina according to VDWR and NCNHP (Hove and Neves 1994, Petty 2005).

According to [redacted] Since USFWS's publication of the James spinymussel Recovery Plan in 1990 (USFWS 1990), [redacted] This expanded spatial distribution is not attributed to the establishment of new populations but rather to increased and more comprehensive survey efforts across the species' historical range. [redacted]

[redacted]

[redacted]

[redacted] its occurrence across much of this range is characterized by low density (typically less than 10 individuals per site), patchy distribution, and reduced population redundancy. [redacted]

Population genetic studies support recognition [redacted] recent evidence points to significant genetic differentiation, further reinforcing the need for basin-specific management strategies [redacted]

4.3.1. Activity Patterns and Habitat

James spinymussel is generally found in clean-swept substrates consisting of sand and cobble with or without boulders, pebbles, or silt (USFWS 1990). Historically, the species inhabited large waterbodies, but its current distribution is confined to small- and medium-sized rivers (Clarke and Neves 1984, Hove and Neves 1994). Waterbodies that contain James spinymussel are of varied widths and depths with slow to moderate water velocities. The widths of the waterbodies range from 10 to 75 feet, and depths range from 0.5 to 3.0 feet (USFWS 1990).

James spinymussel is considered tachytictic (i.e., short-term brooder), and spawning occurs during spring months (USFWS 1990). Males broadcast sperm into the water column, and females siphon in the free-flowing sperm and brood the fertilized eggs until glochidia (larvae) are released in early to mid-summer after water temperatures reach a daily mean of 23 degrees Celsius (USFWS 1990, Hove and Neves 1994). Like most unionids, the James spinymussel is an obligatory parasite during early life stages and depends on fishes to host and transport its glochidia following the brooding period. Known hosts include bluehead chub, rosyside dace, blacknose dace (*Rhinichthys atratulus*), mountain redbelly dace, rosefin shiner, satinfin shiner, and central stoneroller (*Campostoma anomalum*; Hove and Neves 1994). After attachment to a suitable fish host, the glochidia will metamorphosize and in 7 to 50 days, drop into the stream substrate as newly transformed juveniles. Recent evidence and ongoing monitoring efforts have shown that the maximum age of James spinymussel individuals may reach 30 years, but the average lifespan is estimated at 15 to 20 years (USFWS 2022e).

James spinymussel exhibits seasonal and environmentally mediated vertical (endobenthic, epibenthic) and horizontal movement patterns that can have an influence of species detectability during survey activities. These variable detectability rates identify key components of behavior and habitat use. Across multiple studies, vertical positioning within the substrate has been shown to vary with season, flow conditions, and life stage (e.g., Ostby and Angermeier 2012, Esposito 2015, Boisen 2016, Ostby 2022), while horizontal movement is more likely associated with hydrologic events such as flooding (e.g., Verdream 2020).

James spinymussel is often endobenthic, remaining buried within the substrate for extended periods. Seasonal patterns strongly influence vertical movement, with individuals more frequently observed at the surface (epibenthic) during the spring and summer, likely related to spawning activity, and increasingly buried in the fall months. [redacted] Burrowing behavior may be more prevalent in sand-dominated streams, where James spinymussel can be difficult to detect even during excavation survey methods (Ostby 2019).

Epibenthic behavior appears to be promoted by moderate flows and suppressed during high-flow events. Boisen (2016) noted increased surface activity following high flows, suggesting mussels may burrow during flood conditions to avoid displacement and resurface later to resume feeding. On the other hand, no clear relationship was found between water temperature and surfacing. James spinymussel shell length also correlates with vertical position, with larger individuals more likely to be near the surface (Ostby 2022), indicating that juveniles are more consistently endobenthic.

Horizontal movement, including both immigration and emigration, has been documented in more than one system and appears to be episodic and flow-mediated. [redacted]

4.3.2. Site-Specific Data

James spinymussel [redacted]. No critical habitat has been proposed or designated for James spinymussel.

The Amendment Project and its aquatic Action Area [redacted]

The following summarizes the best available science regarding potential James spinymussel occurrence within the Amendment Project's aquatic Action Area in [redacted]

4.3.2.1. Virginia

[redacted] Mountain Valley requested all available occurrence records from VDWR and VDCR regarding any known occurrences [redacted] Mountain Valley will share with USFWS any information that it may receive in the future. [redacted]

Nevertheless, [redacted] USFWS recommended that Mountain Valley [redacted]

In response to USFWS's recommendation, [redacted]

[redacted]

[redacted].

4.3.2.2. North Carolina

[redacted]

[redacted]

Mountain Valley submitted [redacted]

[redacted]

As discussed in Section 1.4.5, Mountain Valley [redacted]

[redacted]

[redacted]

[redacted]

In accordance with the recommendations of NCWRC [redacted]

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34 [redacted]

[redacted]

4.3.2.3. Environmental Baseline and Stressors

James spinymussel is considered extirpated from 90 percent of its historical range (USFWS 1990). Threats from water pollution and sedimentation, competition from introduced Asian clams, and a fragmented population structure prompted USFWS to list James spinymussel as endangered throughout its entire range on July 22, 1988 (Clarke and Neves 1984; USFWS 1988, 1990; 73 Fed. Reg. 3991). For some populations, additional threats included sewer overflow discharge and fluctuations in riverine temperatures due to discharges from upstream reservoirs (USFWS 1990). USFWS issued a species recovery plan in 1990, which outlined four objectives to achieve species delisting. However, despite the recovery plan, declines have continued into the 21st century, and James spinymussel remains rare throughout its range with only small, fragmented populations persisting in a handful of streams and rivers.

When USFWS listed James spinymussel as endangered in 1988, it recognized many of the species' existing populations continued to face the effects of past and ongoing stressors, including invasion of essential habitats by the Asiatic clam and potential water quality degradation by agricultural and silvicultural runoff, effluent from sewage treatment plants, and chemical spills (53 Fed. Reg. 27689, 27689-93 [July 22, 1988]). USFWS observed habitat changes from dam construction, industrial pollution, chemical spills, channelization, and sewage discharges had been a major factor in the decline of James spinymussel. Furthermore, the James spinymussel 5-year review in 2022 list dams, land-use modification, and predation as ongoing stressors for the species (USFWS 2022e). The following provides further information about stressors on James spinymussel based on the best scientific and commercial information available. Impacts to the James spinymussel from climate change are discussed in Section 4.3.3.

- Invasive Species: When listing James spinymussel as endangered, USFWS noted that the James River drainage is infested with Asiatic clams. Asian clams were first introduced into the James River in 1971 and, by 1984, had spread upstream into the distribution of James spinymussel (USFWS 1990). This invasive species continues to compete with James spinymussel for food and interfere with James spinymussel's reproduction, which may be a principal cause of the species' decline, but additional research is needed to understand the full effect Asian clams have on James spinymussel (USFWS 1990, 2022e).
- Dams and Impoundments: Dam construction and other impoundments on rivers in the southeast United States have contributed to the decline of many mussel populations (USFWS 1990). Flood-control dams [redacted] basin present a threat to James spinymussel because impoundments change the habitat from lotic to lentic conditions, lower water temperatures, increase siltation, reduce connectivity, decrease habitat quality and quantity, and possibly eliminate host fish species (USFWS 1990, 2022e).
    - [redacted]

[redacted]

- Industrial and Sewage-Related Pollution: Freshwater mussel populations have been reduced by effluent from chlor-alkali plants, fly ash and sulfuric acid spills, acid mine drainage, and organic wastes (USFWS 1990). Insecticides, specifically low concentrations of lindane, phorate, and trichlorfon, have significant effects on mussels (USFWS 1990). Toxic chemical spills and channelization also threaten James spinymussel habitat.
  - o [redacted]
  - [redacted]
- Agricultural and Silvicultural Activities: Human activity, like agricultural and forestry activities, creates heavy silt loads that can have severe effects on mussels (USFWS 1990). Agricultural runoff, which can include pesticides and fertilizers, also threatens habitat for the species (53 Fed. Reg. 27691). Erosion and siltation also result from commercial logging operations. Siltation resulting from these activities is a significant factor contributing to water quality problems for James spinymussel (USFWS 1990).
- Development and Land-Use Modification: Road construction is a significant factor contributing to water quality problems for James spinymussel (USFWS 1990). Development associated with municipal growth and industrialization in the [redacted] also impacts the species (53 Fed. Reg. 27690). Federal activities like mineral exploration, timber sales, recreation development, stream alterations, road and bridge construction and maintenance, and implementation of forest management plans can also impact James spinymussel and its habitat via water quality issues such as turbidity and sedimentation (USFWS 2022e). Although flooding is a naturally occurring event, it is also a threat to James spinymussel that is exacerbated by land modification. Land modification, such as development and impervious surface in watersheds, can alter flow regime and contribute to the severity and impacts of flood events (USFWS 2022e; 53 Fed. Reg. 27692).
- Predation: At the time of listing, there was no information suggesting that predation was a threat to James spinymussel (53 Fed. Reg. 27689-27693). In recent years, however, it has been observed that raccoons and muskrats (*Ondatra zibethicus*) may pose a serious threat to James spinymussel. Specifically, predation may be a threat to James spinymussel populations [redacted]
- Acid Rain: Acid rain may pose a threat to Atlantic drainage mussel populations, especially those inhabiting poorly buffered systems (USFWS 1990).

[redacted]

As indicated above, the best available science from USFWS and other sources indicates that habitat modification, agricultural and silvicultural activities, invasive species, predation, development, acid rain, and industrial and sewage pollution have occurred and continue to occur in areas across the James spinymussel's range, including in relevant proximity to the Amendment Project, potentially causing stressors that affect the species' baseline condition. To build on the information available in the scientific analyses for James spinymussel, Mountain Valley [redacted]

4.3.2.3.1. Land Cover Baseline Assessment

To help USFWS evaluate the environmental baseline conditions for James spinymussel within the Amendment Project's aquatic Action Area, [redacted]

Table 4-3: [redacted] for Environmental Baseline for James Spinymussel Analysis.

[redacted]	Bare soil/Rocks/Sand	Cultivated Crops	Deciduous Forest	Developed, High Intensity	Developed, Low Intensity	Developed, Medium Intensity	Developed, Open Space	Emergent Herbaceous Wetlands	Evergreen Forest	Grassland/Herbaceous	Mixed Forest	Open Water	Pasture/Hay	Shrub/Scrub	Woody Wetlands	Total Area (acres)
	4	315	8,894	170	1,223	388	2,354	2	1,816	528	2,437	254	3,356	706	70	**22,717**
	2	897	8,083	9	625	63	1,507	2	4,686	1,905	3,593	339	4,283	1,481	316	**27,790**

4.3.2.3.2. Baseline Stream Assessments

A baseline stream characterization was performed for the aquatic Action Area [redacted]

[redacted]

[redacted] Substrates are dominated by sand and episodic occurrences of heterogeneous substrates such as boulder, cobble, and gravel with expanses of uplifted (exposed) bedrock. [redacted] Pool habitats are most common in [redacted] and the relatively low water velocities facilitate deposition of non-coarse substrates. Additionally, woody debris is abundant, particularly along the stream margins.

[redacted] and the associated observations from these *in situ* efforts further inform [redacted] Water depths averaged 1.9 meters with a max depth of 3.0 meters [redacted] Substrate composition was dominated by sand (77.7 percent) with intermittent bedrock (8.1 percent) [redacted]

4.3.3. Climate Change

Based on a review of the best available science, there is no indication that James spinymussel or its habitat has experienced direct effects from climate change to date. But future effects, both beneficial and adverse, are possible.

While the effects of climate change have not been shown to directly impact James spinymussel, it has been related to increased flooding, which can have long-term negative impacts on the species. The Intergovernmental Panel on Climate Change has predicted that freshwater species, including James spinymussel, face a greater threat of extinction and habitat degradation with climate change and the projected trend of climate change (USFWS 2022e).

Kane (2013), a study led by VDWR, in partnership with the National Wildlife Federation and funded by USFWS, modeled the potential for different climate change scenarios to affect James spinymussel in the future. The study concluded that “[w]hile the spiny mussel is threatened by breeding isolation and water quality issues, it does not appear that climate change will have a direct impact on the persistence of this species.” In fact, “[u]nder both the lower and higher emission scenarios, climatic conditions are projected to become more favorable for this species by mid-century.”

While Kane (2013) stated that "[t]hese projections are encouraging," the researchers noted that "[w]ater quality will likely continue to be an issue [for the species] because of more intense rainfall events that will affect runoff, but also from drier soils that will likely influence erosion and base streamflows as temperatures rise, especially in summer months." Given the sedentary nature of mussels, the researchers concluded that James spinymussel "will not be well-suited to respond to these climate-related impacts."

4.3.4. Listing

USFWS listed James spinymussel as an endangered species under the ESA on July 22, 1988 (53 Fed. Reg. 27689). [redacted] According to the listing, the number of James spinymussel had been reduced in its range by 5 to 10 percent, and the few drainages that supported populations were being invaded by Asian clams and degraded by runoff from agriculture, chemical spills, and silvicultural activities (53 Fed. Reg. 27689).

Based on genetic studies performed by Perkins et al. (2017) that assigned James spinymussel to a monophyletic clade within the Pleurobemini tribe, USFWS formalized a taxonomic change from *Pleurobema* to *Parvaspina* for James spinymussel on February 17, 2022 (87 Fed. Reg. 8960-8967). USFWS's latest 5-Year Review for the species, published in 2022, recommends downlisting James spinymussel from endangered to threatened (USFWS 2022e).

4.3.5. Critical Habitat Designation

No James spinymussel critical habitat has been designated or proposed.

4.3.6. Recovery Status

In 1990, USFWS published a Recovery Plan for James spinymussel. At that time, the species had been extirpated from 90 percent of its historical range and had few documented populations, making the species more vulnerable to threats (USFWS 1990). The overall goal of the Recovery Plan was to delist the species by protecting habitat of existing populations and expanding the populations back within its historical range. To accomplish the Recovery Plan goals, USFWS established Recovery Objectives and Recovery Actions needed, which are discussed below.

4.3.6.1. Recovery Plan Objectives and Criteria

The Recovery Plan Objectives for James spinymussel are to delist or reclassify the species from endangered to threatened. The recovery criteria to reclassify James spinymussel were:

Objective 1. Reclassify James spinymussel from endangered to threatened status when the likelihood of extinction in the foreseeable future has been eliminated by meeting the following criteria:

A. Populations of James spinymussel [redacted] and 80 percent of all other known populations are stable or expanding (as shown by monitoring over 10-year period) and show evidence of recruitment (specimens age five or younger).
B. Populations in at least four rivers (or creeks) are distributed widely enough within their respective habitats such that it is unlikely a single adverse event in the river would result in the total loss of that population.
C. All known populations of the species are protected from present and foreseeable anthropogenic and naturals threats that may interfere with their survival. (Note: This objective is not measurable and may

not be reasonably achievable.)

Objective 2. Remove James spinymussel from the federal list of endangered and threatened species when the following criteria has been met, in addition to A–C above:

D. Through reestablishment and/or discoveries of new populations, viable populations of the species exist [redacted] Each river or river segment will contain at least three population centers which are dispersed to the extent that a single adverse event would be unlikely to eliminate James spinymussel from its natural or reestablished location. For a reestablished population, surveys must show that 3 year-classes, including one year-class of age 10 or older, have been naturally produced within each of the population centers.

E. Habitat protection strategies have been successful, as evidenced by recruitment and an increase in population density and/or an increase in the population size and length of river reach inhabited at 75 percent of the sites with viable populations.

4.3.6.2. Recovery Actions

The Recovery Actions needed for James spinymussel are as follows:

- Identification of essential habitat.
- Investigation of threats such as siltation, pesticides, contamination, municipal and industrial effects, and invasive species interactions.
- Assessment and monitoring of projects posing threats to the species and the species' habitat.
- Methods to control invasive species such as the Asian clam.
- Protection strategies for James spinymussel habitat.
- James spinymussel life history studies.
- Reestablish populations.
- Monitor existing and reestablished populations.

To support continued recovery, USFWS recommended conservation actions such as (1) reintroduction into waterbodies across the species' historical range, (2) modification or removal of dams that alter flow regimes and limit habitat connectivity, and (3) reduction of sediment, nutrient, and contaminant loading in stormwater runoff entering occupied watersheds (USFWS 2022e).

4.3.6.3. Five-Year Status Review

In 2022, USFWS published a 5-Year Review evaluating the listing status of James spinymussel. USFWS explained that, since it first listed James spinymussel as endangered in 1988, [redacted] Based on this increased abundance and distribution, USFWS recommended downlisting the species to threatened under the ESA.

The 2022 5-Year Review [redacted] When the species was first proposed for listing, populations in North Carolina were unknown (USFWS 1987). Since then, the species has been documented in additional locations, [redacted]

Despite these positive trends, only one recovery criterion (1B) from the 1992 Recovery Plan has been met. However, the current and projected levels of resiliency and redundancy suggest that James spinymussel is no longer at risk of extinction. According to Objective 1 of the Recovery Plan, the species may be reclassified from endangered to threatened once extinction risk has been sufficiently reduced.

5. Effects Analysis

A "No Effect" determination is appropriate when the action will not affect the species (USFWS and National Marine Fisheries Service [NMFS] 1998). A "May Affect" determination is appropriate when a proposed action could result in adverse effects to the species. A "May Affect – Is Not Likely to Adversely Affect" determination is appropriate when effects on the species are expected to be insignificant, discountable, or completely beneficial. Insignificant effects relate to the size of the impact and never reach the scale of a take. Discountable effects are extremely unlikely to occur. Beneficial effects are contemporaneous positive effects without any adverse effects. A "May Affect – Likely to Adversely Affect" determination is appropriate if any adverse effect may occur to the listed species as a result of the proposed action.

5.1. Terrestrial Species

5.1.1. Northern Long-Eared Bat

The effects analysis addresses potential impacts to habitat and individuals from exposure to potential stressors identified in Section 4.1.3 that may result from the proposed Amendment Project's construction, operation, maintenance, and restoration activities. Analysis of potential effects to northern long-eared bats that may result from Amendment Project activities is based on potential occurrence of northern long-eared bat in the terrestrial Action Area during the annual seasonal life cycle of the species. [redacted]

5.1.1.1. Effects of Dust

Fugitive dust generation can occur during site preparation, infrastructure construction, and access road use. Dust from construction sites can coat natural and anthropogenic surfaces. At high levels, dust deposition can damage plants and affect the diversity of ecosystems, thereby degrading habitat quality for northern long-eared bats. Whether northern long-eared bats experience direct effects from dust exposure is unknown, but it is likely high amounts of dust would be needed to result in an adverse effect to northern long-eared bats, and potentially only if the dust is toxic. Nevertheless, as discussed in Section 2.5, Mountain Valley will implement dust control and suppression measures that will avoid, minimize, and contain any dust emissions from the Amendment Project.

5.1.1.2. Effects of Light

Lighting can affect the behavior and biology of northern long-eared bats, including foraging, commuting, emergence, roosting, and hibernation. A predictor of when many species of bats emerge from day roosts is ambient light level (Brack 1983, Viele et al. 2002). Thus, artificial lighting could delay the emergence of bats from their roost at sundown. Given that insect densities decline rapidly at sundown (Speakman et al. 1991), delayed emergence could cause bats to miss important foraging time. Delayed emergence could, therefore, negatively affect the fitness of individuals. Lighting at a roost might also cause roost abandonment or cause bats to use alternate roosts.

Light may change the ways northern long-eared bats move through a landscape by causing commuting bats to take indirect routes among roosting and foraging sites and by making some sites inaccessible. Such barriers to movement may disrupt the ecological functionality of the landscape. Northern long-eared bats using sub-optimal routes may fly farther, increasing energy costs and flight time, which could increase exposure to predators and the elements. If alternative routes are not available, colonies may be isolated from their foraging areas, potentially forcing them to abandon their roosts.

Light may affect foraging behavior by affecting insect prey and can potentially prevent or reduce foraging activity, effectively causing a loss of foraging areas. Some insects are drawn to light, depending in large part upon the species of insect and the wavelengths of light. An abundance of insects can attract some species of bats that may benefit from the concentrated food resource. For example, moths are often attracted to lights, and northern long-eared bats often eat moths (Nagorsen and Brigham 1993, Brack and Whitaker 2001). However, northern long-eared bats are not known to concentrate foraging efforts in lighted areas. Lighting can change the composition and abundance of insect prey, which is potentially harmful if bats harvest fewer or less nutritious prey or prey that require a higher energy cost to catch and consume. Insects may be attracted away from dark areas, negatively affecting bats by reducing prey availability for bats that do not forage in lit areas.

To avoid the potential for such light effects adversely affecting northern long-eared bats, Mountain Valley will implement the conservation measures described in Section 2.5.

5.1.1.3. Effects of Noise

For bats, sound is perceived as any vibration of the eardrum in the audible frequency range resulting from an incremental variation in air pressure at the ear. Little brown bats, a congener species to northern long-eared bats, hear sounds in the 0.002 to 50 kilohertz range with a focus on sounds within the range of their echolocation (Henson 1965). If northern long-eared bats occupy habitat adjacent to construction activities, exposure to above-ambient noise levels may startle or displace individuals; decrease time spent on roosting, reproductive, or foraging behaviors; increase time in flight to search for and travel to alternative habitat; or mask communication signals. While increased noise may mask communication signals, bats can reduce signal masking through a variety of behavioral mechanisms (Lopez et al. 1988, Slabbekoorn and Peet 2003, Brumm et al. 2004, Ulanovsky et al. 2004, Leonard and Horn 2005, Penna et al. 2005, Fuller et al. 2007, Gillam et al. 2007), allowing them to habituate to noisy environments (Bunkley et al. 2014, California Department of Transportation [Caltrans] 2016). Exposure to above-ambient noise levels may also result in acute acoustic trauma through permanent or temporary hearing loss. While Amendment Project noise impacts will depend on the noise level, frequency, duration, and distance from the point source, acute acoustic trauma is not anticipated from general construction, operation, and maintenance activities due to bats' physiological adaptations to prevent noise overexposure (Caltrans 2016). Blasting activities result in sudden, very loud noise exposure and vibrations. Blasting in close proximity to roosts or hibernacula could result in individual mortality or injury via acoustic trauma or crushing caused by structural hibernacula damage from percussive vibrations.

To avoid the risk of northern long-eared bats being adversely affected by noise from Amendment Project activities, including blasting, Mountain Valley will implement the conservation measures described in Section 2.4.2.4 and Section 2.5.

5.1.1.4. Effects of Water Quality

During land-disturbance activities, stormwater runoff from upland areas can carry sediments and pollutants into aquatic habitat, such as excavated soil contamination, accumulated heavy metals from vehicle emissions, fluid leaked from vehicles, and pesticides. Such inputs may result in increased sediment loading and temporarily degrade water quality. Additional impacts include alteration of physical habitat and changes in primary productivity, which can limit the suitability of stream habitats for aquatic biota, including insects that northern long-eared bats prey upon (Nagorsen and Brigham 1993, Brack and Whitaker 2001). However, E&SC measures will be applied throughout the Amendment Project to protect water quality and reduce sedimentation associated with wetland/stream crossings. Potential impacts from suspended sediment associated with sedimentation are expected to be localized, and foraging northern long-eared bats are expected to have alternative adequate drinking water and foraging locations in the surrounding landscape. Likewise, no significant changes in water quality or invertebrate prey are expected to occur as a result of operations and maintenance activities. Mountain Valley will implement AMMs for mowing and pesticide application during operations and maintenance (Section 2.5), as well as numerous other conservation measures described in Section 2.5 to protect against water quality impacts. Therefore, no significant changes in water quality or invertebrate prey that would adversely affect northern long-eared bats are anticipated from Amendment Project construction, operation, and maintenance activities.

5.1.1.5. Effects by Season

5.1.1.5.1. Winter

5.1.1.5.1.1. Hibernacula

The Amendment Project is not likely to adversely affect any hibernating northern long-eared bats or hibernacula.

In general, when conducted in proximity to hibernacula, construction activities such as tree clearing, blasting, and drilling can impact hibernacula structure and/or microclimate, including changes to hydrology or air flow, which can impact the suitability of hibernacula for northern long-eared bats. Additionally, construction activities can directly affect hibernating northern long-eared bats if the integrity or environment of a hibernaculum is affected. Construction activities such as tree clearing, blasting, and drilling also can generate dust, noise, or light that may disturb or displace hibernating northern long-eared bats when generated at sufficient levels. Project operation and maintenance activities could similarly generate dust, noise, or light that may disturb or displace northern long-eared bats hibernating in proximity to those activities. Disturbance that causes arousal from hibernation can be deleterious if it causes depletion of fat reserves needed to sustain the bats during the hibernation period (USFWS 2022b).

USFWS recommends implementing a 0.5-mile conservation buffer (defining an impact analysis distance) around any known or potentially occupied hibernacula to avoid impacts to hibernating northern long-eared bats and their hibernacula and recommends implementing a 5.0-mile conservation buffer around known or potentially occupied hibernacula to avoid impacts to spring staging and fall swarming habitat (USFWS 2024d). Mountain Valley, therefore, [redacted]

[redacted]

[redacted] Additionally, [redacted] Therefore, [redacted] there will be no effect to hibernating northern long-eared bats or their hibernacula.

5.1.1.5.1.2. Buildings and Structures

Northern long-eared bats could hibernate [redacted]. Removal or modification of human-made structures during winter hibernation (November 16 – March 31) could potentially injure or kill northern long-eared bats if hibernating individuals are present. Mountain Valley [redacted] Therefore, the Amendment Project is not likely to adversely affect hibernating northern long-eared bats [redacted]

5.1.1.5.2. Spring Staging and Fall Swarming

The Amendment Project is not likely to adversely affect any spring staging or fall swarming northern long-eared bat or their staging/swarming habitat.

After emerging from hibernation, northern long-eared bats are thought to participate in spring staging, where bats remain in forest habitat near hibernacula for a short time (i.e., two to three days) before migrating to summer maternity areas (Section 4.1.6.1). A similar process, although over a longer period of time, occurs in fall with bats roosting in forested habitat near hibernacula. When conducted in staging and swarming habitat, construction activities, such as tree clearing, can permanently remove potential roost sites or fragment suitable habitat areas. [redacted]

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35 [redacted]

[redacted]

Felling trees during the spring staging or fall swarming periods could adversely affect individual northern long-eared bats through death, injury, or disturbance to bats roosting in a tree that is cut down. Dust, noise, or light generated by construction activities also may temporarily disturb or displace northern long-eared bats during spring staging and fall swarming if they experience impactful levels of those stressors.

[redacted] Therefore, [redacted] there will be no effect to spring staging and fall swarming northern long-eared bats or their staging/swarming habitat.

[redacted]

[redacted]

5.1.1.5.3. Summer

5.1.1.5.3.1. Forest

Construction activities could permanently or temporarily remove, fragment, or degrade portions of suitable forest roosting habitat [redacted] could be impacted by changes to the surrounding environment due to construction activities that result in tree clearing or the generation of dust, noise, or light. Exposure to dust, noise, or light generated by construction activities could disturb any northern long-eared bats [redacted] As a result, any northern long-eared bats subjected to impactful levels of these stressors may need to search for and travel to alternative roost trees, foraging habitat, and travel corridors. Additionally, tree clearing during the summer occupancy season (April 1 – September 30) could injure or kill adult northern long-eared bats or non-volant pups or disturb bats roosting in a tree that is cut down.

[redacted]

[redacted]

[redacted] Nevertheless, roost trees are ephemeral in nature, and northern long-eared bats use adjacent trees as alternate roosts as trees become unsuitable. In a multi-year study in Kentucky, Silvis et al. (2015) found that, "loss of a primary roost or less than or

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36 [redacted]

equal to 20 percent of secondary roosts in the dormant season may not cause northern long-eared bats to abandon roosting areas or substantially alter some roosting behaviors . . . .” Northern long-eared bats often use a variety of alternate roosts, and this flexibility in roost selection may allow them to better adapt to roost loss, especially in areas where roosting habitat is abundant (Silvis et al. 2015, USFWS 2022b). Based on Silvis et al. (2015), [redacted]

According to USFWS guidance, [redacted] As a result, forest removal is not likely to adversely affect northern long-eared bats.

Some trees along the edges of areas cleared for the Amendment Project may be damaged during tree clearing activities. Most damaged trees will survive but may be more prone to insect infestation and disease that may cause the trees to die, in turn providing new potential maternity roosts for northern long-eared bats. Tree clearing will only be conducted within the Amendment Project LOD [redacted] for foraging and travel. To avoid direct impacts to roosting northern long-eared bats and their forest roosting habitat, [redacted] Additionally, to avoid or minimize impacts to adult northern long-eared bats or non-volant pups from potential exposure, or impacts to surrounding forested roosting habitat from dust, noise, or light, Mountain Valley will implement a number of conservation measures, including the following (see also Sections 2.4.2.4 and 2.5):

- [redacted]
- [redacted]
- implement a 7:00 a.m. to 7:00 p.m. workday for most construction activities[38]
- utilize “full cut-off” lighting fixtures to maximize shielding
- use water to control fugitive dust as needed

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37 [redacted]

38 [redacted]

After construction is complete, ROW operations and maintenance will primarily involve mowing the pipeline ROW to keep vegetation in an herbaceous state. Operations and maintenance may also include hazard tree removal and tree trimming to keep an open canopy over the ROW and for human safety reasons. Tree trimming is unlikely to make entire trees unsuitable as roosts for northern long-eared bats (USFWS 2024d). Hazard tree removal potentially could eliminate suitable roosts. Nevertheless, hazard trees by definition already are at significant risk of failure. [redacted] Mountain Valley will coordinate with USFWS and FERC to ensure that any such activity is not likely to adversely affect northern long-eared bats (Section 2.5). As a result, hazard tree removal and tree trimming are not likely to adversely affect northern long-eared bats.

Finally, northern long-eared bats and their forested roosting habitat could be affected through disturbance from ROW operations and maintenance activities if they generate impactful levels of added dust, noise, or light. However, any such potential impacts from the Amendment Project to forested roosting habitat or individuals would be temporary and limited in scope. Moreover, Mountain Valley will implement the conservation measures described above (see also Sections 2.4.2.4 and 2.5) to avoid and minimize these impacts. Therefore, the Amendment Project is not likely to adversely affect northern long-eared bats or their forest roosting habitat.

5.1.1.5.3.2. Culverts and Bridges

The suitability of any culverts/bridges occurring in [redacted] Additionally, culvert/bridge removal or modifications during the summer occupancy period (April 1 – September 30) could adversely affect roosting adult northern long-eared bats and non-volant pups through death, injury, or disturbance. ROW operations and maintenance activities also may add minor amounts of dust, noise, or light and may include hazard tree removal, which could affect the microclimate and suitability of culverts/bridges and, if generated at sufficient levels, may disturb or displace northern long-eared bats. [redacted] However, potential impacts from dust, noise, and light during construction, operations, and maintenance would be temporary, limited in scope, and minimized by the implementation of the conservation measures described above.

To avoid impacts to northern long-eared bats, [redacted]

[39] In response to a request for clarification from WEST, [redacted]

Culverts less than 4.5 feet in diameter/height and 23.0 feet in length are unlikely to provide suitable roosting habitat for northern long-eared bats (USFWS 2024c). The 23.0-feet length is based on the typical width of a 2-lane road, and bats are unlikely to be present in shorter culverts. Thus, culverts associated with roads narrower than two lanes are unlikely to support roosting habitat for northern long-eared bats. [redacted] Therefore, the Amendment Project is not likely to alter the suitability of any culvert roost habitat or adversely affect northern long-eared bats roosting in culverts.

Finally, [redacted] As a result, the Amendment Project will not alter the suitability of any northern long-eared bat bridge roost habitat or affect northern long-eared bats roosting in bridges.

[redacted]

[redacted]

5.1.1.5.3.3. Buildings and Structures

[redacted] As a result, no effects to northern long-eared bats roosting in buildings or structures are expected to occur from building or structure removal or modification.

5.1.1.5.4. Migration

Given the varied landscapes traversed by northern long-eared bats during their migrations between summer habitat and winter habitat (e.g., USFWS 2022b; Section 4.1.6.1), [redacted] Potential impacts from construction activities to tree roosts, bridges, and culverts related to suitability for migration habitat and effects on northern long-eared bats from dust, noise, or light are similar in scope to potential impacts described for summer roosting habitat (Section 5.1.1.5.3) but are likely to be shorter in duration and intensity, as bats are not tied to the area and can simply move away from the potential stressor. The types of potential impacts from operation and maintenance activities on migration habitat and northern long-eared bats would be similar to the potential impacts described for summer roosting habitat (Section 5.1.1.5.3), but, again, exposure is likely to be shorter in both duration and intensity.

The terrestrial Action Area in Virginia contains [redacted] Temporary impact areas will be reclaimed and/or allowed to regenerate following construction but could take up to 25 years to become suitable roosting habitat for migrating bats. [redacted]

The Amendment Project will remove [redacted] Some trees along the edges of the Amendment Project LOD are likely to be damaged during tree clearing activities, [redacted]. Tree clearing will only be conducted within the Amendment Project LOD and may [redacted]

[redacted]

The loss of forest along the linear Amendment Project route that will occur due to the proposed construction, operation, and maintenance of the Amendment Project may [redacted] Northern long-eared bats are known to select forest edge habitat for foraging and as travel corridors and may use forest edge habitat as migration travel corridors (USFWS 2022b; Section 4.1.6.1.3). Changes to baseline conditions in northern long-eared bat migration habitat could result from added dust, noise, and light from construction, operation, and maintenance activities. However, these small changes to baseline habitat conditions will be temporary and limited in scope.

[redacted] Impacts of operations and maintenance on northern long-eared bats during migration would be similar to the impacts described for summer roosting habitat (Section 5.1.1.5.3). Based on [redacted] Additionally, migrant individuals are transient and not expected to stay in one location for an extended period of time, and there are areas of suitable roost habitat available [redacted]

Culverts and bridges within [redacted] temporary day and/or night roosts by northern long-eared bats during migration. [redacted] Impacts from the generation of dust, noise, or light during construction, operations, and maintenance on migrating northern long-eared bats using culverts or bridges would be temporary, limited in scope, and minimized and avoided by the implementation of the conservation measures described above (Sections 2.4.2.4 and 2.5).

During migration, northern long-eared bats may also roost in [redacted] Removal or modification of human-made structures during migration could potentially injure or kill northern long-eared bats if individuals are present. [redacted]

Nighttime construction activities could displace northern long-eared bats from foraging habitat and travel corridors during migration. Mountain Valley will implement a 7:00 a.m. to 7:00 p.m. workday for most construction activities, use “full cut-off” lighting fixtures, and fugitive dust control (Section 2.5) to avoid or minimize potential impacts from dust, noise, or light generated by construction activities including nighttime construction. Therefore, the Amendment Project may affect but is not likely to adversely affect northern long-eared bats during migration.

5.1.1.6. Beneficial Effects

Many bat species, including northern long-eared bats, select edge habitat for foraging and as travel corridors (USFWS 2022a). Where the Amendment Project LOD occurs within forested land cover, n[redacted]

The conversion of forest to herbaceous cover and the use of native herbaceous plant species during restoration in the ROW could increase and improve foraging opportunities for northern long-eared bats. To the extent that the Amendment Project increases diversity of land cover, new or increased insect abundance could improve northern long-eared bat foraging habitat. Maintaining the Amendment Project ROW in an herbaceous vegetative state [redacted] flight may be more energetically efficient than flight through structurally complex areas such as forests.

5.1.1.7. Effects Determination

The proposed construction, operation, and maintenance of the Amendment Project may affect but is not likely to adversely affect northern long-eared bats. This conclusion is supported by the following:

- Mountain Valley will implement conservation measures (Sections 2.4.2.4 and 2.5) that will avoid or minimize impacts [redacted] during the summer occupancy and migration periods.
- [redacted] (i.e., the hibernacula/swarming/staging impact assessment area; VDWR 2025).
- [redacted]
    - [redacted]
    - [redacted]
- [redacted]
- [redacted]
- There will not be any [redacted] (Section 5.1.1.5.3.2).
- Potential impacts to [redacted] temporary and are not expected to change the habitat suitability for northern long-eared bats.
- Where the Amendment Project occurs within forested land, [redacted]

- Habitat restoration using native herbaceous plant species in the permanent, linear Amendment Project LOD and continuous maintenance will [redacted]

5.2. Aquatic Species

5.2.1. Sediment Impacts to Aquatic Species

5.2.1.1. Suspended and Deposited Sediment

Sediment is defined as a soil particle that is either suspended within the water column or settled at the bottom of a stream, lake, or other waterbody. Sediment originates from the geologic processes in which earthen material (e.g., soil) is worn away and transported by natural forces such as wind and water. These processes are highly variable under natural conditions due to variations in parent material, precipitation, and other environmental factors. Sediment also originates from human activities that cause upland and instream disturbance. Incremental increases in sedimentation due to Amendment Project construction can be divided into two main categories that may impact aquatic species: suspended sediment (total suspended solids [TSS], suspended sediment, or suspended sediment concentration [SSC])[41] and deposited sediment. Suspended sediment primarily consists of abiotic particles larger than two microns that are suspended in the water column. Deposited sediments are those particles that settle out of the streamflow and accumulate on the streambed. The potential implications of each category for aquatic species are described in detail below.

5.2.1.2. Suspended Sediment and Mussels

In general, it is widely recognized that increased sedimentation and turbidity may impact freshwater mussels, which has been documented at sufficiently increased concentrations to impair feeding, reduce respiration efficiency, and inhibit recruitment or survivorship (e.g., Osterling et al. 2010, Gascho Landis et al. 2013, Osterling and Hogberg 2014, Gascho Landis and Stoeckel 2015, Tuttle-Raycraft and Ackerman 2019, Goldsmith et al. 2021). While sedimentation is broadly acknowledged as a stressor to mussels at elevated concentrations, there is no specific suspended sediment or turbidity concentration threshold available for identifying potential adverse effects to freshwater mussels. The absence of such a threshold is associated with methodological inconsistencies, limited standardizations, and ecological complexities across mussel species and their habitats. Below are some examples of the limitations and challenges in identifying a specific suspended sediment or turbidity concentration threshold.

- Numerous field and laboratory studies have unsuccessfully attempted to quantify the effects of sedimentation on unionid mussels. Acute and chronic exposure studies have demonstrated that juvenile mussels are particularly sensitive to pollutants and other stressors, including those associated with sedimentation metrics (Bringolf et al. 2007). Laboratory research also has demonstrated that mollusk fertilization in some species is impacted by elevated TSS levels (Gascho Landis et al. 2013, Gascho Landis and Stoeckel 2015). For example, at TSS levels less than 20 milligrams per liter, fertilization of female pondmussel (*Ligumia subrostrata*) was not observed, and glochidia development of ebonyshell (*Reginaia ebenus*) was severely stunted (Gascho Landis et al. 2013, Gascho Landis and Stoeckel 2015). However, such effect-concentrations vary widely among species and life stages, complicating the development of a uniform, numeric sediment threshold for freshwater mussels.

[41] Measurement of sediment suspended in water can be described in several ways such as suspended sediment, TSS, or SSC. [redacted]

- Excessive sedimentation can cause impacts that extend across multiple biological scales, from individuals to entire communities, demonstrating a lack of consistent endpoints, exposure metrics, and biological indicators as summarized by Henley et al. (2000) and Goldsmith et al. (2021).
- The available sediment impact assessment methods are inconsistent in definitions, methods, references, substrate composition, loading rates, exposure durations, or biological endpoints, all of which hinder cross-study comparisons (Brim Box and Mossa 1999; Vondracek et al. 2005). Even fundamental parameters such as TSS and turbidity (including the measurement units) are measured inconsistently across studies, thereby preventing reliable data analyses and synthesis efforts (Goldsmith et al. 2021).
- As noted by Zhu et al. (2024), many studies lack baseline data or reference sites for post-disturbance event comparisons. Field assessments are often constrained by the absence of real-time water quality data, incomplete understanding of background variability, and/or lack of sufficient temporal and spatial resolution. In many cases, it would also be impossible to accurately isolate any effects attributably solely to sedimentation as studies observe a suite of co-occurring stressors.

Verifiable biological responses of freshwater mussels to sedimentation are also strongly dependent on species-specific tolerances, environmental context, and synergistic effects. Even closely related mussel species can exhibit vastly different responses to elevated sediment loads due to differences in life history strategies or microhabitat use (Strayer et al. 2004). Mussel recruitment studies have also shown sedimentation impacts vary significantly based on site-specific environmental contexts, like altered flow regimes, and the presence of other stressors like pollution or habitat fragmentation (Osterling et al. 2010, Strayer and Malcom 2012, Gascho Landis and Stoeckel 2015). Mussels are naturally adapted to tolerate periodic increases in turbidity and suspended sediment, such as those caused by rain or small flood events, because they can temporarily close apertures in response to changed water quality conditions (Brim Box and Mossa 1999). A seminal study on sedimentation impacts on mussels, Ellis (1936), found that, even in silt-free environments, mussel apertures were closed approximately half of the time. This behavior indicates that mussel species have different exposure profiles to sedimentation compared to fish species and can be less vulnerable to temporary changes.

Given the significant variability and ambiguity among available studies, Mountain Valley requested from USFWS a specific sediment concentration exposure threshold for mussels to use in this analysis. USFWS explained that the best available science cannot support establishing a specific threshold (J. Stanhope, USFWS, pers. comm. to Mountain Valley, October 2, 2024). This is due to the complex interplay of biological, ecological, and watershed-specific factors that influence mussel responses mentioned above.

In the absence of a numeric threshold for identifying potential adverse effects to mussels from sedimentation and turbidity, for purposes of this analysis, Mountain Valley is [redacted] USFWS concurred that this was a reasonable approach (J. Stanhope and K. Matthews, USFWS, pers. comm. to Mountain Valley, May 14, 2025). [redacted]

[redacted]

[redacted]

In summary, for the reasons discussed above, suspended sediment that originates from the Amendment Project is not likely to adversely affect freshwater mussels within the aquatic Action Area, including Atlantic pigtoe and James spinymussel. Similarly, suspended sediment that originates from the Amendment Project is not likely to adversely affect freshwater mussel habitat, including designated critical habitat for Atlantic pigtoe. As a result, no additional discussion of potential suspended sediment-related effects to mussels or critical habitat for mussels is warranted in this BA.

5.2.1.3. Sediment Deposition and Mussels

Increased deposition and embeddedness can temporarily reduce aquatic habitat suitability by filling interstitial spaces within gravel and cobble substrates, limiting water flow through the substrate, and affecting benthic productivity. However, these effects are generally short-lived. Deposited sediment is typically transported downstream within one year following instream disturbance (Reid and Anderson 1999). It is reasonable to expect a similar timeline for deposited sediment that originates from upland activities.

Sediment deposition and associated increases in substrate embeddedness are closely linked to elevated levels of suspended sediment (e.g., Sylte and Fischenich 2003, Kjelland et al. 2015). The potential for effects on sensitive aquatic species from deposition and embeddedness, therefore, are reasonably expected to be comparable to those from increased turbidity and suspended sediment. The same holds true for the areas expected to be affected by suspended sediment and deposited sediment. [redacted] Accordingly, the stream reaches most likely to exhibit increased sediment deposition and embeddedness are those where elevated Amendment Project-related suspended sediment concentrations are predicted. [redacted]

As discussed above, [redacted]

In addition, while deposited sediment can be resuspended during high-flow events, any such resuspension [redacted] For these reasons, resuspension of any deposited Amendment Project-related sediment is unlikely to adversely affect freshwater mussels.

Finally, any incremental increases in sediment deposition [redacted]

In summary, for the reasons discussed above, deposited sediment and subsequent embeddedness that originates from the Amendment Project is not likely to adversely affect freshwater mussels within the aquatic Action Area, including Atlantic pigtoe and James spinymussel. Similarly, deposited sediment and related embeddedness that originates from the Amendment Project is not likely to adversely affect freshwater mussel habitat, including designated critical habitat for Atlantic pigtoe. As a result, no additional discussion of potential deposited sediment-related effects to mussels or critical habitat for mussels is warranted in this BA.

5.2.2. Atlantic Pigtoe

Analyses of effects to Atlantic pigtoe and its critical habitat as a result of the Amendment Project are based on the best available information, including species and habitat occurrence [redacted] For the reasons explained below, this information supports conclusions that the Amendment Project is not likely to adversely affect Atlantic pigtoe and is not likely to adversely affect its critical habitat.

5.2.2.1 Potential Effects to Individuals

Potential effects to Atlantic pigtoe individuals from construction, operation, and maintenance of pipeline projects can result from both instream and upland activities that impact the aquatic environment. Instream work often involves open-cut crossings, which include temporary dewatering of stream channels and removal of bedload substrates for pipeline installation, as well as maintenance of these segments during project operations. Upland activities typically involve land disturbance, including clearing and grading, which can lead to erosion, sediment-laden stormwater runoff, and removal of riparian vegetation. Additional pipeline construction-related activities with the potential to affect Atlantic pigtoe include blasting, noise, artificial lighting, leaks and spills, and water withdrawal for hydrostatic testing and dust suppression. As discussed below, none of these potential stressors are likely to adversely affect Atlantic pigtoe individuals.

5.2.2.1.1. Potential Effects to Individuals within the LOD

Stream Crossings and Other Upland Activities. Adverse impacts to Atlantic pigtoe individuals from stream crossings and other upland land-disturbing activities are not anticipated. [redacted] As a result, no instream construction or maintenance activities are planned or expected for this crossing, which will avoid the need to dewater the stream channel, remove bedload substrates, or otherwise alter the streambed. [redacted]

Construction and other activities in upland areas can result in erosion and sediment loss that may impact freshwater mussels if generated and transported to occupied streams at sufficient levels. Sedimentation has been shown to impair feeding, reduce respiration efficiency, inhibit recruitment or survivorship, limit burrowing activity, and decrease interstitial flow rates (Gordon et al. 1992, Brim Box and Missa 1999, Osterling et al. 2010, Gascho Landis et al. 2013, Osterling and Hogberg 2014, Gascho Landis and Stoeckel 2015, Tuttle-Raycraft and Ackerman 2019, Goldsmith et al. 2021). While sedimentation is generally recognized as a stressor, freshwater mussels have shown the ability to re-emerge from deposited sediments (Marking and Bills 1979, Brim Box and Mossa 1999). Regardless, as discussed above (Section 5.2.1), Mountain Valley's [redacted] As a result, sediment from the Amendment Project's upland activities is not likely to adversely affect Atlantic pigtoe individuals.

Construction activities that remove riparian vegetation can increase sun exposure to streams, decrease bank stability, and subject individuals to augmented turbidity and suspended sediments. Increased bank erosion has similar impacts to mussels as increased sediment (discussed above), though there also is evidence that growth rates of juvenile mussels are negatively correlated with erosion and suspended sediments (Cheung and Shin 2005, Zhu et al. 2024). Regardless, none of these present an appreciable risk of adverse effects to Atlantic pigtoe individuals from the Amendment Project. [redacted] Even if some minimal level of riparian vegetation removal is ultimately required, there still would be no additive potential for adverse effects to Atlantic pigtoe individuals. [redacted] In addition, Mountain Valley will implement the FERC 2013 *Upland Erosion Control, Revegetation, and Maintenance Plan*, site-specific E&SC plans, and the suite of AMMs described above. As a result, Atlantic pigtoe are not likely to be adversely affected by upland activities associated with the Amendment Project.

Impacts from Water Withdrawal. [redacted] Mountain Valley will implement several conservation measures to avoid adverse impacts to Atlantic pigtoe individuals including appropriate, site-specific E&SC installations and maintenance, use of a temporary and floating intake structure, adherence to time-of-year restrictions, use of holding tanks to facilitate withdrawing water over a longer period, maintaining minimum pass-by flows equal to at least 90 percent of instantaneous riverflow , and achieving a through-screen approach velocity less than 0.25 foot per second with a 1.0-millimeter mesh screen, which will minimize risk of impingement and entrainment.

[redacted] However, Mountain Valley will monitor flow conditions and, if extreme drought conditions are observed, [redacted] will be evaluated to ensure the water withdrawal will not exceed 10 percent of the flow.

Upon completion of the hydrostatic testing, [redacted] No permanent or fixed instream infrastructure will be installed to support this temporary use. Minimum riparian vegetation (i.e., understory) may need to be removed along the already existing narrow riparian zone to facilitate deployment of the hose and intake but as discussed above, no impactful loss of riparian canopy and no adverse effects to Atlantic Pigtoe are anticipated. [redacted] Any potential slight increases in water temperature due to elevated solar exposure, therefore, would be negligible. Due to the implementation of AMMs and the temporary nature of the withdrawal, the water withdrawal is not likely to result in adverse effects to Atlantic pigtoe individuals.

Effects from Blasting. Although it has yet to be determined if blasting will be necessary [redacted] blasting-related impacts would be possible if blasting is required in any of those areas and appropriate conservation measures are not implemented. Blasting in aquatic or near-stream environments is a potential concern for benthic fauna due to substrate vibration and pressure waves. However, Keevin and Hempen (1997), in a seminal review of underwater blasting effects, noted that adverse impacts to benthic invertebrates are limited when appropriate setback distances and controlled charge sizes are used. Freshwater mussels are generally shielded by substrate and should tolerate low to moderate levels of vibration without impacts. Accordingly, should blasting be necessary in relevant proximity to any areas relevant to federally listed freshwater mussels, it would be conducted according to an approved site-specific blasting plan with prior consultation and approval (if required) from the appropriate federal, state, and local authorities having applicable jurisdiction to determine appropriate protective measures for avoiding and minimizing damage to the environment and aquatic life of the stream. However, blasting is not currently planned [redacted] Thus, there is no risk of potential adverse effects to Atlantic pigtoe individuals from blasting.

Noise Impacts. Freshwater mussels lack auditory organs and rely instead on limited mechanosensory inputs (Kraemer 1970). These inputs help mussels detect substrate vibrations for orientation and burrowing, but they do not appear to moderate behavior in a way that would be significantly disrupted by nearby or distant noise sources. Construction noise and blasting are two potential noise sources.

Because mussels are largely buried within the sediment and at water depth, this positioning insulates them from the effects of any sound waves traveling through the water column. The best available science supports a conclusion that noise associated with Amendment Project activities is not likely to adversely affect Atlantic pigtoe individuals.

Impacts from Artificial Lighting. Freshwater mussels are benthic, often burrowed organisms with no documented reliance on visual perception. Mussels may have rudimentary light-sensing capabilities (Watters 1994) but are not reliant on light cues for essential behaviors, particularly when buried in the substrate. To the extent possible, in addition to implementing the conservation measures described in Section 2.5, Mountain Valley will focus temporary construction lighting on the work area(s) and away from natural waterbodies and other natural areas. Thus, Atlantic pigtoe individuals are not likely to be adversely affected from the temporary presence of artificial lighting

Impacts from Leaks and Spills. Equipment and vehicles will be transporting or operating with diesel fuel and oil thereby posing risks of an accidental spill of compounds that could inadvertently enter nearby waterways. Mountain Valley has developed an Amendment Project-specific SPCC Plan and Unanticipated Discovery of Contamination Plan for Construction Activities to minimize the risk of spills and leaks and will implement procedures to minimize any adverse effect, in the event a spill or leak unexpectedly occurs. As a result, the potential risk of Atlantic pigtoe individuals experience adverse effects associated with spills and leaks is insignificant and discountable.

Potential Sediment Effects to Individuals. As described in [redacted]

[redacted]

Freshwater mussels, including Atlantic pigtoe, are less susceptible than other aquatic species to temporary increases in suspended sediment and minor increases in depositional sediment. This is due to key differences in habitat use, behavior, and physiology. Mussels are not reliant on visual foraging or sheltering in interstitial spaces. Mussels are largely sessile filter feeders capable of tolerating a range of sediment conditions (Brim Box and Mossa 1999). Mussels have evolved to enact behavioral responses—such as aperture closure (during turbidity spikes) and vertical burrowing—that help them reduce exposure to elevated sediment levels (Aldridge et al. 1987, Aldridge and McIvor 2003, Schwalb and Pusch 2007). Additionally, mussels often remain endobenthic with only their apertures exposed (and often closed), which further insulates them from suspended particles and minor sediment deposition (Balfour and Smock 1995, Amyot and Downing 1997). For these reasons, it is reasonable to conclude that Atlantic pigtoe are not likely to be adversely affected by suspended sediment from the Amendment Project. And because sediment deposition significantly correlates with suspended sediment concentration, as discussed above, it is reasonable to conclude that Atlantic pigtoe are not likely to be adversely affected by deposited sediment from the Amendment Project.

Moreover, in addition to receiving only low inputs of sediment from the Amendment Project, [redacted] Thus, while a combination of chronic and excessive sedimentation that can cause burial (Ellis 1936, Marking and Bills 1979) when a stream experiences excessive sedimentation, the de minimis and episodic sediment contributions from the Amendment Project are insufficient to adversely affect Atlantic pigtoe.

Summarily, [redacted] sedimentation from upland construction and other Amendment Project activities is not likely to adversely affect Atlantic pigtoe individuals.

5.2.2.2. Potential Effects to Critical Habitat

As described above, the Amendment Project's aquatic Action Area overlaps [redacted] Mountain Valley, therefore, analyzed the potential for the Amendment Project to affect that Atlantic pigtoe critical habitat from activities associated with construction, maintenance, and operation, with specific consideration given to potential impacts on the PBFs associated with that critical habitat: (1) Stable Substrates and Connected Instream Habitats, (2) Adequate Hydrologic Flow Regimes, (3) Water and Sediment Quality, and (4) Presence of Suitable Fish Hosts. The following provides an analysis of those potential effects.

5.2.2.2.1. Potential Critical Habitat Effects within the LOD

Potential effects to Atlantic pigtoe critical habitat that generally can occur during construction, operation, and maintenance of pipeline projects involve both instream activities and upland activities that affect the aquatic environment. Instream work often involves construction of open-cut crossings, including temporary dewatering of stream channels and removal of bedload substrates for pipeline installation, and maintenance of those crossing segments after the project begins operations. Upland activities typically involve land disturbance and construction work from which sediment-laden stormwater runoff originates, as well as removal of riparian vegetation. Finally, projects that include a water withdrawal component could involve potential impacts to Atlantic pigtoe critical habitat attributed to both instream and upland activities. Each of these categories of activities is analyzed below for the Amendment Project.[42]

[42] Other disturbances typically associated with projects of this sort include blasting, leaks and spills, artificial lighting, and noise impacts. For the reasons discussed above and in Section 5.2.2.1.1, none of these potential disturbances are expected to adversely affect Atlantic pigtoe critical habitat.

Stream Crossings. Mountain Valley [redacted] For the same reasons, significant removal of vegetation from the riparian zone within the LOD is not anticipated. In the event some minor clearing of riparian vegetation is required, there would be no appreciable impact to critical habitat (e.g., temperature increases during the summer season) [redacted] is not likely to impact any of the four PBFs or adversely affect Atlantic pigtoe critical habitat.

Water Withdrawal. Mountain Valley [redacted] Mountain Valley will implement a suite of AMMs to avoid adverse impacts to Atlantic pigtoe critical habitat [redacted] including location-specific E&SC measures, use of a temporary floating structure (rather than a fixed structure), adherence to time-of-year restrictions to avoid impacting aquatic species, use of holding tanks to facilitate withdrawing water over a longer period, maintaining minimum pass-by flows equal to at least 90 percent of instantaneous riverflow, and a through-screen approach velocity less than 0.25 foot per second with a 1.0-millimeter mesh screen (which will avoid the risk of impingement, entrainment, and crushing of fish host species). [redacted] No permanent or fixed instream infrastructure will be installed. A very limited amount of understory riparian vegetation may need to be removed to facilitate deployment of the hose and intake, but no loss of riparian canopy will occur. [redacted] Together, these measures will avoid appreciable impacts to the PBFs associated with the critical habitat, including substrate stability, habitat connectivity, streamflow, water and sediment quality, and host fish availability. Accordingly, due to the implementation of AMMs and the temporary nature of the withdrawal, the water withdrawal is not likely to adversely affect Atlantic pigtoe critical habitat.

5.2.2.2.2. Potential Effects to Critical Habitat from Sediment

In general, Atlantic pigtoe critical habitat can be impacted by significant increases in deposited sediment and, to a lesser degree, by increases in suspended sediment. Though fish host species could be affected by suspended sediment increases if they are excessive. For the same reasons as explained above in the analysis of effects to individuals, Atlantic pigtoe critical habitat within the aquatic Action Area will experience neither.

[redacted]

[redacted]

[redacted] For each of these reasons, sediment from the Amendment Project is not likely to adversely affect critical habitat for the Atlantic pigtoe.

5.2.2.3. Effects Determination

The Amendment Project may affect but is not likely to adversely affect Atlantic pigtoe individuals.

The Amendment Project may affect but is not likely to adversely affect Atlantic pigtoe critical habitat.

5.2.3. James Spinymussel

As explained above (Section 4.3.2.2), [redacted] Analysis of potential effects to James spinymussel from the Amendment Project is based on the best available science and information, including species and habitat occurrence [redacted]. For the reasons explained below, this information supports a conclusion that the Amendment Project is not likely to adversely affect James spinymussel.

5.2.3.1. Potential Effects to Individuals

Potential effects to James spinymussel from construction, operation, and maintenance of pipeline projects generally can result from both instream and upland activities. Instream work often involves open-cut crossings, which include temporary dewatering of stream channels and removal of bedload substrates for pipeline installation, as well as maintenance of these segments during project operations. Upland activities typically involve land disturbance, including clearing and grading, which can lead to erosion, sediment-laden stormwater runoff, and removal of riparian vegetation. Additional pipeline construction-related activities with the potential to affect James spinymussel include blasting, noise, artificial lighting, leaks and spills, and water withdrawal for hydrostatic testing and dust suppression. As discussed below, none of these potential stressors are likely to adversely affect James spinymussel.

5.2.3.1.1. Potential Effects to Individuals within the LOD

Stream Crossings and Other Upland Activities. Adverse impacts to James spinymussel individuals from stream crossings and other upland land-disturbing activities are not anticipated. [redacted] As a result, no instream construction or maintenance activities are planned or expected for this crossing, which will avoid the need to dewater the stream channel, remove bedload substrates, or otherwise alter the streambed. [redacted] will avoid instream impacts to any James spinymussel individuals.

Construction and other activities in upland areas can result in erosion and sediment loss that may impact freshwater mussels if generated and transported to occupied streams at sufficient levels. Sedimentation has been shown to impair feeding, reduce respiration efficiency, inhibit recruitment or survivorship, limit burrowing activity, and decrease interstitial flow rates (Gordon et al. 1992, Brim Box and Missa 1999, Osterling et al. 2010, Gascho Landis et al. 2013, Osterling and Hogberg 2014, Gascho Landis and Stoeckel 2015, Tuttle-Raycraft and Ackerman 2019, Goldsmith et al. 2021). While sedimentation is generally recognized as a stressor, freshwater mussels have shown the ability to re-emerge from deposited sediments (Marking and Bills 1979, Brim Box and Mossa 1999). [redacted] As a result, sediment from the Amendment Project's upland construction activities is not likely to adversely affect James spinymussel individuals.

Construction activities that remove riparian vegetation can increase sun exposure to streams, decrease bank stability, and subject individuals to augmented turbidity and suspended sediments. Increased bank erosion has similar impacts to mussels as increased sediment (discussed above), though there also is evidence that growth rates of juvenile mussels are negatively correlated with erosion and suspended sediments (Cheung and Shin 2005, Zhu et al. 2024). Regardless, none of these present an appreciable risk of adverse effects to James spinymussel individuals from the Amendment Project. [redacted] Even if some minimal level of removal of riparian vegetation is ultimately required, there still would be no additive potential for adverse effects to James spinymussel individuals. [redacted]. In addition, Mountain Valley will implement the FERC 2013 *Upland Erosion Control, Revegetation, and Maintenance Plan*, site-specific E&SC plans, and the suite of AMMs described above. As a result, James spinymussel are not likely to be adversely affected by upland activities associated with the Amendment Project.

Impacts from Water Withdrawal. Mountain Valley [redacted] Mountain Valley will implement several conservation measures to avoid adverse impacts to James spinymussel individuals including appropriate, site-specific E&SC installations and maintenance, use of a temporary, floating intake structure, adherence to time-of-year restrictions, use of holding tanks to facilitate withdrawing water over a longer period, maintaining minimum pass-by flows equal to at least 90 percent of instantaneous riverflow, and achieving a through-screen approach velocity less than 0.25 foot per second with a 1.0-millimeter mesh screen, which will minimize risk of impingement and entrainment.

Upon completion of the hydrostatic testing, [redacted] No permanent or fixed instream infrastructure will be installed to support this temporary use. Minimum riparian vegetation (i.e., understory) may need to be removed along the already existing narrow riparian zone to facilitate deployment of the hose and intake but as discussed above, no impactful loss of riparian canopy and no adverse effects to James spinymussel are anticipated. [redacted] Any potential slight increases in water temperature due to elevated solar exposure, therefore, would be negligible. Due to the implementation of AMMs and the temporary nature of the withdrawal, the water withdrawal is not likely to result in adverse effects to James spinymussel individuals.

Effects from Blasting. Although it has yet to be determined if blasting will be necessary [redacted] blasting-related impacts would be possible if blasting is required in any of those areas and appropriate conservation measures are not implemented. Blasting in aquatic or near-stream environments is a potential concern for benthic fauna due to substrate vibration and pressure waves. However, Keevin and Hempen (1997), in a seminal review of underwater blasting effects, noted that adverse impacts to benthic invertebrates are limited when appropriate setback distances and controlled charge sizes are used. Freshwater mussels are generally shielded by substrate and should tolerate low to moderate levels of vibration without impacts. Accordingly, should blasting be necessary in relevant proximity to any areas relevant to federally listed freshwater mussels, it would be conducted according to an approved site-specific blasting plan with prior consultation and approval (if required) from the appropriate federal, state, and local authorities having applicable jurisdiction to determine appropriate protective measures for avoiding and minimizing damage to the environment and aquatic life of the stream. [redacted] Thus, there is no risk of potential adverse effects to James spinymussel individuals from blasting.

Noise Impacts. Freshwater mussels lack auditory organs and rely instead on limited mechanosensory inputs (Kraemer 1970). These inputs help mussels detect substrate vibrations for orientation and burrowing, but they do not appear to moderate behavior in a way that would be significantly disrupted by nearby or distant noise sources. Construction noise and blasting are two potential noise sources. Because mussels are largely buried within the sediment and at water depth, this positioning insulates them from the effects of any sound waves traveling through the water column. The best available science supports a conclusion that noise associated with Amendment Project activities is not likely to adversely affect James spinymussel individuals.

Impacts from Artificial Lighting. Freshwater mussels are benthic, often burrowed organisms with no documented reliance on visual perception. Mussels may have rudimentary light-sensing capabilities (Watters 1994) but are not reliant on light cues for essential behaviors, particularly when buried in the substrate. To the extent possible, in addition to implementing the conservation measures described in Section 2.5, Mountain Valley will focus temporary construction lighting on the work area(s) and away from natural waterbodies and other natural areas. Thus, James spinymussel individuals are not likely to be adversely affected from the temporary presence of artificial lighting

Impacts from Leaks and Spills. Equipment and vehicles will be transporting or operating with diesel fuel and oil thereby posing risks of an accidental spill of compounds that could inadvertently enter nearby waterways. Mountain Valley has developed an Amendment Project-specific SPCC Plan and Unanticipated Discover of Contamination Plan for Construction Activities to minimize the risk of spills and leaks and will implement procedures to minimize any adverse effect, in the event a spill or leak unexpectedly occurs. As a result, the potential risk of James spinymussel individuals experiencing adverse effects associated with spills and leaks is insignificant and discountable.

Potential Sediment Effects to Individuals. As described in [redacted]

[redacted]

[redacted]

Freshwater mussels, including James spinymussel, are less susceptible than other aquatic species, to temporary increases in suspended sediment and minor increases in depositional sediment. This is due to key differences in habitat use, behavior, and physiology. Mussels are not reliant on visual foraging or sheltering in interstitial spaces. Mussels are largely sessile filter feeders capable of tolerating a range of sediment conditions (Brim Box and Mossa 1999). Mussels have evolved to enact behavioral responses—such as aperture closure during turbidity spikes and vertical burrowing—that helps them reduce exposure to elevated sediment levels (Aldridge et al. 1987, Aldridge and McIvor 2003, Schwalb and Pusch 2007). Additionally, mussels often remain endobenthic with only their apertures exposed (and often closed), which further insulates them from suspended particles and minor sediment deposition (Balfour and Smock 1995, Amyot and Downing 1997). For these reasons, it is reasonable to conclude that James spinymussel are not likely to be adversely affected by suspended sediment from the Amendment Project. And because sediment deposition significantly correlates with suspended sediment concentration, as discussed above, it is reasonable to conclude that James spinymussel are not likely to be adversely affected by deposited sediment from the Amendment Project.

Moreover, in addition to receiving only low inputs of sediment from the Amendment Project, [redacted] Thus, while a combination of chronic and excessive sedimentation that can cause burial (Ellis 1936, Marking and Bills1979), the de minimis and episodic sediment contributions from the Amendment Project are insufficient to adversely affect James spinymussel.

In sum, [redacted] sedimentation from upland construction and other Amendment Project activities is not likely to adversely affect James spinymussel individuals.

5.2.3.2. Effects Determination [43]

The Amendment Project may affect but is not likely to adversely affect James spinymussel individuals.

[43] Other disturbances typically associated with projects of this sort include blasting, leaks and spills, artificial lighting, and noise impacts. For the reasons discussed above and in Section 5.2.3.1.1, none of these potential disturbances are expected to cause a loss of James spinymussel habitat or alter the suitability of that habitat.

6. Cumulative Effects

For purposes of ESA Section 7 consultation, cumulative effects are defined as the effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area of the federal action subject to consultation (50 CFR § 402.02). These "cumulative effects involve only future non-federal actions: past and present impacts of non-federal actions are part of the environmental baseline" (USFWS and NMFS 1998).

Cumulative effects result from specific future activities that are reasonably certain to occur and aggregate with Amendment Project-related effects to alter the baseline conditions in the Action Area. Any reasonably certain non-federal activity that will cause or contribute to a loss of forest lands, increased sedimentation, additional noise, and/or the other above-identified stressors in the Action Area could potentially add cumulatively to the effects of the Amendment Project.

Such impacts could result from a variety of non-federal activities, including tree cutting and removal; agricultural activities; mining; industrial, commercial, and residential development; construction and operation of transportation infrastructure; and traditional and renewable energy development and operation. Accordingly, for purposes of this BA, available information was compiled from publicly available sources and public records requests and reviewed to identify any such future non-federal activities that are reasonably certain to occur in relevant proximity to the Amendment Project's Action Area (referred to herein as Planned Projects). Potential impacts from Planned Projects were then evaluated to determine if they could contribute to cumulative effects in the Amendment Project's Action Area.

6.1. Identification of Planned Projects

To ensure a comprehensive list of potential future projects was identified, Mountain Valley compiled information from numerous state, county, and local agencies, including the VDEQ; VADOE; VADOE Gas and Oil Information System; Virginia Department of Forestry; VDOT; NCDEQ; NCDEQ Division of Energy, Mineral, and Land Resources; NCDOT; North Carolina Forest Service; county planning departments; and county floodplain coordinators. Mountain Valley submitted Freedom of Information Act/public records requests and/or contacted directly state and county agencies for information about possible Planned Projects in the counties crossed by the Amendment Project in Virginia and North Carolina. [redacted]

Based on that analysis, there are four Planned Projects with potential to contribute to cumulative effects within the Action Area (Tables 6-1 and 6-2). In currently developed areas there is likely to be future industrial project construction and operation, although the type and location of such developments are not known or reasonably certain at this time. However, because any such future development is most likely to

[44] The cumulative effects analysis is limited to activities that are reasonably certain to cause effects within the Amendment Project's Action Area. [redacted]

occur in areas with existing similar industrial activity, it is not likely to appreciably contribute additional sound, light, dust, or other environmental impacts above baseline conditions, or to influence cumulative effects from the Amendment Project along with these other effects. In areas where industrial development does not presently occur, there are no known planned, reasonably certain, or likely future activities that would affect baseline conditions or contribute to cumulative effects.

6.2. Cumulative Effects Analysis

6.2.1 Northern Long-Eared Bat

[redacted] the cumulative effects analysis for northern long-eared bats evaluated potential impacts from one Planned Project, a proposed battery storage facility in Pittsylvania County, Virginia.

The proposed Battery Storage Facility, [redacted], is expected to encompass a pad of up to 4 acres on an 85-acre leased site within the Berry Hill Mega Site in Pittsylvania County, Virginia, will be designed to support large industrial operations at the site (Mabeus-Brown 2024). The facility will be located next to an existing American Electric Power substation (Mountain Valley 2025), which will collect and store energy that will be released during peak demand times (Mabeus-Brown 2024). To evaluate potential cumulative effects resulting from this project, Mountain Valley conservatively assumes [redacted] Therefore, the Amendment Project will not contribute cumulative effects to hibernating or staging/swarming northern long eared bats that could arise from activities associated with the proposed Battery Storage Facility.

The Battery Storage Facility development could potentially [redacted] Commercially available information indicates that the Battery Storage Facility will encompass a pad of up to 4 acres developed on an 85-acre site (Mabeus-Brown 2024). However, information gathered commercially and from county and state agencies in Virginia (Section 6.1) did not include the anticipated LOD of the Battery Storage Facility. Lacking specific details on the Battery Storage Facility's LOD, Mountain Valley has taken a conservative approach and is assuming [redacted] When combined with the Amendment Project's anticipated impacts [redacted]

While details of the future Battery Storage Facility development and construction are unknown, the primary impact from the facility on northern long-eared bats [redacted] Northern long-eared bats are already exposed to these stressors from a variety of sources, so it is impossible to reasonably differentiate between these additional inputs attributed to existing sources (i.e., baseline conditions) and the Battery Storage Facility based on the available information.

6.2.2 Atlantic Pigtoe

As discussed in Section 5.2.2, the Amendment Project is not expected to adversely affect Atlantic pigtoe or its critical habitat. Mountain Valley's comprehensive search for future non-federal activities that are reasonably certain to have effects within the aquatic Action Area identified two Planned Projects in [redacted] Two HUC-12 watershed [redacted] The two Planned Projects identified are expected to occur [redacted] and each has the potential to contribute impacts.

Although the extent and intensity of these Planned Projects along with their associated disturbances are uncertain, they could potentially result in cumulative effects to Atlantic pigtoe by virtue of being [redacted]

6.2.3 James Spinymussel

As discussed in Section 5.2.3, the Amendment Project is not expected to adversely affect James spinymussel. Mountain Valley's comprehensive search for future non-federal activities that are reasonably certain to have effects within the aquatic Action Area identified two Planned Projects in [redacted] Two HUC-12 watersheds [redacted] Each of the two Planned Projects identified is expected to occur in the [redacted] watershed and has the potential to contribute impacts.

The Planned Projects that could cause impacts within the aquatic Action Area are provided in Tables 6-1 and 6-2, with the two that are relevant to James Spinymussel [redacted]

Although the extent and intensity of these Planned Projects along with their associated disturbances are uncertain, they could potentially result in cumulative effects to James spinymussel by virtue of being [redacted]

Table 6-1: Summary of Planned Projects in [redacted]

[redacted]	Planned Projects		
[redacted]	# of Projects	LOD (acres)	Aquatic Resources Impacts (acres)
[redacted]	0	0	0
[redacted]	2	0	0
[redacted]	0	0	0
[redacted]	0	0	0
[redacted]	0	0	0
[redacted]	0	0	0
[redacted]	2	1.0	0.4
[redacted]	0	0	0
[redacted]	**4**	**1.0**	**0.4**

Table 6-2: Planned Projects in the Amendment Projects [redacted] HUC-12 [redacted].

Project Name/ Permit Number	Source	County	State	Description	[redacted]
[redacted]	Energy	Pittsylvania	VA	3,500-megawatt gas powerplant and data center, connecting to the Mountain Valley Pipeline in the Banister District. [redacted]	
[redacted]	Transportation	Pittsylvania	VA	About $10.2 million in upgrades to [redacted]	
[redacted]	Residential/ Commercial/ Industrial	Pittsylvania	VA	Solar battery storage facility at [redacted] next to an American Electric Power substation that will collect and store energy that will be released during peak times.	
[redacted]	USACE – Norfolk District	Pittsylvania	VA	Berry Hill Extension, Pittsylvania, VA.	

USACE = U.S. Army Corps of Engineers.

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