# MVP Southgate Amendment Project

Docket No. CP25-XX-000

# Resource Report 6 – Geological Resources

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

Amended February 2025

# MVP Southgate Amendment Project
# Resource Report 6 – Geological Resources

| Resource Report 6 – Filing Requirements | |
|---|---|
| **Information** | **Location in Resource Report** |
| **Minimum Filing Requirements** | |
| 1. Identify the location (by milepost) of mineral resources and any planned or active surface mines crossed by the proposed facilities. (§ 380.12(h)(1 & 2)).<br>• Describe hazards to the facilities from mining activities, including subsidence, blasting, slumping or landslides or other ground failure. | Section 6.4 |
| 2. Identify any geologic hazards to the proposed facilities. (§ 380.12(h)(2))<br>• For the offshore, this information is needed on a mile-by-mile basis and will require completion of geophysical and other surveys before filing. | Section 6.5 |
| 3. Discuss the need for and locations where blasting may be necessary in order to construct the proposed facilities. (§ 380.12(h)(3)) | Section 6.3 |
| 4. For LNG Projects in seismic areas, the materials required by "Data Requirements for the Seismic Review of LNG Facilities," NBSIR84-2833. (§ 380.12(h)(5)) | Not Applicable (not an LNG project) |
| 5. For underground storage facilities, how drilling activity by others within or adjacent to the facilities would be monitored, and how old wells would be located and monitored within the facility boundaries. (§ 380.12(h)(6)) | Not Applicable (no underground storage proposed) |
| **Additional Information Often Missing and Resulting in Data Requests** | |
| 6. Identify any sensitive paleontological resource areas crossed by the proposed facilities. (Usually only if raised in scoping or required by land-managing agency.) | Section 6.6 |
| 7. Briefly summarize the physiography and bedrock geology of the project area. | Section 6.2.4 |
| 8. If proposed pipeline crosses active drilling areas, describe plan for coordinating with drillers to ensure early identification of other companies' planned new wells, gathering lines, and aboveground facilities. | Not Applicable |
| 9. If the application is for underground storage facilities:<br>• Describe monitoring of potential effects of the operation of adjacent storage or production facilities on the proposed facility, and vice versa;<br>• Describe measures taken to locate and determine the condition of old oil wells within the field and buffer zone and how the applicant would reduce risk from failure of known and undiscovered wells; and<br>• Identify and discuss safety and environmental safeguards required by state and federal drilling requirements | Not Applicable (no underground storage proposed) |

# RESOURCE REPORT 6
# GEOLOGICAL RESOURCES

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Amendment Project | MVP Southgate Amendment Project |
| E&SC | Erosion and Sediment Control |
| FERC or Commission | Federal Energy Regulatory Commission |
| HDD | horizontal directional drill |
| MLV | mainline valve |
| Mountain Valley | Mountain Valley Pipeline, LLC |
| MP | milepost |
| NCDEQ | North Carolina Department of Environmental Quality |
| NPS | National Park Service |
| Original Certificated Project | MVP Southgate Project, as approved on June 18, 2020 |
| U.S. | United States |
| USGS | U.S. Geological Society |

# RESOURCE REPORT 6
# GEOLOGICAL RESOURCES

## 6.1 INTRODUCTION

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

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

### 6.1.1 Environmental Resource Report Organization

Resource Report 6 includes descriptions and supporting information regarding soils and sediments crossed by the Amendment Project and is prepared and organized according to the FERC *Guidance Manual for Environmental Report Preparation* (FERC 2017). The information presented in Resource Report 6 has not changed from the FEIS issued for the Original Certificated Project on February 14, 2020, except where noted.

## 6.2 GEOLOGIC SETTING

### 6.2.1 Pipeline Facilities

Consistent with the Original Certificated Project as described in the FEIS, the entirety of the Amendment Project is within the Piedmont Upland Section of the Piedmont Physiographic Province (United States ["U.S."] Geological Survey ["USGS"] 2023).

### 6.2.2 Aboveground Facilities

Proposed aboveground facilities include the construction of four new meter (interconnect) stations, pig launchers and pig receivers, and mainline valves ("MLVs") that will be installed at various locations along the pipeline. Table 1.2-2 of Resource Report 1 provides a summary by location of the aboveground facilities for the Amendment Project by milepost ("MP"). These facilities are depicted on the topographic maps in Resource Report 1, Appendix 1-B. The aboveground facilities for the Amendment Project are located within the same physiographic province as described in Section 6.2.1 and the FEIS. Elevations at these facilities are identified below in Table 6.2-1.

**Table 6.2-1**

**Elevations at the Amendment Project Aboveground Facilities**

| Facility | MP | County, State | Approx. Minimum Elevation (feet above mean sea level) | Approx. Maximum Elevation (feet above mean sea level) |
|---|---|---|---|---|
| Lambert Interconnect / MLV 1 | 0.0 | Pittsylvania, VA | 648 | 664 |
| MLV 2 | 7.8 | Pittsylvania, VA | 726 | 728 |
| MLV 3 | 18.8 | Pittsylvania, VA | 660 | 662 |
| LN 3600 Interconnect | 28.2 | Rockingham, NC | 508 | 514 |
| Dan River Interconnect #1 / MLV 4 | 31.3 | Rockingham, NC | 504 | 508 |
| Dan River Interconnect #2 | 31.3 | Rockingham, NC | 504 | 508 |

### 6.2.3 Surficial Geologic Materials

A recent review of surficial geologic databases, including the National Park Service ("NPS") Natural Atlas and the USGS's surficial materials database, provides detailed information regarding the nature of surficial deposits expected in the Amendment Project area (Natural Atlas 2024, NPS 2024, Soller and Reheis 2004). The surficial geology of the Amendment Project is consistent with that of the Original Certificated Project as described in the FEIS. Table 6.2-2 below summarizes surficial geology by MP in the vicinity of the Amendment Project facilities. Figure 6-A-1 in Appendix 6-A illustrates surficial geology in the Amendment Project area.

**Table 6.2-2**

**Surficial Materials in the Amendment Project Area**

| Project Facilities | Begin MP | End MP | Surficial Geology Material |
|---|---|---|---|
| **Pipeline Facility** | | | |
| H-650 Pipeline | 0.35 | 0.64 | Residual materials developed in bedrock, discontinuous |
| | 0.64 | 2.35 | Residual materials developed in sedimentary rocks, discontinuous |
| | 2.35 | 15.59 | Residual materials developed in igneous and metamorphic rocks |
| | 15.59 | 31.36 | Residual materials developed in bedrock, discontinuous |
| **Aboveground Facilities** | **Area (acres)** | **Approx. MP** | **Surficial Geology Material** |
| Lambert Interconnect / MLV 1 | 0.72 | 0 | Residual materials developed in bedrock, discontinuous |
| MLV 2 | 0.02 | 7.7 | Residual materials developed in igneous and metamorphic rocks |
| MLV 3 | 0.02 | 18.7 | Residual materials developed in bedrock, discontinuous |
| LN 3600 Interconnect | 0.28 | 28.9 | Residual materials developed in bedrock, discontinuous |
| Dan River Interconnect #1 / MLV 4 | 0.68 | 31.2 | Residual materials developed in bedrock, discontinuous |
| Dan River Interconnect #2 | 0.47 | 31.2 | Residual materials developed in bedrock, discontinuous |

#### 6.2.3.1 Pipeline Facilities

**Residual materials developed in bedrock, discontinuous**

These materials were formed by the partial chemical dissolution and physical disintegration of bedrock and, to a lesser extent, colluvial sediments. They include the modern soil profile and extend downward to unweathered rock. Depending on the composition of the source rock or colluvium, these materials can be generally fine- to coarse-grained and commonly are poorly sorted. Unlike mass-movement sediments (e.g., colluvium), these materials were not transported. This material is generally less than 10 feet thick and is patchy in distribution. Particularly in mountainous areas, exposed rock can more commonly be found than residual material (Soller et al. 2009).

**Residual materials developed in igneous and metamorphic rocks**

These materials were formed by the partial chemical dissolution and physical disintegration of igneous and metamorphic rock and include the modern soil profile and extend downward to unweathered rock. Depending on the composition of the source rock or colluvium, these materials can be generally fine- to coarse-grained and commonly are poorly sorted. Unlike mass-movement sediments (e.g., colluvium), these materials were not transported. This material is generally less than 10 feet thick and, in many places, is patchy in distribution. Particularly in mountainous areas, exposed rock can more commonly be found than residual material (Soller et al. 2009).

**Residual materials developed in sedimentary rocks, discontinuous**

These materials were formed by the partial chemical dissolution and physical disintegration of sedimentary rocks and include the modern soil profile and extend downward to unweathered rock. Depending on the composition of the source rock, these materials can be generally fine- to coarse-grained and commonly are poorly sorted. Unlike mass-movement sediments (e.g., colluvium), these materials were not transported. This material is generally less than 10 feet thick and is patchy in distribution. Particularly in mountainous areas, exposed rock can more commonly be found than residual material (Soller et al. 2009).

#### 6.2.3.2 Aboveground Facilities

Surficial materials underlying the Lambert Interconnect/MLV 1, MLV 3, LN 3600 Interconnect, Dan River Interconnect #1/MLV 4, and Dan River Interconnect #2 consist of residual materials developed in bedrock, discontinuous. This surficial material is described in Section 6.2.3.1 above.

Surficial materials underlying MLV 2 consist of residual materials developed in igneous and metamorphic rocks. This surficial material is described in Section 6.2.3.1 above.

### 6.2.4 Bedrock

Bedrock located in the vicinity of the Amendment Project facilities is summarized by MP in Appendix 6-B, Table 6-B-1, and illustrated in Figure 6-A-2 in Appendix 6-A. The bedrock types potentially encountered are consistent with those described in the FEIS for the Original Certificated Project. Those bedrock types specifically crossed by the Amendment Project are described below (USGS 2024a).

#### 6.2.4.1 Pipeline Facilities

**Cambrian Leatherwood Granite (lw)**: Light gray, medium- to coarse-grained, porphyritic biotite granite.

**Proterozoic Z-Cambrian Alligator Back Formation (Zab)**: Light gray, medium- to coarse-grained porphyroblastic garnet-mica schist; contains interbeds of dark gray graphitic mica schist, calc-gneiss, mica gneiss, feldspathic quartzite with blue quartz granule beds, and garnet-hornblende schist.

**Proterozoic Z-Cambrian Fork Mountain Formation (Zfm)**: Light to medium gray, fine- to medium-grained, polydeformed and polymetamorphosed porphyroblastic aluminosilicate-mica schist, interlayered with medium gray irregularly layered garnetiferous biotite gneiss, migmatitic in part; calcsilicate granofels; amphibolite; rare white marble; and coarse calc-quartzite lenses.

**Proterozoic – Paleozoic Mylonite Gneiss (my)**: Includes protomylonite, mylonite, ultramylonite, and cataclastic rocks. Lithology is highly variable, depending on the nature of the parent rock, and on intensive parameters and history of deformation.

**Upper Triassic Newark Supergroup; Conglomerate, mixed clasts (TRc)**: Rounded to subangular pebbles, cobbles, and boulders of mixed lithologies including quartz, phyllite, quartzite, gneiss, schist, greenstone, and marble in a matrix of medium- to very-coarse-grained, reddish brown to gray, locally arkosic, sandstone.

**Triassic Newark Supergroup; Triassic Sandstone, Siltstone, Shale, and Coal (TRcs)**: Sandstone, fine- to coarse-grained, reddish brown to gray, arkosic in places, micaceous, displays channel-type primary features. Siltstone light to dark gray, micaceous. Shale, light to dark gray, carbonaceous, micaceous, fossiliferous. Coal, bituminous, banded, moderate- to well-developed, fine- to medium-cleat, partings and inclusions of shale, siltstone, and sandstone.

**Triassic Newark Supergroup, Dan River Group; Cow Branch Formation (TRdc)**: Mudstone with minor sandstone, gray, laterally continuous bedding. Intertongues with Stoneville and Pine Hall formations.

**Triassic Newark Supergroup Dan River Group; Pine Hall Formation (TRdp)**: Sandstone, mudstone, and conglomerate, yellowish orange to brown.

**Upper Triassic Newark Supergroup; Sandstone, undifferentiated (TRs)**: Fine- to coarse-grained, reddish brown to gray, primary bedding features such as cross-beds, channel lags, and ripple marks, minor conglomerate, siltstone, and shale beds.

**Upper Triassic Newark Supergroup; Triassic Sandstone, Siltstone, and Shale (TRss)**: Sandstone, very fine- to coarse-grained, reddish brown to gray, micaceous, minor conglomerate beds. Siltstone, reddish brown to gray, micaceous. Shale, reddish brown, greenish gray, gray, yellowish brown, laminated, fossiliferous. Upward-fining sequences, discontinuous vertically and horizontally.

**Proterozoic Z Ashe Formation (Zau)**: Light gray, medium-grained muscovite and muscovite biotite gneiss with thick interbeds of muscovite schist and pebbly feldspathic quartzite. Thick lenses of garnet-hornblende schist locally mark the basal and upper contacts with the underlying basement gneiss and the overlying metapelites, respectively. The unit is cut by dikes, sills, and thick sheets of pegmatite and alaskite, especially concentrated along the zone of transitional contact with Alligator Back mica schist units.

#### 6.2.4.2 Aboveground Facilities

**Lambert Interconnect / MLV 1**

**Upper Triassic Newark Supergroup; Triassic Sandstone, Siltstone, and Shale (TRss)**: See description in Section 6.2.4.1 above.

**LN 3600 Interconnect**

**Triassic Newark Supergroup, Dan River Group; Pine Hall Formation (TRdp)**: See description in Section 6.2.4.1 above.

**Dan River Interconnect #1 / MLV 4 and Dan River Interconnect #2**

**Triassic Newark Supergroup, Dan River Group; Pine Hall Formation (TRdp)**: See description in Section 6.2.4.1 above.

**Mainline Valves**

Bedrock underlying the MLV locations is identified in Appendix 6-B and described in Section 6.2.4.1 above.

### 6.2.5 Geotechnical Engineering Investigations

Mountain Valley is evaluating horizontal directional drills ("HDD") at the crossing of the Sandy River in Virginia and the crossing of the Dan River in North Carolina. Mountain Valley is currently completing a geotechnical investigation for the Sandy River crossing, and the results of this investigation will be provided to FERC in a supplemental filing in Q1 2025.

The HDD at the Dan River crossing has been slightly modified from the Original Certificated Project, shifting the pipeline approximately 165 feet to the west. The geotechnical results completed at the Dan River, as presented in the FEIS, determined that the HDD design was feasible. The geotechnical results remain applicable for the revised HDD path; therefore, no further geotechnical surveys are planned for this crossing. Other geotechnical investigations conducted include U.S. Highway 29 (MP 4.7) and U.S. Highway 58 (MP 20.4). These roads will be crossed through the use of conventional bore and were conducted in 2019. No concerns were identified through the geotechnical investigations conducted at these locations.

## 6.3 BLASTING

Blasting potentially will need to be conducted in areas with shallow bedrock, as described in the FEIS for the Original Certificated Project. Areas of shallow bedrock along the Amendment Project, as provided in Appendix 6-B, Table 6-B-1, were reviewed for potential blasting. The areas proposed for potential blasting along the Amendment Project are provided in Appendix 6-B, Table 6-B-2. Blasting would be conducted in accordance with the methods described in the FEIS and in accordance with the revised General Blasting Plan included in Resource Report 1, Appendix 1-G.

## 6.4 MINERAL RESOURCES

Information regarding mineral resources in Virginia and North Carolina was re-reviewed through the Virginia Department of Energy, the North Carolina Department of Environmental Quality ("NCDEQ"), the

North Carolina Geological Survey, and the USGS (NCDEQ 2024; USGS 2024b; Virginia Department of Energy 2024). Based on this review, and as concluded in the FEIS for the Original Certificated Project, no active, inactive, abandoned, and proposed surface or subsurface extraction and deposits of fuel resources (coal, oil, and natural gas) were identified within 0.25 mile of Amendment Project workspaces.

Non-fuel mineral resources were also re-reviewed and are consistent with those described in the FEIS for the Original Certificated Project. One non-fuel mineral site is located within 0.2 mile of the Amendment Project (USGS-identified plant) near MP 26.6; however, no active plant was observed on aerial imagery. Given this plant's location and distance from the Amendment Project, no impacts from construction or operation are anticipated to occur.

## 6.5 GEOLOGIC HAZARDS

Geologic hazards evaluated for the Original Certificated Project as described in the FEIS (e.g., karst terrain, seismicity, soil liquefaction, landslides, subsidence, flooding, and the presence of uranium deposits in the Amendment Project vicinity) were re-evaluated for the Amendment Project and further described below. The conditions necessary for the development of other geologic hazards, including avalanches and volcanism, are not present in the area of the Amendment Project and, therefore, not discussed. Potential geologic hazards with the potential to be encountered on the Amendment Project are the same as those described in the FEIS for the Original Certificated Project. Acid-forming materials were also examined for the Amendment Project (see Section 6.5.8), though they were not evaluated in the FEIS.

### 6.5.1 Karst

A karst assessment was conducted on the Original Certificated Project and included as part of the FEIS. The results of this assessment are still applicable to the Amendment Project. Table 6.5-1 lists potential karst terrains that may be encountered along the Amendment Project centerline. Appendix 6-A contains Figure 6-A-3 depicting karst materials to be crossed by the Amendment Project.

Consistent with the Original Certificated Project discussed in the FEIS, there are minimal areas of karst geology within 0.25 mile of the Amendment Project. Mountain Valley's karst specialist assessed areas of potential karst terrain along the Original Certificated Project route and determined that no impacts on karst formations were anticipated during construction and operation. These conclusions remain valid for the Amendment Project. In the event that areas of karst are identified during construction, Mountain Valley would implement the measures outlined in the FEIS.

**Table 6.5-1**

**Potential Karst Terrain Crossed by the Amendment Project**

| County, State | Begin MP | End MP | Crossing Length (feet) | Rock Type a/ | Construction Method |
|---|---|---|---|---|---|
| **H-650 Pipeline** | | | | | |
| Pittsylvania, VA | 0.03 | 1.00 | 3,696 | Conglomerate (covered by terrace deposits) | Open-cut and bore (road crossings) |
| Pittsylvania, VA | 14.95 | 15.70 | 3,960 | Conglomerate | Open-cut and bore (road crossings) |
| Pittsylvania, VA | 21.20 | 21.50 | 1,584 | Conglomerate | Open-cut and bore (road crossings) |
| Pittsylvania, VA | 21.80 | 21.91 | 581 | Conglomerate | Open-cut and bore (road crossing) |

**Table 6.5-1**

**Potential Karst Terrain Crossed by the Amendment Project**

| County, State | Begin MP | End MP | Crossing Length (feet) | Rock Type a/ | Construction Method |
|---|---|---|---|---|---|
| Pittsylvania, VA | 22.12 | 22.30 | 950 | Conglomerate | Open-cut and bore (road crossing) |

a/ Sources: Heinika et al. 1983, Marr 1984, Price et al. 1980.

### 6.5.2 Seismic Risk

The FEIS associated with the Original Certificated Project describes the geographic plausibility of seismic risks, earthquake probability within a specific area, and the Mercalli scale (Table 6.5-2). The Amendment Project area was re-reviewed to identify potential active faults within 100 miles of the Amendment Project and their classification. A seismic hazard map can be found in Appendix 6-A as Figure 6-A-4.

Consistent with the FEIS conclusion for the Original Certificated Project and due to the relatively low seismic risk and the absence of active faults in the immediate Amendment Project vicinity, impacts from seismic activity are not anticipated to affect the construction or operation of the Amendment Project.

**Table 6.5-2**

**Modified Mercalli Intensity Scale**

| Intensity | Observed Effects |
|---|---|
| I | Not felt except by a very few under especially favorable conditions. |
| II | Felt by only a few persons at rest, especially on upper floors of buildings. |
| III | Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated. |
| IV | Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably. |
| V | Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop. |
| VI | Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. |
| VII | Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. |
| VIII | Damage slight in specially designed structures; considerable damage in ordinary substantial buildings, with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. |
| IX | Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. |
| X | Some well-built wooden structures destroyed; most masonry and frame structures destroyed along with foundations. Rails bent. |
| XI | Few, if any masonry structures remain standing. Bridges destroyed. Rails bent greatly. |
| XII | Damage total. Lines of sight and level are distorted. Objects thrown into the air. |

Source: USGS 1997

Like the Original Certificated Project, the Amendment Project crosses the same six regional, USGS-recognized faults and faults zones as described in the FEIS. The nearest Class A fault to the Amendment Project, Central Virginia Seismic Zone, is 95 miles from the Amendment Project alignment (Crone and Wheeler 2000; Monteleone 1996; USGS 2024c; Wheeler 2006).

### 6.5.3 Soil Liquefaction

Soil liquefaction is described in the FEIS for the Original Certificated Project. Due to the Amendment Project being located within the same vicinity as the Original Certificated Project and the low potential for seismic activities, the potential for soil liquefaction to occur on the Amendment Project is not anticipated.

### 6.5.4 Landslides

A landslide risk analysis, Landslide Mitigation Report, and proposed minimization measures for the Original Certificated Project were described in the FEIS. The Amendment Project was evaluated for potential landslide susceptibility, and those areas of potential concern are provided in Table 6.5-3 and Table 6.5-4. A landslide hazard map can be found in Appendix 6-A as Figure 6-A-5.

**Table 6.5-3**

**Summary of Landslide Susceptibility and Incidence for Pipeline Facilities**

| Facility a/ | Landslide Susceptibility and Incidence b/ | MP Range |
|---|---|---|
| **H-650 Pipeline** | High susceptibility / moderate incidence | 0 – 24.3 |
| | Moderate susceptibility / low incidence | 24.3 – 31.6 |

Source: Godt 2000
a/ Represents all components associated with the facility (e.g., construction right-of-way, cathodic protection system, MLV facilities, additional temporary workspaces, and access roads).
b/ Susceptibility and incidence ratings:
High: High landslide susceptibility or incidence (>15 percent of area involved).
Moderate: Moderate landslide susceptibility or incidence (1.5 percent to 15 percent of area involved).
Low: Low landslide susceptibility or incidence (<1.5 percent of area is involved).

**Table 6.5-4**

**Summary of Landslide Susceptibility and Incidence for Aboveground Facilities**

| Facility | County, State | Landslide Susceptibility and Incidence a/ |
|---|---|---|
| **Aboveground Facilities** | | |
| Lambert Interconnect / MLV 1 | Pittsylvania, VA | Moderate susceptibility / low incidence |
| LN 3600 Interconnect | Pittsylvania, VA | Moderate susceptibility / low incidence |
| Dan River Interconnect #1 / MLV 4 | Rockingham, NC | Moderate susceptibility / low incidence |
| Dan River Interconnect #2 | Rockingham, NC | Moderate susceptibility / low incidence |

Source: Godt 2000
a/ Susceptibility ratings:
High: High landslide susceptibility or incidence (>15 percent involved).
Moderate: Moderate landslide susceptibility or incidence (1.5 percent to 15 percent of area is involved).
Low: Low landslide susceptibility or incidence (<1.5 percent of area is involved).

#### 6.5.4.1 Landslides and Steep/Side Slopes Mitigation

The Amendment Project facilities located in regions of Virginia and North Carolina are generally characterized by moderate to high landslide susceptibility and low to moderate incidence of landslides. Some steep slopes or side slopes are encountered in areas crossed by the Amendment Project, as indicated in Appendix 6-C, Tables 6-C-1 and 6-C-2. However, the Amendment Project is within the Piedmont physiographic province, which is characterized by a topography of low-rounded ridges and generally traverses much flatter terrain than what was previously encountered on the Mountain Valley Pipeline Project (i.e., Mainline Project).

Mountain Valley is evaluating these locations and will update its Landslide Mitigation Report and will file the revised plan with FERC in Q1 2025. However, as concluded in the FEIS, with the implementation of the revised Landslide Mitigation Report, the revised General Blasting Plan, and the project-specific Erosion and Sediment Control ("E&SC") plan, it is anticipated that impacts on geological resources would be adequately minimized.

### 6.5.5 Land Subsidence

Subsidence is the local downward movement of surface material with little or no horizontal movement. Common causes of land subsidence include dissolution of limestone in areas of karst terrain, over-pumping of groundwater aquifers, extraction of oil and gas from underground formations, and collapse of underground mines. Underground mining, oil and gas well production, and large groundwater withdrawals were not identified in the Amendment Project area. Karst terrain can increase the potential for land subsidence. However, as discussed in Section 6.5.1, the Amendment Project is not expected to affect such areas.

### 6.5.6 Flooding

Flooding and floodplain risks associated with the Original Certificated Project, as described in the FEIS are anticipated to be consistent along the Amendment Project. Mountain Valley will implement the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (2013) and its project-specific E&SC plan within floodplains to minimize potential impacts from flood events as described in the FEIS.

### 6.5.7 Uranium

The potential for uranium deposits, occurrences, environmental mobility, regional geochemistry, and soil absorption are described in the FEIS for the Original Certificated Project and are applicable to the Amendment Project facilities. Like the Original Certificated Project, the Amendment Project will be installed in shallow depths (generally 5.5 to 9 feet below grade). As was concluded in the FEIS, pipeline construction activities are not anticipated to disturb or mobilize uranium into the environment at concentrations significantly exceeding background concentrations. Therefore, significant impacts on human health and the environment are not anticipated during the construction and operation of the Amendment Project.

### 6.5.8 Acid-Forming Materials

Acid-producing rock and soils could be encountered along the pipeline in areas of active or previous mining activities where sulfide minerals are exposed to runoff. Acid sulfate soils occur at several sites in different

geologic and geomorphic settings in the Piedmont physiographic province. Phyllite and slate of the Quantico Formation could potentially generate acid drainage during construction. Mountain Valley would coat the pipe in fusion-bonded epoxy to prevent any damage or deterioration to the pipeline. Mountain Valley would segregate excavated bedrock that could potentially produce acidic conditions, limiting the amount of time the materials would be exposed. Mountain Valley would also conduct periodic inspections of the cathodic corrosion prevention system to ensure the proper function of corrosion mitigation. Mountain Valley has not developed an Acid-Forming Materials Mitigation Plan due to the low likelihood of encountering problematic concentrations of acid-producing sulfides.

## 6.6 PALEONTOLOGICAL RESOURCES

Consistent with the Original Certificated Project as described in the FEIS, the Amendment Project has the potential to encounter fossils in areas of shallow sedimentary bedrock. Mountain Valley will implement the measures described in the FEIS for training its environmental inspectors and implementing its Unanticipated Discovery Plan for Paleontological Resources. This plan has been updated for the Amendment Project and is included in Resource Report 1, Appendix 1-G. With the implementation of these measures, it is anticipated that potential impacts on paleontological resources will be avoided or adequately mitigated.

## 6.7 REFERENCES

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# MVP Southgate Amendment Project

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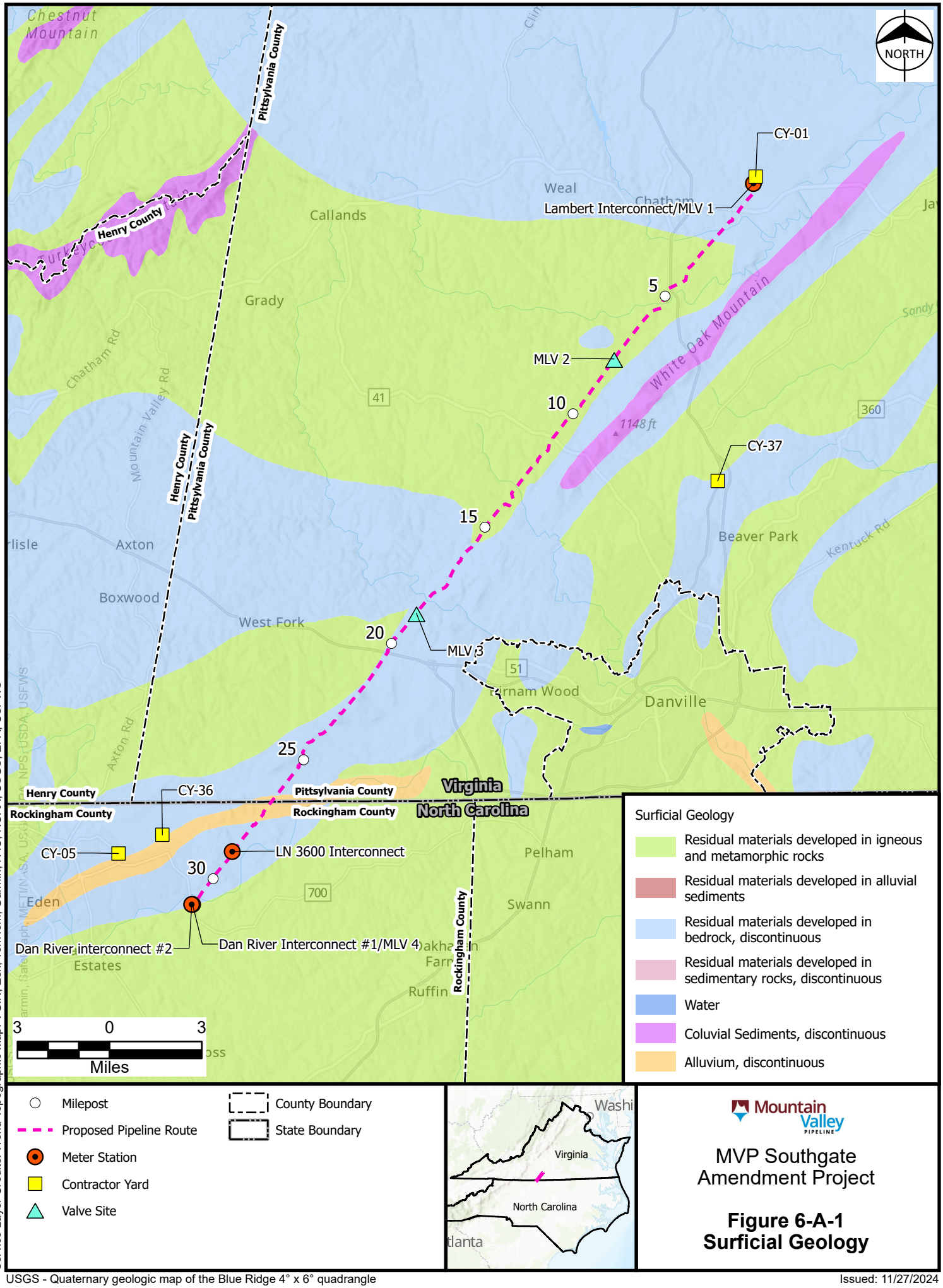
## Appendix 6-A

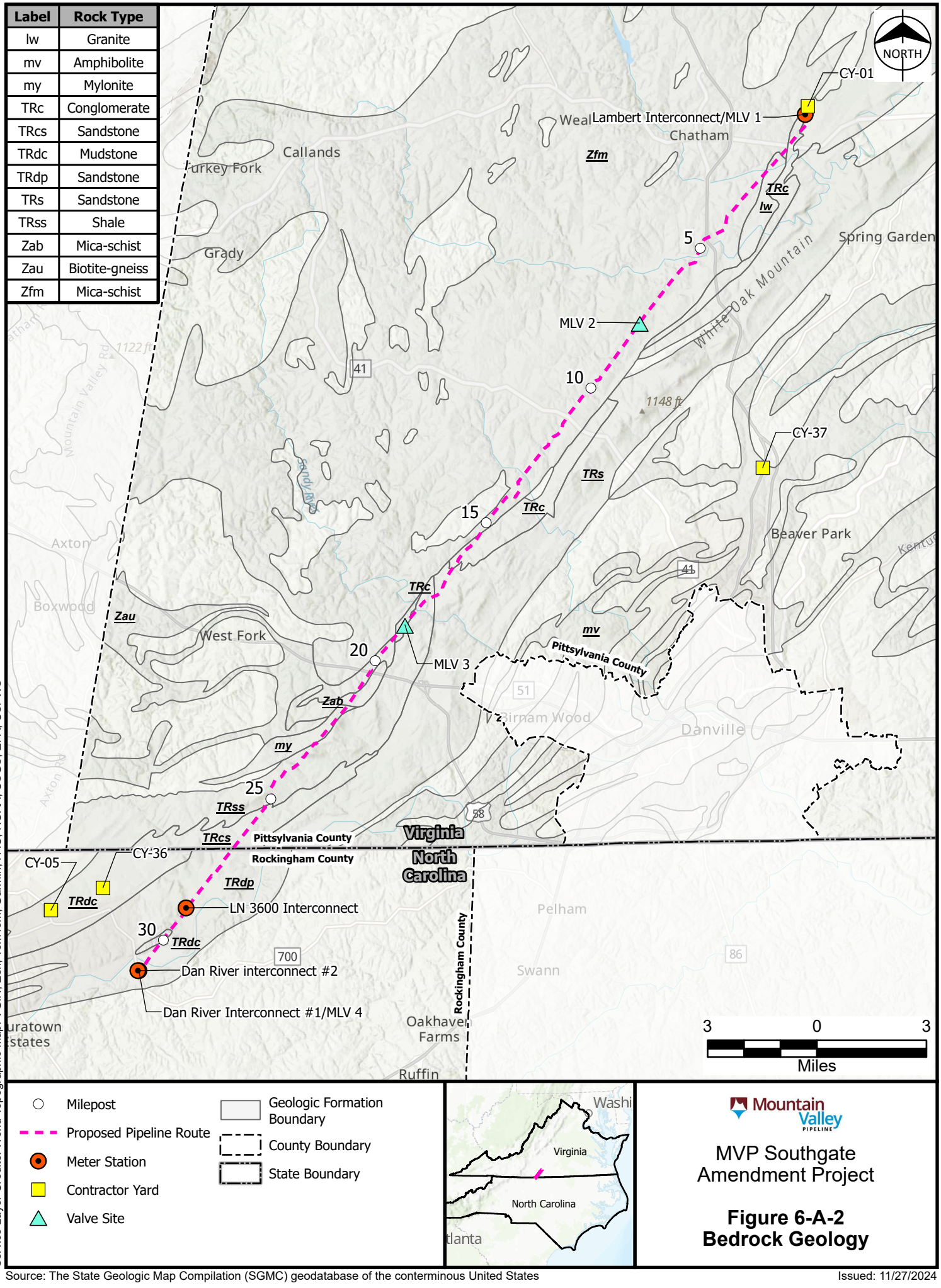
## Figures

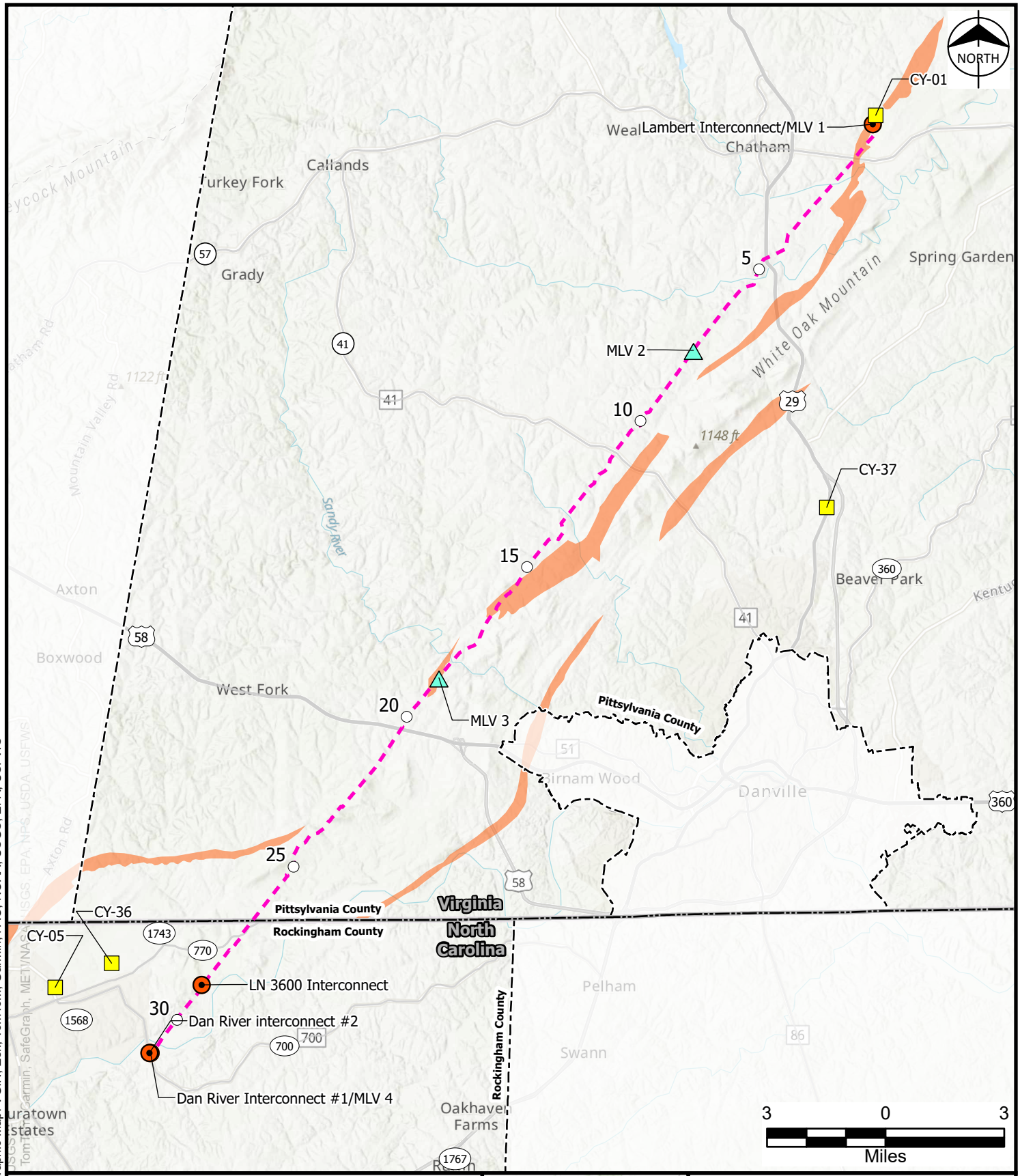


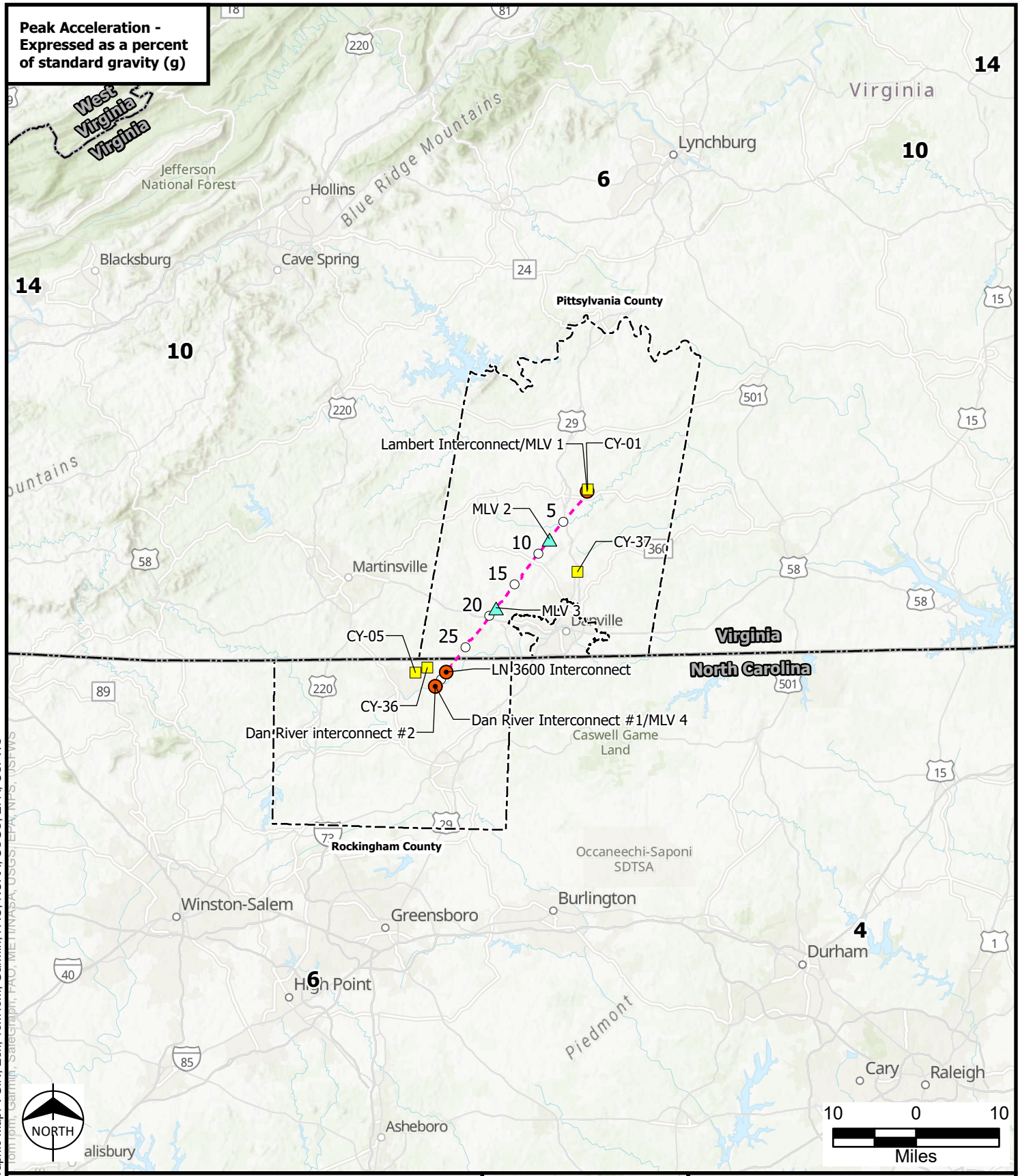

Service Layer Credits: World Topographic Map: VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS

USGS - Quaternary geologic map of the Blue Ridge 4° x 6° quadrangle

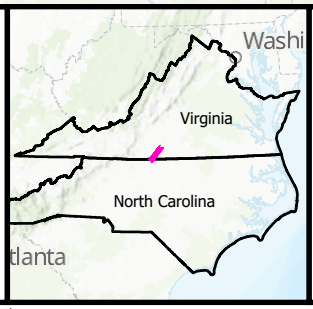
Issued: 11/27/2024


Label
Rock Type
lw
Granite
mv
Amphibolite
my
Mylonite
TRc
Conglomerate
TRcs
Sandstone
TRdc
Mudstone
TRdp
Sandstone
TRs
Sandstone
TRss
Shale
Zab
Mica-schist
Zau
Biotite-gneiss
Zfm
Mica-schist
NORTH
CY-01
Lambert Interconnect/MLV 1
Chatham
Callands
Grady
Zfm
TRc
lw
5
Spring Garden
White Oak Mountain
MLV 2
10
1148 ft
CY-37
TRs
15
TRc
Beaver Park
Axton
Boxwood
Zau
West Fork
TRc
20
MLV 3
mv
Pittsylvania County
Zab
Danville
my
25
TRss
TRcs
Pittsylvania County
Rockingham County
Virginia
North Carolina
CY-05
CY-36
TRdc
TRdp
LN 3600 Interconnect
30
TRdc
Dan River interconnect #2
Dan River Interconnect #1/MLV 4
Rockingham County
Pelham
Swann
Oakhaven Farms
Ruffin
3
0
3
Miles
Milepost
Proposed Pipeline Route
Meter Station
Contractor Yard
Valve Site
Geologic Formation Boundary
County Boundary
State Boundary
Virginia
North Carolina
Mountain Valley Pipeline
MVP Southgate Amendment Project
Figure 6-A-2
Bedrock Geology
Service Layer Credits: World Topographic Map: VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS
Source: The State Geologic Map Compilation (SGMC) geodatabase of the conterminous United States
Issued: 11/27/2024


NORTH
CY-01
Lambert Interconnect/MLV 1
Weal
Chatham
Callands
Turkey Fork
Grady
Spring Garden
White Oak Mountain
MLV 2
5
10
15
20
25
30
CY-37
Sandy River
Axton
Boxwood
West Fork
Beaver Park
MLV 3
Pittsylvania County
Rockingham County
Virginia
North Carolina
Danville
Pelham
Swann
Oakhaven Farms
CY-36
CY-05
LN 3600 Interconnect
Dan River interconnect #2
Dan River Interconnect #1/MLV 4
1122 ft
1148 ft
3 0 3
Miles
Milepost
Proposed Pipeline Route
Meter Station
Contractor Yard
Valve Site
Karst Formation
County Boundary
State Boundary
Virginia
North Carolina
Mountain Valley Pipeline
MVP Southgate Amendment Project
Figure 6-A-3
Karst Formations
Service Layer Credits: World Topographic Map: VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS
Source: USGS
Issued: 11/27/2024




Milepost
Proposed Pipeline Route
Meter Station
Contractor Yard
Valve Site
County Boundary
State Boundary




Mountain Valley Pipeline

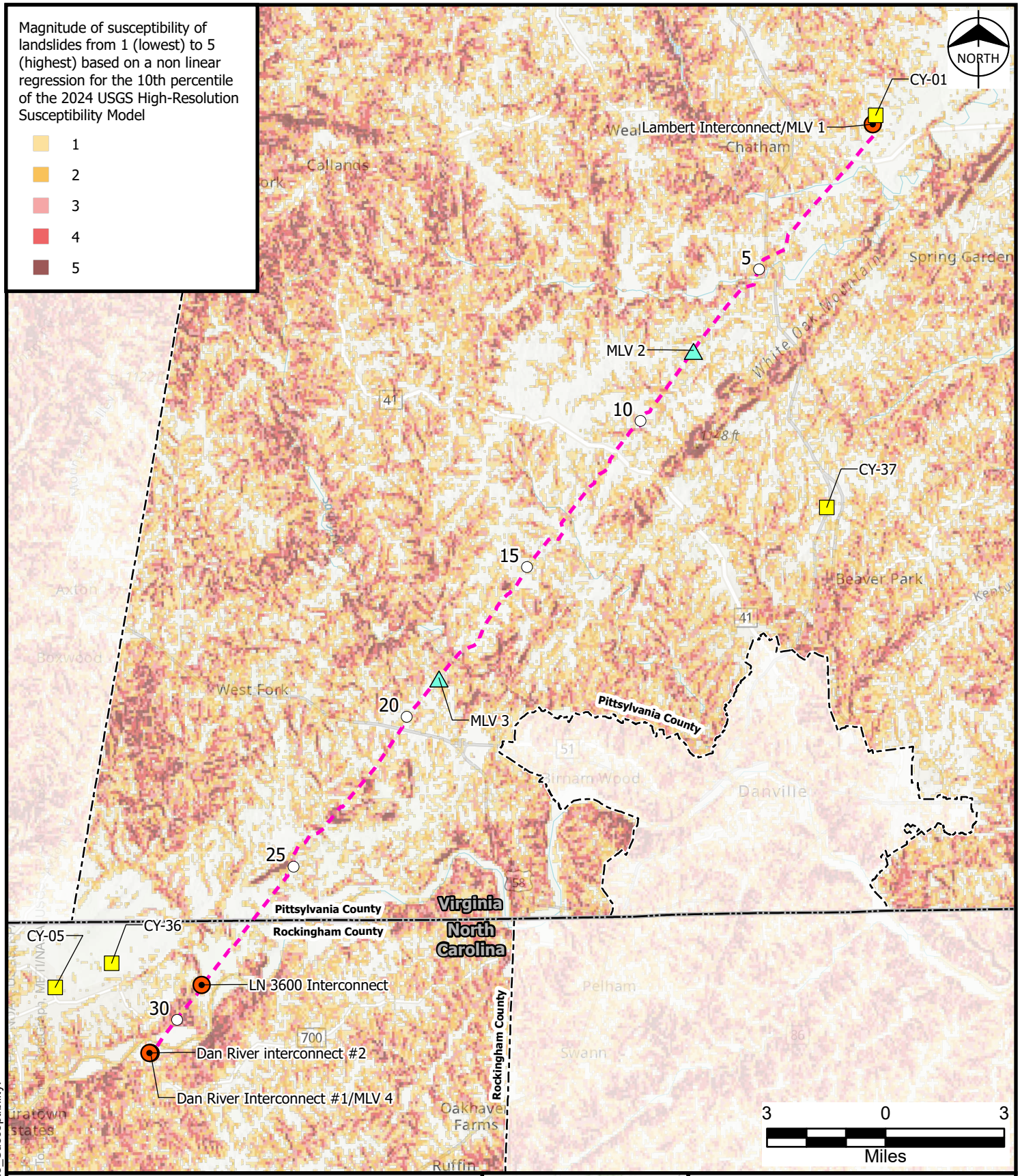
MVP Southgate Amendment Project

**Figure 6-A-4**
**Seismic Hazard**
2% Probability of Exceedance in 50 Years

Service Layer Credits: World Topographic Map: VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS

Source: USGS - USGS National Seismic Hazard Map (Simplified; 2% PGA, 50 years)

Issued: 11/27/2024




Service Layer Credits: US_Landslide_Susceptibility:

Source: USGS (https://www.usgs.gov/tools/us-landslide-inventory-and-susceptibility-map)

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# MVP Southgate Amendment Project

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# Appendix 6-B

# Bedrock Geology and Shallow Bedrock Locations in the Amendment Project Area

**Table 6-B-1**

**Bedrock Geology in the Amendment Project Area**

| Project Facility | Begin MP | End MP | Crossing Length (miles) | Formation | Primary Rock Type | Secondary Rock Type | Map Symbol |
|---|---|---|---|---|---|---|---|
| **H-650 Pipeline** | 0.00 | 0.06 | 0.06 | Upper Triassic | Sandstone | Siltstone | TRss |
| | 0.06 | 0.20 | 0.14 | Upper Triassic | Conglomerate | Mixed Clasts | TRc |
| | 0.20 | 0.64 | 0.44 | Upper Triassic | Sandstone | Siltstone | TRss |
| | 0.64 | 1.20 | 0.55 | Upper Triassic | Conglomerate | Mixed Clasts | TRc |
| | 1.20 | 1.46 | 0.26 | Proterozoic Z – Cambrian | Mica-schist | Gneiss | Zfm |
| | 1.46 | 2.14 | 0.68 | Cambrian | Granite | | lw |
| | 2.14 | 15.36 | 13.22 | Proterozoic Z – Cambrian | Mica-schist | Gneiss | Zfm |
| | 15.36 | 16.59 | 1.23 | Upper Triassic | Conglomerate | Mixed Clasts | TRc |
| | 16.59 | 17.53 | 0.93 | Upper Triassic | Sandstone | Undifferentiated | TRs |
| | 17.53 | 18.43 | 0.90 | Upper Triassic | Sandstone | Siltstone | TRss |
| | 18.43 | 19.09 | 0.67 | Upper Triassic | Conglomerate | Mixed Clasts | TRc |
| | 19.09 | 21.04 | 1.95 | Proterozoic Z | Biotite-gneiss | Amphibolite | Zau |
| | 21.04 | 21.48 | 0.44 | Proterozoic Z – Cambrian | Mica-schist | Amphibolite | Zab |
| | 21.48 | 22.77 | 1.29 | Proterozoic – Paleozoic | Mylonite | Gneiss | my |
| | 22.77 | 25.27 | 2.50 | Upper Triassic | Sandstone | Siltstone | TRss |
| | 25.27 | 26.76 | 1.49 | Triassic | Sandstone | Siltstone | TRcs |
| | 26.76 | 29.65 | 2.89 | Triassic | Sandstone | Mudstone | TRdp |
| | 29.65 | 30.03 | 0.37 | Triassic | Mudstone | Sandstone | TRdc |
| | 30.03 | 31.36 | 1.34 | Triassic | Sandstone | Mudstone | TRdp |
| **Aboveground Facilities** | **Area (acres)** | **Near MP** | | **Formation** | **Primary Rock Type** | **Secondary Rock Type** | **Map Symbol** |
| Lambert Interconnect / MLV 1 | 0.72 | 0.00 | | Upper Triassic | Sandstone | Siltstone | TRss |
| | | | | | Conglomerate | Mixed Clasts | TRc |
| MLV 2 | 0.02 | 7.70 | | Proterozoic Z – Cambrian | Mica-schist | Gneiss | Zfm |
| MLV 3 | 0.02 | 18.70 | | Upper Triassic | Conglomerate | Mixed Clasts | TRc |
| LN 3600 Interconnect | 0.28 | 28.90 | | Triassic | Sandstone | Mudstone | TRdp |
| Dan River Interconnect #1 / MLV 4 | 0.68 | 31.20 | | Triassic | Sandstone | Mudstone | TRdp |
| Dan River Interconnect #2 | 0.47 | 31.20 | | Triassic | Sandstone | Mudstone | TRdp |

**Table 6-B-2**

**Shallow Bedrock Locations in the Amendment Project Area**

| Project Facility | Begin MP | End MP | Crossing Length (miles) | Bedrock Depth (in) | Map Symbol | Formation Name | Primary Rock Type | Secondary Rock Type |
|---|---|---|---|---|---|---|---|---|
| **H-650 Pipeline** | 22.62 | 22.67 | 0.05 | 18.1 | my | Proterozoic – Paleozoic | Mylonite | Gneiss |
| | 23.42 | 23.50 | 0.08 | 29.1 | TRss | Upper Triassic | Sandstone | Siltstone |
| | 25.20 | 25.27 | 0.07 | 29.1 | TRss | Upper Triassic | Sandstone | Siltstone |
| | 25.27 | 25.48 | 0.21 | 29.1 | TRcs | Triassic | Sandstone | Siltstone |
| | 25.61 | 25.67 | 0.06 | 29.1 | TRcs | Triassic | Sandstone | Siltstone |
| | 26.13 | 26.34 | 0.22 | 29.1 | TRcs | Triassic | Sandstone | Siltstone |

Note: No aboveground facilities occur in areas of shallow bedrock.

# MVP Southgate Amendment Project

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# Appendix 6-C

# Potential Areas of Steep Slopes and Side Slopes Crossed by the Amendment Project Pipeline

**Table 6-C-1**

**Potential Areas of Steep Slopes Crossed by the Amendment Project Pipeline**

| Steep Slope Group | Begin MP | End MP | Length of slope crossed (feet) |
|---|---|---|---|
| **H-650 Pipeline** | | | |
| 30 to 50 | 0.12 | 0.13 | 25 |
| 30 to 50 | 4.24 | 4.24 | 26 |
| 30 to 50 | 4.43 | 4.43 | 27 |
| 30 to 50 | 5.15 | 5.16 | 25 |
| 50 to 66 | 5.42 | 5.43 | 21 |
| 50 to 66 | 5.56 | 5.57 | 28 |
| 30 to 50 | 5.57 | 5.57 | 28 |
| 30 to 50 | 5.97 | 5.98 | 24 |
| 50 to 66 | 7.22 | 7.22 | 29 |
| 30 to 50 | 7.92 | 7.93 | 25 |
| 30 to 50 | 8.30 | 8.31 | 75 |
| 30 to 50 | 8.90 | 8.90 | 29 |
| 50 to 66 | 8.90 | 8.91 | 29 |
| 30 to 50 | 8.91 | 8.91 | 34 |
| 66 to 80 | 10.30 | 10.30 | 30 |
| 50 to 66 | 10.30 | 10.31 | 24 |
| 30 to 50 | 10.31 | 10.31 | 18 |
| 30 to 50 | 10.42 | 10.43 | 44 |
| 30 to 50 | 10.63 | 10.64 | 25 |
| 30 to 50 | 10.38 | 10.40 | 76 |
| 50 to 66 | 12.17 | 12.18 | 24 |
| 30 to 50 | 13.12 | 13.13 | 52 |
| 66 to 80 | 13.80 | 13.81 | 35 |
| 30 to 50 | 13.81 | 13.82 | 33 |
| 30 to 50 | 17.68 | 17.69 | 51 |
| 50 to 66 | 17.70 | 17.71 | 31 |
| 30 to 50 | 17.71 | 17.72 | 49 |
| NA | 17.87 | 17.83 | NA |
| 30 to 50 | 18.33 | 18.34 | 50 |
| 30 to 50 | 18.42 | 18.43 | 94 |
| 30 to 50 | 20.81 | 20.83 | 118 |
| 30 to 50 | 21.05 | 21.06 | 72 |
| 30 to 50 | 21.94 | 21.96 | 73 |
| 30 to 50 | 21.96 | 21.97 | 42 |
| 30 to 50 | 22.42 | 22.43 | 27 |
| 30 to 50 | 22.77 | 22.78 | 32 |
| 30 to 50 | 22.92 | 22.93 | 32 |
| 30 to 50 | 23.12 | 22.15 | 120 |
| 30 to 50 | 23.23 | 23.25 | 133 |
| 30 to 50 | 23.26 | 23.27 | 39 |
| 30 to 50 | 23.64 | 23.65 | 72 |
| 30 to 50 | 23.72 | 23.72 | 36 |
| 50 to 66 | 25.03 | 25.03 | N/A |
| 30 to 50 | 25.45 | 25.46 | 77 |

**Table 6-C-1**

**Potential Areas of Steep Slopes Crossed by the Amendment Project Pipeline**

| Steep Slope Group | Begin MP | End MP | Length of slope crossed (feet) |
|---|---|---|---|
| **H-650 Pipeline** | | | |
| 30 to 50 | 24.00 | 24.01 | 90 |
| 30 to 50 | 25.13 | 25.13 | 31 |
| 30 to 50 | 25.54 | 25.55 | 77 |
| 30 to 50 | 25.66 | 25.67 | 56 |
| 30 to 50 | 25.82 | 25.83 | 45 |
| 30 to 50 | 26.86 | 26.87 | 21 |
| 30 to 50 | 22.42 | 22.43 | 27 |
| 30 to 50 | 22.77 | 22.78 | 32 |
| 30 to 50 | 22.92 | 22.93 | 32 |
| 30 to 50 | 28.17 | 28.18 | 22 |
| 66 to 80 | 28.20 | 28.20 | 16 |
| 30 to 50 | 28.20 | 28.20 | 10 |
| 30 to 50 | 29.49 | 28.52 | 142 |
| 30 to 50 | 29.63 | 29.63 | 63 |
| 30 to 50 | 29.95 | 29.95 | 39 |
| 30 to 50 | 30.01 | 30.03 | 124 |
| 30 to 50 | 30.08 | 30.10 | 133 |
| 30 to 50 | 30.19 | 30.20 | 23 |
| 50 to 66 | 30.20 | 30.20 | 9 |
| 50 to 66 | 30.72 | 30.73 | 31 |

Methodology:

1. Steep Slope percentages are grouped as follows according to the percent of grade: 30-50%, 50-66%, 66-80, 80%+
2. Only crossings that are longer than 20 feet are considered. Some locations may seem smaller, but they are still considered if they are a continuation of another slope group.
3. For crossings that have multiple variations of slope groups within small lengths, an average slope group is assigned.
4. The length of slope crossed might be slightly shorter than actual MP lengths because of small stretches of data that are not in slope groups.

Note: Results based on desktop analysis.
NA = Not Applicable

**Table 6-C-2**

**Potential Areas of Side Slopes Crossed by the Amendment Project Pipeline**

| Side Slope Group | Begin MP | End MP | Length of slope crossed (feet) |
|---|---|---|---|
| **H-650 Pipeline** | | | |
| 18 to 25 | 4.12 | 4.13 | 56 |
| 14 to 18 | 4.2 | 4.21 | 27 |
| 18 to 25 | 4.21 | 4.22 | 86 |
| 25+ | 4.22 | 4.24 | 111 |
| 18 to 25 | 4.24 | 4.26 | 59 |
| 14 to 18 | 8.95 | 9.03 | 298 |
| 14 to 18 | 9.32 | 9.34 | 70 |
| 14 to 18 | 10.31 | 10.37 | 283 |
| 14 to 18 | 14.02 | 14.03 | 86 |
| 18 to 25 | 14.12 | 14.14 | 60 |
| 25+ | 14.14 | 14.15 | 66 |
| 14 to 18 | 15.92 | 15.99 | 244 |
| 18 to 25 | 16.42 | 16.43 | 40 |
| 14 to 18 | 16.95 | 16.98 | 98 |
| 14 to 18 | 16.99 | 17 | 43 |
| 18 to 25 | 17.9 | 17.9 | 37 |
| 14 to 18 | 17.9 | 17.94 | 178 |
| 18 to 25 | 17.94 | 17.95 | 46 |
| 14 to 18 | 17.95 | 17.96 | 46 |
| 18 to 25 | 18.4 | 18.43 | 157 |
| 18 to 25 | 18.46 | 18.47 | 52 |
| 14 to 18 | 19.91 | 19.92 | 62 |
| 18 to 25 | 19.96 | 20.02 | 233 |
| 14 to 18 | 20.05 | 20.06 | 40 |
| 18 to 25 | 22 | 22.02 | 87 |
| 25+ | 23.14 | 23.18 | 186 |
| 18 to 25 | 23.18 | 23.2 | 97 |
| 14 to 18 | 23.2 | 23.21 | 53 |
| 18 to 25 | 23.4 | 23.41 | 63 |
| 18 to 25 | 25.81 | 28.88 | 216 |
| 14 to 18 | 29.38 | 29.41 | 70 |
| 14 to 18 | 28.68 | 28.73 | 177 |
| 25+ | 29.78 | 29.82 | 100 |
| 14 to 18 | 29.97 | 29.97 | 60 |

Methodology

1. Side Slope percentages are grouped as follows according to the percent of grade: 14-18%, 18-25%, 25%+
2. Only crossings that are longer than 40 feet are considered. Some locations may seem smaller, but they are still considered if they are a continuation of another slope group.
3. For crossings that have multiple variations of slope groups within small lengths, an average slope group is assigned.
4. The length of slope crossed might be slightly shorter than actual MP lengths because of small stretches of data that are not in slope groups.

Note: Results based on desktop analysis.