

REVISED STUDY PLAN:  
LISTED BAT STUDIES ALONG MVP'S PROPOSED  
MOUNTAIN VALLEY PIPELINE PROJECT  
IN CRAIG, FRANKLIN, GILES, MONTGOMERY, PITTSYLVANIA, AND  
ROANOAKE COUNTIES, VIRGINIA

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## 1.0 Project Description

Mountain Valley Pipeline, LLC (MVP), a joint venture of EQT Corporation, a subsidiary of NextEra Energy, Inc., WGL Holdings, Inc. and Vega Energy Partners, Ltd., plans to construct the Mountain Valley Pipeline (Project), a 42-inch diameter natural gas pipeline, to allow producers and end-users a direct route to transport new gas supplies to meet the growing need for natural gas in the Appalachian, Mid-Atlantic, southeastern United States. The Project will extend from the existing Equitrans transmission system near Mobley in Wetzel County, West Virginia, to Transcontinental Gas Pipeline Company's Zone 5 compressor station 165 in Pittsylvania County, Virginia (Figure 1, Appendix A). In West Virginia, the pipeline is expected to cross Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Upshur, Webster, and Wetzel counties. In Virginia, the pipeline is expected to cross Craig, Franklin, Giles, Montgomery, Pittsylvania and Roanoke counties.

Multiple potential routes are identified within this Study Plan. The total length of all potential routes is approximately 386.93 miles (216.98 miles in West Virginia and 169.95 miles in Virginia). The final alignment will be approximately 300 miles. In addition to the pipeline, the Project will require approximately 225,000 horsepower of compression at approximately four compressor stations along the final route along with measurement, regulation, and other ancillary facilities required for the safe operation of the pipeline. To facilitate the construction and maintenance of the pipeline, 329 access roads are proposed for construction or improvement. Of the 329 access roads, 251 will be in West Virginia ( $\pm 145.18$  miles) and 78 will be in Virginia ( $\pm 222.23$  miles).

The width of the permanent right-of-way (ROW) will be 75 feet. This will encompass a total of 1,773.50 acres in West Virginia and 900.78 acres in Virginia. The width of the construction ROW is 125 feet which will temporarily impact an additional 1,180.50 acres in West Virginia and 600.22 acres in Virginia.

This Study Plan presents all current potential aspects of the Project; however, changes to the alignment and number and location of facilities and access roads may occur. Any additions to the Project will be handled consistently with the level of effort described in this Study Plan. Should a final route be determined prior to the completion of surveys, no surveys will be completed on the eliminated alignment, facilities, and/or access roads.



## 2.0 Basis for ESA Compliance

The Federal Endangered Species Act of 1973 (ESA) [16 U.S.C. 1531 et seq.] provides for the listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Under the ESA, the U.S. Fish and Wildlife Service (USFWS) is mandated to monitor and protect listed species. Many states enacted similar laws.

Section 9 of the ESA prohibits take of listed species. Take is defined by the ESA as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" [16 U.S.C. 1532(19)]. USFWS further defines harm to include significant habitat modification or degradation [50 CFR §17.3].

The Project is within the ranges of the federally endangered Indiana bat (*Myotis sodalis*) and Virginia big-eared bat (*Corynorhinus townsendii virginianus*) as well as the northern long-eared bat (*Myotis septentrionalis*), recently listed as threatened under ESA. Indiana and northern long-eared bats are "tree bats" in summer and a "cave bats" in winter, whereas Virginia big-eared bats use caves year-round.

The use of caves in winter for hibernation also includes spring staging and autumn swarming activities that typically are associated with hibernacula. On behalf of MVP, Environmental Solutions & Innovations, Inc. (ESI) proposes to conduct mist net surveys, portal searches, and detailed habitat assessments within the Project area. Studies are carried out under ESI's USFWS Federal Fish and Wildlife Permit (TE02373A-8) Virginia Department of Game and Inland Fisheries (VDGIF) Scientific Collection and Threatened/Endangered Species Permits.

A single Study Plan for both states was previously submitted in November 2014, prior to a project-agency meeting at USFWS in Elkins, West Virginia, and again in March 2015. Comments for both submissions were obtained from state and federal resource agencies in West Virginia and Virginia. Because agency-specific requests varied, this Study Plan incorporates the Virginia agencies comments and is specific to the Project area in Virginia. This Study Plan is submitted to the USFWS Gloucester Field Office and VDGIF. A separate, West Virginia-specific revised Study Plan will be submitted to the USFWS Elkins Field Office and WVDNR.

Through submittal of this revised Study Plan, ESI and its clients are requesting concurrence with the Study Plan's methods and levels of effort and site-specific authorization from USFWS and VDGIF to conduct the proposed survey activities.

## **3.0 Initial Project Screening**

### **3.1 Step 1. Coordinate with the Federal and State Agencies**

On 13 October 2014, MVP contacted Troy Andersen of the USFWS Virginia Field Office to officially introduce the Project and request information regarding any resources under the agency's jurisdiction that could be potentially affected by the Project (Appendix B). On behalf of MVP, ESI accessed the USFWS's online IPaC on 16 October 2014 to determine if the Project may affect any threatened/endangered bats, designated critical habitat, or proposed critical habitat. According to the IPaC results, no critical habitats were within the Project area, but the Project does have the potential to affect Indiana, Virginia big-eared, and northern long-eared bats (Appendix B). In a letter dated 13 October 2014, MVP contacted Ernie Aschenbach of the VDGIF to officially introduce the Project (Appendix B). ESI followed up with another letter on 3 November to request confirmation of the IPaC results and for any additional information regarding rare, threatened or endangered species in the vicinity of the Project (Appendix B). During a meeting with MVP in Elkins, USFWS indicated the proposed route intersects a documented Indiana bat hibernacula (Tawney's Cave) near the Giles and Montgomery counties border (Figure 1, Appendix A).

### **3.2 Step 2. Conduct Desktop Habitat Assessment**

A desktop habitat analysis was completed for the Project. Potentially suitable summer habitat for the Indiana and northern long-eared bat was identified along the length of the Project in Virginia. Evidence of year-round habitat for the Virginia big-eared bat and winter habitat for the Indiana and northern long-eared bats were identified along portions of the Project (Figure 2 Maps 11-21, Appendix A).

### **3.3 Step 3. Assess Potential for Adverse Effects**

As currently designed, the Project cannot avoid loss to potentially suitable listed bat habitat and therefore it cannot be assumed that the project will definitively NOT affect listed species of bats. As such, MVP proposes to conduct summer field mist net surveys and searches for potential hibernacula (caves and mines) in order to determine the Project's potential effect on listed bats.

## 4.0 Field Surveys

### 4.1 Cave and Mine Survey

#### 4.1.1 Desktop Analysis

Before initiating field studies, a GIS desktop analysis is completed to locate known underground features near (within 4.8 kilometers [3 mi] in VA) the Project that could potentially serve as winter hibernacula (mines and caves). Several resources are used to perform this analysis including data from:

- Virginia Department of Mines, Minerals, and Energy (<http://www.dmme.virginia.gov/>) that details the locations of karst features, sinkholes, and abandoned mines
- GIS data provided by the Virginia Speleological Society
- USGS topographic maps and current aerial imagery (to search for any indication of past and current mining related activity such as evidence of mine test pits or non-maintained access roads).

Any underground features identified near the Project are visited, where access can be obtained, in the field by ESI's permitted bat biologists to confirm the presence and determine potential suitability.

#### 4.1.2 Field Search

A pedestrian search, where access can be obtained, is conducted within 0.8 kilometer (0.5 mi) from the edge of the Project footprint.

Searches within the survey corridor are completed during leaf-off (late autumn to early spring months) to enhance visibility of openings to underground voids. Searches along the Project ROW, access roads and ancillary facilities are conducted by permitted bat biologists walking along the proposed path; biologists search not only for holes in the ground, but also tailings, slag, benches, high-walls, seams, vents, drainage, abandoned structures, and areas of auger activity that could indicate the potential presence of open mine portals. To the degree that property access is provided, mine or cave features on the ROW are followed until they end, to locate any void openings near the proposed Project.

If voids are found, biologists record locations using a GPS unit, complete a potential hibernacula description data sheet, and take photographs. All voids are assessed for their potential to serve as suitable bat hibernacula based on the West Virginia USFWS's *Draft Protocol for Assessing Abandoned Mines/Caves for Bat Use*

(Updated June 2011). In general, portals will be deemed unsuitable for bat use and not require subsequent sampling when:

- Only one opening can be found and it is < 6 inches (15.2 cm) in diameter with little to no outward air flow
- Vertical shafts are < 1 foot (0.3 m) in diameter
- Passage continues < 50 feet (15.2 m) and terminates with no fissures available for bats to access
- Openings are prone to flooding, collapse, heavy predation, or otherwise inaccessible to bats
- The opening(s) has occurred recently due to creation or subsidence

Biologists also note the presence/absence of guano, outside temperature at the void, temperature inside the void, percent canopy closure at the void, approximate distance to nearest water source, and if the void is obstructed by vegetation or spider webs. Example portal search and portal description data sheets are provided in Appendix C.

#### **4.1.3 Potential Hibernacula Survey / Trapping**

A harp trap survey is conducted at portals that are determined to be suitable for bats. Portal trapping follows guidelines contained in the USFWS 2011 *Draft Protocol for Assessing Abandoned Mines/Caves for Bat Use* and Appendix B of the USFWS 2014 *Northern Long-eared Bat Interim Conference and Planning Guidance*. Trapping is conducted prior to any tree clearing from 1 to 21 April or 1 September to 31 October, beginning one-half hour before sunset and continuing for at least 5 hours. Weather conditions include temperatures above 10° Celsius (50° F) for the first two hours, and temperatures remaining above 1.6° Celsius (35° F) until midnight. Sampling is not completed during precipitation, including rain and/or fog that does not stop within 30 minutes or continues intermittently during the survey period. Sampling will also cease if high winds occur and become strong enough to move equipment more than 50 percent of the time. A harp trap is positioned at the portal entrance, and bird netting is hung to block the space surrounding the entrance. Traps are checked at 10-minute intervals.

Concurrent with harp trapping, an acoustic detector (AnaBat [Titley Scientific, LLC]) is placed near the portal entrance. Bat passes are monitored and tallied for at least one hour after 10:00 PM. All files recorded are passed through a noise filter previously provided by the USFWS. A qualified biologist reviews files that pass the filter to eliminate any that were not produced by bats and to note the number of files that contain multiple bats.

For spring harp trapping, a minimum of three nights of sampling per week (i.e., 9 nights of sampling) is conducted at each suitable entrance. For fall harp trapping, a minimum of two evenings of sampling is completed at each suitable entrance. Example habitat description and bat capture data sheets are provided in Appendix C.

## **4.2 Detailed Habitat Assessment**

As mentioned in Section 3.1, approximately 10.1 miles of the Project pipeline route in Virginia occurs within the known occupied habitat for the Indiana bat. (Figure 1, Appendix A). In lieu of a mist net survey, a detailed habitat assessment will be completed areas along this section of the Project to determine the quantity and quality of suitable habitat that will be lost with Project construction. Results of the detailed habitat assessment will be incorporated into a report and submitted to the USFWS for review.

### **4.2.1 Basic Methods**

Impacts to suitable Indiana bat summer habitat within known occurrence areas are addressed by completing an evaluation of the quality of roosting and foraging habitat. This effort consists of:

1. A desktop GIS analysis of habitat within the proposed ROW plus a buffer, to create the 1.5-mile wide Environmental Study Corridor, is completed using the most recent (2011) National Land Cover Dataset (NLCD). This analysis provides a baseline understanding of the Project area and helps guide field studies. It also provides a means of “cross checking” results of field studies.
2. A field survey of the Environmental Study Corridor is completed to assess the quantity and quality of roosting and foraging habitat. The field effort is designed to guide, complement, and “ground truth” the desktop NLCD analyses. Differences in the desktop analysis and field studies are examined to determine whether changes to the landscape occurred after NLCD data were collected.
3. A second desktop GIS analysis using 2011 NLCD data is completed after the field survey to compare cover types within the Project area, within 1.5 miles of the Project, and within areas of known, occupied habitat (i.e., within 5 miles of known Indiana bat captures). These data are used to ascertain proportionality of habitat loss to availability within the area of known, occupied habitat.

### **4.2.2 Field Survey**

Field surveys are completed, where access can be obtained, by walking within 0.75 mile (1.2 km) to either side of the Project’s pipeline and access road centerlines. Biologists identify areas of similar habitat type and quality (habitat “Patches”), and

record characteristics indicative of the quality of the habitat for use by roosting and foraging Indiana bats. The effort is designed to identify:

- Habitat Areal Extent and Location – accomplished by marking locations on aerial photographs, carrying aerial maps, carrying iPads in the field with aerial imagery and GIS features, and by using a field GPS loaded with Project features.
- Roosting Habitat Quality – a search is made to locate potentially suitable roost trees within and immediately adjacent to the Environmental Survey Corridor. Roost trees are characterized as high, moderate, or low value, based on species, diameter at breast height (dbh), status (live, dead, dying), and roost type (exfoliating bark, crevice, or cavity). Roost tree coordinates are recorded with a GPS.
- Foraging Habitat Quality – is ascertained by determining the clutter in the overstory and understory (dependent in large part on the average dbh of trees in the overstory, understory, and combined), the composition of the understory (shrubs, saplings, and lower branches of larger trees), and the presence of woodland edges, vegetated openings, or waterway resources.

Conducting field studies within a 300-foot wide study corridor provides the opportunity for a 125-foot wide construction corridor to deviate slightly and avoid high-quality roost trees. The number of potential roost trees found is an important component of determining the Roosting Habitat Quality, and, in combination with Foraging Habitat Quality, determines the overall habitat quality of habitat patches crossed by the ROW.

Photographs are taken of roost trees and habitat Patches. A short description of each habitat Patch is recorded. Example data sheets are provided in Appendix C.

### **4.3 Mist Netting Survey**

ESI proposes to conduct a summer mist net survey in accordance with guidelines contained in the USFWS 2015 *Range-wide Indiana Bat Summer Survey Guidelines* (Table 1) for portions of the Project that occur outside of known, occupied Indiana bat habitat.

#### **4.3.1 Level of Effort**

A review of GIS data is used to determine areas along the line that exhibit suitable summer habitat and require sampling. USFWS guidelines suggest that for linear projects in Virginia, a sampling effort of 1 site (6 net nights) should occur for every kilometer (0.6 mi) of potentially suitable summer habitat that is proposed for removal. These guidelines recommend that sampling is completed at a rate of 42 net nights per 123 acres.

#### 4.3.1.1 Rights-of-Way

After excluding open, non-forested areas and portions of the pipeline ROW occurring within known, occupied habitat (VA-KM295 to VA-KM310), ESI proposes to mist net approximately 260 sites to provide adequate coverage for the 169.9 miles (273.5 kilometers) of proposed route in Virginia (Figure 3 Maps 23-41, Appendix A).

Table 1. USFWS Indiana Bat Mist Net Survey Guideline.

<b>MIST NETTING GUIDELINES</b>	
<b>Northeast and Appalachian Recovery Units (CT, DE, MA, MD, NC, NJ, NY, PA, eastern TN, WV, VA, VT)</b>	
1. Netting Season: Broadly 15 May to 15 August broadly;	
2. Equipment (Mist Nets): constructed of the finest, lowest visibility mesh commercially available – monofilament or black nylon – with the mesh size approximately 1½ inch (1¼ – 1¾) (38 mm).	
3. Net Placement: mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A “typical” net set consists of two (or more) nets “stacked” on top of one another; width may vary up to 60 feet (20 m).	
4. Net Site Spacing:	
♦ Linear Projects – minimum of 6 net nights per 0.6 mile (1 km); 1 net night = 1 net set deployed for 1 night	
♦ Non-linear Projects – minimum of 42 net nights per 123 acres (0.5 km)	
5. Minimum Level of Effort Per Net Site:	
♦ Maximum of 3 nights of consecutive netting at any given location; must change net locations or wait at least 2 calendar nights before resuming netting at same location	
♦ Sample Period: begin at dusk and net for 5 hours (approximately 0200h)	
♦ Nets are monitored at approximately 10-minute intervals	
♦ No disturbance near the nets between checks	
6. Weather: Negative surveys combined with any of the following conditions throughout all or most of a sampling period are likely to require an additional night of mist-netting:	
♦ Precipitation (rain and/or heavy fog) lasting >30 minutes or continuing intermittently during the survey period	
♦ Temperatures <10°C (50°F)	
♦ Sustained wind >9 mi/hr (4 m/sec) (3 on Beaufort scale)	
Source: U.S. Fish and Wildlife Service; 2015	

Currently, there are 14 proposed access roads that extend beyond 0.5 kilometer from the centerline in Virginia. The combined length of these roads is approximately 1.9 miles (3.1 km). Of these, approximately 1.7 miles (2.8 km) is associated with roads that are new or where upgrades are very likely to be required, and 0.2 mile (0.3 km) is associated with existing roads that may or may not need upgrading. It is possible that up to 3 net sites may be required to address these access roads; the

final determination on the number of sites will be based on the level of construction, improvement, or widening and the resulting disturbance of forested habitat.

Sampling at each site is conducted by operating 3 net sets for 2 nights each or 2 net sets operated for 3 nights each. Nets may be placed up to 0.5 kilometer on either side of the centerline.

#### 4.3.1.2 Aboveground Facilities

There are currently three proposed compressor stations associated with the Project route in Virginia (Table 2), and all three are within existing proposed mist net site kilometer buffers. Compressor station facilities along the pipeline route, within 0.5 kilometer of the centerline (“mist net buffer”) will be covered by the netting completed for the pipeline and no additional netting is proposed for them.

Table 2. Compressor stations associated with the proposed Mountain Valley Pipeline Project in Virginia.

Compressor Station Name	Acreage	Forested Acreage	Within Pipeline Kilometer Buffer?	Within Known Occupied Habitat?	Proposed Number of Net Nights	Figure 4 Map Number
Swann CS4	44.03	1.53	Yes (VA-KM321)	No	0	35
Swann CS4 Alternate	40.34	40.34	Yes (VA-KM486 & VA-KM487)	No	0	24
Swann CS4 Alternate 2	15.76	0.93	Yes (VA-KM483)	No	0	23

There are currently 25 proposed laydown yards associated with the Project route and seven occur within Virginia (Table 3). As evidenced by the table, these yards are generally in areas that are already cleared so forested impacts are not anticipated or minimum for most yards. ESI proposes to generally treat these facilities the same as compressor stations with regard to level of survey effort; yards where clearing of forest habitat is required, and which are located outside or extending outside of the pipeline “mist net buffer”, will be surveyed in accordance with parcel/area based requirements of the survey guidelines. At this time, only one yard, MVP Wareyard 29, qualifies for partial coverage by netting of the ROW. The site contains approximately 50.34 acres, but of that only 0.14 acre is forested. Given the extraordinarily small forest impacts, no additional netting is proposed for this yard (Appendix A, Figure 4). Due to the relatively small amounts of forest existing in the three of the laydown yards, ESI proposes to conduct site assessments to determine if the forested areas contain suitable bat habitat or if the site is eligible for exclusion (see Section 4.3.2.).



Table 3. Laydown yards stations associated with the proposed Mountain Valley Pipeline Project in Virginia.

Laydown Yard Name	Acreage	Forested Acreage	Within Pipeline Kilometer Buffer?	Within Known Occupied Habitat?	Proposed Number of Net Nights	Figure 4 Map Number
MVP Wareyard 29	50.34	0.14	Partial (VA-KM431)	No	0	30
MVP Route 220 Yard	16.44	0.84	No	No	0	28
MVP Route 81 Wareyard	7.20	0.00	No	No	0	26
MVP 81 Wareyard 2	20.84	0.17	No	No	0	26
MVP Route 40 Yard	9.57	0.00	No	No	0	29
MVP Route 11 Yard	8.67	1.35	No	No	0	27
MVP Rt. 311 Wareyard	29.98	0.00	No	No	0	22

#### 4.3.2 Areas Unsuitable for Mist Netting

ESI's estimated number of sites is based on a desktop analysis that assumes all forested areas contain suitable summer habitat. In some cases, field examination of proposed Project areas may indicate that suitable summer habitat is either lacking or is extremely limited. When the habitat being removed is forested but contains no roosting habitat (i.e., no trees  $\geq 7.6$ -centimeter [3-in] dbh) and is not integral to the viability of suitable habitat, ESI will provide documentation (photographs and a datasheet) to the USFWS explaining why the site is not suitable prior to excluding it.

When the ROW intersects one or very few potential roost trees (e.g., a fence row with 5 trees  $\geq 7.6$ -centimeter dbh) that cannot be viably netted, ESI will visually monitor the trees for a minimum of 2 nights at dusk to determine the presence/absence of roosting bats.

Trees with the following characteristics qualify for monitoring:

- Cavities
- Splits in trunks or branches
- Exfoliating, peeling or loose bark

For emergence counts, biologists arrive at least 30 minutes before sunset and remain until (1) one hour past sunset or (2) it has become too dark to see. Emergence counts/surveys are not completed during continuous bad weather, such as precipitation, strong wind, and/or temperatures below 10° Celsius (50°F). Each emergence count is documented with a datasheet and supplemented by photographs. Monitored trees are considered unoccupied by northern long-eared or Indiana bats if any of the following criteria are met:

- No bats are observed emerging from the tree(s)
- Bats are observed emerging from the canopy but can be visually identified as foliage roosting species (i.e., eastern red bats)

ESI will consult with MVP and USFWS if bats are observed emerging from the trees that cannot be ruled out using these techniques.

#### **4.3.3 Net Placement**

Mist nets are set to maximize coverage of flight paths used by bats along suitable travel corridors, foraging areas, and/or drinking areas. Riparian corridors are often used for travel or foraging; however, upland corridors (e.g., trails or logging roads) also provide suitable sites. In upland areas, net sites in the vicinity of road ruts holding water have resulted in the capture of Indiana and northern long-eared bats. Site selection is based upon the extent of canopy cover, presence of an open flyway, and forest conditions near the site. The actual location and orientation of each net set is determined in the field by a permitted bat biologist. Coordinates of each net set are recorded with a Garmin, model eTrex Vista HCx, GPS unit which has an accuracy of 10 to 3 meters in WAAS-enabled areas.

#### **4.3.4 Bat Capture**

Bats are live-caught in mist nets and released unharmed near the point of capture. Captured bats are identified to species, sex, age class, and reproductive condition. Weight and right forearm length of each individual are also recorded. Age is determined by examining the epiphyseal-diaphyseal fusion of long bones in the wing. Reproductive condition of female bats is recorded as pregnant (based on gentle abdominal palpation), lactating, post lactating, or non-reproductive. Time and location/net site of captured bats is recorded. Processing is typically completed within 30 minutes of the time each bat is removed from the net. All bats captured and identified as Indiana, northern long-eared, evening (*Nycticeius humeralis*), or Virginia big-eared bat will be photographed. USFWS and VDGIF will be contacted within 48 hours of any capture of listed bats.

#### **4.3.5 Protocol for Addressing White-nose Syndrome**

White-nose syndrome (WNS) is a disease killing millions of bats in the eastern U.S. All current federal and state guidelines for WNS decontamination, containment, and avoidance are implemented. Biologists are kept aware of all current and changing WNS regulations. Bat handling follows current WNS protocols set by the USFWS and requirements of VDGIF. Captured bats are examined for damage associated with WNS to the wing and uropatagium (tail) membranes, including use of white and/or ultraviolet light. Wing damage is categorized using the Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome established by Jon Reichard in 2008.

#### **4.3.6 Habitat Characterization**

Concurrent with mist netting, habitat is described for each net site. The emphasis of this description is habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees, canopy closure, understory clutter/openness, water availability, and flight corridors. Habitat form is emphasized because the Indiana and northern long-eared bat roost in a variety of tree species.

ESI's habitat characterization does more than emphasize species of large trees near the net. It identifies components of the canopy and subcanopy layers. All trees that reach into the canopy are canopy trees, regardless of their diameter/size. Many smaller trees are often also found in the canopy, and in some situations, the canopy can be entirely composed of smaller diameter trees. ESI's habitat characterization identifies dominant and subdominant elements of the canopy.

The subcanopy, or understory, vegetation layer is well defined in classical ecological literature. It is that portion of the forest structure between the ground vegetation (to approximately 0.6 meter [2 ft]) and the canopy layers, usually beginning at about 7.6 meters (24.9 ft). Vegetation in the understory may come from:

- Lower branches of overstory trees
- Small trees that will grow into the overstory
- Small trees and shrubs that are confined to the understory

The amount of understory, or clutter, is also recorded because, unlike the Indiana bat, the northern bat forages more under the tree canopy and closer to the ground where it can glean insects from vegetation.

Each net site is documented with a sketch on the Habitat Assessment data sheet (Appendix C).

#### **4.3.7 Weather and Temperature**

Weather conditions are monitored each night of survey to assure compliance with mist netting guidelines. Conditions recorded include temperature, wind speed and direction, and percent cloud cover. Any of a variety of standard mercury or electric thermometers is used to record temperature, wind speed is determined by use of the Beaufort wind scale, and cloud cover is visually estimated. Weather data are recorded on the Bat Capture data sheet (Appendix C) and summarized in the report.

#### **4.3.8 Tracking of Listed Bats**

After collecting morphometric data, listed bats (including northern long-eared bats) are fitted with radio-transmitters. A maximum of 3 Indiana bats and 3 northern long-eared bats per site will be fitted with transmitters. A maximum of 2 (with

preference given to females and juveniles) northern long-eared bats will be fitted with transmitters for every 3 miles of the Project.

ESI will notify USFWS and VDGIF of any captures of federally listed bats within 48 hours.

#### **4.3.8.1 Transmitter Attachment**

A small interscapular area is trimmed of fur and the transmitter is attached to this area with non-toxic surgical adhesive. Transmitters are activated and tested before attachment. The adhesive degrades over time (typically 1 to 4 weeks) and the transmitter falls off the bat. Biologists record the transmitter weight, weight of the bat before and after transmitter attachment, and holding time. Bats are released unharmed near the points of capture. Standardized data forms are used for transmitter attachment information.

Transmitters are typically obtained from either ®Holohil Systems Ltd. or ®Blackburn Transmitters (frequency of 171 and 172). Bat transmitter weights range from 0.25 to 0.5 gram. Whenever possible, ESI uses 0.25- to 0.35-gram transmitters, as they are the lightest commercially available, least stressful to the bats, are usually less than 5 percent of the pre-attachment weight of the bat, and are not more than 10 percent of a bat's total body weight. Batteries on these transmitters typically last 7 to 14 days.

#### **4.3.8.2 Diurnal Roost Telemetry**

To locate roosting bats, ESI tracks radio-telemetry signals using either a ®Wildlife Materials TRX-2000S PLL Synthesized Tracking Receiver, an ®Advanced Telemetry Systems, Inc. Model R2000 Scanning Receiver, or a ®Titley Australis 26k receiver with three-element folding Yagi directional antennas manufactured by either ®Wildlife Materials, Inc. or ®Titley Electronics, PTY LTD. Receivers are not water resistant and are not used during periods of heavy rain. If a day of effort is missed due to inclement weather, an additional day will be added.

Beginning the day after bat capture and transmitter attachment, ESI biologists use telemetry to locate each bat's diurnal roost. Roost trees are identified to species and dbh is measured using a dbh tape or Biltmore stick. The approximate height at which the bat is roosting and general condition of the roost tree (dead, live, dying, % bark cover, etc.) is noted. A description of habitat near the roost tree is recorded. Occasionally, northern long-eared bats roost in man-made structures. Standardized data forms are used to characterize roost trees and assess associated habitat; the form also provides for assessment of man-made structures used as roosts (Appendix C). Depending on specific requests by landowners or the client, roosts can either be flagged, painted, receive a metal tag, or be staked for ease of future identification. Coordinates of each roost are recorded with a GPS unit. If a roost tree occurs in an

area where biologists are not permitted access, then triangulation will be used to estimate its location.

Indiana and northern long-eared bats are tracked for approximately 7 and 4 days respectively, for a minimum of 4 hours per day per bat (or until the bat is found), after the date of capture or until the transmitter is shed or fails, whichever happens first. Emergence counts are performed on each identified roost tree for a minimum of 2 days as suggested in Appendix E (Phase 4 Emergence Surveys for Known Indiana Bat Roosts) of the USFWS 2015 *Range-wide Indiana Bat Summer Survey Guidelines*. If the listing status of a bat species changes prior to the beginning of mist net surveys, ESI will coordinate with the state and federal agencies regarding the recommended tracking effort of individuals from each species and minimum days of emergence counts required for roost trees.

#### **4.3.9 Property Access**

ESI's biologists may work only on those properties to which the landowner or other competent authorities have granted access. When no suitable net site locations exist within a particular 1-kilometer (0.6-mi) segment, ESI mist nets, in order of preference:

1. First in an adjacent ("above" or "below") KM, provided that a second suitable site exists within that KM

OR

2. Any KM with suitable net site locations, within 3 KMs of the one for which access cannot be obtained.

If a second acceptable, accessible site cannot be identified within 3 kilometers of the intended survey kilometer, ESI will contact USFWS to determine the best course of action given the particular circumstance.

If a listed bat is captured, ESI and the client will work to gain access to roost(s) and/or foraging areas. Studies will be conducted only where landowners grant permission to do so. If ESI biologists locate a roosting area on a parcel where land access cannot be gained, triangulation from accessible areas will be used to approximate the bat's diurnal location.

## **5.0 Timeline and Reporting**

### **5.1 Cave and Mine Survey**

Field searches for abandoned mines and caves began in November 2014 and will continue until completion. Provided land access exists, these are anticipated to be complete by summer 2015. Any suitable portals located during the field searches will be sampled during the allotted survey spring or autumn survey windows. Separate reports for the field search and portal sampling will be submitted to the appropriate state and federal agencies within a month of each survey's completion. Reports include detailed descriptions of the Project, methods, results, and discussion/conclusion as well as copies of data sheets and photographs.

### **5.2 Detailed Habitat Assessment**

Detailed habitat assessments within areas of known, occupied habitat are scheduled concurrent with portal search efforts. A detailed report is submitted to USFWS within a month of completing the habitat assessment. It includes detailed descriptions of the Project, methods, results, and discussion/conclusion, and copies of data sheets and photographs. Data from the detailed habitat assessment are submitted to the USFWS as soon as possible after completion of surveys.

### **5.3 Mist Net Survey**

Mist netting is conducted during the allotted survey window (15 May to 15 August). Data are summarized in a detailed report and submitted to the appropriate state and federal agencies within a month of completing the mist net survey. The detailed report includes the following:

1. Detailed description of the project, methods, results, and discussion/interpretation of results.
2. Explanation of any modifications from the original survey plan (e.g., altered net locations or addition of net locations due to changes in Project design)
3. Legible copies of datasheets that describe in detail:
  - Mist net locations (including a site diagram and coordinates) and net set-ups (height and number of net set-ups)
  - Habitat (including roosting potential) adjacent each mist net location
  - Date, name of biologist(s) conducting survey, duration of survey, and weather conditions at each mist net location

- Bat species, time of capture, sex, weight, reproductive status, right forearm length, and Reichard's wing damage index score.
  - Results of radio-tracking and roost tree emergence counts (if listed bats are captured)
4. Color photographs of all captured listed bats, mist net set-ups, and bat roosts if located during radio-tracking

Example data sheets are provided in Appendix C.

## **6.0 Requests for Agency Concurrence**

### **6.1 Request for Site-Specific Authorization to Proceed**

Please consider this Study Plan a request for site-specific authorization to begin sampling along the length of the line as soon as possible and within the season designated for sampling.

### **6.2 Time of Clearing Restrictions**

In areas where mist net survey results are negative (i.e., no captures of listed bats), and there are no known previous occurrences of known, occupied habitat, we seek confirmation, as a part of this plan, that no seasonal restrictions pertaining to bats are placed on clearing or other construction activities associated with this Project.

Clearing activities within 5 miles of listed bat hibernacula is restricted to between 15 November and 31 March.

If listed bats are captured, the location of each capture site and roost(s) will be plotted in relation to the Project.

- a 2.5-mile buffer is placed around Indiana bat roost sites within which clearing will be restricted to between 15 October and 31 March.
- a 5-mile buffer is placed around Indiana bat capture sites not associated with a known roost, within which clearing will be restricted to between 15 October and 31 March.

In Virginia, capture rates of northern long-eared bats are expected to be low, if not rare, and protective buffers associated with northern long-eared bat captures or roosts will be equal to those afforded to Indiana bats.

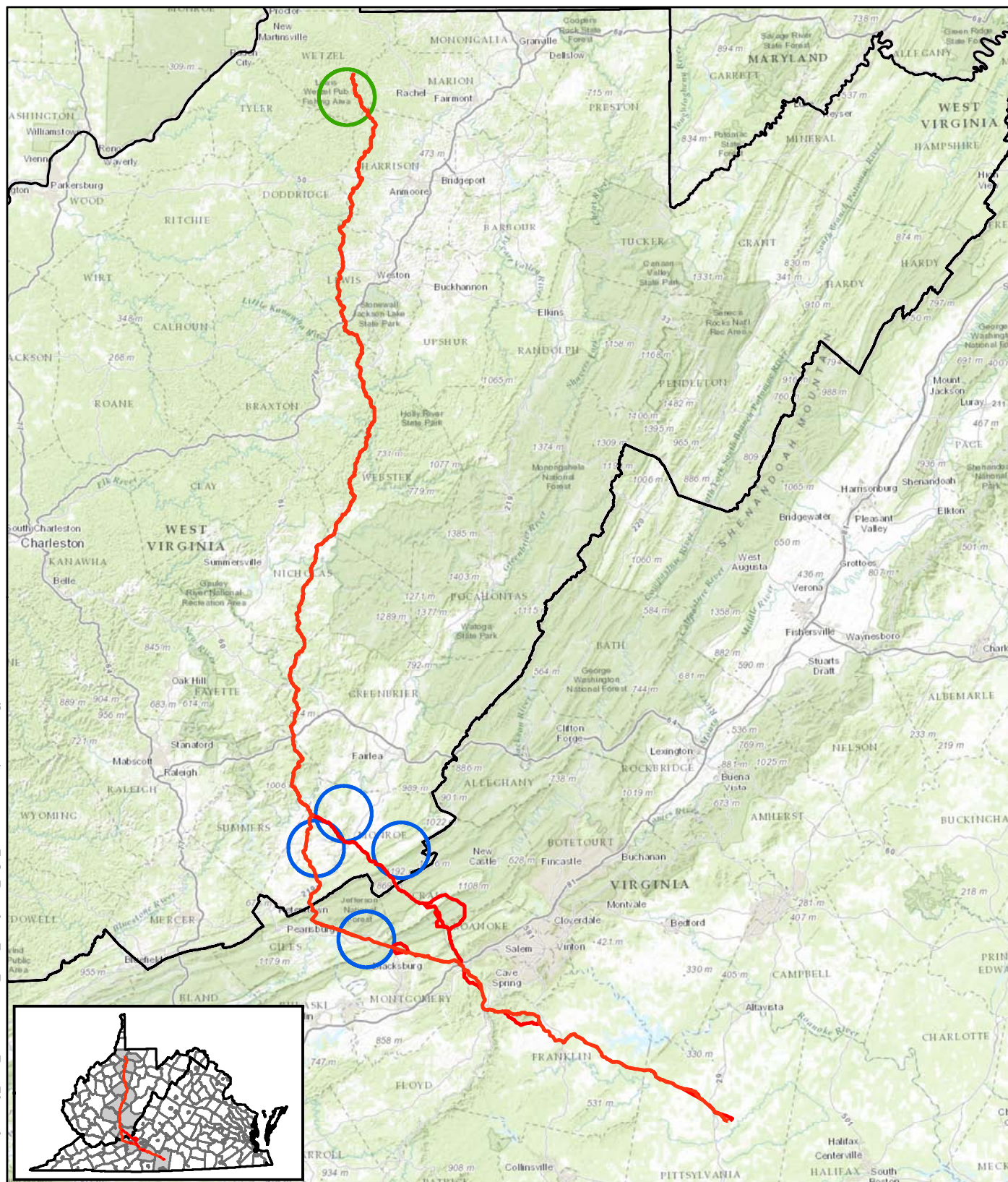
Identified, maternity roost trees (those with greater than 5 bats seen emerging for at least one calendar night) will not be removed by the Project during any time of year.

### **6.3 Period for Which Survey Results are Valid**

We seek confirmation that results of the mist net survey remain valid for a period of three years after the summer when the survey is completed.



## APPENDIX A FIGURES



— MVP Potential Routes (Alignment as of 2015 March 2)
   Indiana Bat Hibernacula
   Indiana Bat Summer Capture

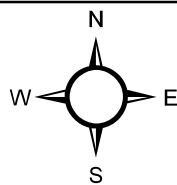


Figure 1. Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Project No.  
593

20 0 20 40  
Kilometers



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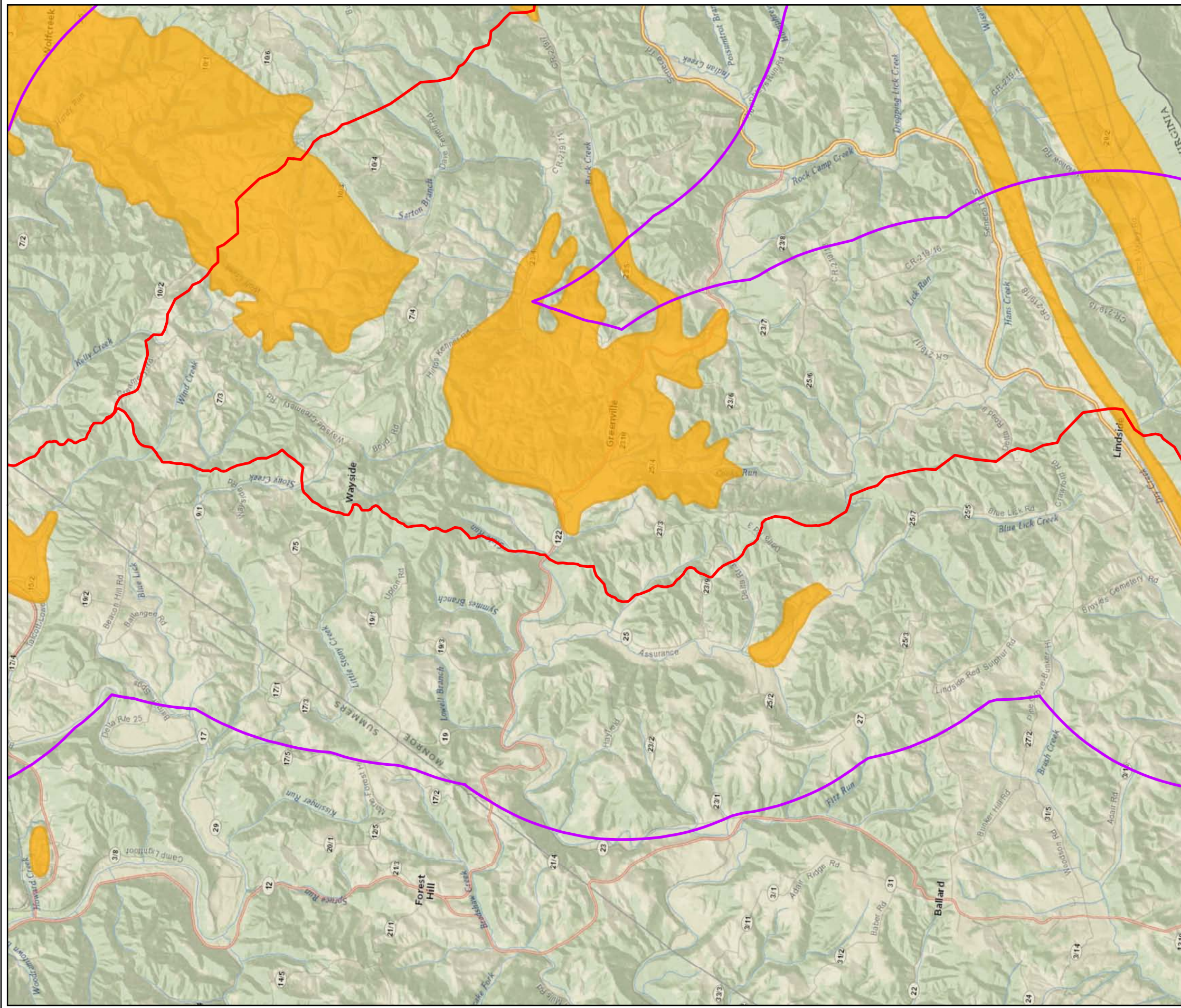
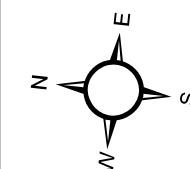
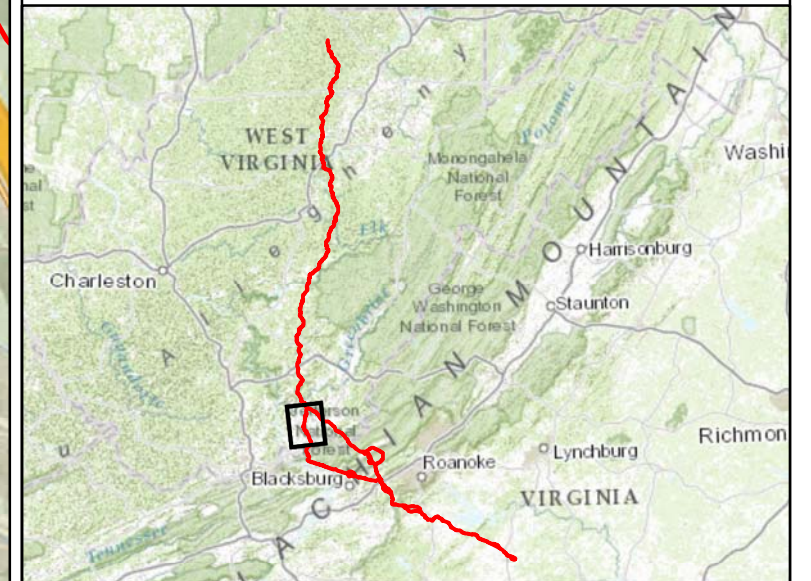


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 11 of 21

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer
- Karst Formation



0 2,000 4,000 Meters

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,



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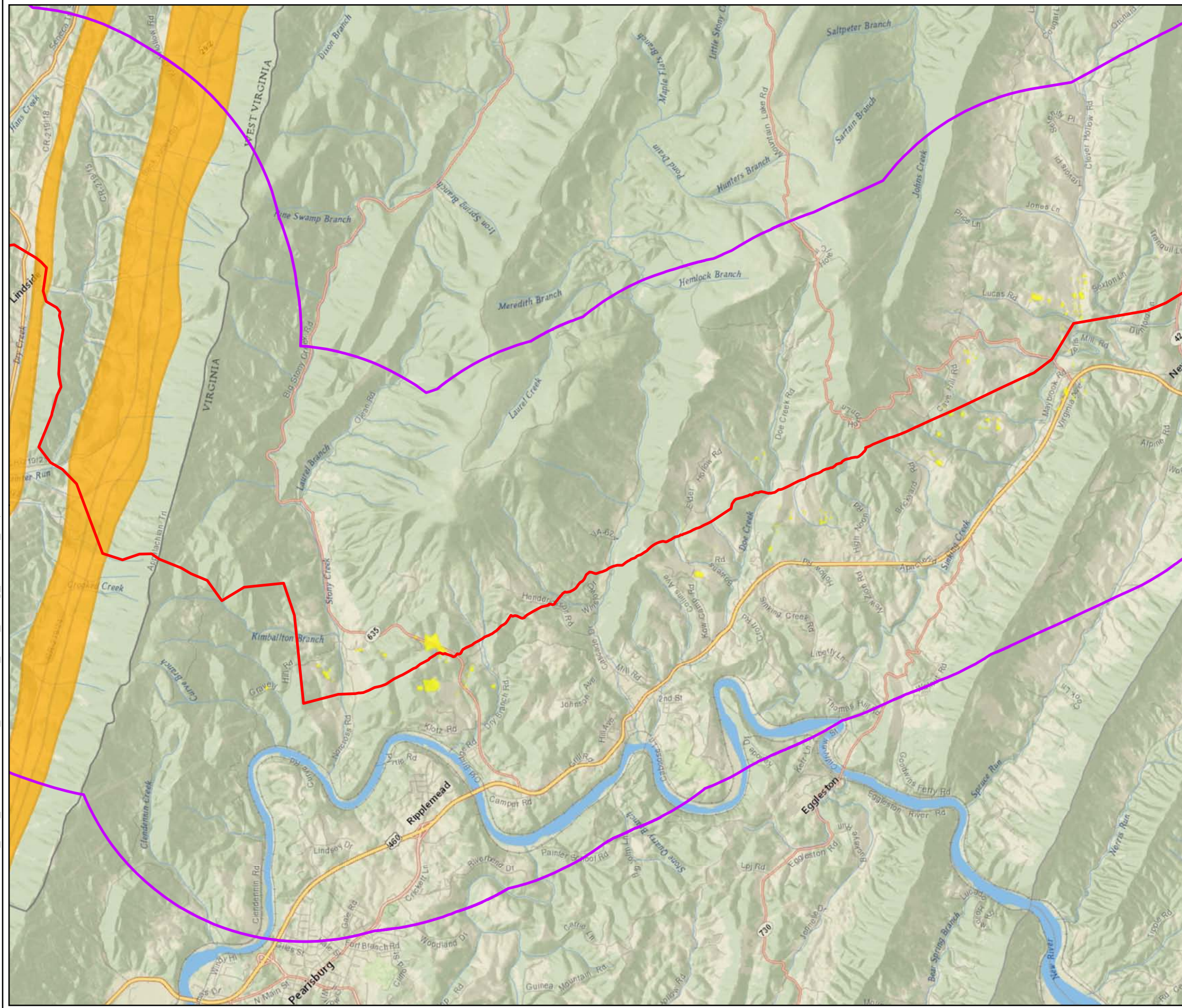
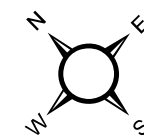
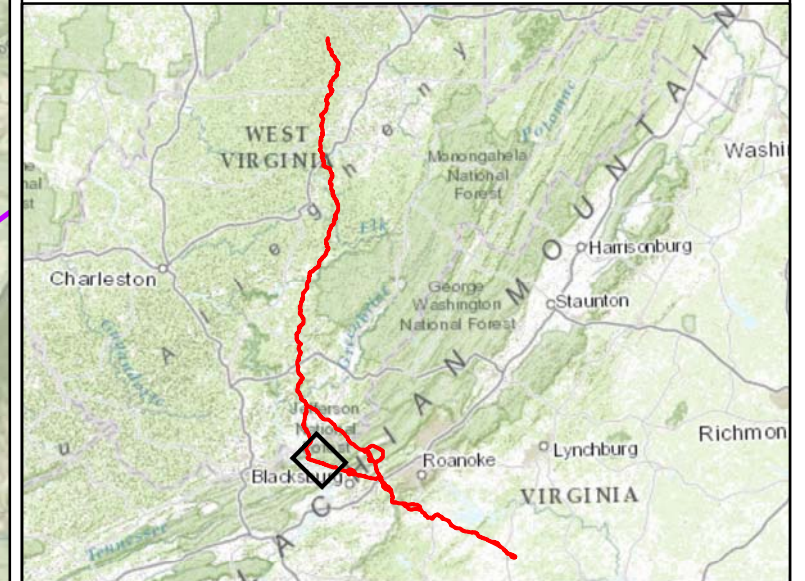


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 12 of 21

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer
- Karst Formation
- Sinkhole



0 2,000 4,000 Meters

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,



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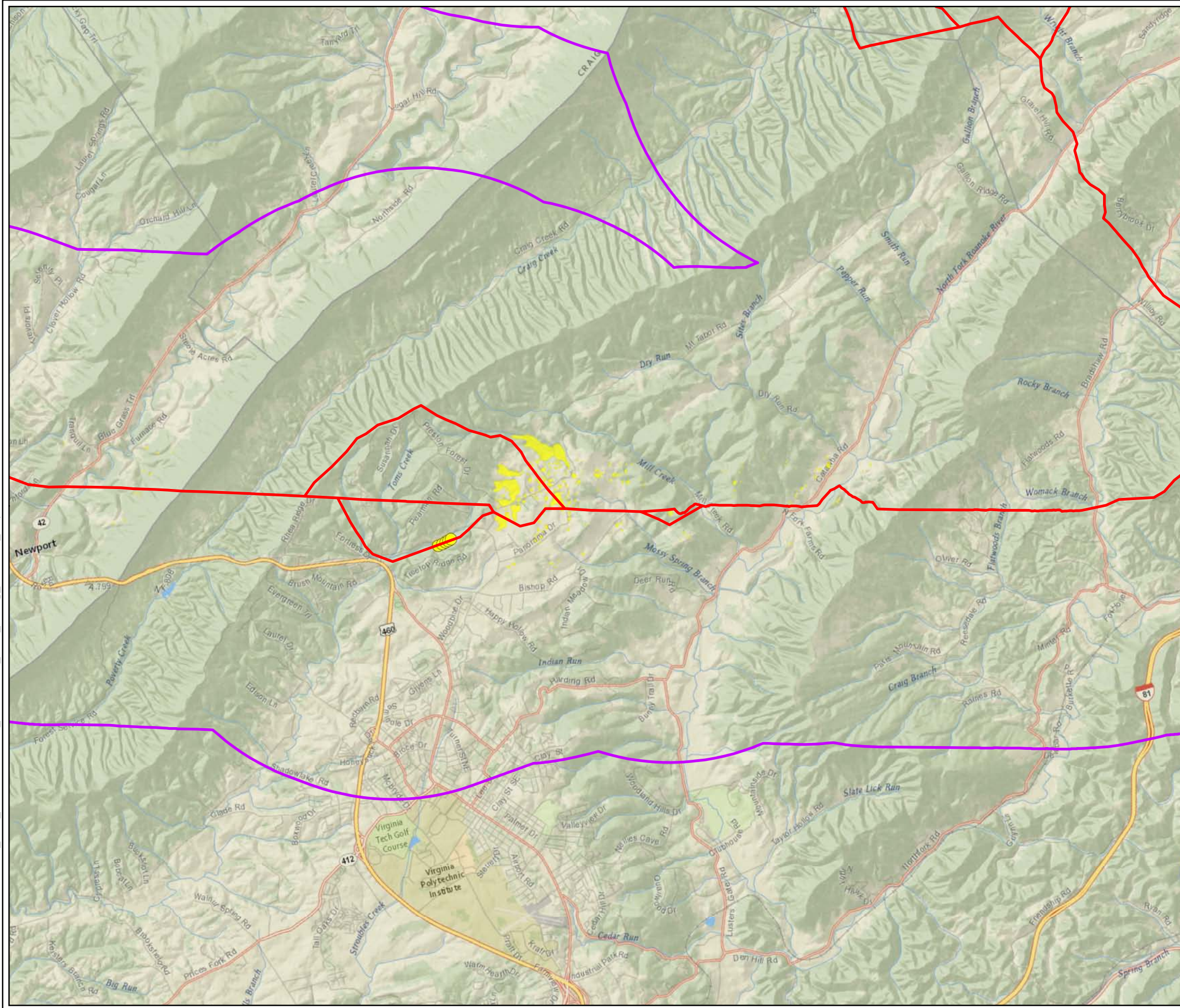
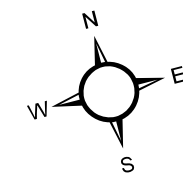
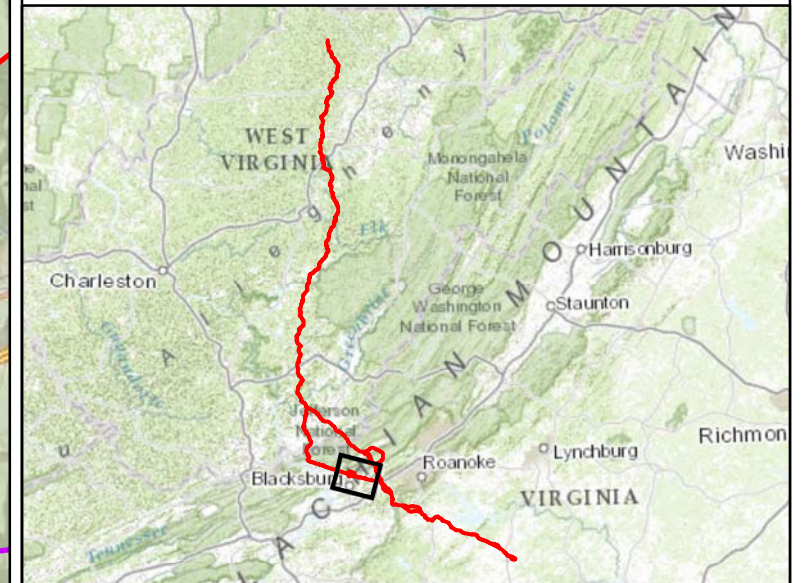


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 13 of 21

- Mine Opening
- Mountain Valley Pipelin Alignment
- ▭ Mining evidence Buffer
- Sinkhole



0 2,000 4,000 Meters

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,



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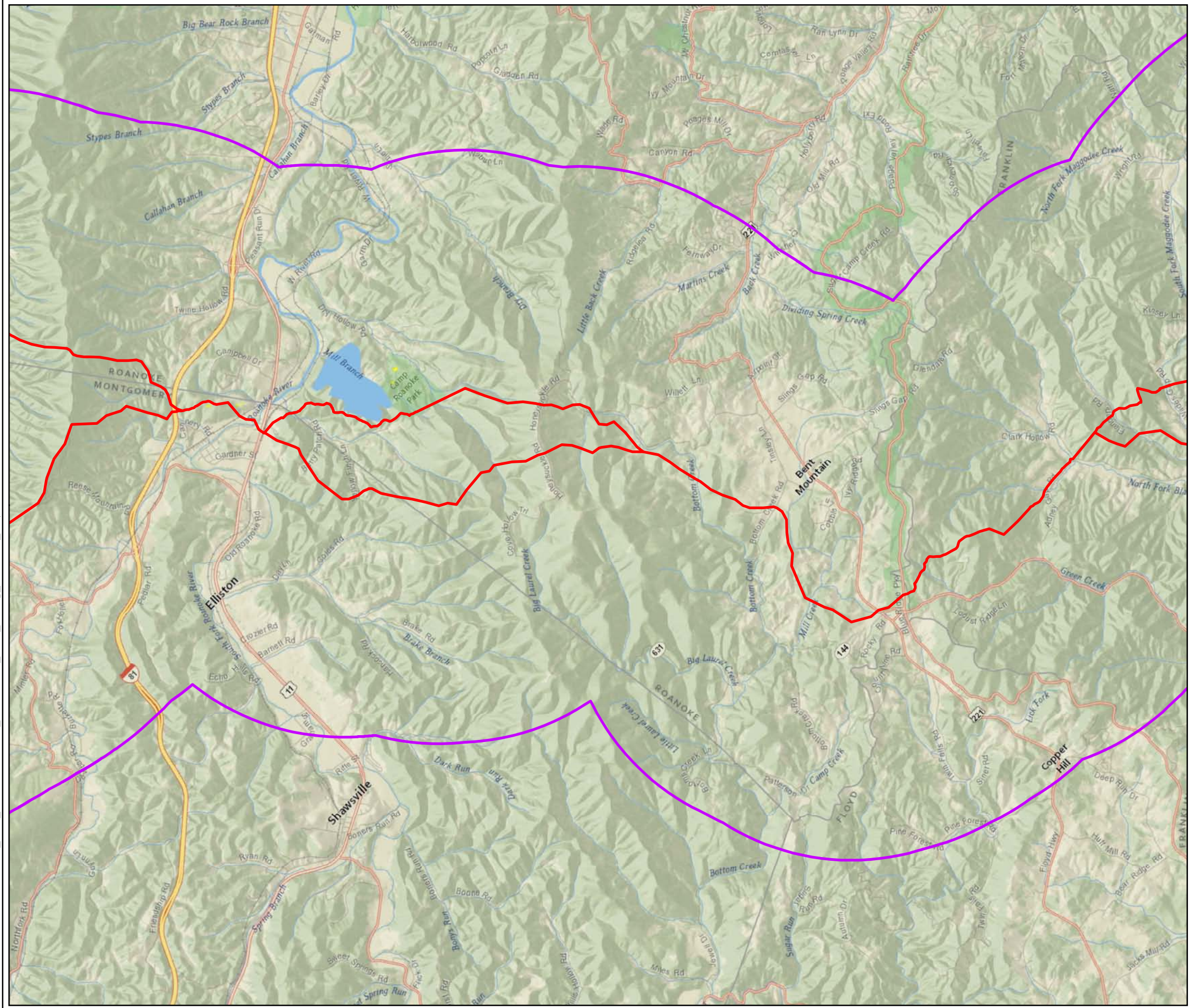
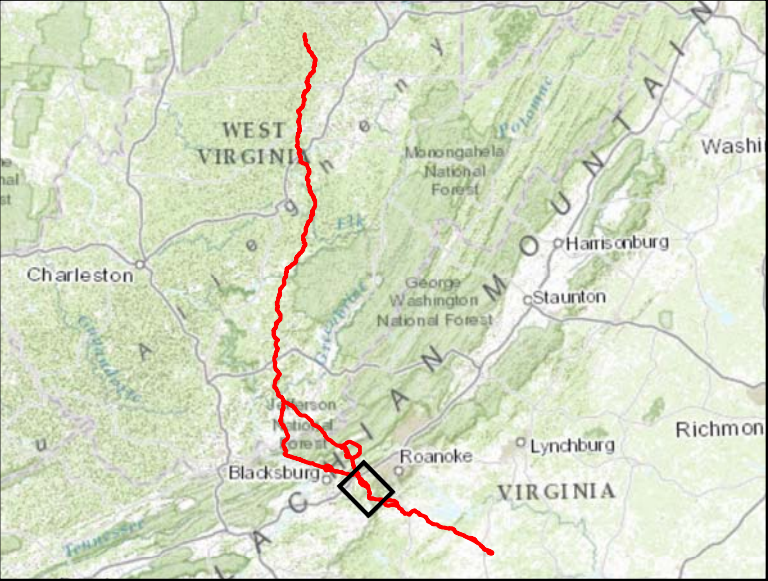


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer
- Sinkhole



0 2,000 4,000 Meters

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,



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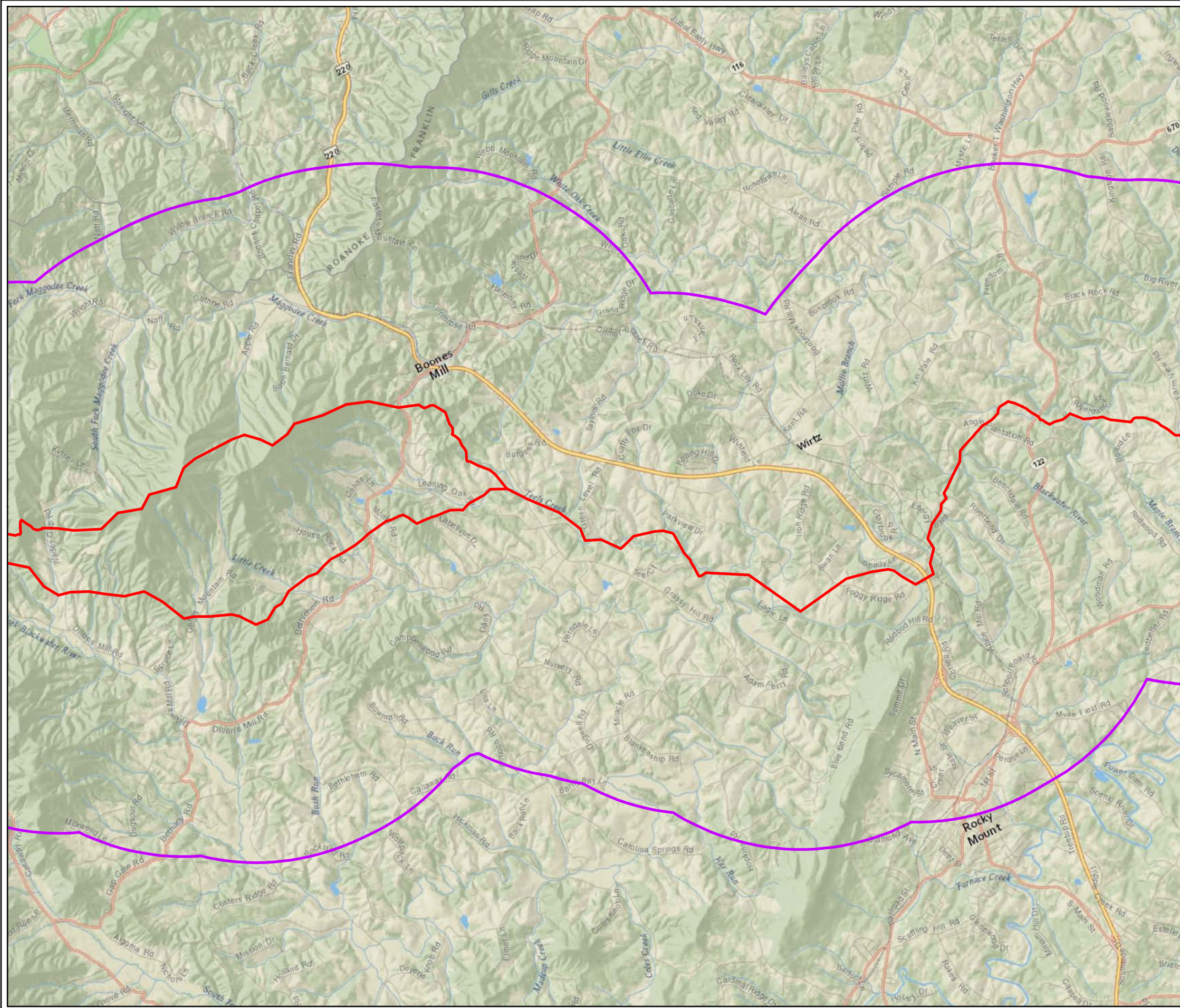
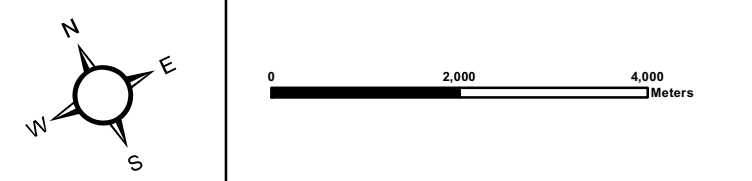
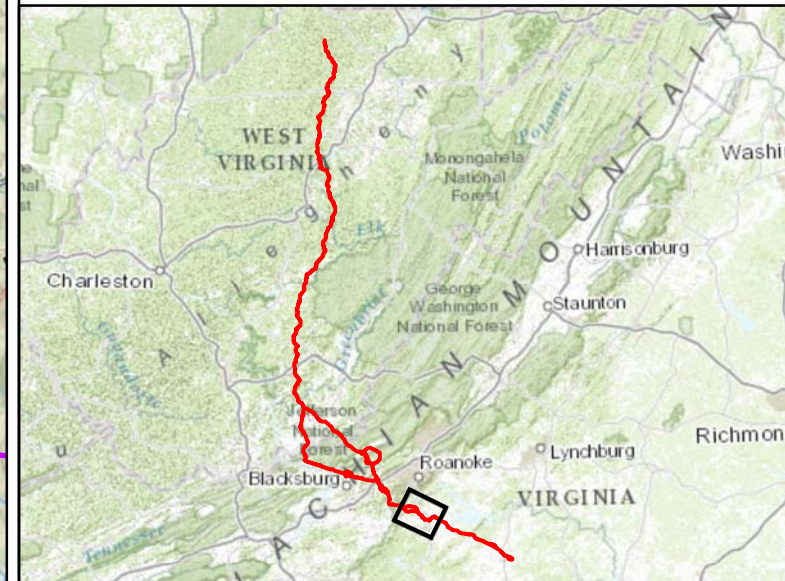


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer



Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,



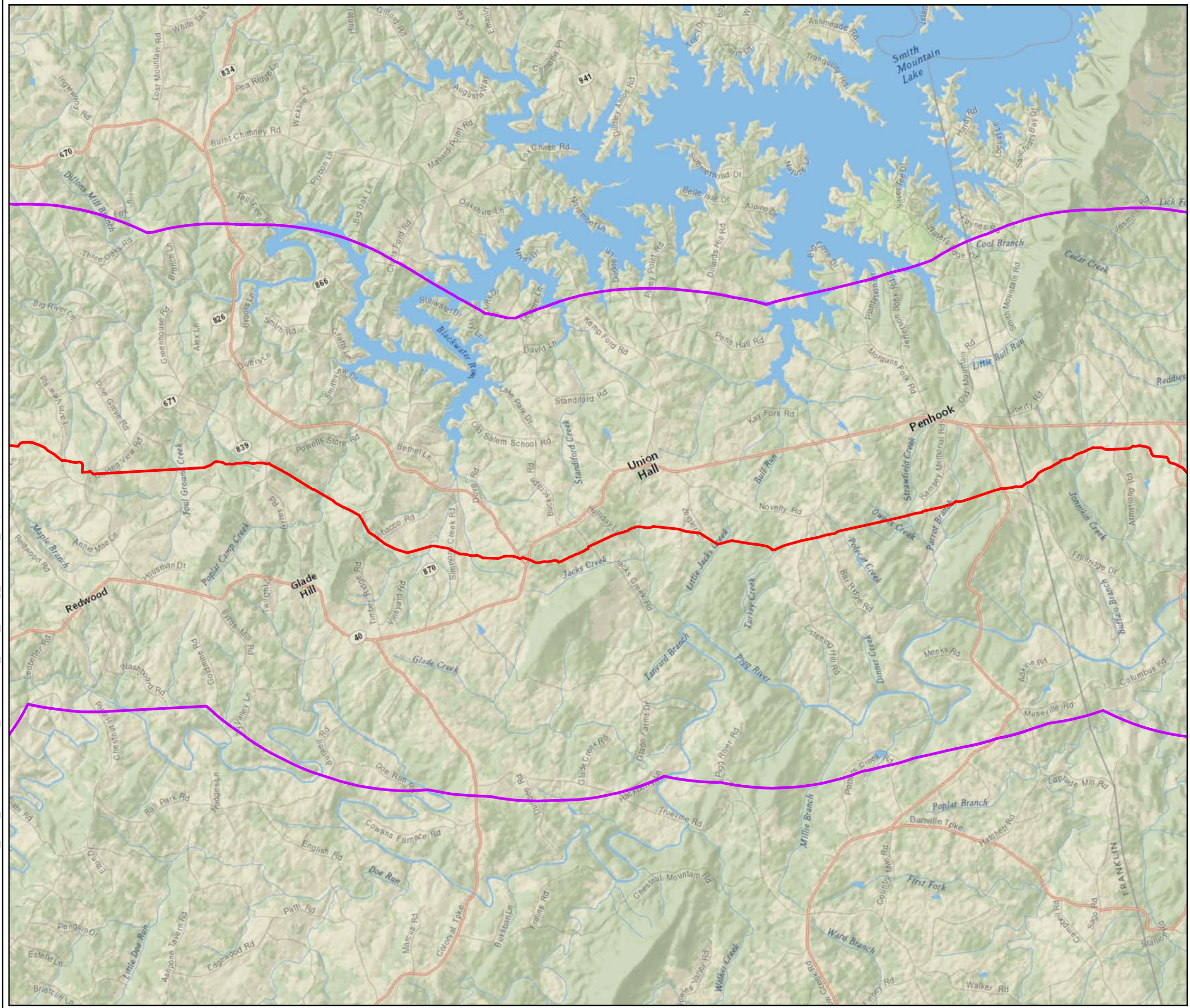
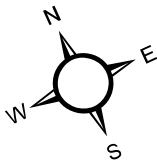
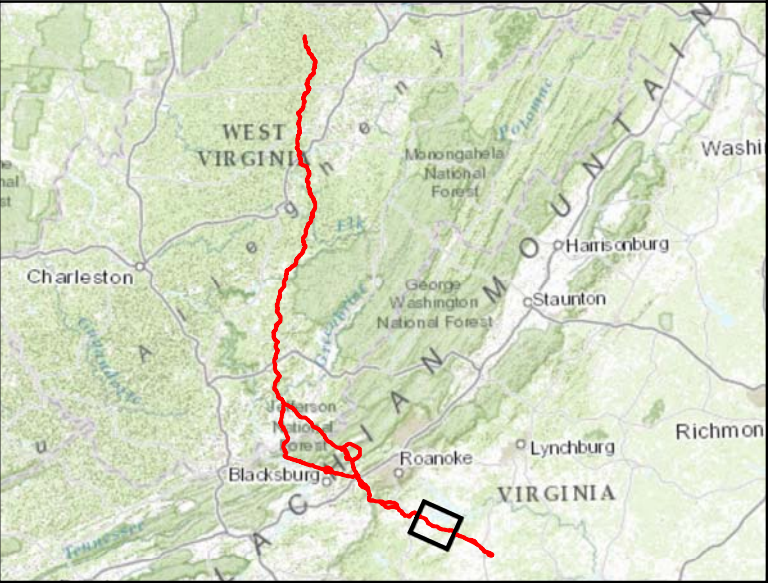


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer



0 2,000 4,000 Meters

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,



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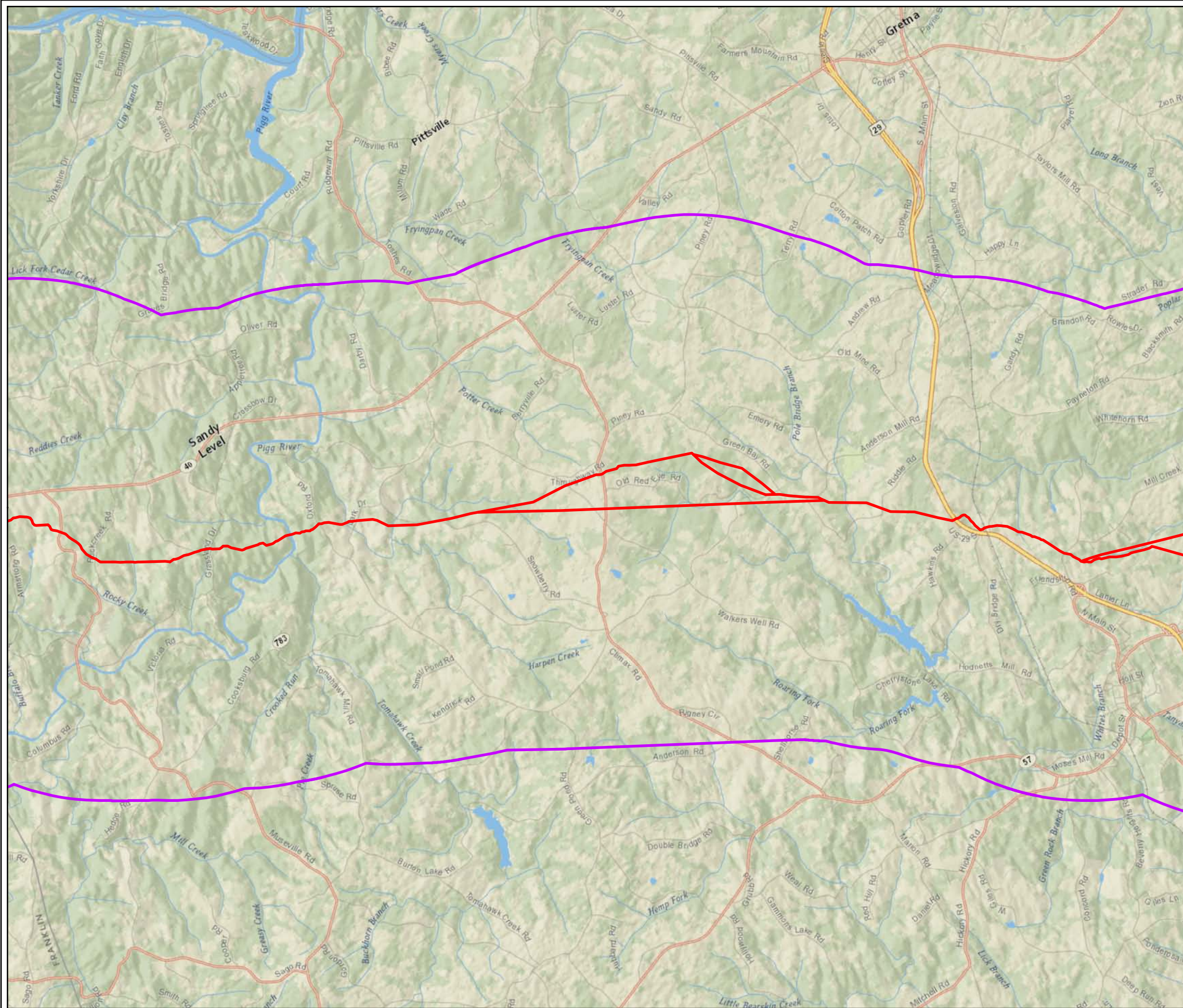
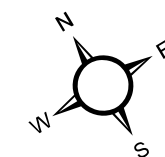
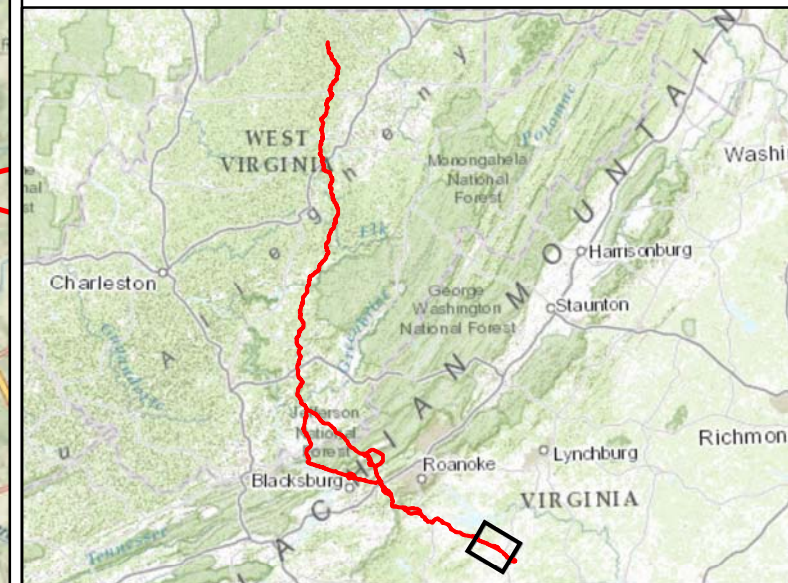


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 17 of 21

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer



0 2,000 4,000 Meters

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp.,

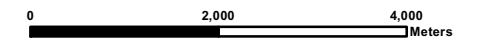


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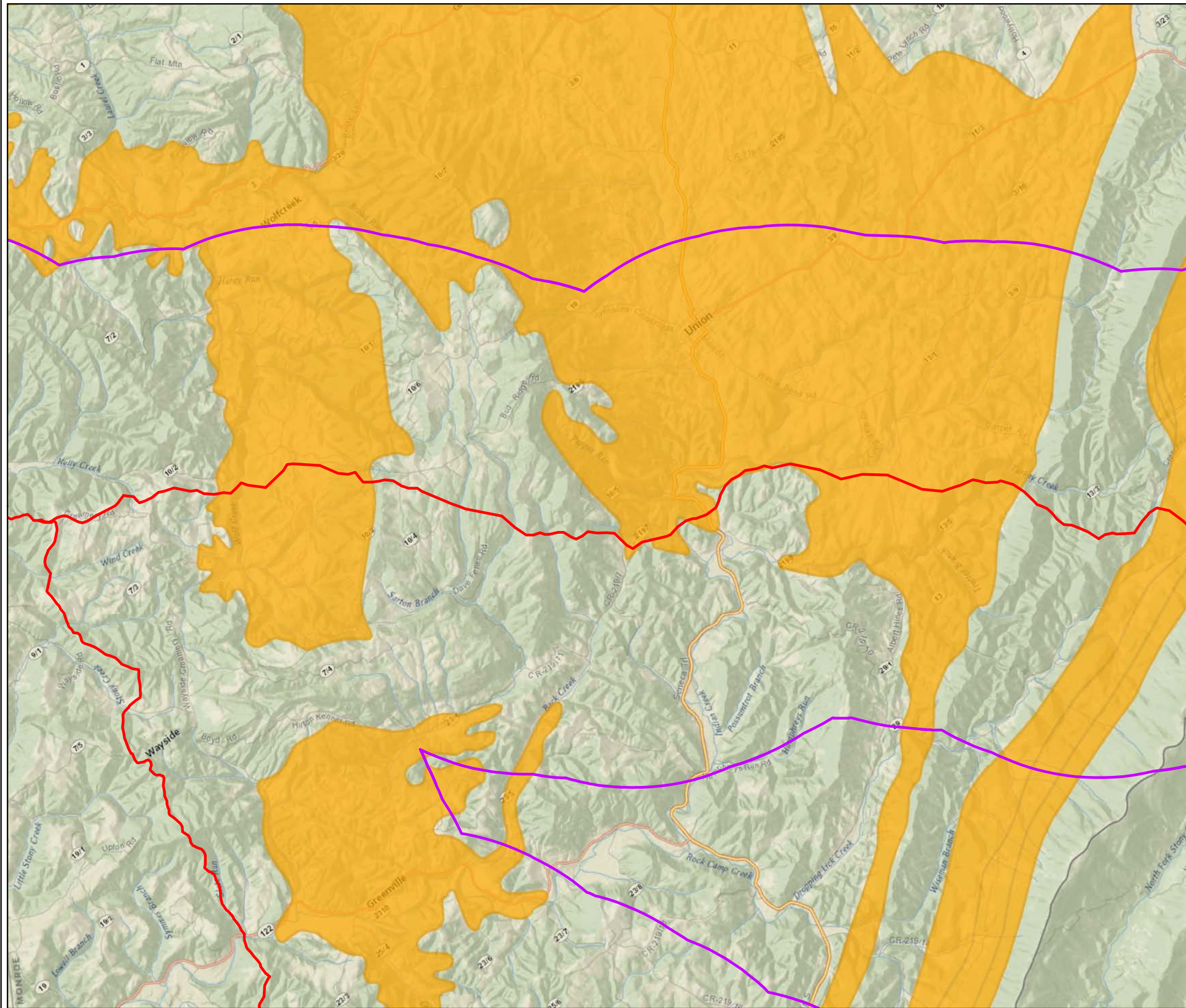
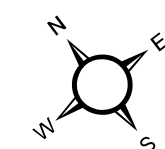
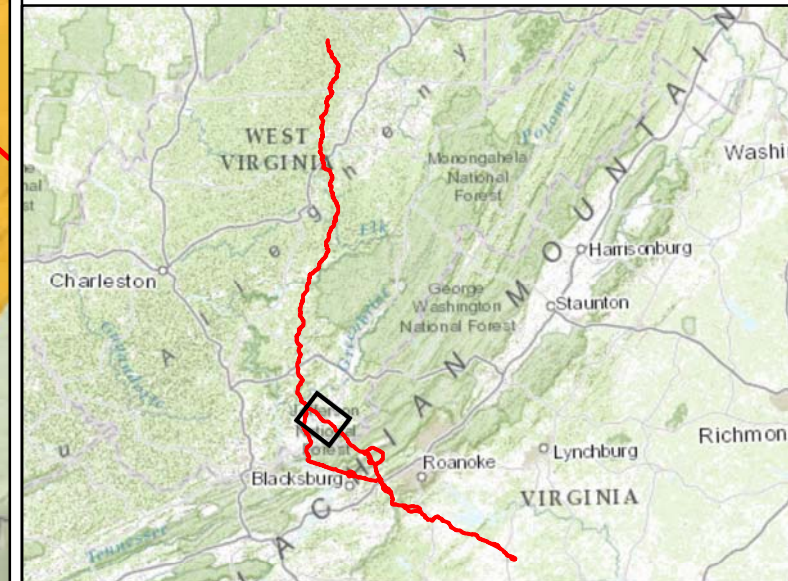


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer
- Karst Formation



0 2,000 4,000 Meters

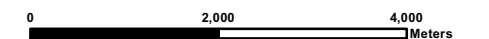
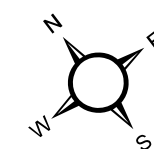
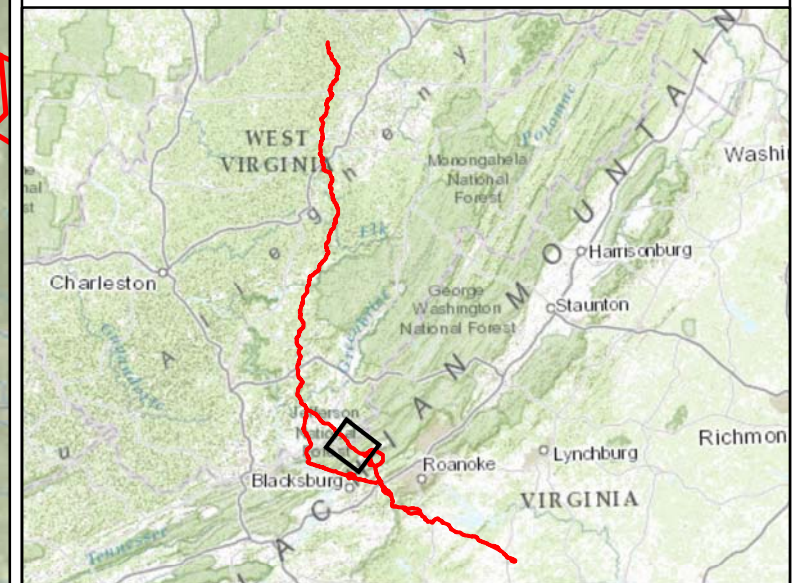
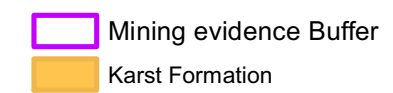
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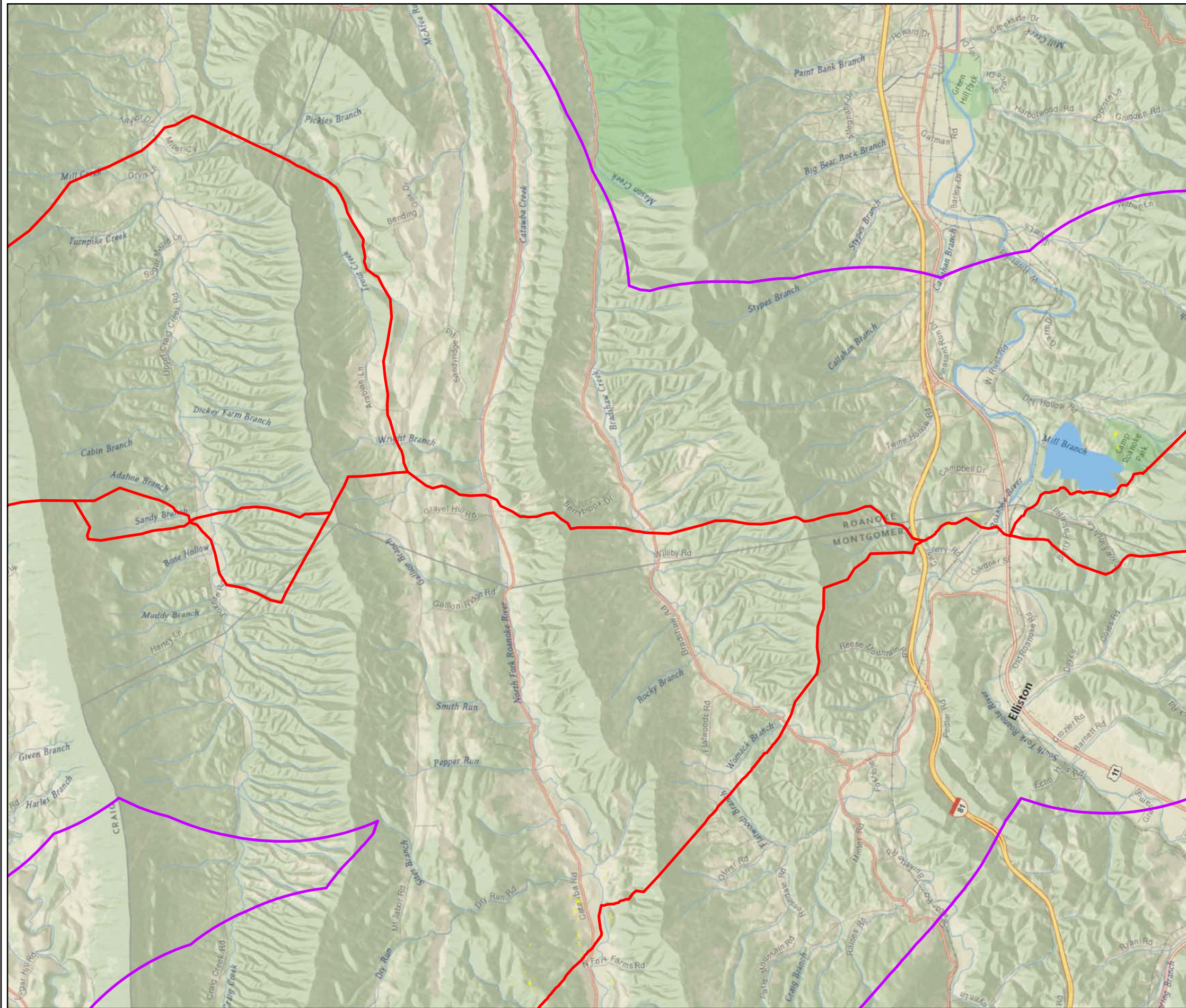
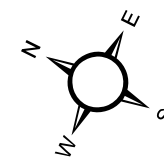
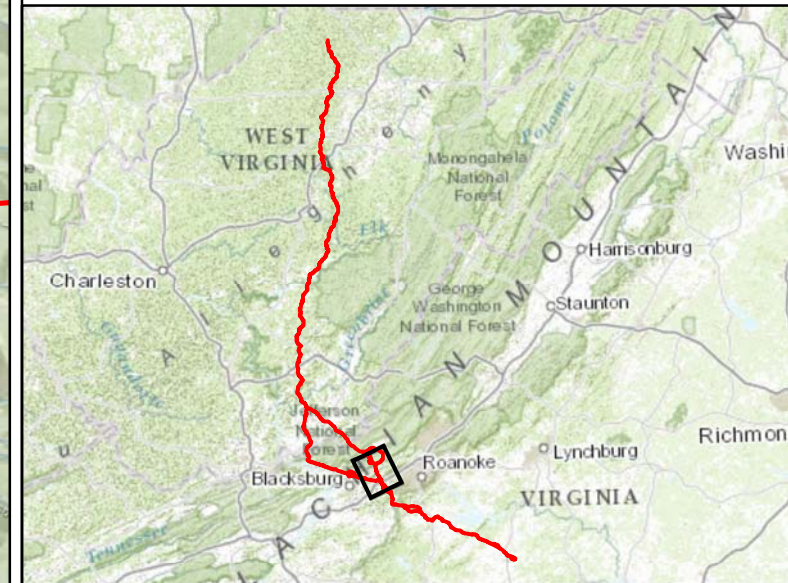


Figure 2. Evidence of mining near the proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 21 of 21

- Mountain Valley Pipelin Alignment
- Mining evidence Buffer
- Sinkhole



0 2,000 4,000 Meters

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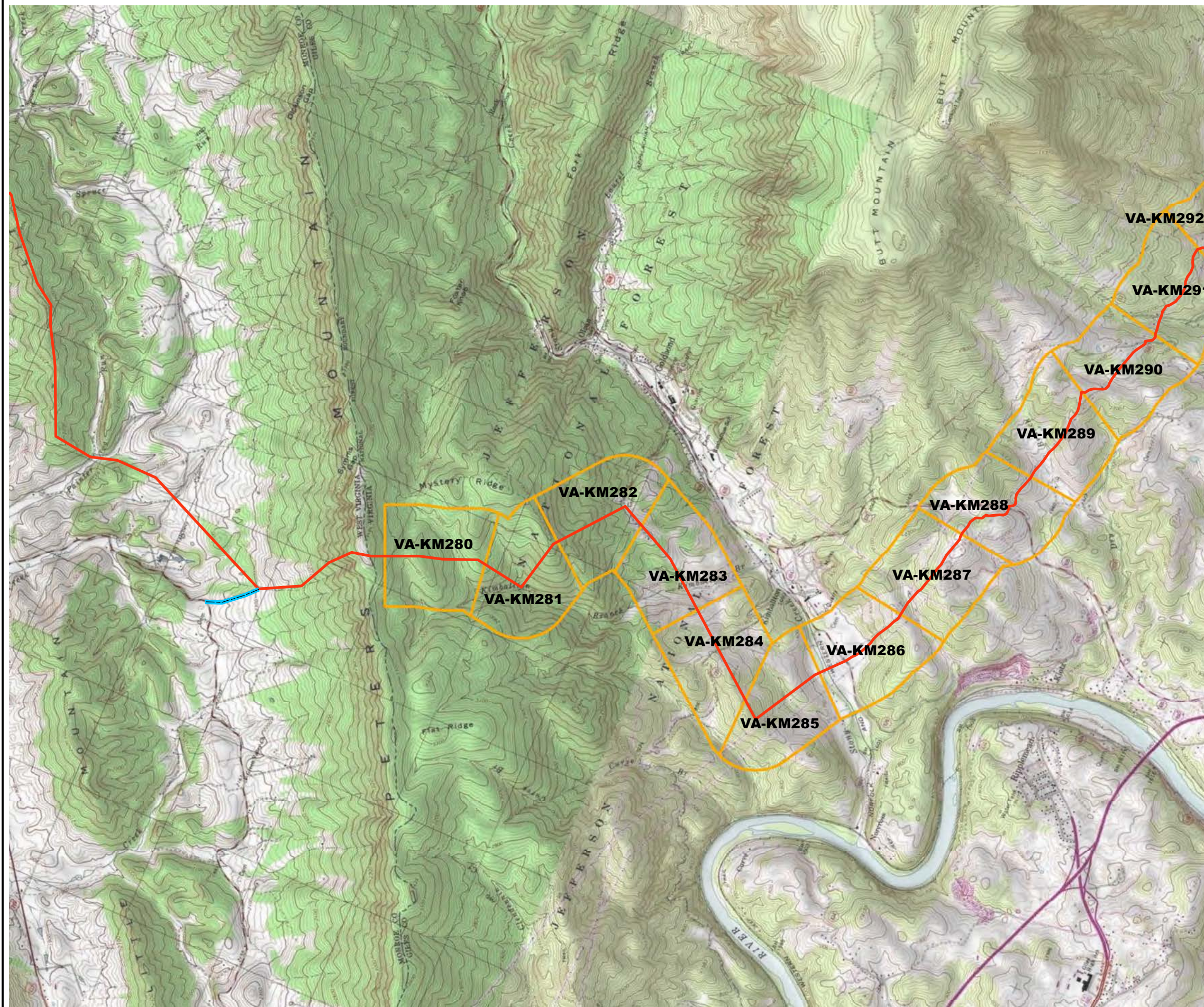
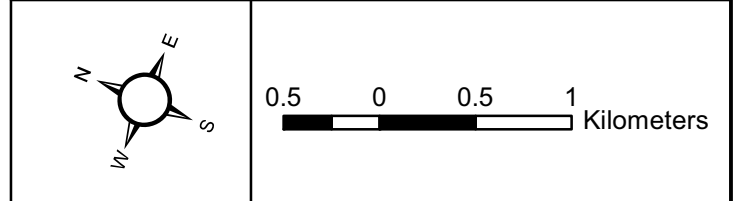
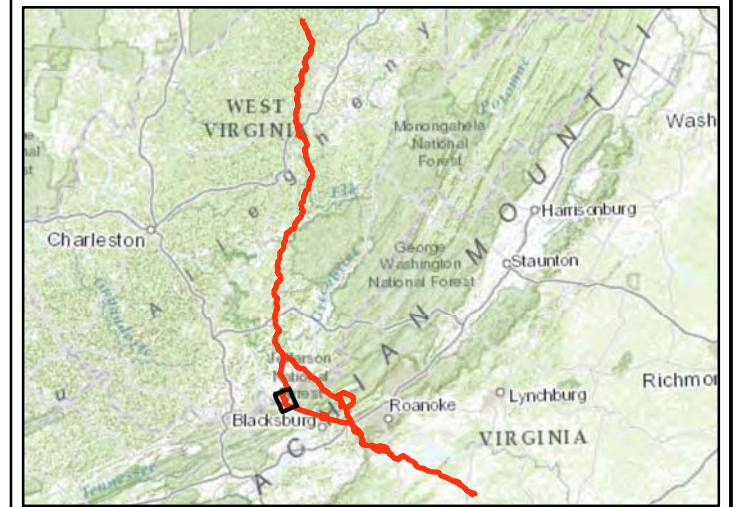


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)



Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



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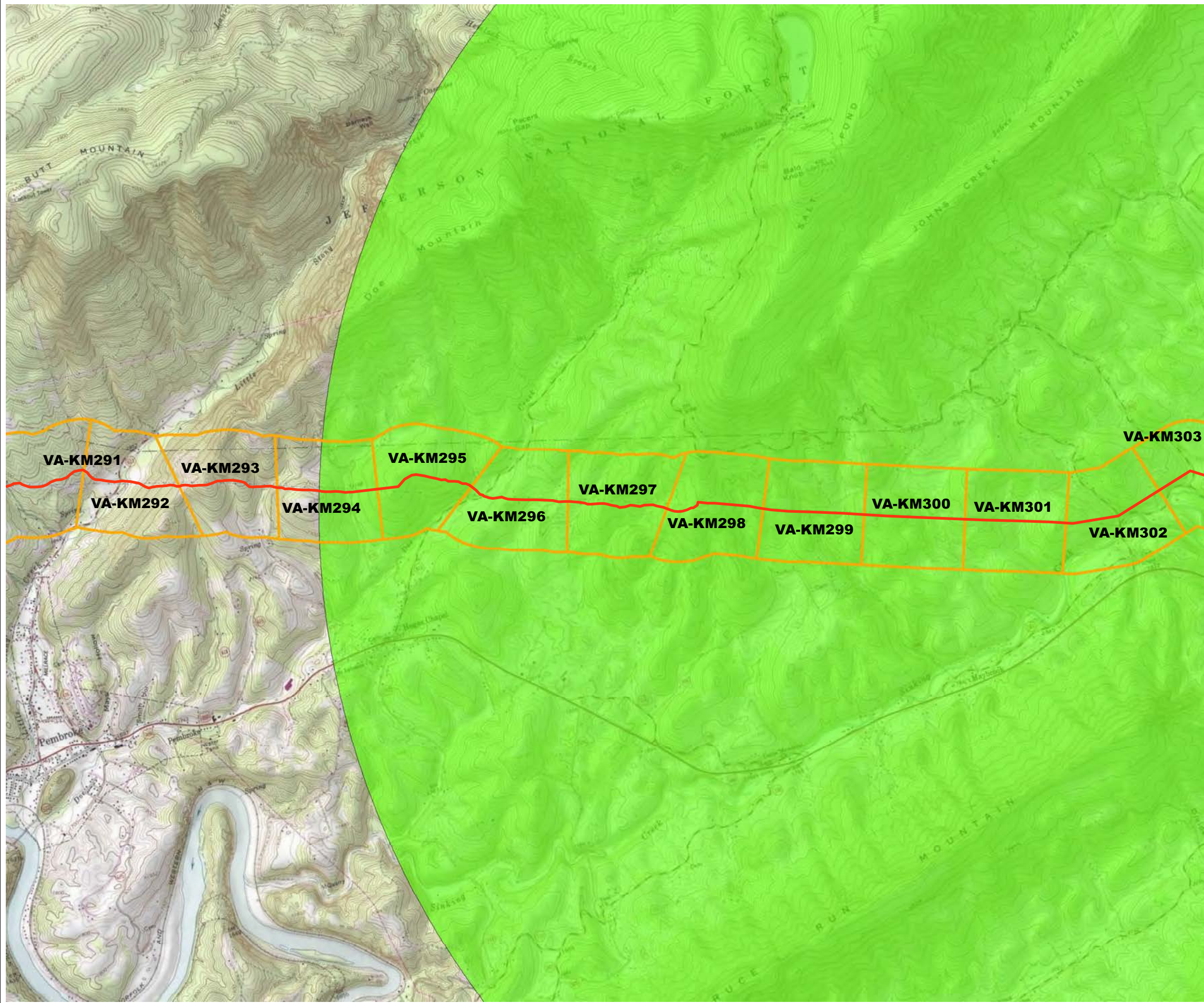
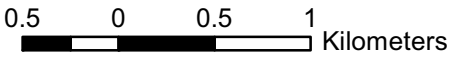
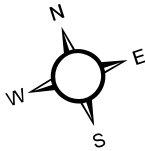
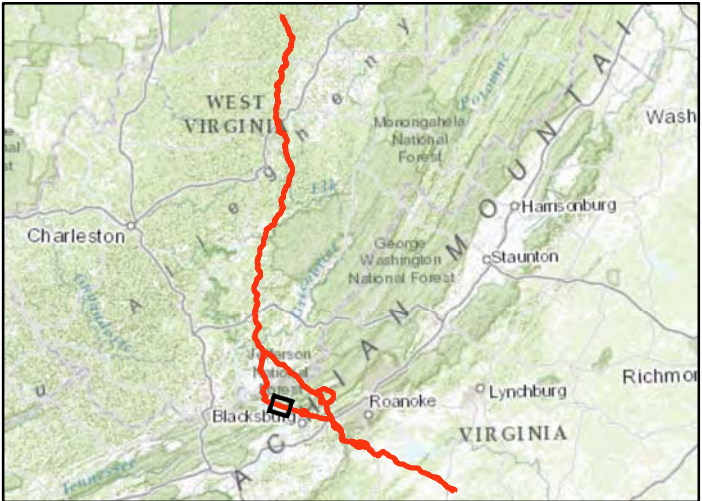


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- USFWS Terrestrial Buffer (Known Occupied Indiana Bat Habitat)



Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



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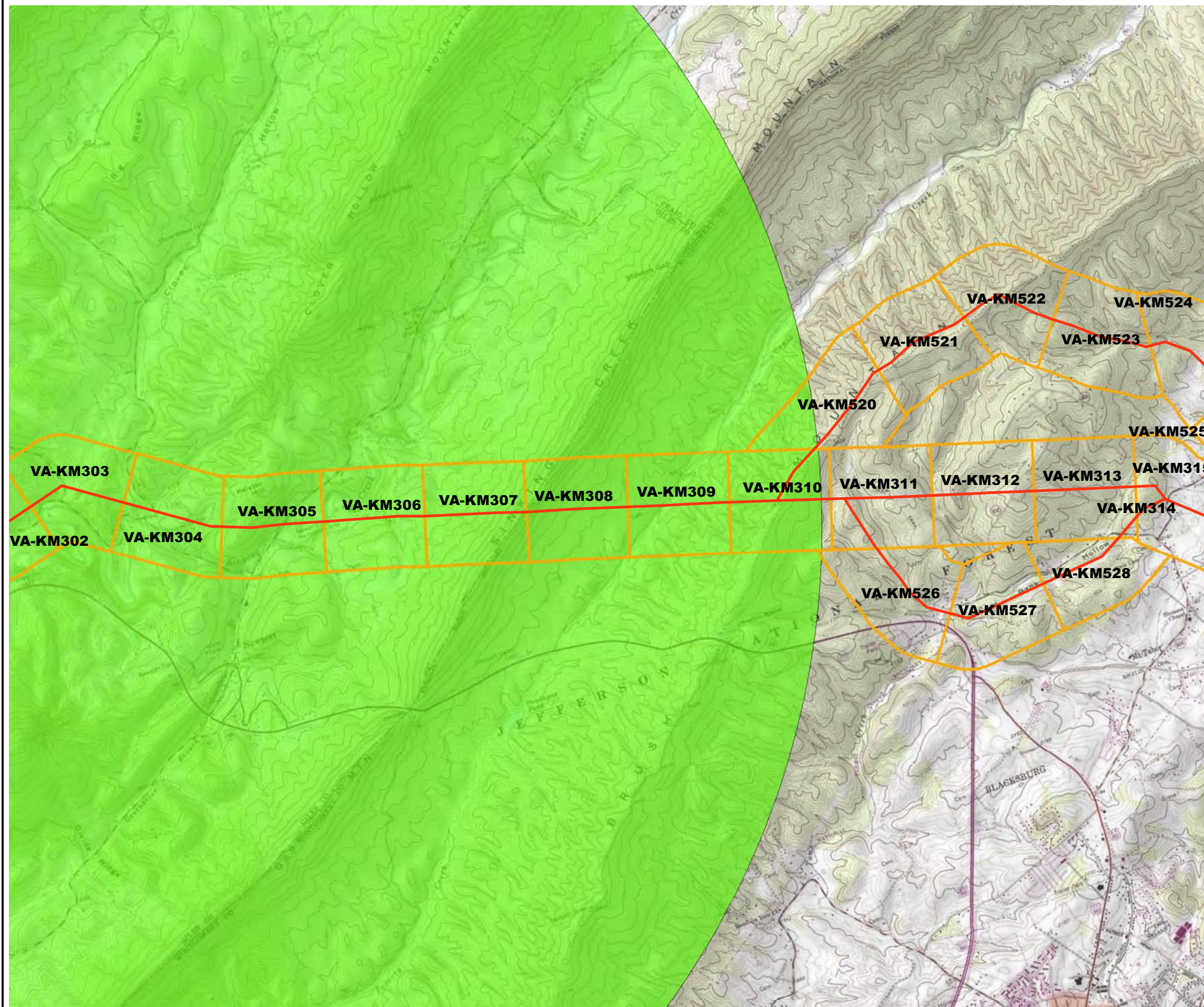
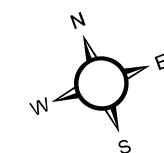
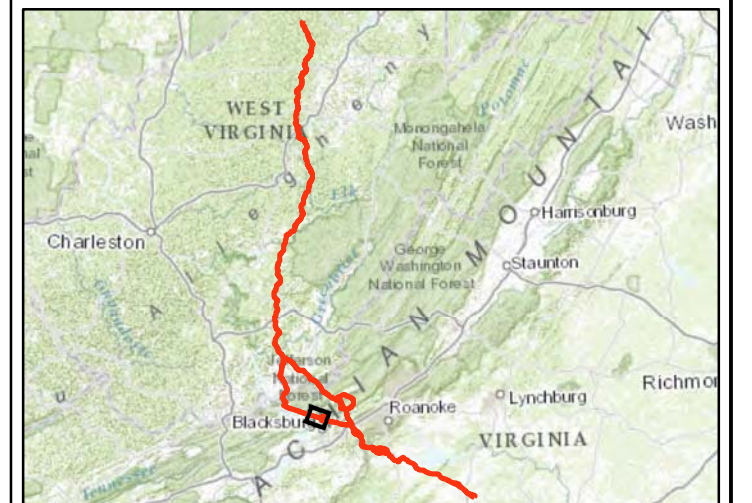


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 25 of 41

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- USFWS Terrestrial Buffer (Known Occupied Indiana Bat Habitat)



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



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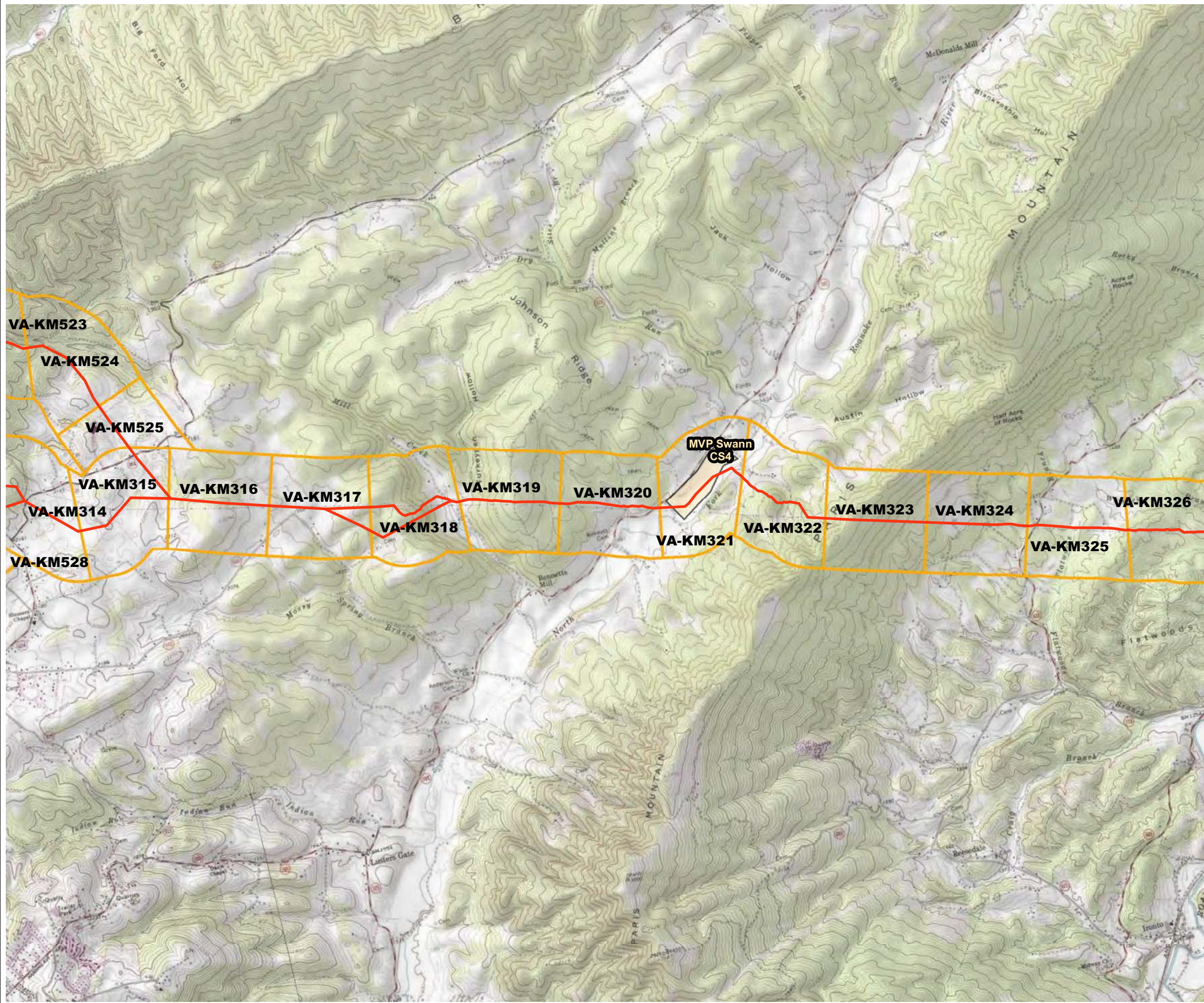
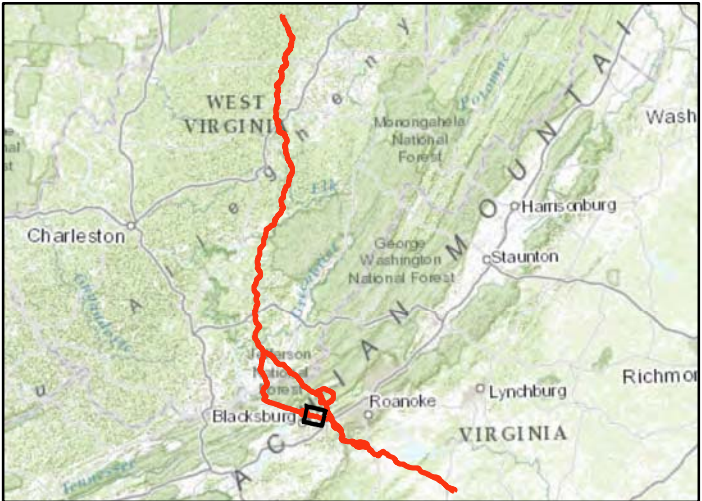


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Compressor Station



Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



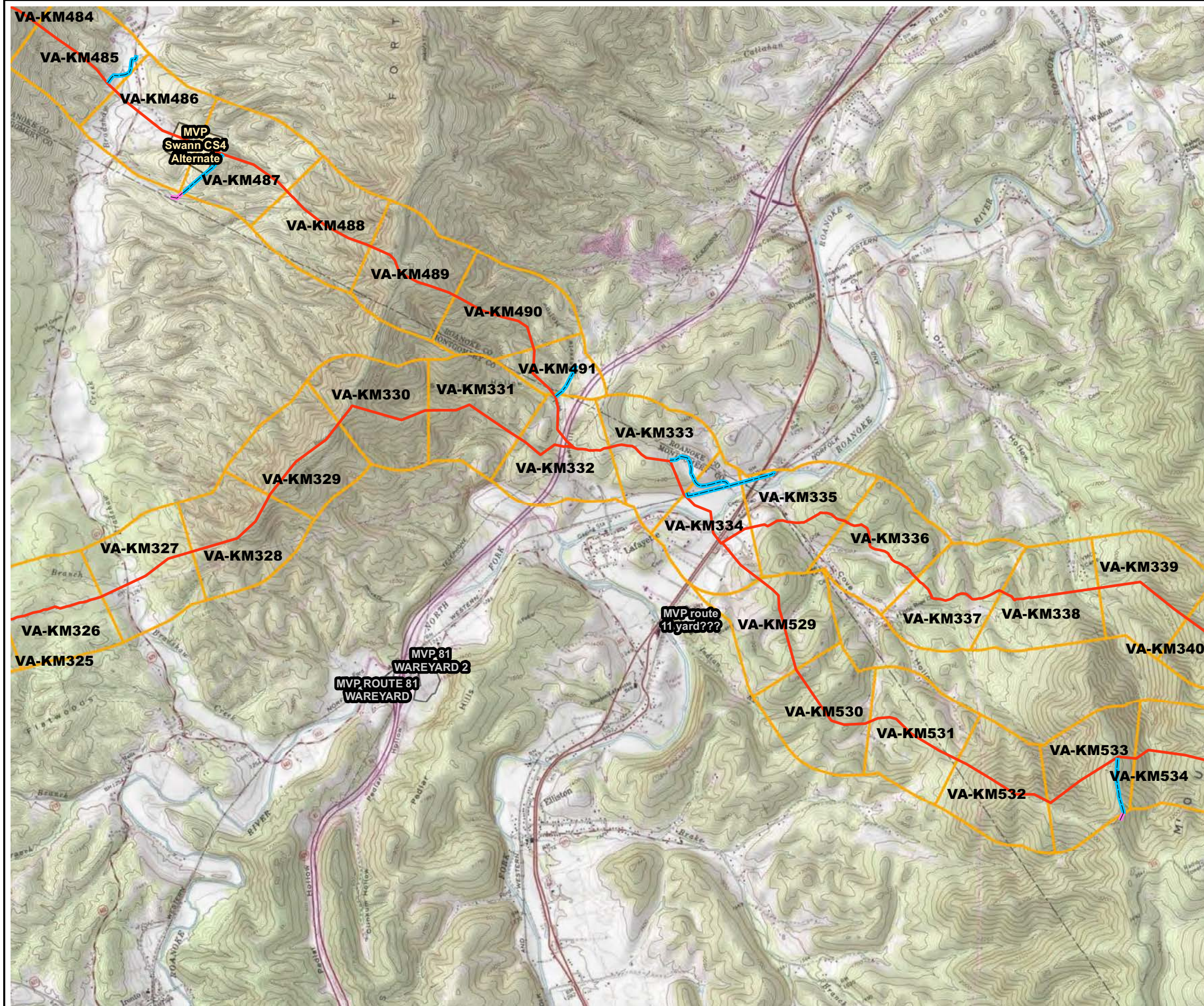
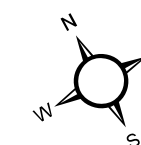
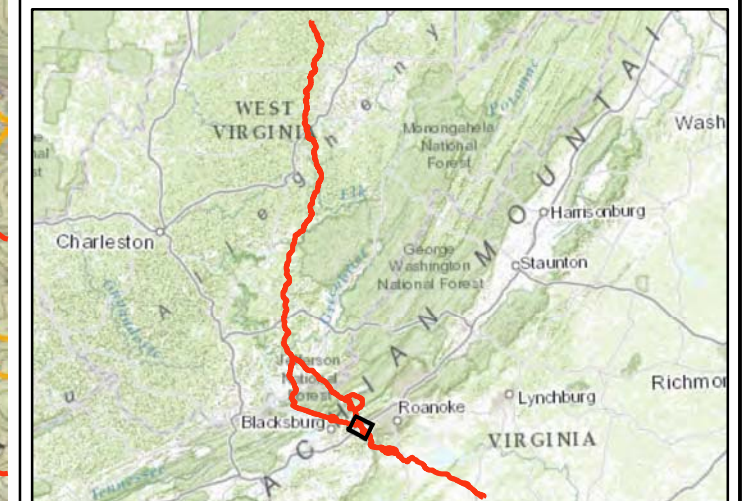


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 27 of 41

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)
- MVP Proposed Laydown Yard
- MVP Proposed Compressor Station



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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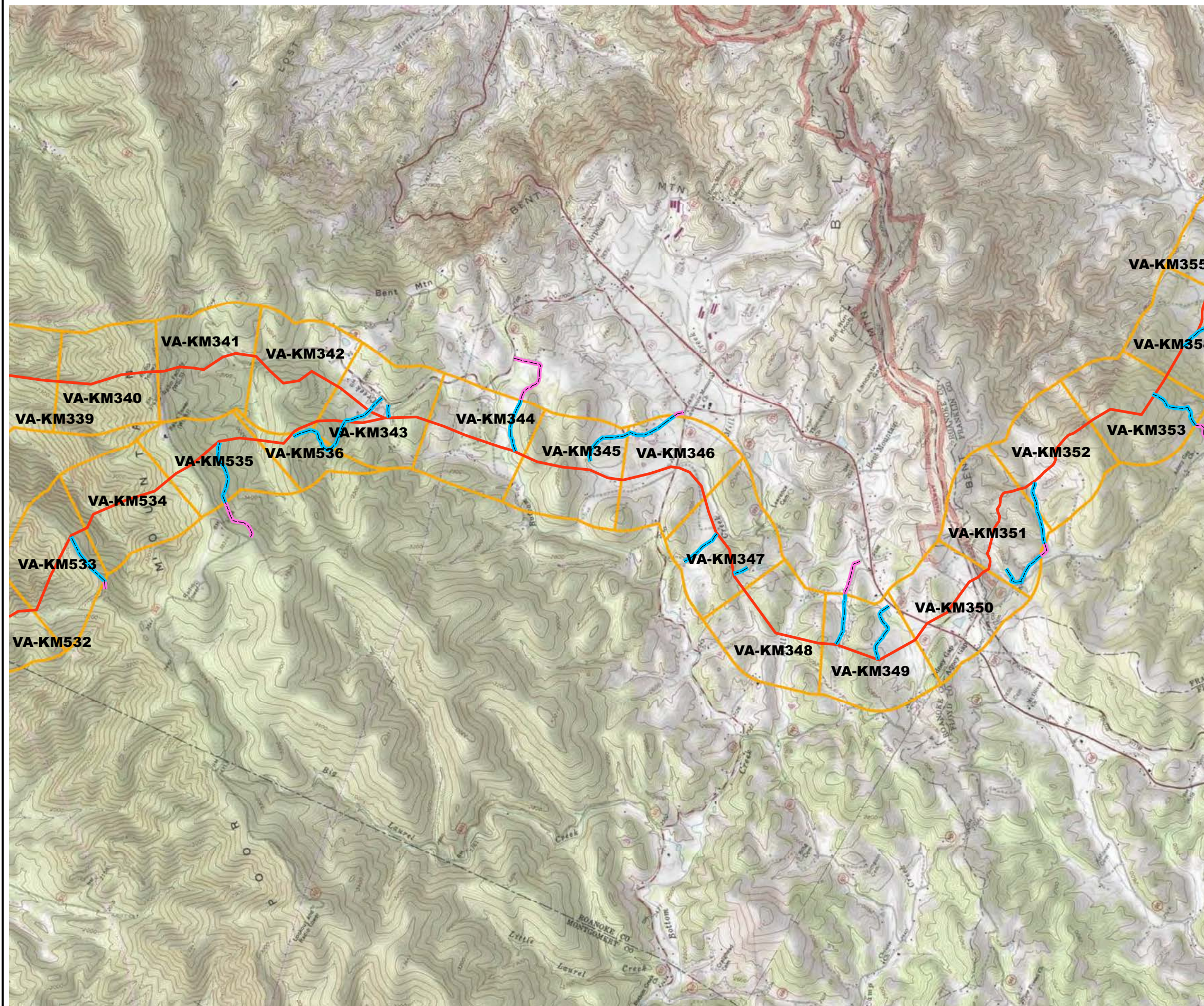
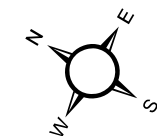
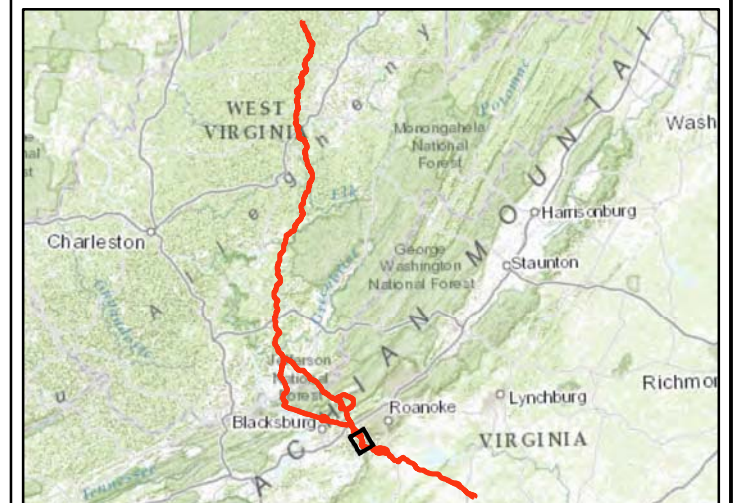


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 28 of 41

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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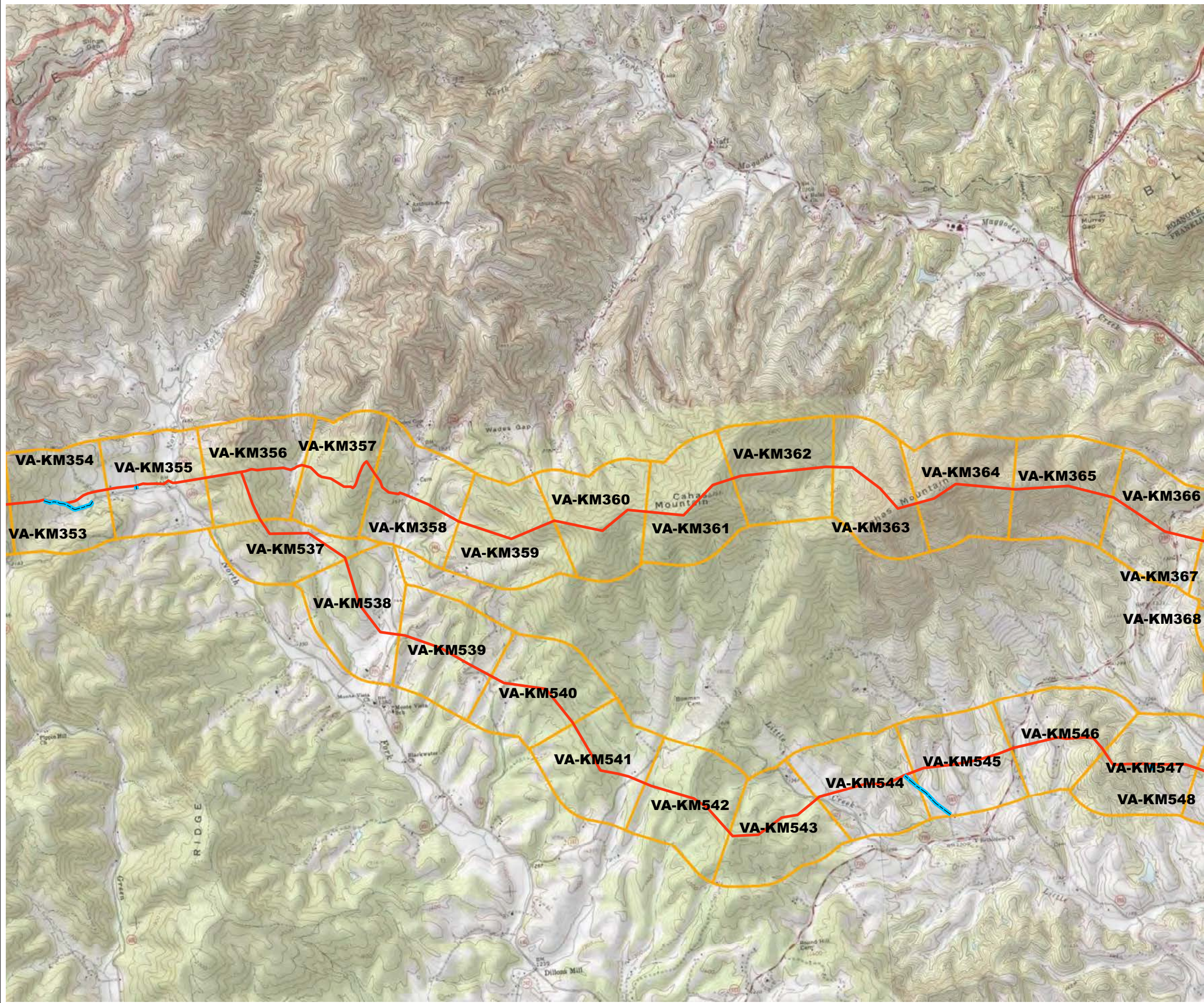
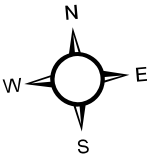
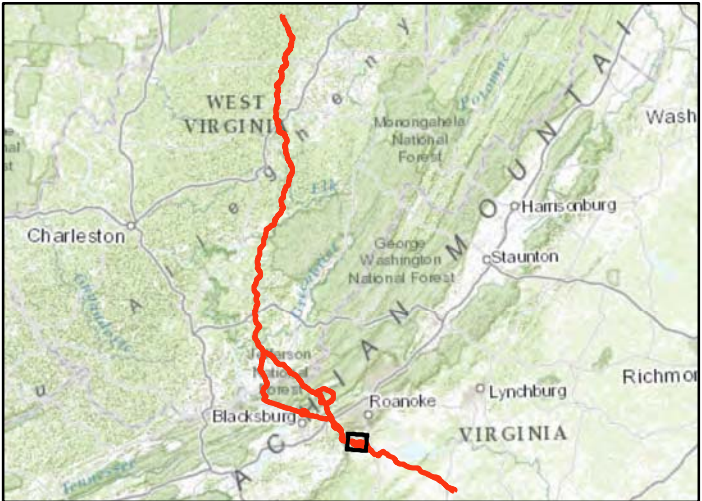


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



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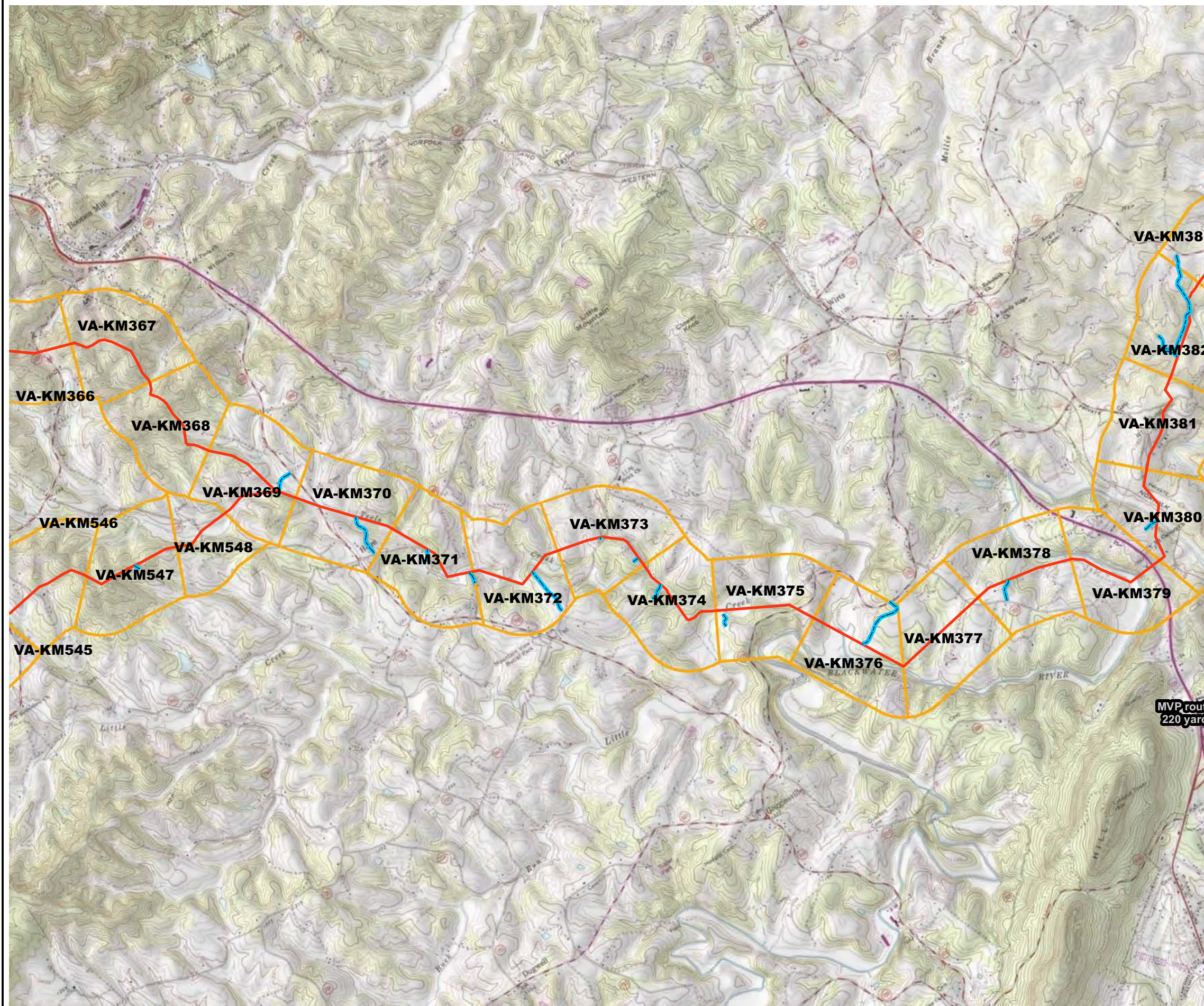
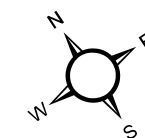
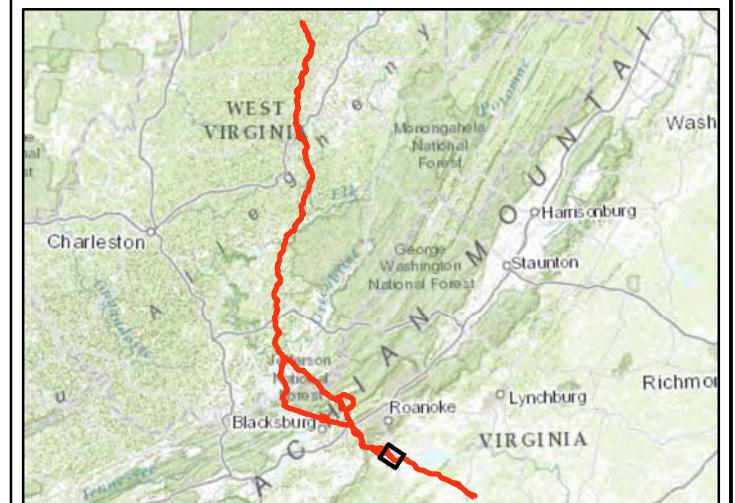


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 30 of 41

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Laydown Yard



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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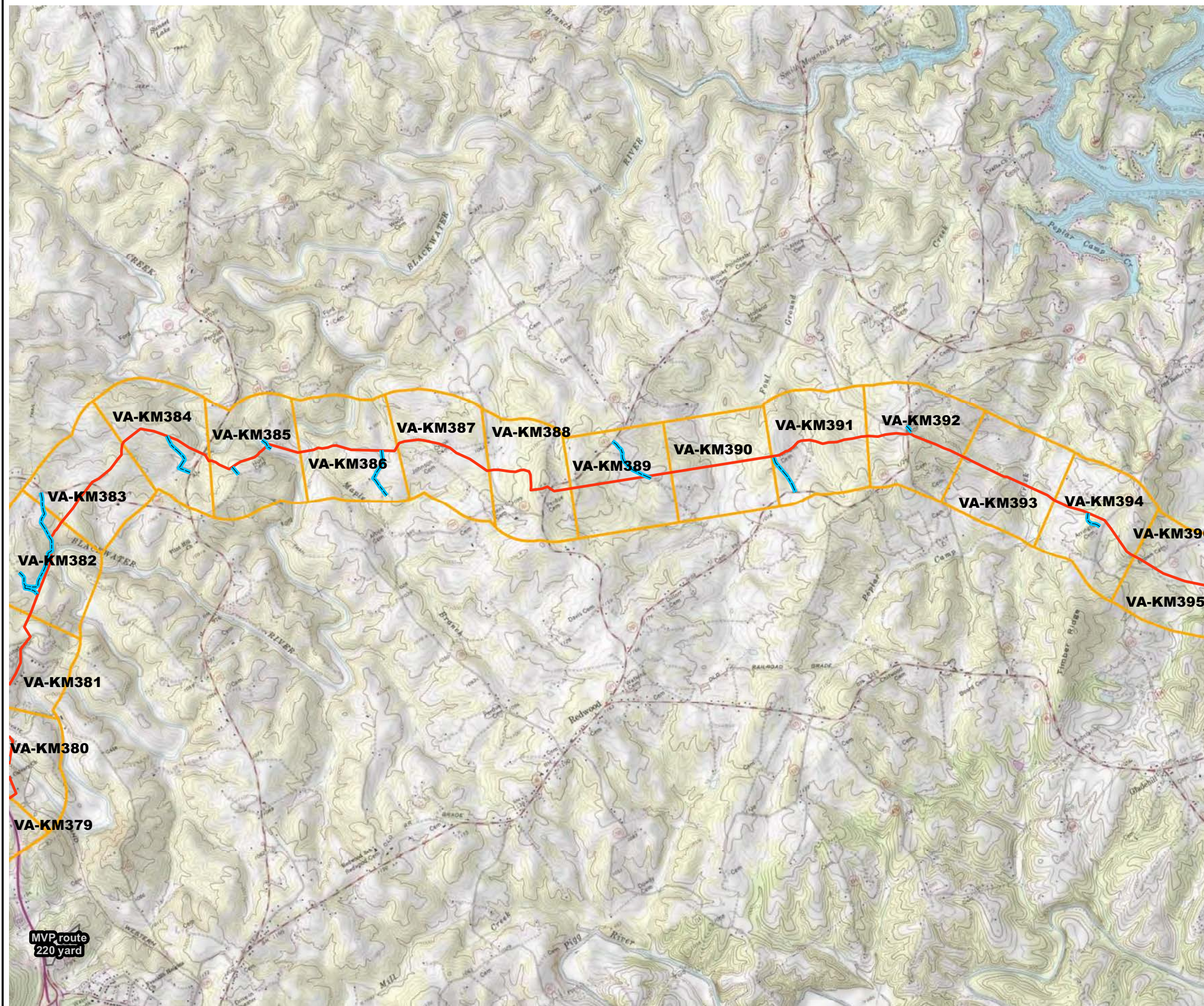
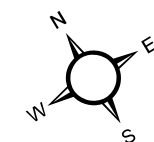
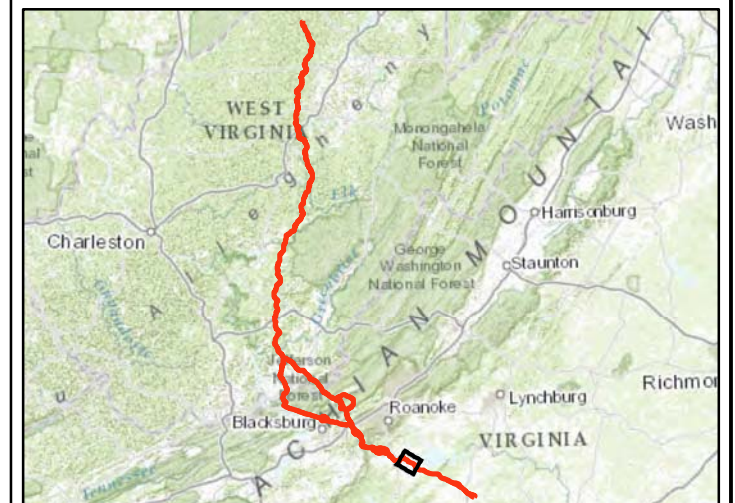


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 31 of 41

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Laydown Yard



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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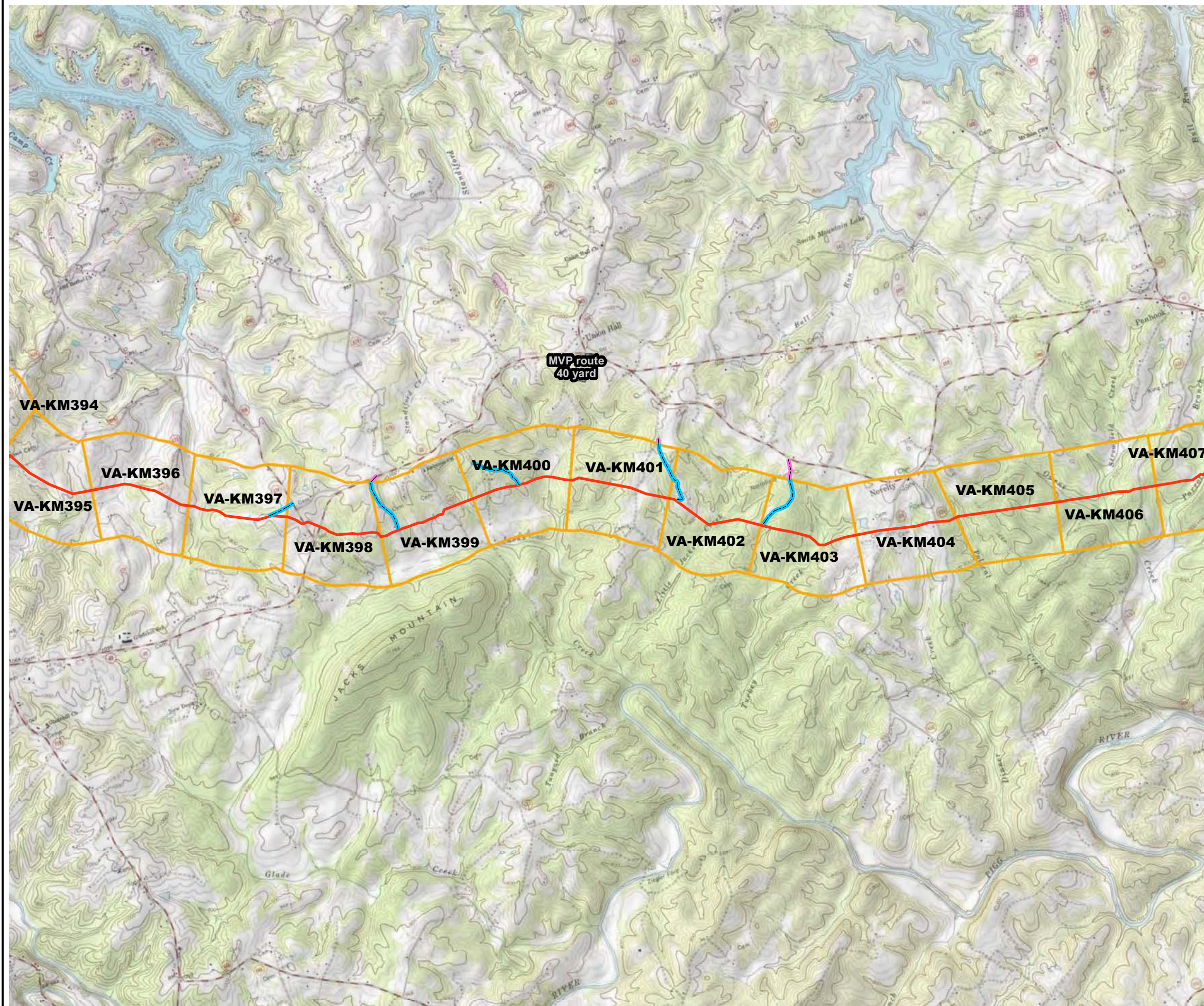
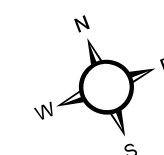
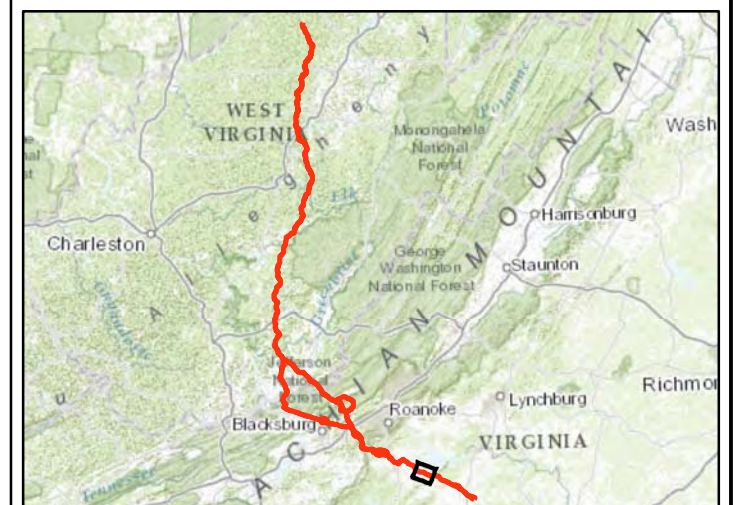


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)
- MVP Proposed Laydown Yard



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



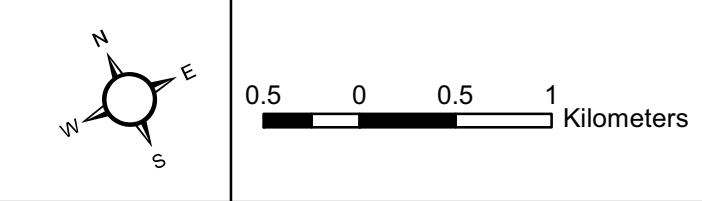
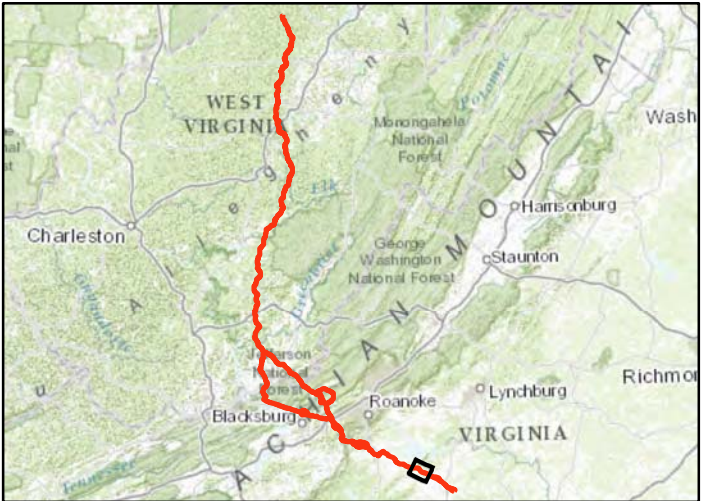
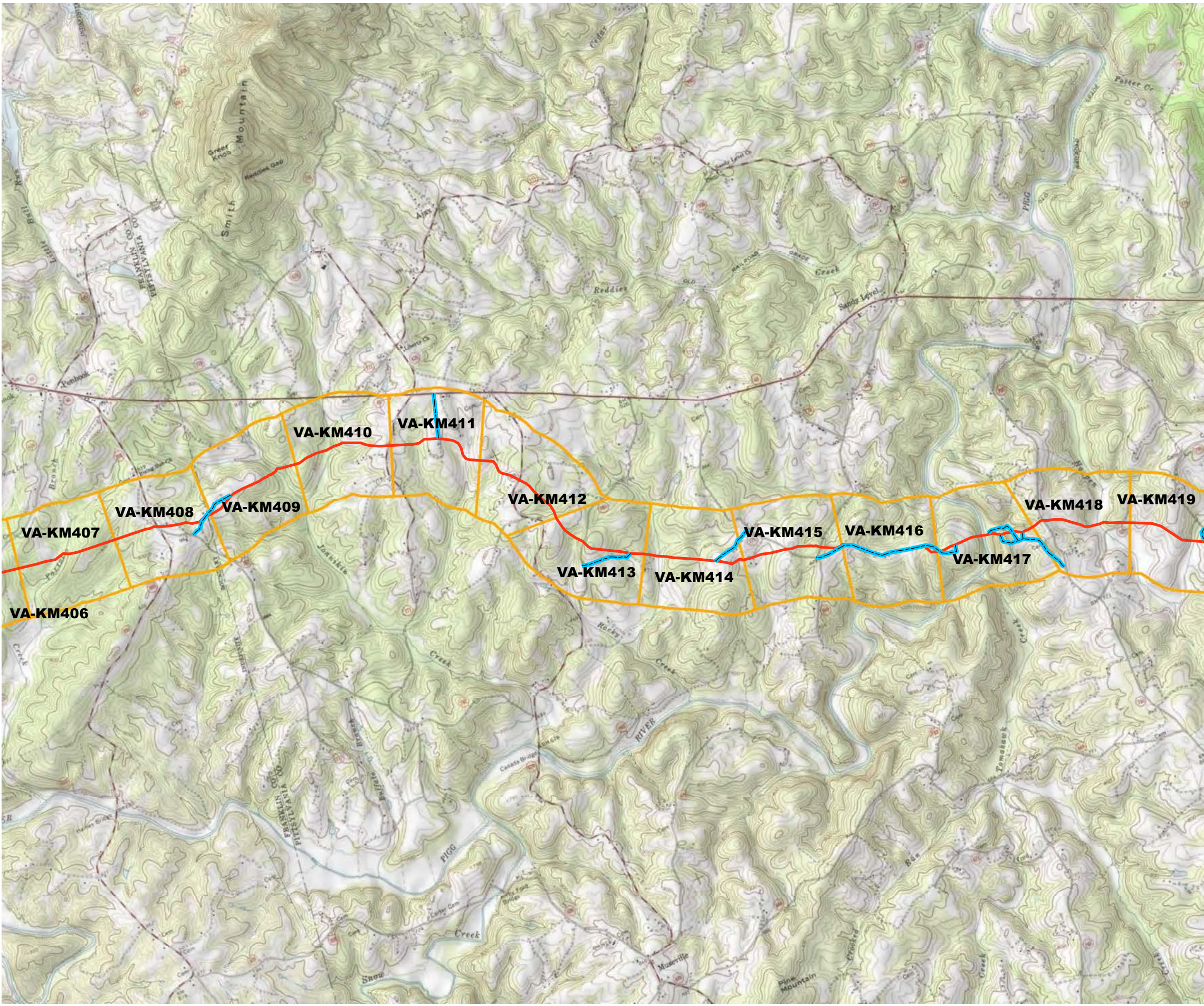
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Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)



Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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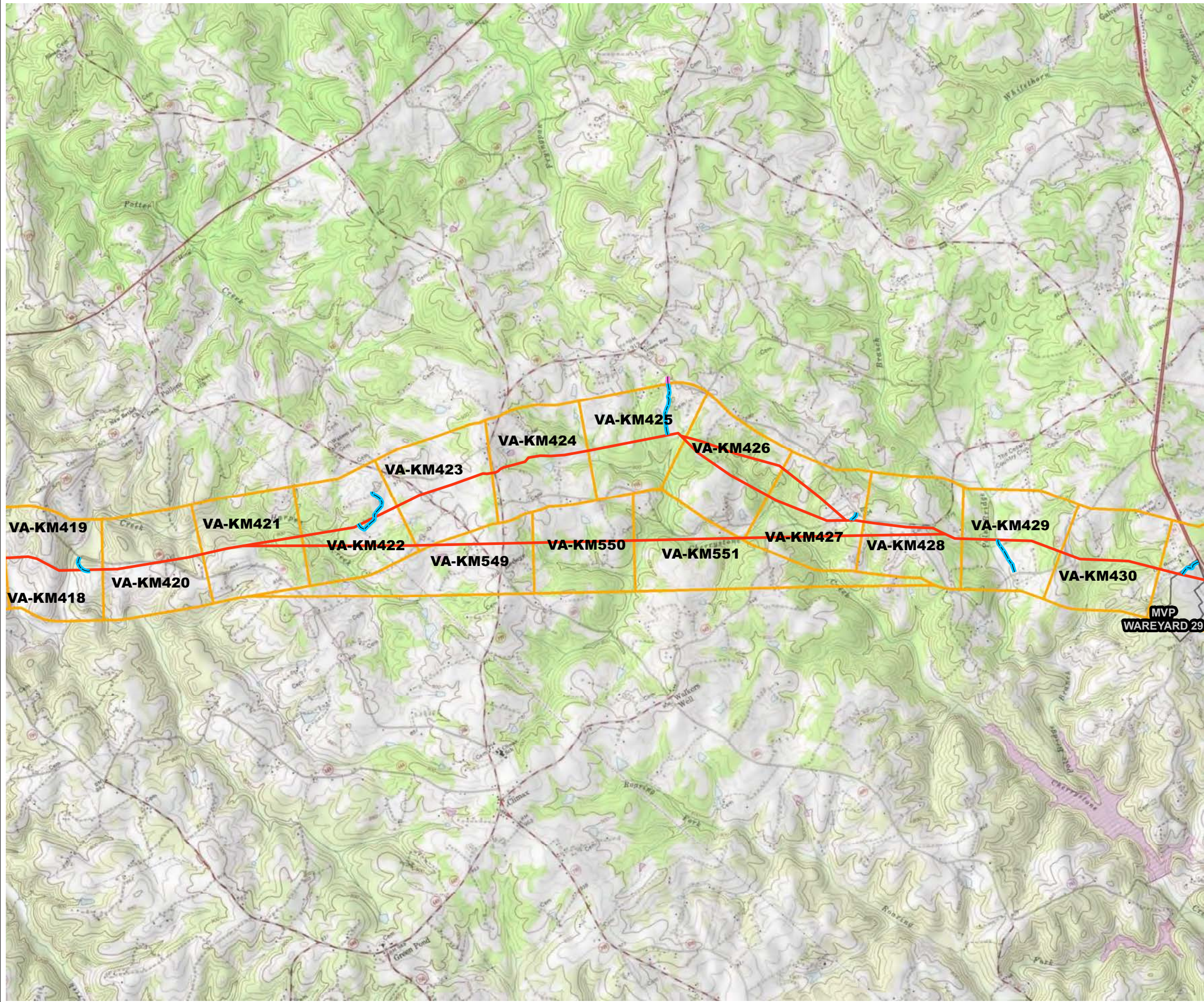
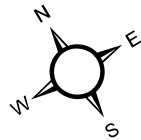
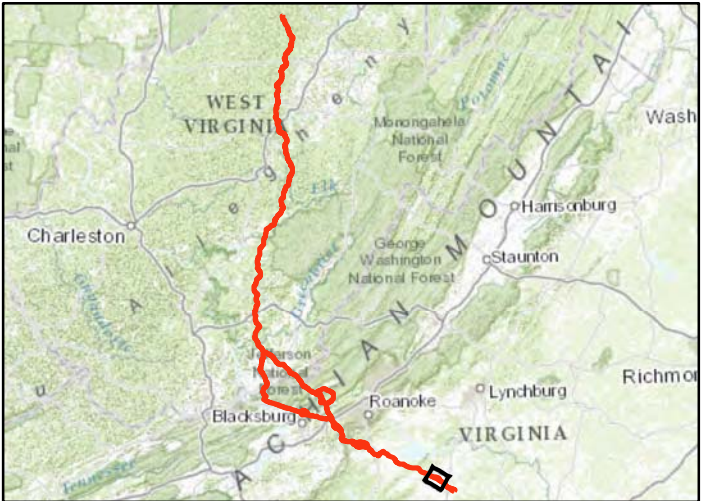


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)
- MVP Proposed Laydown Yard



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



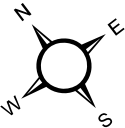
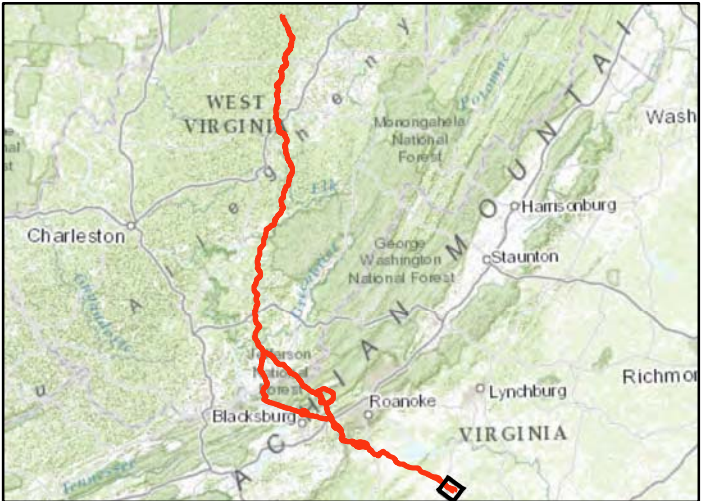
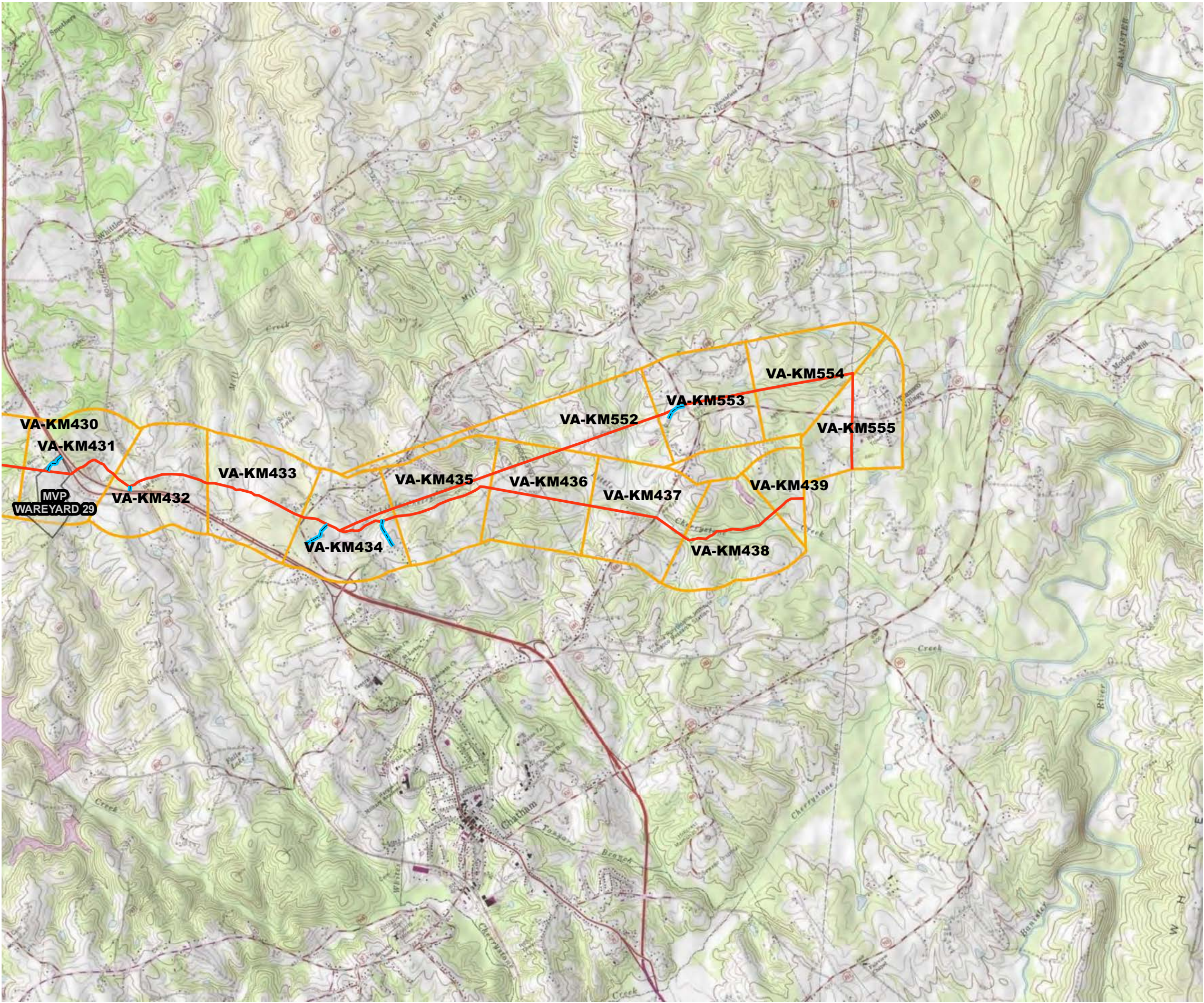
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Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

- Proposed MVP Pipeline Alignment
- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Laydown Yard



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



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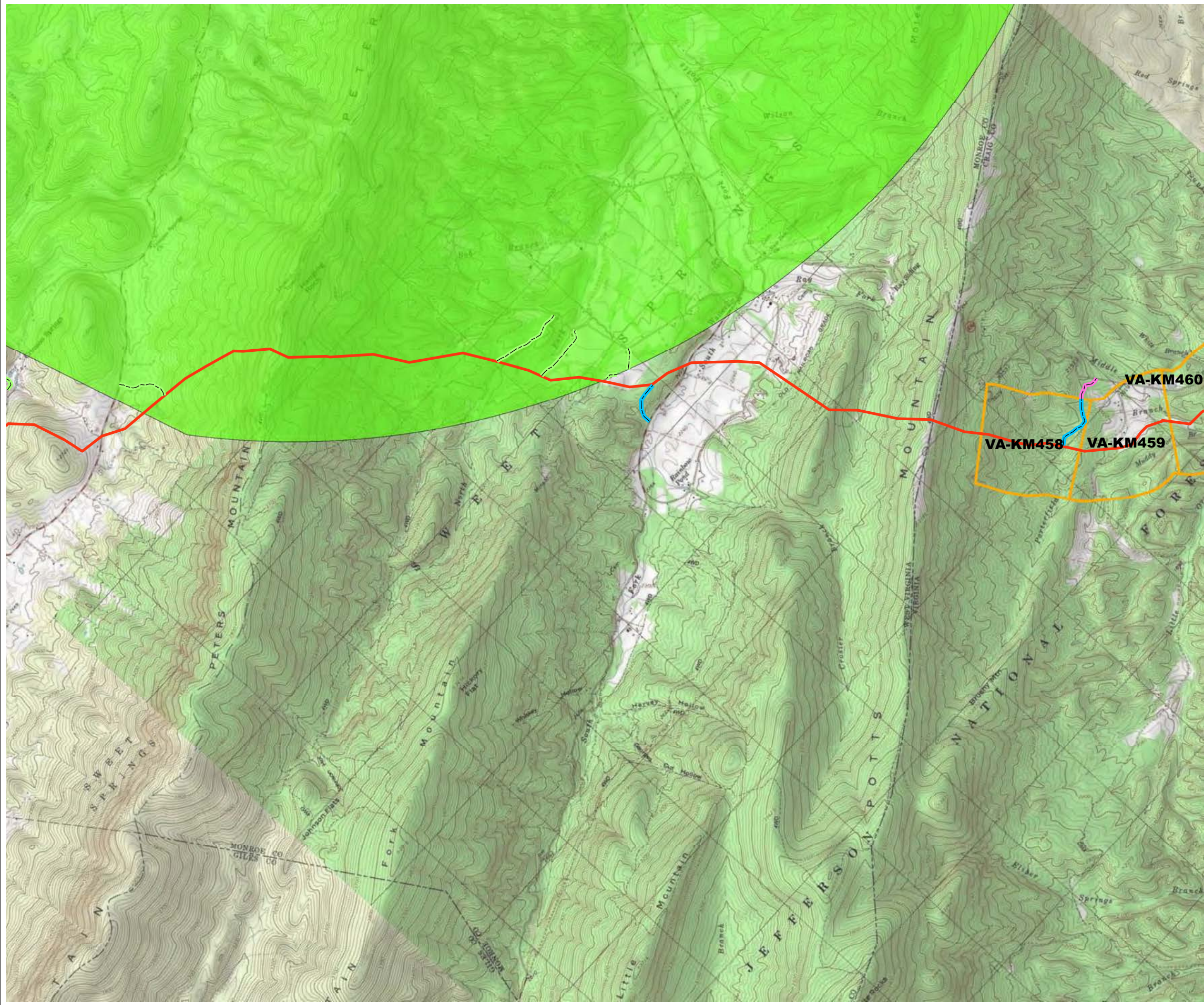
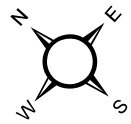
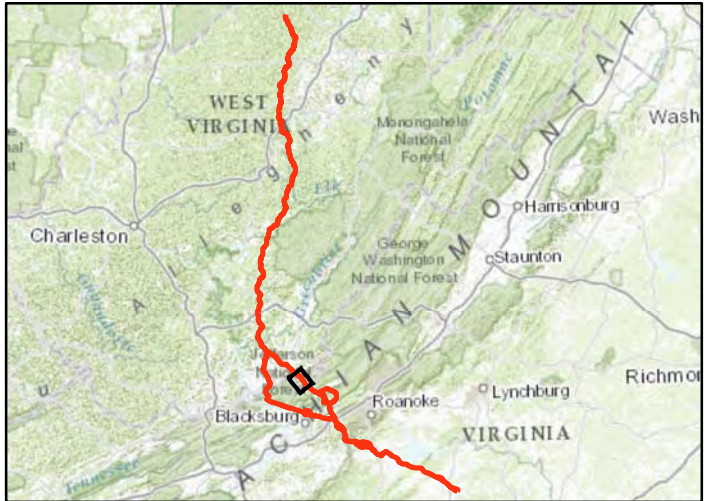


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 38 of 41

- 1-Kilometer (KM) Mist Net Segment
- USFWS Terrestrial Buffer (Known Occupied Indiana Bat Habitat)
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)
- MVP Proposed Access Roads (Inside Known Bat Habitat)



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS" accessed - 4/23/2015



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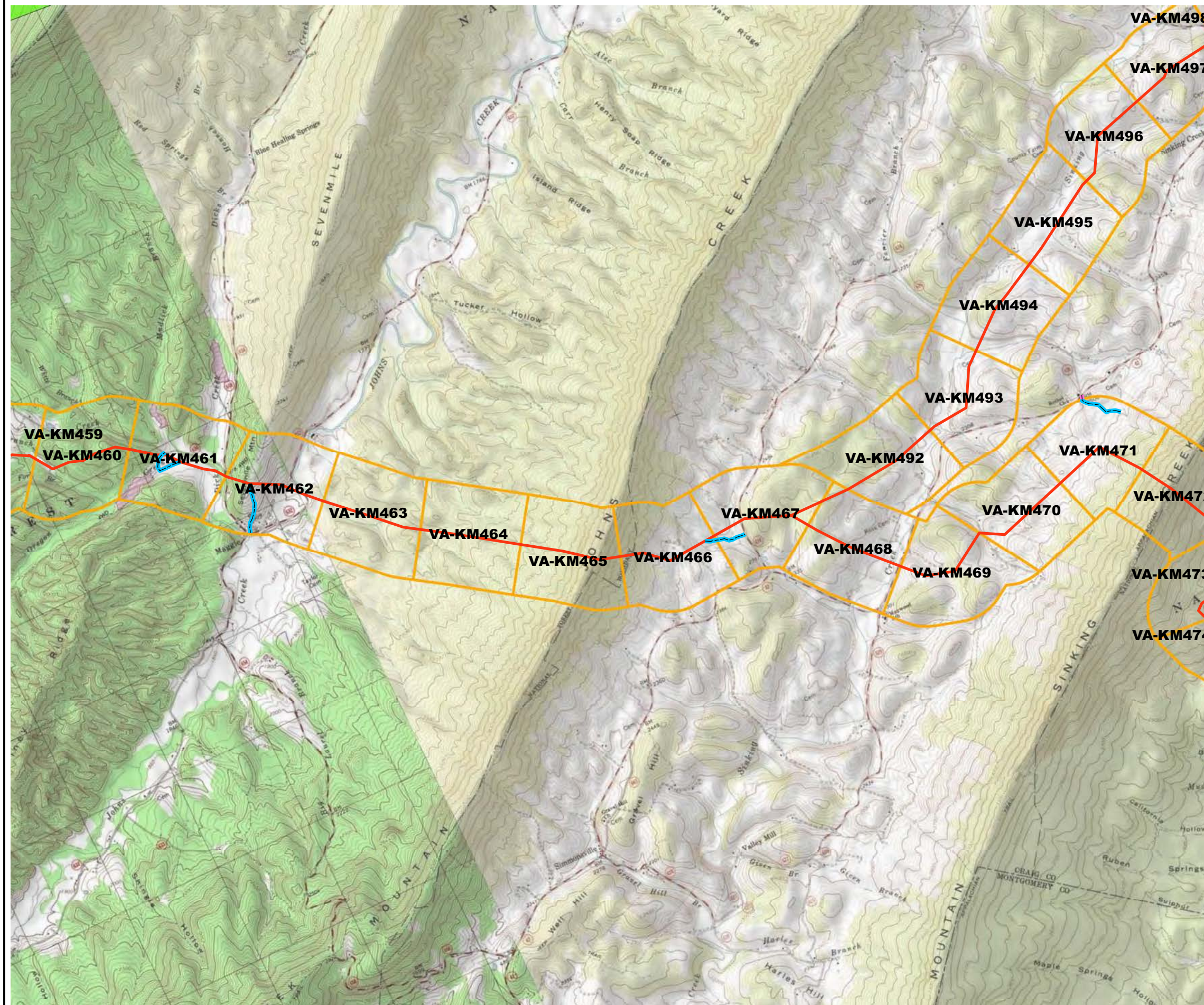
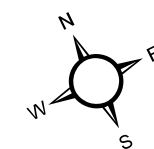
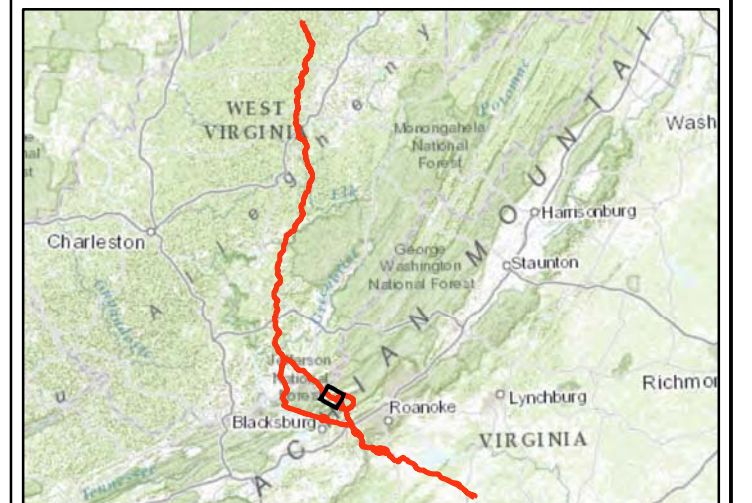


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 39 of 41

- 1-Kilometer (KM) Mist Net Segment
- USFWS Terrestrial Buffer (Known Occupied Indiana Bat Habitat)
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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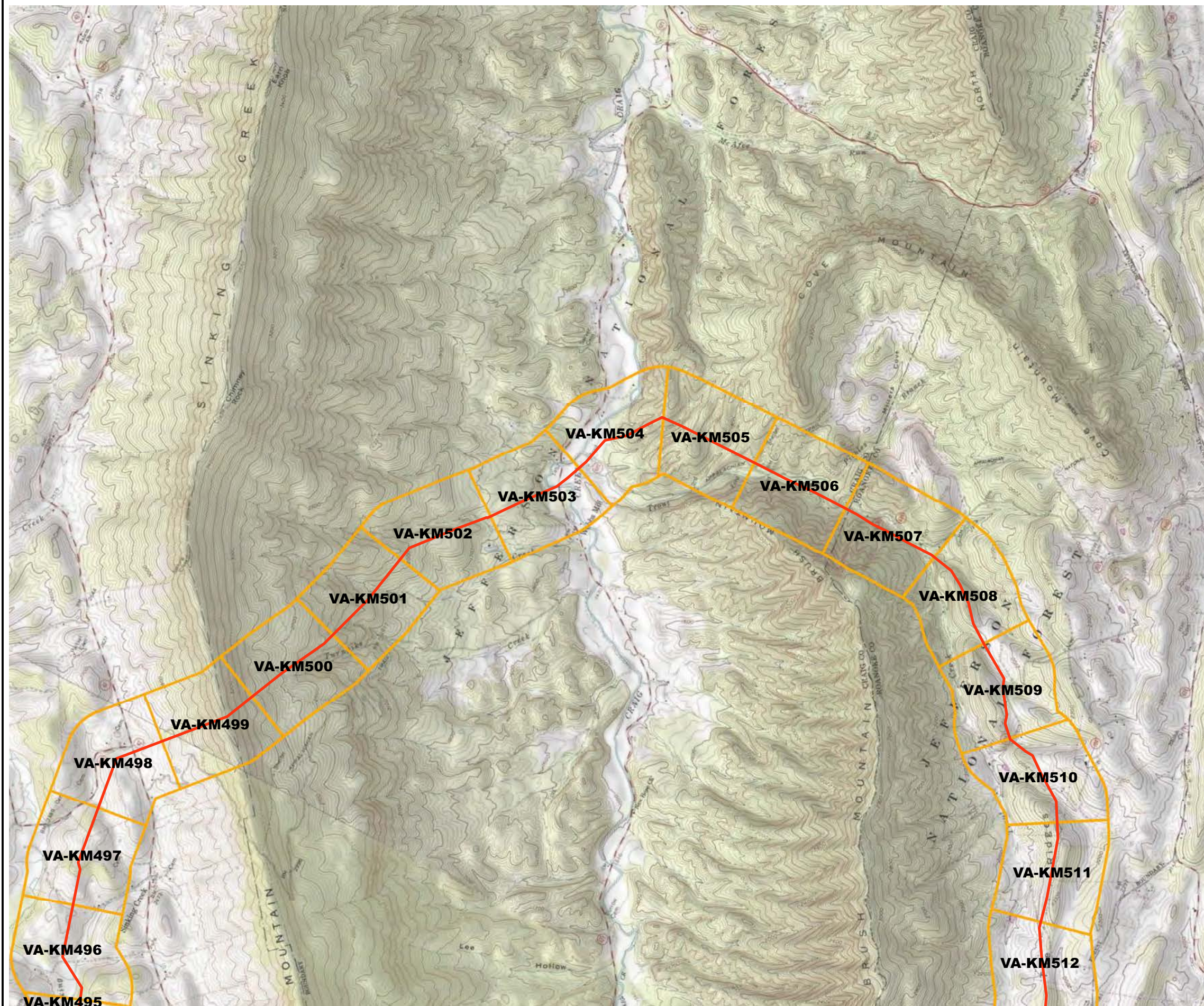
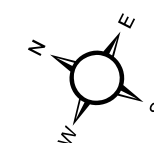
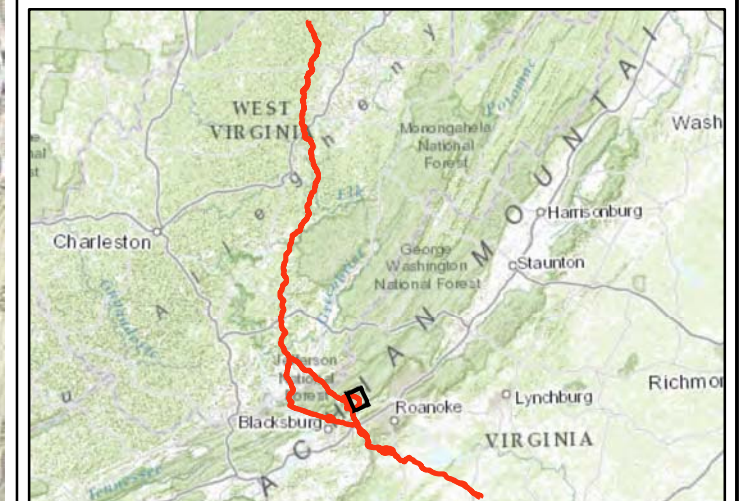


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 40 of 41

1-Kilometer (KM) Mist Net Segment



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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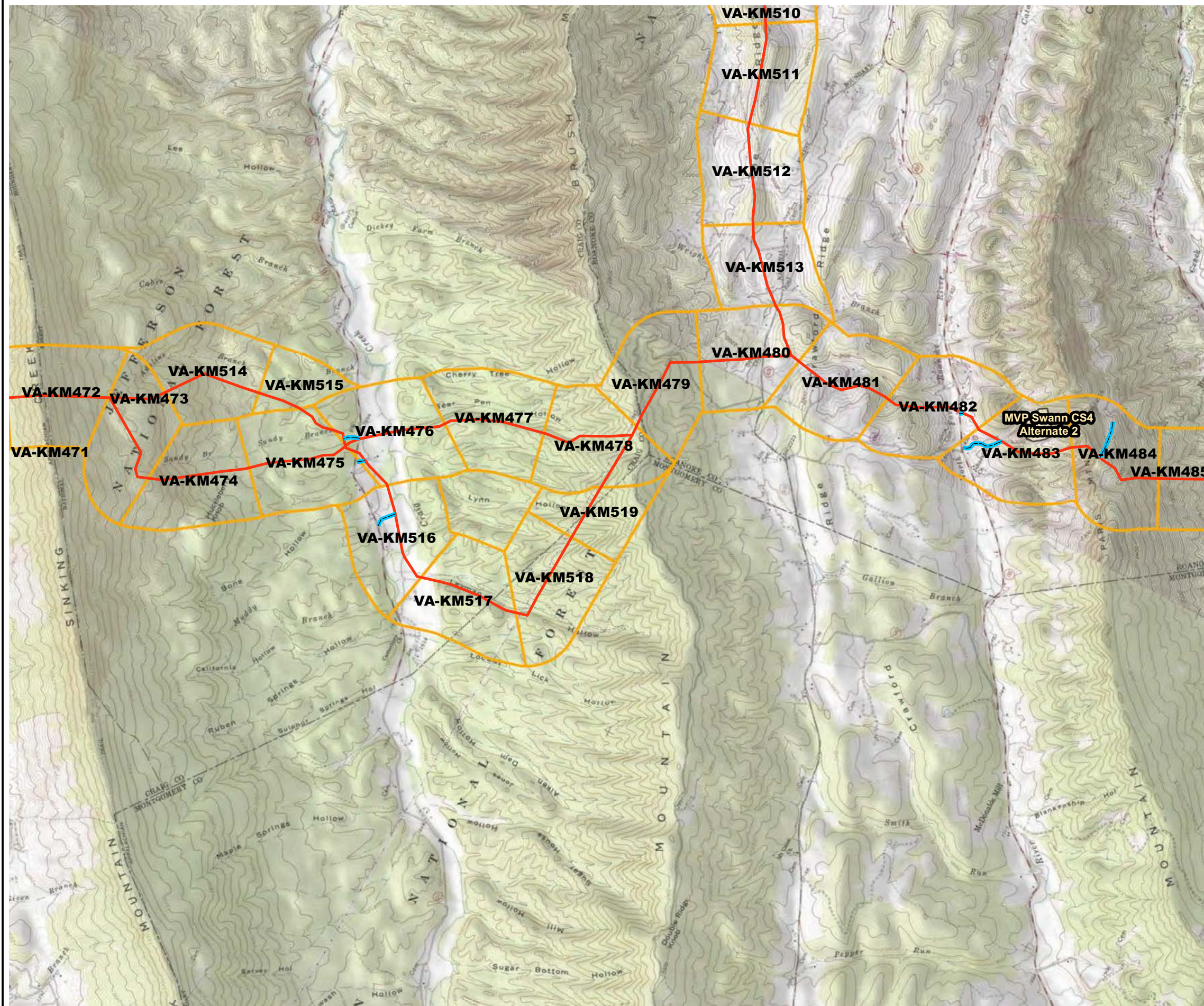
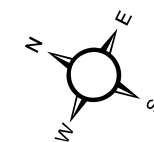
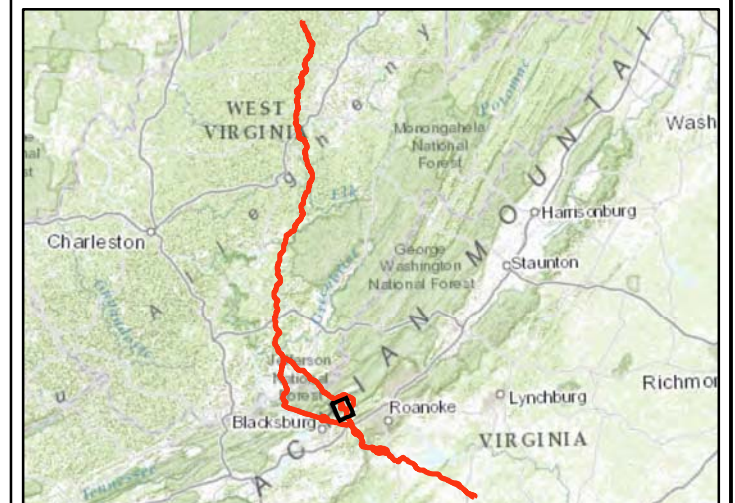


Figure 3. Mist net locations along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 41 of 41

- 1-Kilometer (KM) Mist Net Segment
- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Compressor Station



0.5 0 0.5 1 Kilometers

Base Map: ESRI ArcGIS Web service - "US TOPO MAPS"  
accessed - 4/23/2015



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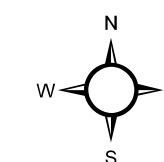
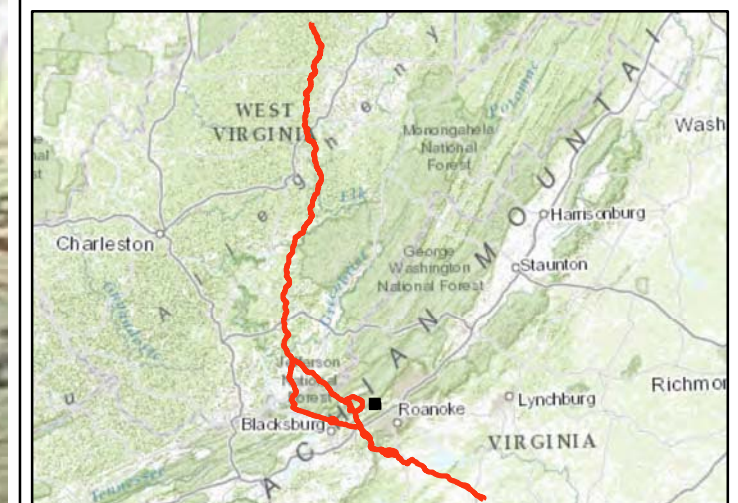




Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 22 of 30

■ MVP Proposed Laydown Yard



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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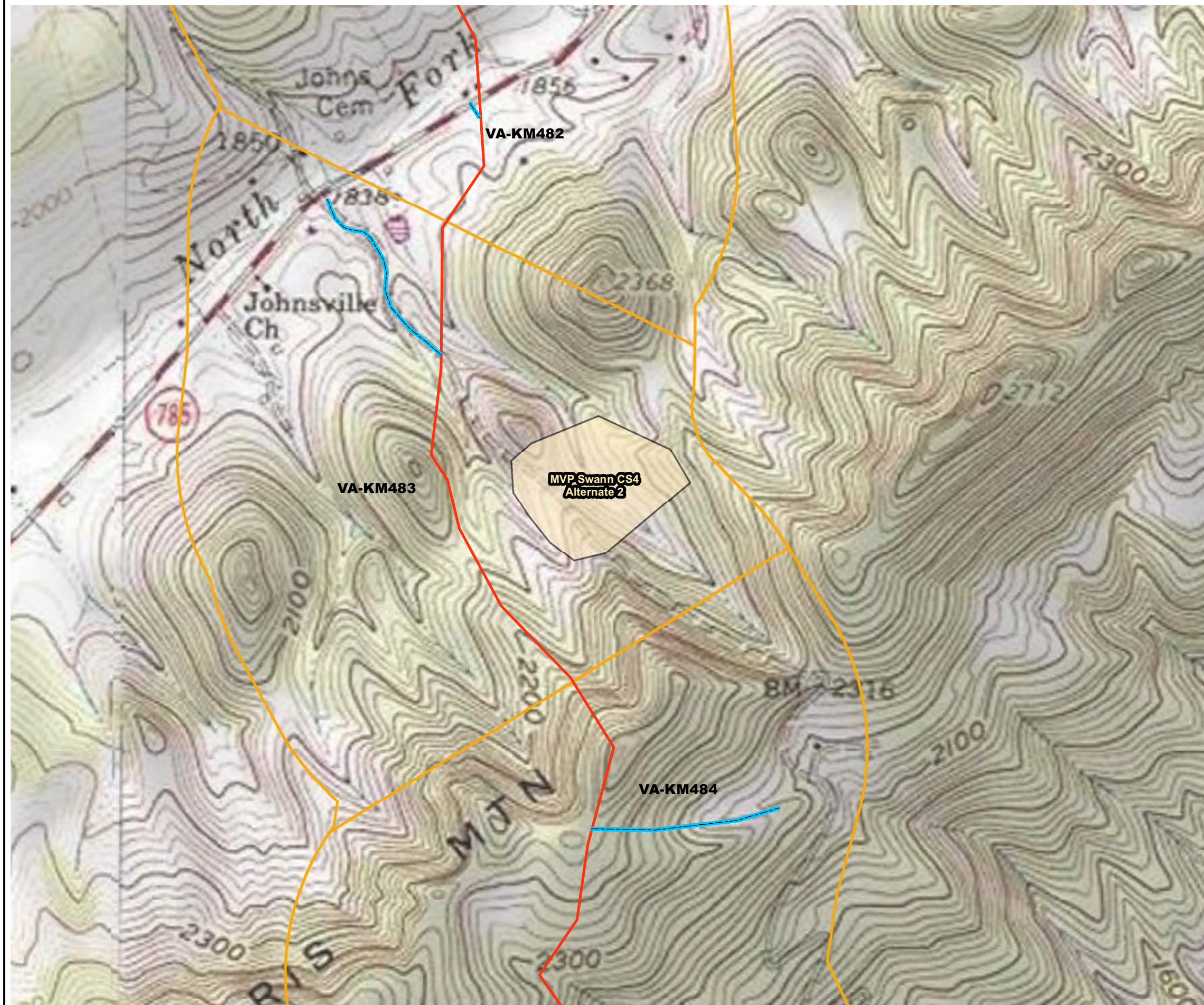
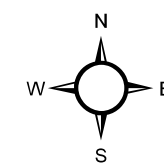
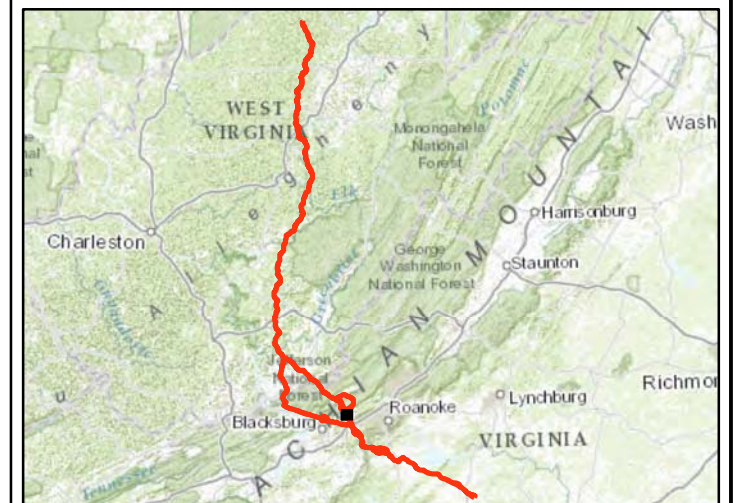


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 23 of 30

- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Compressor Station
- 1-Kilometer (KM) Mist Net Segment



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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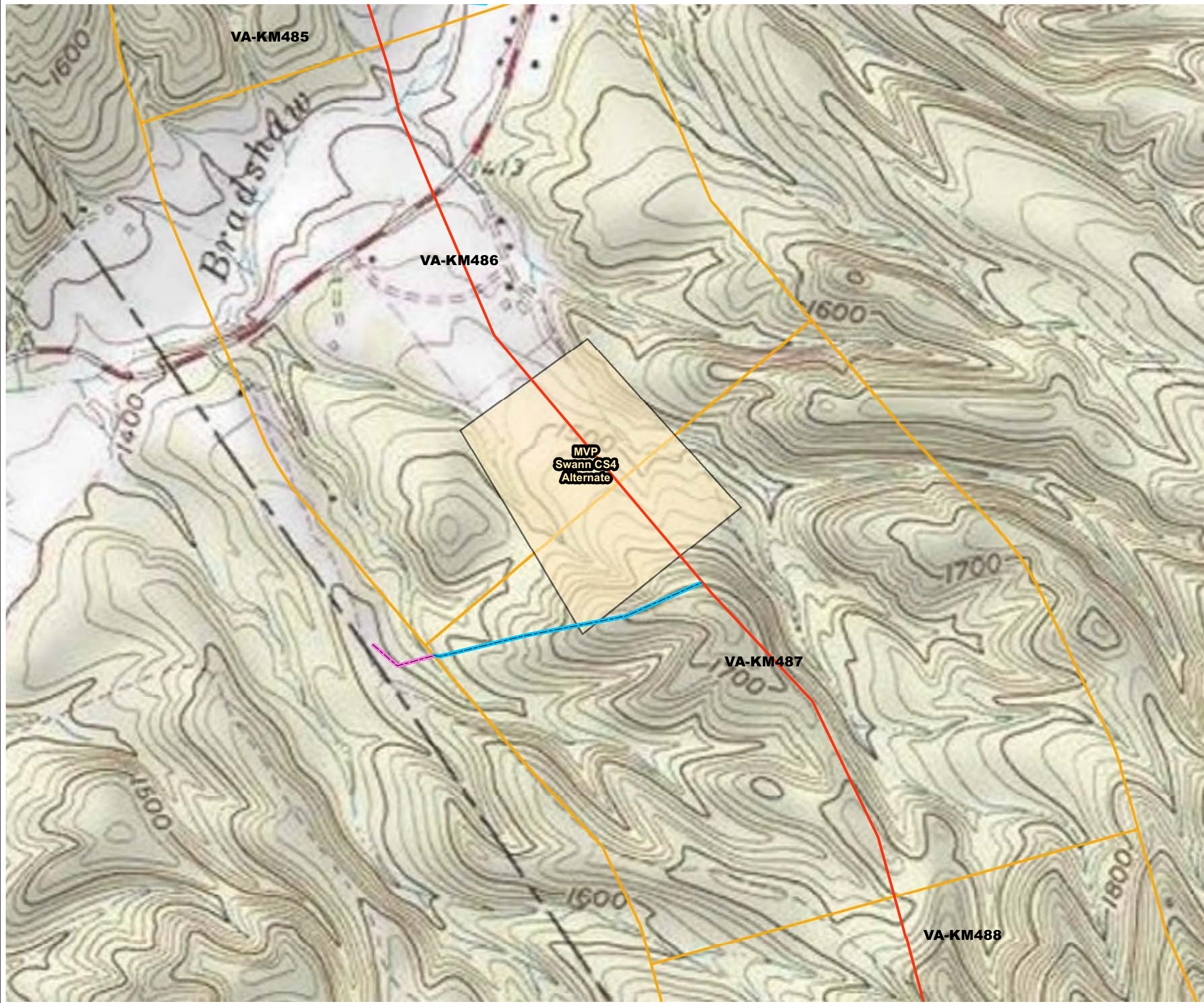
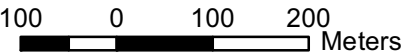
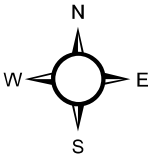
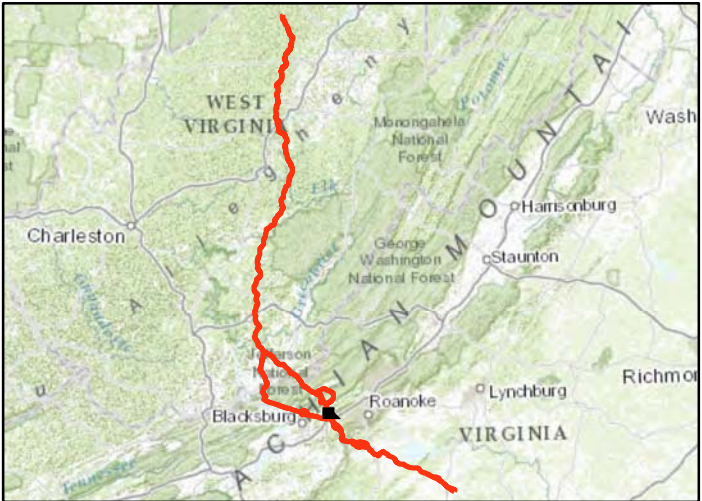


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 24 of 30

- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)
- MVP Proposed Compressor Station
- 1-Kilometer (KM) Mist Net Segment



Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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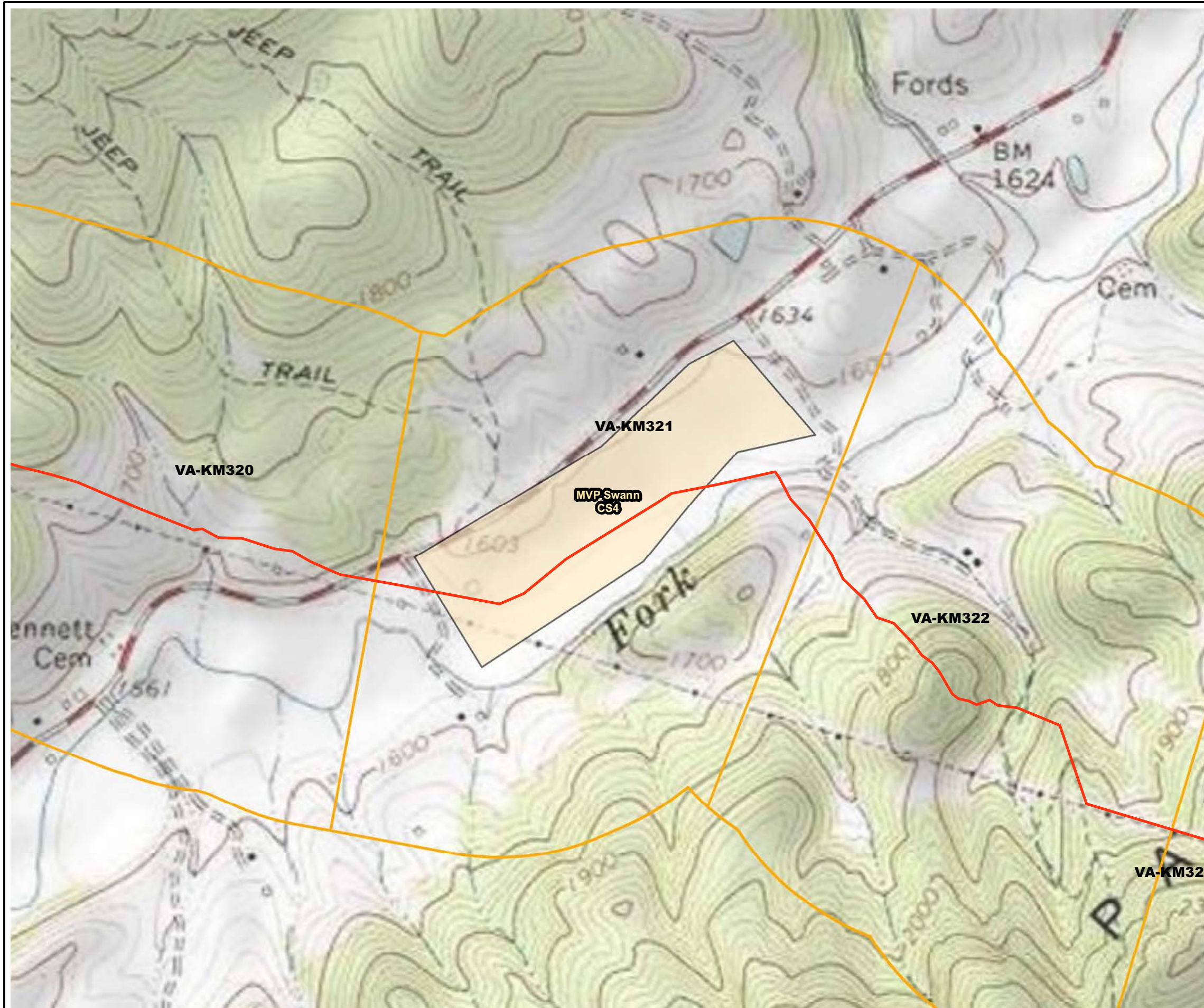
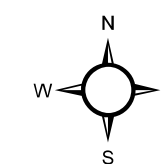
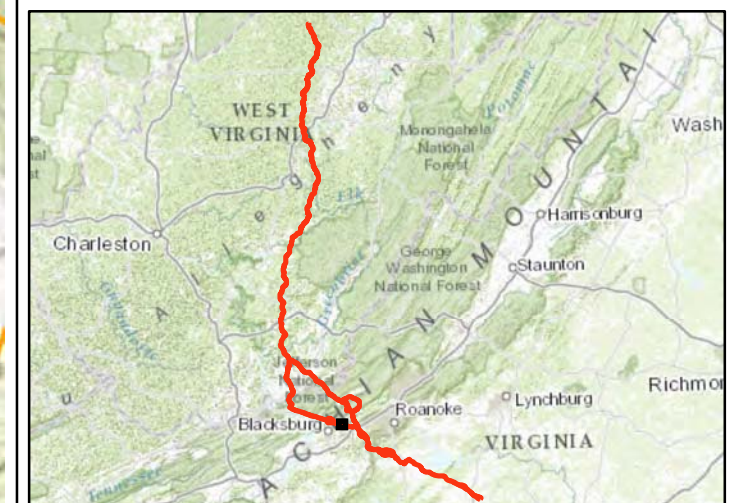


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 25 of 30

- Proposed MVP Pipeline Alignment
- MVP Proposed Compressor Station
- 1-Kilometer (KM) Mist Net Segment



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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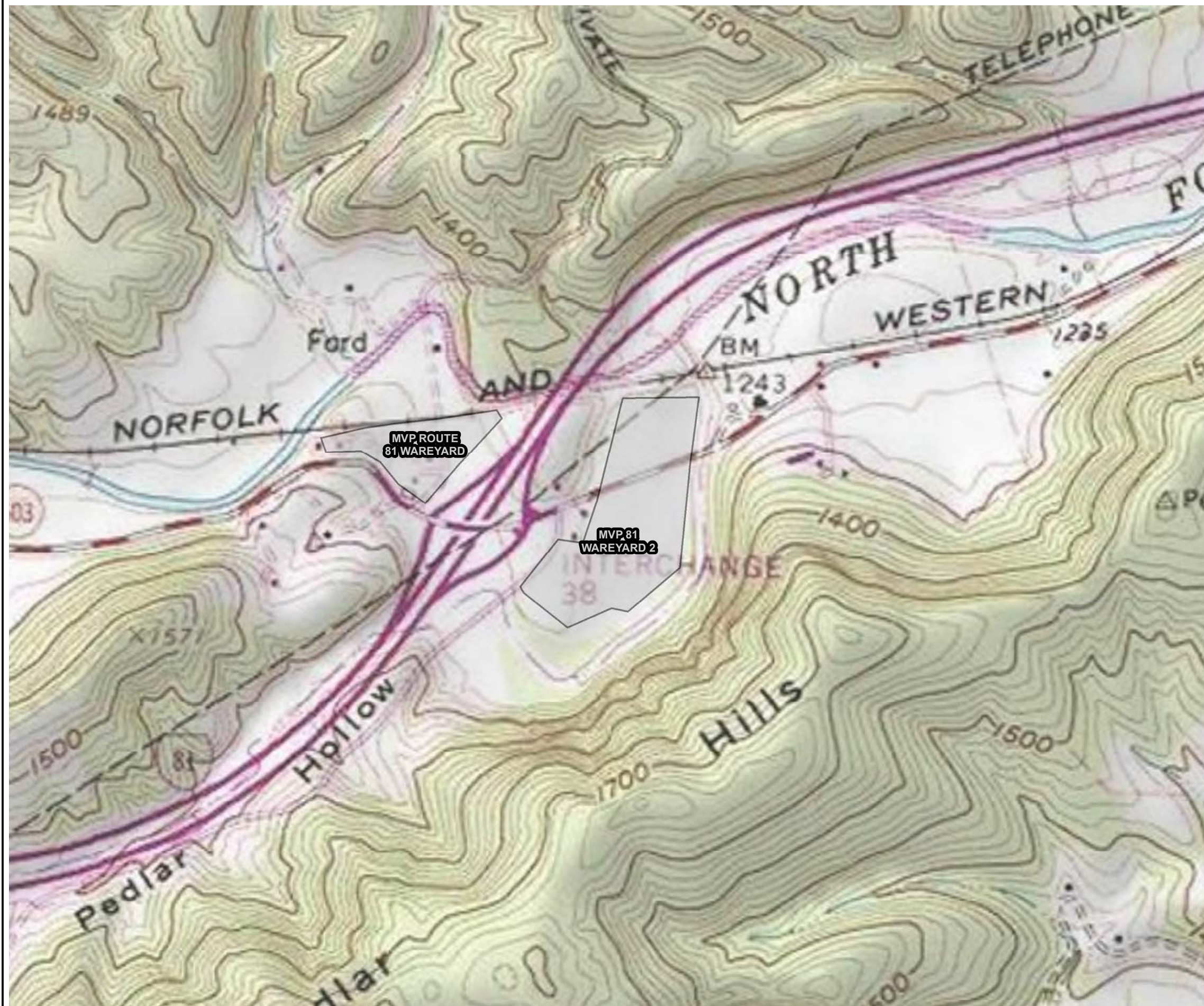
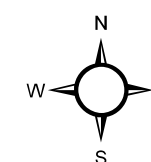
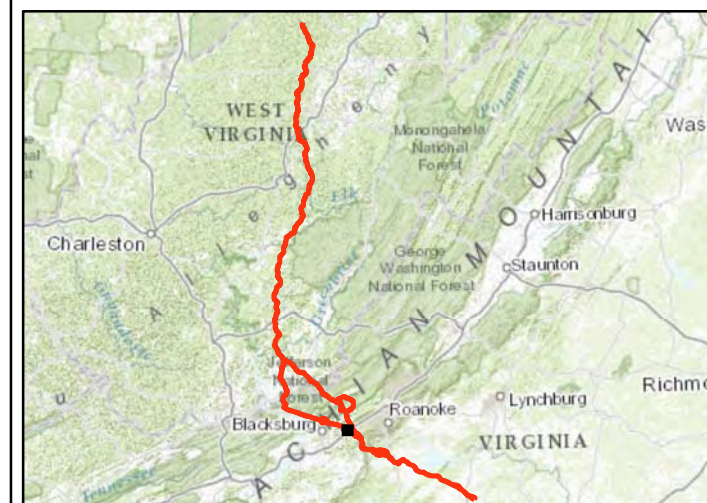


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 26 of 30

■ MVP Proposed Laydown Yard



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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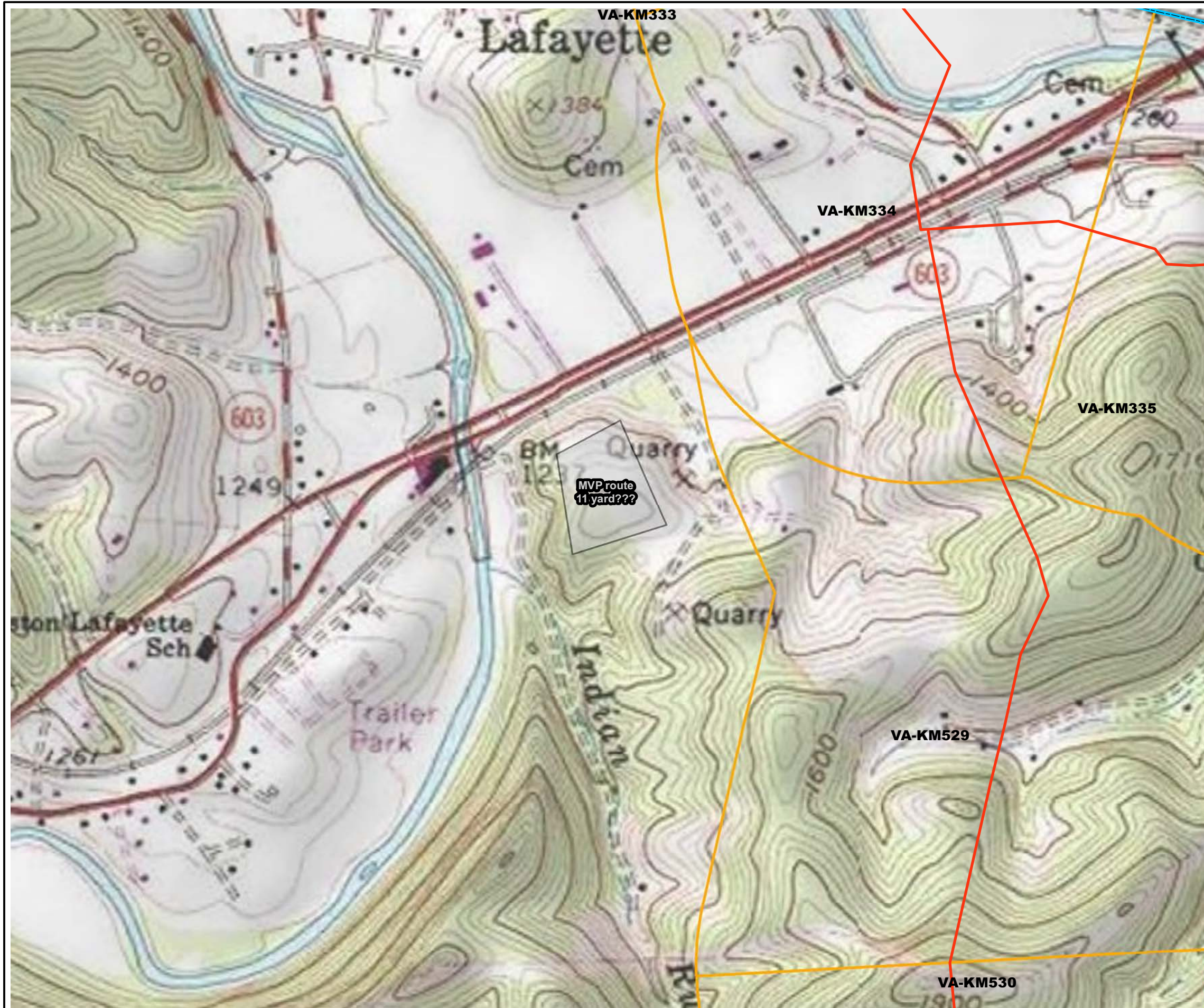
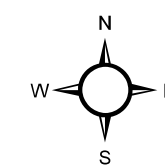
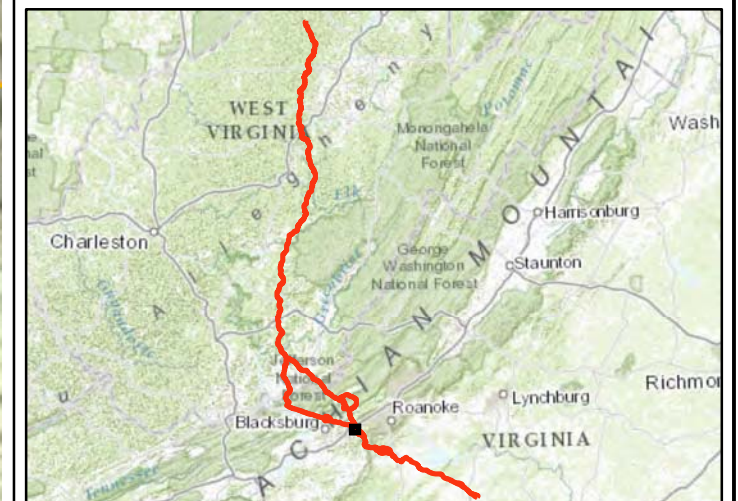


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 27 of 30

- MVP Proposed Access Roads (Inside KM Segments)
- Proposed MVP Pipeline Alignment
- MVP Proposed Laydown Yard
- 1-Kilometer (KM) Mist Net Segment



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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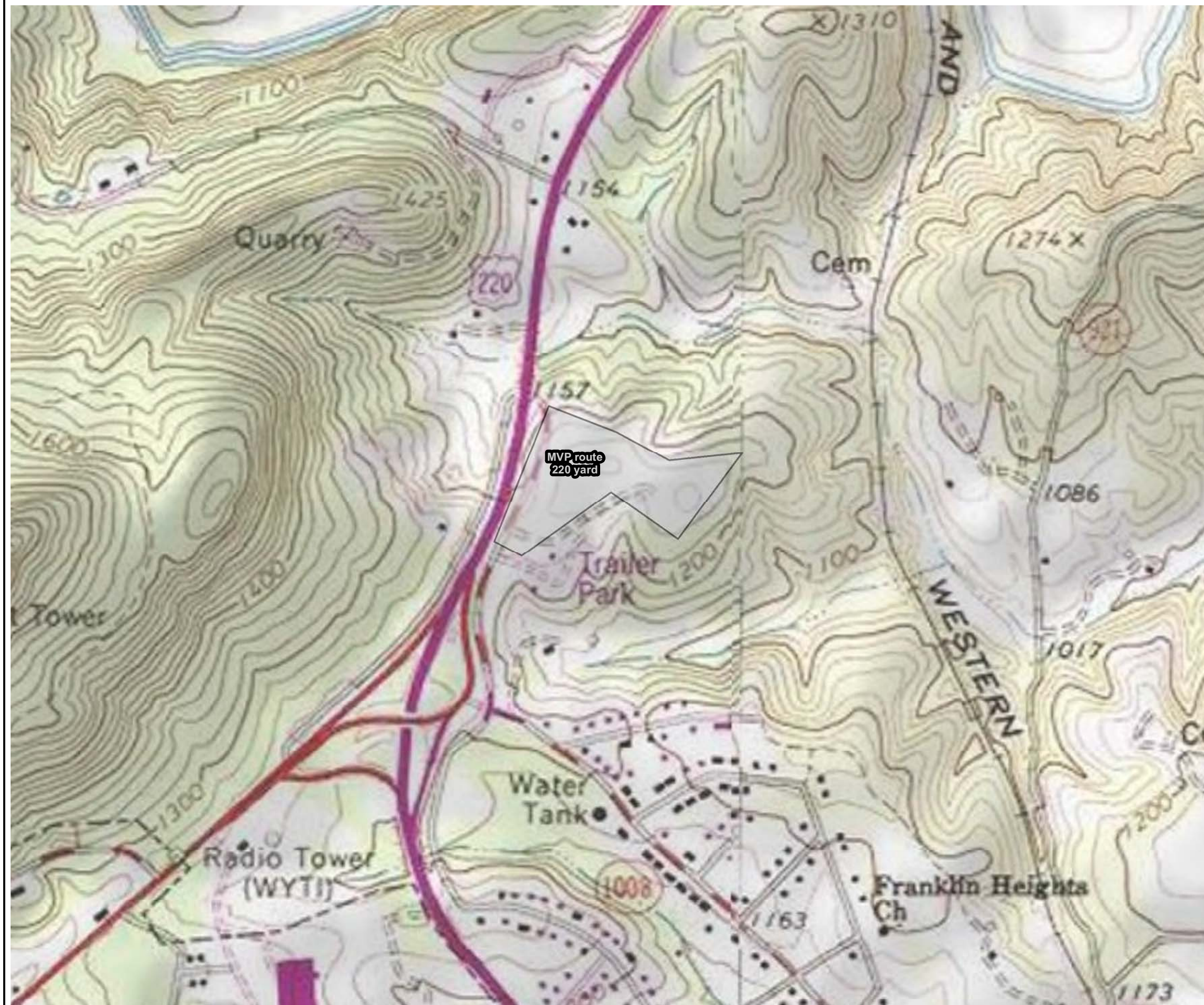
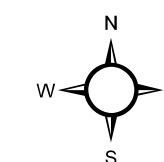
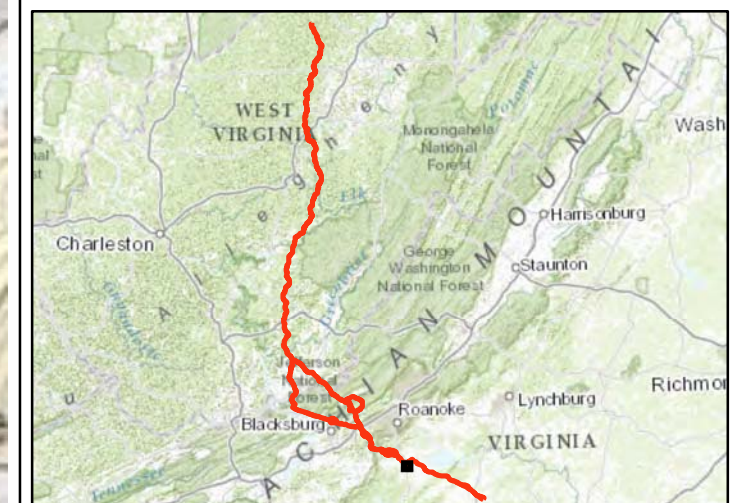


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

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■ MVP Proposed Laydown Yard



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery"  
accessed - 4/23/2015



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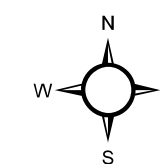
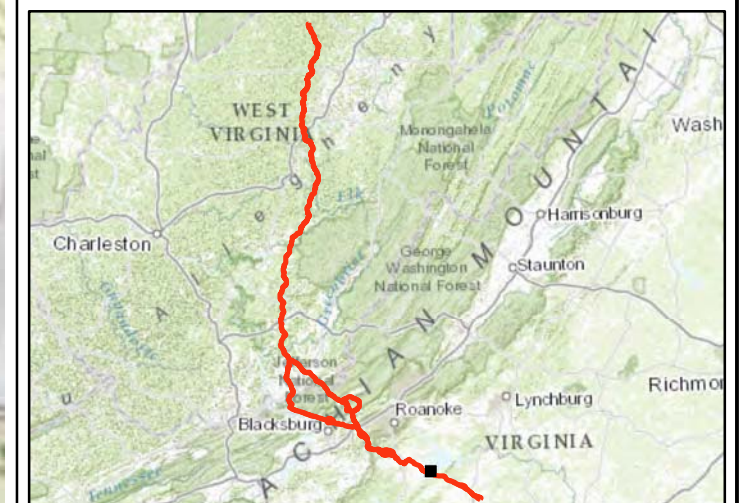




Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 29 of 30

- MVP Proposed Access Roads (Inside KM Segments)
- MVP Proposed Access Roads (Outside KM Segments)
- Proposed MVP Pipeline Alignment
- MVP Proposed Laydown Yard
- 1-Kilometer (KM) Mist Net Segment



100 0 100 200 Meters

Base Map: ESRI ArcGIS Web service - "World\_Imagery" accessed - 4/23/2015



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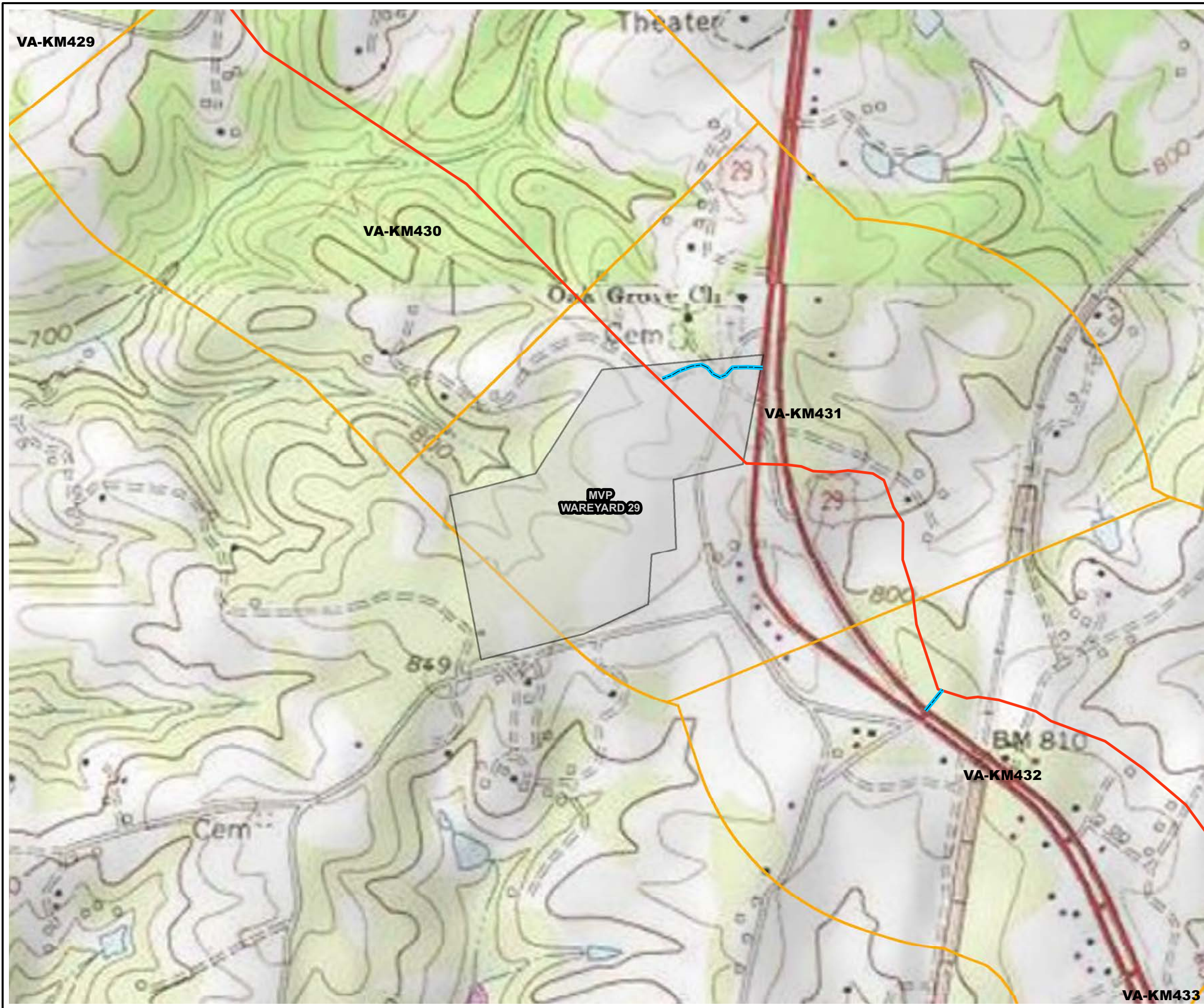
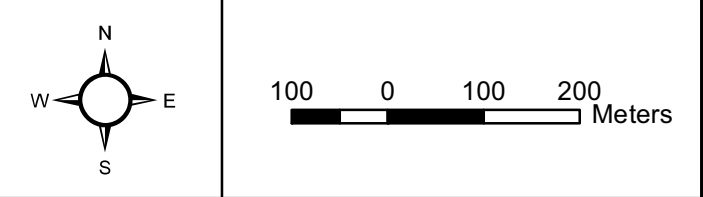
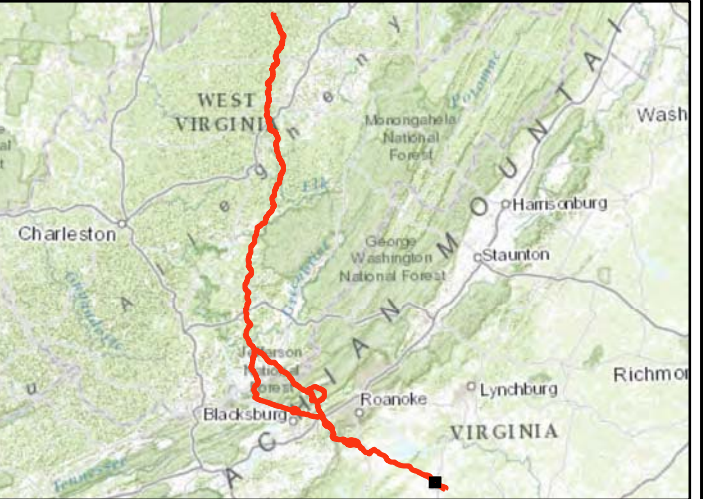


Figure 4. Compressor Stations and Laydown yards along the Proposed Mountain Valley Pipeline Project in Virginia and West Virginia.

Map 30 of 30

- MVP Proposed Access Roads (Inside KM Segments)
- Proposed MVP Pipeline Alignment
- MVP Proposed Laydown Yard
- 1-Kilometer (KM) Mist Net Segment



Base Map: ESRI ArcGIS Web service - "World\_Imagery" accessed - 4/23/2015



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**APPENDIX B  
CORRESPONDENCE**





October 13, 2014

Mr. Troy Andersen  
United States Fish and Wildlife Service  
Virginia Field Office  
6669 Short Lane  
Gloucester, VA 23061

**Subject: Mountain Valley Pipeline Project**

Dear Mr. Andersen,

Mountain Valley Pipeline, LLC, a joint venture of EQT Corporation and a subsidiary of NextEra Energy, Inc., is hereby providing background information on the proposed Mountain Valley Pipeline (MVP) Project (Project). MVP plans to construct an approximately 300-mile, 42-inch diameter natural gas pipeline to allow producers and end-users a direct route to transport new gas supplies to meet the growing need for natural gas in the southeastern United States.

The pipeline will extend from the existing Equitrans transmission system in Wetzel County, West Virginia to Transcontinental Gas Pipeline Company's (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. In addition to the pipeline, the Project will require approximately 225,000 horsepower of compression at approximately four compressor stations along the route along with measurement, regulation, and other ancillary facilities required for the safe operation of the pipeline. A Project map has been included as an attachment to this letter.

The Federal Energy Regulatory Commission (FERC) will serve as the lead agency for the Project. MVP plans to request to use the FERC's pre-filing process in late October 2014 and anticipates filing a formal application with the FERC in the third quarter of 2015. The FERC will then prepare an Environmental Assessment or an Environmental Impact Statement to satisfy the National Environmental Policy Act (NEPA) process for the Project.

MVP and their consultants, Tetra Tech, Inc. and Environmental Solutions & Innovation, Inc., will be consulting with the United States Fish and Wildlife Service Virginia Field Office as necessary during development of the Project. However, in order to assist MVP in preparing the FERC application and identifying possible issues to be addressed during the NEPA process, the purpose of this letter is to notify the United States Fish and Wildlife Service Virginia Field Office of MVP's intent to utilize the FERC's NEPA Pre-Filing Process, and to request information on resources under your agency's jurisdiction that could be potentially affected by the Project.



Mr. Troy Andersen

October 13, 2014

Page 2 of 2

The MVP team looks forward to working with your agency as we move forward with development of this Project. We appreciate your assistance and thank in you advance for any help you can provide. A representative of MVP will be in contact with you soon to discuss the Project in further detail.

If you have questions or would like additional information about the Project please contact me at 304-848-0061 ([MLandfried@eqt.com](mailto:MLandfried@eqt.com)), or Sean Sparks at 617-443-7565 ([sean.sparks@tetrattech.com](mailto:sean.sparks@tetrattech.com)).

Sincerely,

A handwritten signature in blue ink that reads "Megan Landfried Neylon". The signature is written in a cursive, flowing style.

Megan Landfried Neylon

Senior Environmental Coordinator

cc: John Centofanti, EQT Corporation  
Blayne Gunderman, NextEra Energy Resources, LLC  
Sean Sparks, Tetra Tech  
Daniel Judy, Environmental Solutions & Innovations





U.S. Fish and Wildlife Service

## Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Virginia Ecological Services Field Office  
6669 SHORT LANE  
GLOUCESTER, VA 23061  
(804) 693-6694  
<http://www.fws.gov/northeast/virginiafield/>

### ***Project Name:***

MVP\_Rev 3-2

### ***Project Counties:***

Franklin, VA | Giles, VA | Montgomery, VA | Pittsylvania, VA | Roanoke, VA

### ***Project Type:***

Oil Or Gas

### ***Endangered Species Act Species List (USFWS Endangered Species Program).***

There are a total of 9 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fishes may appear on the species list because a project could cause downstream effects on the species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section below for critical habitat that lies within your project area. Please contact the designated FWS office if you have questions.

**Species that should be considered in an effects analysis for your project:**

Clams	Status		Has Critical Habitat	Contact
-------	--------	--	----------------------	---------





## Trust Resources List

James spinymussel ( <i>Pleurobema collina</i> ) Population: Entire	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
Fishes				
Roanoke logperch ( <i>Percina rex</i> ) Population: Entire	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
Flowering Plants				
Northeastern bulrush ( <i>Scirpus ancistrochaetus</i> )	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
Peter's Mountain mallow ( <i>Iliamna corei</i> )	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
Small Whorled pogonia ( <i>Isotria medeoloides</i> )	Threatened	<a href="#">species info</a>		Virginia Ecological Services Field Office
Smooth coneflower ( <i>Echinacea laevigata</i> )	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
Insects				
Mitchell's Satyr Butterfly ( <i>Neonympha mitchellii mitchellii</i> ) Population: Entire	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
Mammals				
Indiana bat ( <i>Myotis sodalis</i> ) Population: Entire	Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office
northern long-eared Bat ( <i>Myotis septentrionalis</i> ) Population:	Proposed Endangered	<a href="#">species info</a>		Virginia Ecological Services Field Office

### Critical habitats within your project area:

*There are no critical habitats within your project area.*





## Trust Resources List

### ***FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).***

*There are no refuges found within the vicinity of your project.*

### ***FWS Migratory Birds (USFWS Migratory Bird Program).***

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see: <http://www.fws.gov/migratorybirds/RegulationsandPolicies.html>.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to:

<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html>.

To search and view summaries of year-round bird occurrence data within your project area, go to the Avian Knowledge Network Histogram Tool links in the Bird Conservation Tools section at: <http://www.fws.gov/migratorybirds/CCMB2.htm>.

For information about conservation measures that help avoid or minimize impacts to birds, please visit:

<http://www.fws.gov/migratorybirds/CCMB2.htm>.

#### **Migratory birds of concern that may be affected by your project:**

There are 24 birds on your Migratory birds of concern list. The underlying data layers used to generate the migratory bird list of concern will continue to be updated regularly as new and better information is obtained. User feedback is one method of identifying any needed improvements. Therefore, users are encouraged to submit comments about any questions regarding species ranges (e.g., a bird on the USFWS BCC list you know does not occur in the specified location appears on the list, or a BCC species that you know does occur there is not appearing on the list). Comments should be sent to [the ECOS Help Desk](#).





## Trust Resources List

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern ( <i>Botaurus lentiginosus</i> )	Yes	<a href="#">species info</a>	Wintering
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Yes	<a href="#">species info</a>	Year-round
Black-billed Cuckoo ( <i>Coccyzus erythrophthalmus</i> )	Yes	<a href="#">species info</a>	Breeding
Blue-winged Warbler ( <i>Vermivora pinus</i> )	Yes	<a href="#">species info</a>	Breeding
Brown-headed Nuthatch ( <i>Sitta pusilla</i> )	Yes	<a href="#">species info</a>	Year-round
Canada Warbler ( <i>Wilsonia canadensis</i> )	Yes	<a href="#">species info</a>	Breeding
cerulean warbler ( <i>Dendroica cerulea</i> )	Yes	<a href="#">species info</a>	Breeding
Chuck-will's-widow ( <i>Caprimulgus carolinensis</i> )	Yes	<a href="#">species info</a>	Breeding
Fox Sparrow ( <i>Passerella liaca</i> )	Yes	<a href="#">species info</a>	Wintering
Golden-Winged Warbler ( <i>Vermivora chrysoptera</i> )	Yes	<a href="#">species info</a>	Breeding
Henslow's sparrow ( <i>Ammodramus henslowii</i> )	Yes	<a href="#">species info</a>	Breeding
Kentucky Warbler ( <i>Oporornis formosus</i> )	Yes	<a href="#">species info</a>	Breeding
Least Bittern ( <i>Ixobrychus exilis</i> )	Yes	<a href="#">species info</a>	Breeding
Loggerhead Shrike ( <i>Lanius ludovicianus</i> )	Yes	<a href="#">species info</a>	Year-round
Louisiana Waterthrush ( <i>Parkesia motacilla</i> )	Yes	<a href="#">species info</a>	Breeding
Pied-billed Grebe ( <i>Podilymbus podiceps</i> )	Yes	<a href="#">species info</a>	Year-round, Breeding
Prairie Warbler ( <i>Dendroica discolor</i> )	Yes	<a href="#">species info</a>	Breeding
Prothonotary Warbler ( <i>Protonotaria citrea</i> )	Yes	<a href="#">species info</a>	Breeding





## Trust Resources List

Red-headed Woodpecker ( <i>Melanerpes erythrocephalus</i> )	Yes	<a href="#">species info</a>	Year-round, Breeding
Rusty Blackbird ( <i>Euphagus carolinus</i> )	Yes	<a href="#">species info</a>	Wintering
Swainson's Warbler ( <i>Limnothlypis swainsonii</i> )	Yes	<a href="#">species info</a>	Breeding
Wood Thrush ( <i>Hylocichla mustelina</i> )	Yes	<a href="#">species info</a>	Breeding
Worm eating Warbler ( <i>Helmitheros vermivorum</i> )	Yes	<a href="#">species info</a>	Breeding
Yellow-Bellied sapsucker ( <i>sphyrapicus varius</i> )	Yes	<a href="#">species info</a>	Breeding

### ***NWI Wetlands (USFWS National Wetlands Inventory).***

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

### **Data Limitations, Exclusions and Precautions**

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.





U.S. Fish and Wildlife Service

## Trust Resources List

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

**Exclusions** - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

**Precautions** - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

*IPaC is unable to display wetland information at this time.*





October 13, 2014

Ms. Rene Hypes  
Virginia Department of Conservation & Recreation  
Division of Natural Heritage  
600 East Main Street, 24<sup>th</sup> Floor  
Richmond, VA 23219

**Subject: Mountain Valley Pipeline Project**

Dear Ms. Hypes,

Mountain Valley Pipeline, LLC, a joint venture of EQT Corporation and a subsidiary of NextEra Energy, Inc., is hereby providing background information on the proposed Mountain Valley Pipeline (MVP) Project (Project). MVP plans to construct an approximately 300-mile, 42-inch diameter natural gas pipeline to allow producers and end-users a direct route to transport new gas supplies to meet the growing need for natural gas in the southeastern United States.

The pipeline will extend from the existing Equitrans transmission system in Wetzel County, West Virginia to Transcontinental Gas Pipeline Company's (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. In addition to the pipeline, the Project will require approximately 225,000 horsepower of compression at approximately four compressor stations along the route along with measurement, regulation, and other ancillary facilities required for the safe operation of the pipeline. A Project map has been included as an attachment to this letter.

The Federal Energy Regulatory Commission (FERC) will serve as the lead agency for the Project. MVP plans to request to use the FERC's pre-filing process in late October 2014 and anticipates filing a formal application with the FERC in the third quarter of 2015. The FERC will then prepare an Environmental Assessment or an Environmental Impact Statement to satisfy the National Environmental Policy Act (NEPA) process for the Project.

MVP and its consultant, Tetra Tech, Inc., will be consulting with the Virginia Department of Conservation & Recreation Division of Natural Heritage as necessary during development of the Project. However, in order to assist MVP in preparing the FERC application and identifying possible issues to be addressed during the NEPA process, the purpose of this letter is to notify the Virginia Department of Conservation & Recreation Division of Natural Heritage of MVP's intent to utilize the FERC's NEPA Pre-Filing Process, and to request information on resources under your agency's jurisdiction that could be potentially affected by the Project.



Ms. Rene Hypes  
October 13, 2014  
Page 2 of 2

The MVP team looks forward to working with your agency as we move forward with development of this Project. We appreciate your assistance and thank in you advance for any help you can provide. A representative of MVP will be in contact with you soon to discuss the Project in further detail.

If you have questions or would like additional information about the Project please contact me at 304-848-0061 ([MLandfried@eqt.com](mailto:MLandfried@eqt.com)), or Sean Sparks at 617-443-7565 ([sean.sparks@tetrattech.com](mailto:sean.sparks@tetrattech.com)).

Sincerely,

A handwritten signature in blue ink that reads "Megan Landfried Neylon". The signature is written in a cursive, flowing style.

Megan Landfried Neylon  
Senior Environmental Coordinator

cc: John Centofanti, EQT Corporation  
Blayne Gunderman, NextEra Energy Resources, LLC  
Sean Sparks, Tetra Tech





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## ENVIRONMENTAL SOLUTIONS & INNOVATIONS, INC.

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2250 Lucien Way, Suite 302  
Maitland, FL 32751  
Phone: (321) 972-3958; Fax: (321) 972-3959

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Pesi 593

3 November 2014

Mr. Ernie Aschenbach  
Virginia Department of Game and Inland Fisheries  
P.O. Box 11104  
Richmond, VA 23230

**RE: Mountain Valley Pipeline Project Review Request**

Dear Mr. Aschenbach,

Environmental Solutions & Innovations, Inc. (ESI) is submitting this correspondence in association with the letter submitted by Mountain Valley Pipeline, LLC (MVP) regarding the Mountain Valley Pipeline (Project) on 13 October 2014. The Federal Energy Regulatory Commission (FERC) will serve as the lead agency for the Project with Tetra Tech, Inc. and ESI as MVP's environmental consultants.

The 42-inch diameter natural gas pipeline (≈300 miles) will extend from the existing Equitrans transmission system in Wetzel County, West Virginia to Transcontinental Gas Pipeline Company's (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. In Virginia, the pipeline is expected to cross Giles, Montgomery, Roanoke, Franklin, and Pittsylvania counties (**Figure 1**). Electronic shapefiles for the Project accompany this letter to assist in your review.

ESI is currently completing the Project Review process for the United States Fish and Wildlife Service Virginia Field Office (USFWS-VA). As part of this process within the Information, Planning and Consultation system (IPaC), ESI respectfully requests information from the Virginia Department of Game and Inland Fisheries (VDGIF) regarding the results of the IPaC (**Species Conclusions Table** attached). For the completion of this process, ESI requires the following information:

- Are the species listed in the Species Conclusions Table found within the Project's action area (150 feet from each side of project centerline)?
- Does suitable or critical habitat exist within the Project's action area for the species listed in the Species Conclusions Table?



- Based on VDGIF data, are there additional species that should be added to this table?

The Species Conclusions Table currently includes information from the Virginia Department of Conservation & Recreation, United States Geological Survey, and United States Department of Agriculture.

Any additional information/clarification regarding the matters of this letter would be greatly appreciated.

In closing, we appreciate your time and attention to this matter. Please feel free to contact me or Megan Landfried Neylon from MVP if you have any questions or need additional Project information.

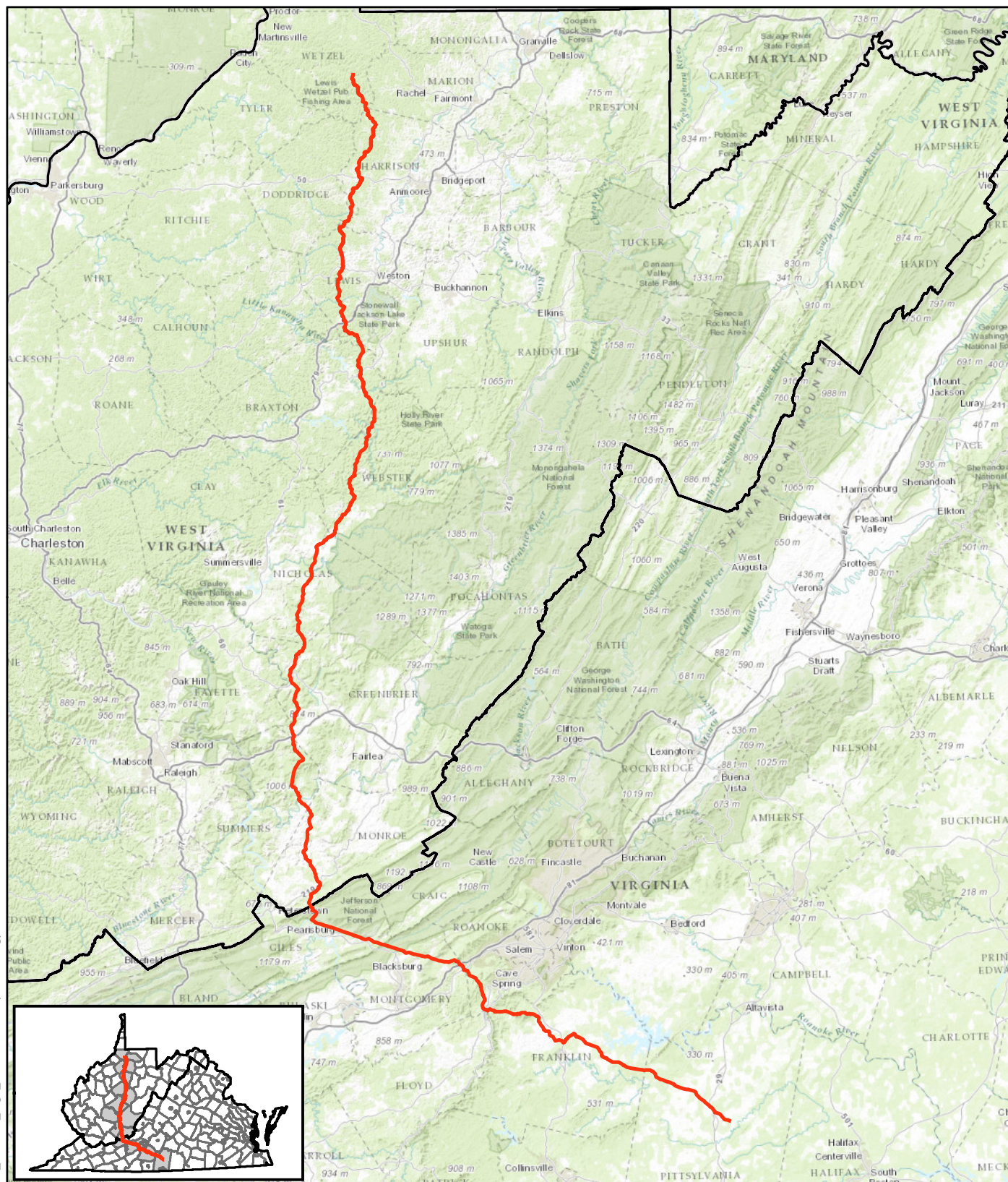
Sincerely,



Daniel Judy  
Southeast Regional Manager  
(407) 269-7492  
DJudy@envsi.com

Enclosure: Project Location Map (Figure 1)  
Species Conclusions Table  
Project shapefiles





— MVP Route Rev3 (20141001)

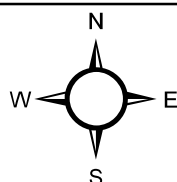


Figure 1. MVP's proposed Mountain Valley Pipeline Project within the States of Virginia and West Virginia.

Project No.  
593

20 0 20 40  
Kilometers



ENVIRONMENTAL SOLUTIONS  
& INNOVATIONS, INC.







## Species Conclusions Table

Project Name: Mountain Valley Pipeline

Date: 3 November 2014

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
James spinymussel	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database
Roanoke logperch	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database
Northeastern (barbedbristle) bulrush	Potential habitat present and no current survey conducted	May affect	Obtained a map displaying county occurrences from USDA Plants Database
Peter's Mountain mallow	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database Viewer
Shale barren rock cress	Potential habitat present and no current survey conducted	May affect	Obtained a map displaying county occurrences from USDA Plants Database
Small whorled pogonia	Potential habitat present and no current survey conducted	May affect	Obtained a map displaying county occurrences from USDA Plants Database
Smooth coneflower	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database
Mitchell's Satyr Butterfly	Species not present, no suitable habitat present	No effect	USFWS Species Profile website
Indiana bat	Potential habitat present and no current survey conducted	May affect	USFWS GAP Analysis dataset
Northern long-eared bat	Potential habitat present and no current survey conducted	May affect	USFWS GAP Analysis dataset



Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
American bittern	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Bald Eagle	<p>Unlikely to disturb nesting bald eagles</p> <p>Does not intersect with an eagle concentration area</p>	No Eagle Act permit required	USFWS-VA Bald Eagle Map Tool consulted on 20 October 2014
Black-billed Cuckoo	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Blue-winged Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Brown-headed Nuthatch	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Canada Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Cerulean Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Chuck-will's-widow	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Fox Sparrow	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Golden-winged Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset



Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Henslow's Sparrow	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Kentucky Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Least Bittern	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Loggerhead Shrike	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Louisiana Waterthrush	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Pied-billed Grebe	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Prairie Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Prothonotary Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Red-headed Woodpecker	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Rusty Blackbird	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset



Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Swainson's Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Wood Thrush	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Worm eating Warbler	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Yellow-bellied Sapsucker	Bird of Conservation Concern	Recommend agency coordination	USGS GAP Analysis dataset
Critical Habitat	No critical habitat present	No effect	Virginia Field Office Critical Habitat Map Tool on 20 October 2014
Orangefin Madtom	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database
Green Floater	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database
Candy Darter	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database
Hellbender	Potential habitat present and no current survey conducted	May affect	VADCR Natural Heritage Database



**APPENDIX C**  
**EXAMPLE DATASHEETS**





## PORTAL SEARCH DATA SHEET

Project #: \_\_\_\_\_ Task #: \_\_\_\_\_ Date: \_\_\_\_\_ Project Name: \_\_\_\_\_ Page \_\_\_\_ of \_\_\_\_

Biologist(s): \_\_\_\_\_ GPS Unit: \_\_\_\_\_ Camera : \_\_\_\_\_ County: \_\_\_\_\_

Feature/ Segment ID	Start Time	End Time	Evidence of Mining?	Portal(s) Present?	Portal ID(s) if present *	GPS Coordinates/Waypoints				Photos	Comments
						Start	End	Wpt	Wpt		
						Lat/Long	Lat/Long				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				
						N	N				
						W	W				

\* Refer to Mine Portal Description data sheets





## MINE PORTAL DESCRIPTION

Project No: \_\_\_\_\_ Project Name: \_\_\_\_\_

Date: \_\_\_\_\_ Biologists: \_\_\_\_\_

State: \_\_\_\_\_ County: \_\_\_\_\_

Site Name/#	No. of Portals:
STATE PERMIT NUMBER:	FEDERAL PERMIT NUMBER:

GPS: Unit #: \_\_\_\_\_ Waypoint Name: \_\_\_\_\_

Latitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"N Longitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"W

Camera #: \_\_\_\_\_ Photo ID #s: \_\_\_\_\_

Portal/opening	#1	#2	#3	#4
Diameter (height x width)				
Is opening vertical or horizontal (V or H)				
Is opening sloped (estimated degree of slope)				
Estimated length of portal				
Estimated internal dimensions (height x width)				
Entrance appears stable?				
Evidence of collapse?				
Ceiling condition stable?				
Amount of airflow (slight, moderate, heavy)				
Direction of airflow (in or out)				
Outside temperature				
Temperature at portal				
Evidence of past flooding?				
% Canopy closure at entrance				
Estimated distance to nearest water source				
Evidence of foraging (insect remains)?				
Presence of guano?				
Portal obstructed by vegetation?				
Portal obstructed by spider webs?				
Would use make bat susceptible to predation?				

Is portal recommended for bat survey? No\_\_\_\_ Yes\_\_\_\_ Why\_\_\_\_\_

Comments: \_\_\_\_\_

Please include site sketch on back when feasible.



COMPLETE 4 STEPS: DO NOT LEAVE BLANKS, EXPLAIN WHY MISSING INFORMATION (eg. No photo taken)



Property of: Environmental Solutions & Innovations, Inc.  
4525 Este Ave. Cincinnati, OH 45232  
(Phone: 513-451-1777)

STEP ONE: ☐ DETAILED Evaluation OR ☐ General Assessment of Indiana Bat Habitat

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ Biologists: \_\_\_\_\_  
Project Name: \_\_\_\_\_ Site Name: \_\_\_\_\_  
State: \_\_\_\_\_ County: \_\_\_\_\_ How many Patches? \_\_\_\_\_  
Camera #: \_\_\_\_\_ GPS Unit #: \_\_\_\_\_ Map Unit(s) \_\_\_\_\_

STEP THREE: For EACH PATCH OF HABITAT of the search area delineated, complete this form  
**DRAW & WRITE** on the map on reverse: Show patch numbers, show estimated patch boundaries, show potential roosts, and ALL other pertinent information

1. Patch # _____ Map Unit _____ Estimated Size of Patch _____ Photo #s _____	2. Waypoints & Coordinates that Delineate the Habitat Patch Start: _____ End: _____ 3. Does the patch look like it is supposed to look based on mapping? Y OR N Is forest now gone? _____ Describe: _____
4. Foraging Potential is: <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> None Based on (Circle one): <input type="checkbox"/> Edge: (Woodland <b>OR</b> Stream) <input type="checkbox"/> Opening: (Shrubby-Old field/early succession <b>OR</b> grassy <b>OR</b> bare ground)	5. If <b>FORESTED (MUST complete through Item 12 below DO NOT LEAVE BLANKS):</b> <input type="checkbox"/> Wodland-recently logged AND upland <b>OR</b> bottomland (circle one) <input type="checkbox"/> Wodland-generally less mature AND upland <b>OR</b> bottomland (circle one) <input type="checkbox"/> Wodland-generally more mature AND upland <b>OR</b> bottomland (circle one) <input type="checkbox"/> Woodland generally more mature AND upland <b>OR</b> bottomland (circle one) Woodland: <input type="checkbox"/> Hardwood <input type="checkbox"/> Evergreen <input type="checkbox"/> Mixed CANOPY 5. Avg. DBH _____ Dominated by what DBH size class (0-5, 5-10 etc) _____ 6. Species _____ _____ _____ _____ 7. Canopy closure _____ % 8. Roosting Potential is: <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> None Based on: <input type="checkbox"/> Snags <input type="checkbox"/> Partially Dead Trees <input type="checkbox"/> Large Live Trees <input type="checkbox"/> Other SUBCANOPY 9. Species _____ _____ _____ _____ 10. Dominated By: <input type="checkbox"/> Sapplings <input type="checkbox"/> Shrubs <input type="checkbox"/> Lower Limbs of Canopy Trees 11. Subcanopy is: <input type="checkbox"/> Closed <input type="checkbox"/> Moderate <input type="checkbox"/> Open 12. Clutter is: : <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> None
STEP FOUR: Detailed Patch Description Required: _____ _____ _____	

STEP TWO: Comparison of Project to Surrounding Landscape on this MAP Unit **Required**

HOW DOES PROJECT HABITAT COMPARE TO SURROUNDING LANDSCAPE ON THIS MAP UNIT??  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
See map on reverse: Has anything changed since the map was made? Y or N  
What changed?? \_\_\_\_\_

STEP THREE CONT. : Complete for EACH PATCH OF HABITAT of the search area delineated.  
Use more sheets for more patches

1. Patch # _____ Map Unit _____ Estimated Size of Patch _____ Photo #s _____	2. Waypoints & Coordinates that Delineate the Habitat Patch Start: _____ End: _____ 3. Does the patch look like it is supposed to look based on mapping? Y OR N Is forest now gone? _____ Describe: _____
4. Foraging Potential is: <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> None Based on (Circle one): <input type="checkbox"/> Edge: (Woodland <b>OR</b> Stream) <input type="checkbox"/> Opening: (Shrubby-Old field/early succession <b>OR</b> grassy <b>OR</b> bare ground)	5. If <b>FORESTED (MUST complete through Item 12 below DO NOT LEAVE BLANKS):</b> <input type="checkbox"/> Wodland-recently logged AND upland <b>OR</b> bottomland (circle one) <input type="checkbox"/> Wodland-generally less mature AND upland <b>OR</b> bottomland (circle one) <input type="checkbox"/> Wodland-generally more mature AND upland <b>OR</b> bottomland (circle one) <input type="checkbox"/> Woodland generally more mature AND upland <b>OR</b> bottomland (circle one) Woodland: <input type="checkbox"/> Hardwood <input type="checkbox"/> Evergreen <input type="checkbox"/> Mixed CANOPY 5. Avg. DBH _____ Dominated by what DBH size class (0-5, 5-10 etc) _____ 6. Species _____ _____ _____ _____ 7. Canopy closure _____ % 8. Roosting Potential is: <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> None Based on: <input type="checkbox"/> Snags <input type="checkbox"/> Partially Dead Trees <input type="checkbox"/> Large Live Trees <input type="checkbox"/> Other SUBCANOPY 9. Species _____ _____ _____ _____ 10. Dominated By: <input type="checkbox"/> Sapplings <input type="checkbox"/> Shrubs <input type="checkbox"/> Lower Limbs of Canopy Trees 11. Subcanopy is: <input type="checkbox"/> Closed <input type="checkbox"/> Moderate <input type="checkbox"/> Open 12. Clutter is: : <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> None
STEP FOUR: Detailed Patch Description Required: _____ _____ _____	





## POTENTIAL ROOSTS

Project #: \_\_\_\_\_ Task #: \_\_\_\_\_ Date: \_\_\_\_\_ Project Name: \_\_\_\_\_ Page \_\_\_ of \_\_\_  
Biologist(s): \_\_\_\_\_ GPS Unit: \_\_\_\_\_ Camera : \_\_\_\_\_ County: \_\_\_\_\_

ID	Species	Tree DBH (inches)	Tree Status (L,D,P)	Roost Type (EB,CR, CA)	Roost Potential (H,M,L)	GPS Coordinates			Photo(s)	Comments
						Wpt	Latitude	Longitude		

**Tree Status:** Live (L), Dead (D), Partially Dead (P)

**Roost Type:** Exfoliating Bark (EB), Crevice (CR), Cavity (CA)

**Roost Potential:** High (H), Moderate (M), Low (L)





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Property of: Environmental Solutions & Innovations, Inc.  
4525 Este Avenue. Cincinnati, OH 45232 (Phone: 513-451-1777)**HABITAT ASSESSMENT**

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ State: \_\_\_\_\_ County: \_\_\_\_\_

Project Name: \_\_\_\_\_ Site Name/ #: \_\_\_\_\_ USGS Quad: \_\_\_\_\_

Permitted Biologist: \_\_\_\_\_ (full name) Other Field Staff: \_\_\_\_\_ (full name) State Permit #: \_\_\_\_\_  
Federal Permit #: \_\_\_\_\_

Net/Trap/ Detector	Net/Trap/ Detector #	Latitude	Longitude	Picture #	Waypoint #
		° ' "N	° ' "W		
		° ' "N	° ' "W		
		° ' "N	° ' "W		
		° ' "N	° ' "W		

Distance to closest water source (meters): \_\_\_\_\_ Type of water source: \_\_\_\_\_

Water source name: \_\_\_\_\_

**ESTIMATED WATER SOURCE CHARACTERISTICS (IF UNDER NETS OR DETECTOR):**

Bank Height: \_\_\_\_\_ meters Channel Width: \_\_\_\_\_ meters Stream Width: \_\_\_\_\_ meters

Substratum: \_\_\_\_\_ Bedrock \_\_\_\_\_ Boulder \_\_\_\_\_ Cobble \_\_\_\_\_ Gravel \_\_\_\_\_ Sand \_\_\_\_\_ Silt/Clay

Still Water Present (Y/N): \_\_\_\_\_ Average Water Depth: \_\_\_\_\_ m or cm Clarity (H,M,L): \_\_\_\_\_

**VEGETATION:**

Dominant Canopy Species (&gt; 40 cm/16" dbh)

Subdominant Canopy Species (&lt; 40 cm/16" dbh)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Estimated dbh range: Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Estimated dbh range: Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Relative abundance of dominant vs. subdominant (ratio): \_\_\_\_\_

Estimated canopy closure: \_\_\_\_\_ Closed \_\_\_\_\_ Moderate \_\_\_\_\_ Open

Roost tree potential consists of: \_\_\_\_\_ Large Trees \_\_\_\_\_ Snags \_\_\_\_\_ Neither

Roost tree potential for the area is: \_\_\_\_\_ High \_\_\_\_\_ Moderate \_\_\_\_\_ Low

Roost potential comments: \_\_\_\_\_

Subcanopy clutter: \_\_\_\_\_ Closed \_\_\_\_\_ Moderate \_\_\_\_\_ Open

Subcanopy comprised largely of: \_\_\_\_\_ Lower Branches of Canopy Trees \_\_\_\_\_ Saplings \_\_\_\_\_ Shrubs

Common Subcanopy Species: \_\_\_\_\_  
\_\_\_\_\_Habitat Description: \_\_\_\_\_  
\_\_\_\_\_**Check all that apply:**

\_\_\_\_ Mature Upland Forest \_\_\_\_ Recently Logged Forest \_\_\_\_ Crop/Pasture Land \_\_\_\_ Other \_\_\_\_\_

\_\_\_\_ Young Upland Forest \_\_\_\_ Forest Edge \_\_\_\_ Stream/River \_\_\_\_\_

\_\_\_\_ Mature Lowland Forest \_\_\_\_ Woodlot \_\_\_\_ Vernal Pool \_\_\_\_\_

\_\_\_\_ Young Lowland Forest \_\_\_\_ Old Field \_\_\_\_ Deepwater Lake/Pond \_\_\_\_\_

Herbaceous Cover: \_\_\_\_ Sparse \_\_\_\_ Moderate \_\_\_\_ Dense







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## HABITAT ASSESSMENT (continued)

<b>Project #:</b>	<b>State/County:</b>	<b>Site Name/#:</b>	<b>Initials:</b>
<b>SKETCH NETS and/or DETECTORS</b>			
<div style="text-align: center;"><p>N</p></div>			
<b>LEGEND</b>		<b>COMMENTS</b>	
<b>Net:</b> ● — ●		<hr/> <hr/> <hr/> <hr/> <hr/>	
<b>Detector:</b> 			



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## BAT CAPTURE DATA

**Project #:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Project Name:**\_\_\_\_\_ **Site Name/#:**\_\_\_\_\_

**State:** \_\_\_\_\_ **County:** \_\_\_\_\_

GPS Unit #: \_\_\_\_\_ Camera #: \_\_\_\_\_

Permitted Biologist: \_\_\_\_\_ (full name)      Other Field Staff: \_\_\_\_\_ (full name)

State Permit #: \_\_\_\_\_ Federal Permit #: \_\_\_\_\_

## WEATHER DATA

[illegible]

Net/Trap/ Detector	Net/Trap/ Detector #	Latitude	Longitude	Length (m)	Height (m)	Time Up (xxxx h)	Time Down (xxxx h)	Picture #	Waypoint #
		° ' "N	° ' "W						
		° ' "N	° ' "W						
		° ' "N	° ' "W						
		° ' "N	° ' "W						

**Net Placement/Site Description:** \_\_\_\_\_

[illegible]<sup>1</sup> Reproductive Condition: Female = NR/PG/L/PL; Male = ↑/↓ \* Refer to table on the back









## ROW HABITAT EXCLUSION (Linear Corridor Study)

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ Biologists: \_\_\_\_\_

Project Name: \_\_\_\_\_ Picture #: \_\_\_\_\_

State: \_\_\_\_\_ County: \_\_\_\_\_ USGS Quad: \_\_\_\_\_

### Location of Excluded Section:

#### Eastern Terminus

Approximate Milepost: \_\_\_\_\_ and/or Landmark: \_\_\_\_\_

Latitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"N Longitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"W

#### Western Terminus

Approximate Milepost: \_\_\_\_\_ and/or Landmark: \_\_\_\_\_

Latitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"N Longitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"W

Approximate Length: \_\_\_\_\_

### Reasons for Exclusion:

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### Habitat Types: (Check all that apply)

<input type="checkbox"/> Industrial / Commercial	<input type="checkbox"/> Recent Clearcut	<input type="checkbox"/> Open Agriculture
<input type="checkbox"/> Residential	<input type="checkbox"/> Saplings only	<input type="checkbox"/> Meadow
<input type="checkbox"/> Open Water / Lake	<input type="checkbox"/> Scrub / Shrub	<input type="checkbox"/> Mowed Grass
<input type="checkbox"/> Large River	<input type="checkbox"/> Trees unsuitable as roosts	<input type="checkbox"/> Other _____

Estimated tree dbh range: Lg: \_\_\_\_\_ Sm: \_\_\_\_\_ Stream Present: ☐ No ☐ Yes

Roost Tree Potential: ☐ None ☐ Poor ☐ Moderate

Travel Corridor: ☐ No ☐ Yes IF YES, THEN ☐ Riparian ☐ Upland





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## BAT TRANSMITTER DATA

**Project #:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Site Name/#:** \_\_\_\_\_  
**Project Name:** \_\_\_\_\_ **Camera #:** \_\_\_\_\_  
**State:** \_\_\_\_\_ **County:** \_\_\_\_\_ **Picture #:** \_\_\_\_\_  
**Bat Species:** \_\_\_\_\_ **Capture Time:** \_\_\_\_\_  
**Permitted Biologist:** \_\_\_\_\_ **Other Field Staff:** \_\_\_\_\_  
(full name) (full name)  
**State Permit #:** \_\_\_\_\_ **Federal Permit #:** \_\_\_\_\_

Age Ad or Jv	Sex M or F	Reproductive Condition F=(NR/PG/L/PL; M=↑/↓	Wt (g)	RFA (mm)

Transmitter weight = \_\_\_\_\_ grams      Frequency number: \_\_\_\_\_  
Transmitter + bat total weight = \_\_\_\_\_ grams      Band/color number: \_\_\_\_\_

### FINAL CHECK:

- 1) Transmitter attachment (Y/N): \_\_\_\_\_
- 2) Signal receiving (frequency): \_\_\_\_\_
- 3) Band attachment (Y/N): \_\_\_\_\_
- 4) Condition of animal: \_\_\_\_\_
- 5) Description of release: \_\_\_\_\_

**RELEASE TIME:** \_\_\_\_\_ **TOTAL HOLD TIME:** \_\_\_\_\_ minutes

**RELEASE LOCATION:** \_\_\_\_\_

### COMMENTS:

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## MOBILE TELEMETRY DATA (continued)

**Project #:**\_\_\_\_\_ **Date:**\_\_\_\_\_ **State :**\_\_\_\_\_ **County:**\_\_\_\_\_ **Initials:**\_\_\_\_\_

[illegible]





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**ROOST TREE DATA**

Project #: \_\_\_\_\_ Project Name: \_\_\_\_\_ Date: \_\_\_\_\_ State: \_\_\_\_\_ County: \_\_\_\_\_

GPS Unit #: \_\_\_\_\_ Waypoint: \_\_\_\_\_ Camera #: \_\_\_\_\_ Picture #: \_\_\_\_\_

Permitted Biologist: \_\_\_\_\_ (full name) Other Field Staff: \_\_\_\_\_ (full name) State Permit #: \_\_\_\_\_

Federal Permit #: \_\_\_\_\_

Latitude: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "N Longitude: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "W

Bat Species: \_\_\_\_\_ Sex(M/F): \_\_\_\_\_ Age(Ad/Jv): \_\_\_\_\_ Repro.: \_\_\_\_\_

Capture Date: \_\_\_\_\_ Capture Site: \_\_\_\_\_

Frequency: \_\_\_\_\_ Roost Name/#: \_\_\_\_\_

**ROOST TREE DATA**

Roost tree species: \_\_\_\_\_ dbh: \_\_\_\_\_ cm

Estimated height from ground to roost: \_\_\_\_\_ (meters) Tree height \_\_\_\_\_ (meters)

Exfoliating bark (%): \_\_\_\_\_ Distance from capture site: \_\_\_\_\_ m or km (circle one)

Tree health: \_\_\_\_\_ Live \_\_\_\_\_ Dead \_\_\_\_\_ Partial

Observed roost potential: \_\_\_\_\_ Exfoliating Bark \_\_\_\_\_ Cracks/crevasses \_\_\_\_\_ Hollow \_\_\_\_\_ Unknown

Bat vocalizations: \_\_\_\_\_ Yes \_\_\_\_\_ No

Guano on ground/foilage: \_\_\_\_\_ Yes \_\_\_\_\_ No

Is guano fresh (if present)?: \_\_\_\_\_ Yes \_\_\_\_\_ No

Guano volume (if present): \_\_\_\_\_

**DESCRIPTION OF SURROUNDING HABITAT**

Dominant Canopy Species (&gt; 40 cm/16" dbh)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Subdominant Canopy Species (&lt; 40 cm/16" dbh)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Estimated dbh range (cm): Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Estimated dbh range (cm): Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Estimated canopy closure at roost: \_\_\_\_\_ %

Slope: \_\_\_\_\_ Steep \_\_\_\_\_ Moderate \_\_\_\_\_ Slight \_\_\_\_\_ None Slope aspect: \_\_\_\_\_

Subcanopy Clutter: \_\_\_\_\_ Closed \_\_\_\_\_ Moderate \_\_\_\_\_ Open

Distance to nearest water source: \_\_\_\_\_ m or km (circle one) Distance to nearest flight corridor: \_\_\_\_\_ meters

Habitat Description: \_\_\_\_\_

**Check all that apply:**

<input type="checkbox"/> Mature Upland Forest	<input type="checkbox"/> Recently Logged Forest	<input type="checkbox"/> Crop/Pasture Land	<input type="checkbox"/> Shrub/scrub Swamp
<input type="checkbox"/> Young Upland Forest	<input type="checkbox"/> Pine Plantation	<input type="checkbox"/> Stream/River	<input type="checkbox"/> Vernal Pool
<input type="checkbox"/> Mature Lowland Forest	<input type="checkbox"/> Woodlot/ForestEdge	<input type="checkbox"/> Emergent Wetland	<input type="checkbox"/> Deepwater Lake/Pond
<input type="checkbox"/> Young Lowland Forest	<input type="checkbox"/> Old Field	<input type="checkbox"/> Forested Swamp	<input type="checkbox"/> Other _____

Comments: \_\_\_\_\_





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## ROOST TREE DATA (continued)

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State/County: \_\_\_\_\_

Project Name/ #: \_\_\_\_\_

Date: \_\_\_\_\_

Frequency: \_\_\_\_\_

Roost Name/ #: \_\_\_\_\_

Initials: \_\_\_\_\_

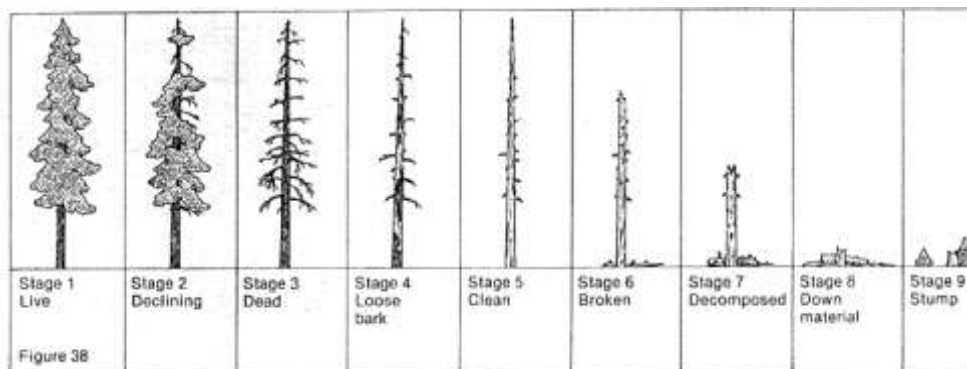
### Sketch: Roost Tree Habitat



Comments: \_\_\_\_\_

Sketch: Roost Tree

### Stages of Decay:







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**ROOST TREE EMERGENCE DATA****Project #:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **State:** \_\_\_\_\_ **County:** \_\_\_\_\_**Project Name:** \_\_\_\_\_ **GPS Unit #:** \_\_\_\_\_ **Waypoint:** \_\_\_\_\_**Permitted Biologist:** \_\_\_\_\_ (full name) **Other Field Staff:** \_\_\_\_\_ (full name) **State Permit #:** \_\_\_\_\_**Federal Permit #:** \_\_\_\_\_**Latitude:** \_\_\_\_° \_\_\_\_' \_\_\_\_"N **Longitude:** \_\_\_\_° \_\_\_\_' \_\_\_\_"W**Roost Name/#:** \_\_\_\_\_**Radio-tagged bat present in tree: Yes** \_\_\_\_ **No** \_\_\_\_

Complete the following information only if a radio-tagged bat is present in the roost

**Bat species:** \_\_\_\_\_ **Sex(M/F):** \_\_\_\_ **Age(Ad/Jv):** \_\_\_\_ **Repro:** \_\_\_\_\_**Capture date:** \_\_\_\_\_ **Capture site:** \_\_\_\_\_ **Frequency:** \_\_\_\_\_**NOTE:** Tallies of bat exits should be made at 2-minute intervals. Use the back lighting of the setting sun to help distinguish bats as silhouettes against the sky as they exit the roost. Please ensure that you are close enough to the roost to observe all exiting bats, but not close enough to influence emergence (do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights).**Arrival time:** \_\_\_\_\_ **Departure time:** \_\_\_\_\_ **Total bats:** \_\_\_\_\_

Emergence Time	Number of Bats	Emergence Aspect

Describe emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. What time did the transmitter bat(s) emerge? What direction did the transmitter bat fly?

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**Project name:** \_\_\_\_\_

**Roost #:** \_\_\_\_\_

[illegible]