TETRA TECH

March 18, 2015

Ms. Susan Pierce
Director/Deputy SHPO
West Virginia Division of Culture and History
1900 Kanawha Boulevard East
Charleston, West Virginia 25305

Subject: Mountain Valley Pipeline Project
Request for Review and Comment under Section 106 of NHPA
Work Plan Amendment 1

Dear Ms. Pierce,

On behalf of Mountain Valley Pipeline, LLC, a joint venture of EQT Corporation and a subsidiary of NextEra Energy, Inc., Tetra Tech requests your review under Section 106 of the National Historic Preservation Act (NHPA), 1966, as amended, of the attached Mountain Valley Pipeline Project, Archaeology and Historic Architecture, West Virginia Work Plan, Amendment 1. This attachment represents an amendment to the work plan originally presented in October, 2014 and approved by your office on November 21, 2014.

As presented in the October 2014 work plan, Tetra Tech proposed to perform LIDAR slope analysis of the West Virginia portion of the Mountain Valley Pipeline direct effects Area of Potential Effects (APE). We wish to amend the work plan so that it reflects how the LIDAR data will be used during the Phase I field investigation. We have attached a sample of the resulting slope analysis maps for Lewis and Harrison counties (Attachment A). The full complement of maps would be included in the Phase I report. If you prefer to see the slope analysis for all of the counties in the APE, we can send them to you for review as they become available.

Tetra Tech requests that you review the attached *AMENDMENT 1 to the CULTURAL RESOURCES WORK PLAN for The Mountain Valley Pipeline Project, WV*, and provide your written concurrence.

Very truly yours,

James T Marine

James T. Marine, RPA
Cultural Resources Lead
Tetra Tech Inc., Pittsburgh PA: Direct: 484-680-9997
james.marine@tetratech.com

Enclosure: Work Plan Amendment 1
Attachment A – LIDAR-based Slope Analysis

cc: S Sparks (Tetra Tech) (no attachments)
M Neylon (EQT) (no attachments)
R Estabrook (NEER) (no attachments)
L Hesch (NEER) (no attachments)
L Lamarre-DeMott (e-mail with attachment)

TETRA TECH

MOUNTAIN VALLEY PIPELINE PROJECT

Counties of Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Webster, and Wetzel, West Virginia

AMENDMENT 1:
to the

CULTURAL RESOURCES WORK PLAN

for

WEST VIRGINIA

FR # 15-67-MULTI

Prepared for

Mountain Valley PIPELINE LLC

March 2015

1.0 Introduction

Mountain Valley Pipeline, LLC (MVP) is a joint venture of EQT Corporation and a subsidiary of NextEra Energy, Inc. MVP proposes to construct a natural gas pipeline (the Project) that would extend from the existing Equitrans transmission system in Wetzel County, West Virginia to Transcontinental Gas Pipeline Company's Zone 5 compressor station 165 in Pittsylvania County, Virginia. The Project will be approximately 300 miles, of which 188.5 miles will be located in West Virginia. The Project will include the construction of four new compressor stations along the pipeline route. Staging areas for construction equipment will be sited along the Project corridor, although at the current stage of design no specific locations have been selected.

In the October 2014 work plan for the Mountain Valley Pipeline Project Phase I Archaeology Survey, approved by the West Virginia Division of Culture and History (WVDCH) office November 21, 2014, Tetra Tech agreed to submit the results of a slope analysis based on LIDAR data. The slope analysis would serve as the basis for accurately identifying areas sloped greater than 20 percent, which would be evaluated by surface inspection during pedestrian survey but excluded from subsurface testing.

2.0 Amendment to Archaeology Survey Design

As indicated in the October 2014 work plan, Tetra Tech intends to use slope analysis based on LIDAR (elevation) data as a tool for directing fieldwork during Phase I survey. LIDAR, which stands for Light Detection and Ranging, is a remote sensing technology that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. These light pulses, combined with other data recorded by the airborne system, generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. As stated in the original Work Plan (Section 2.1- Archaeological Sensitivity in Project APE):

> *Archaeological sensitivity is described as the relative potential for specific locations or generalized landform types to contain archaeological resources, mediated by the presence of key environmental factors (e.g., water sources, well-drained soils, natural resources) or built-environment infrastructure (e.g., roads, railroads, and canals). Reliable estimates of archaeological sensitivity, or potential, are essential for the implementation of effective*

and meaningful survey strategies. After a review of WVDCH site files, Tetra Tech will synthesize site location data along with slope data and distance-to-water measurements within the Project APE to develop a sensitivity model. Detailed LIDAR information, as available, would provide a basis for slope analysis and development of an archaeological sensitivity model that would accurately identify areas sloped in excess of 20 percent, which would be excluded from subsurface testing. This model will be presented to the WVDCH for review and comment when it has been fully developed.

Based on Tetra Tech's regional field experience, review of the topographic mapping, and the linear nature of the direct effects Area of Potential Effects (APE), Tetra Tech has determined that a LIDAR-based slope analysis is essentially equivalent to an archaeological sensitivity model based on key environmental factors (e.g., water sources, well-drained soils, natural resources) or built-environment infrastructure (e.g., roads, railroads, and canals). The portions of the APE sloped less than or equal to 20 percent were found to be primarily composed of ridgetops, structural benches and floodplains that would be considered high probability areas under any sensitivity modeling scenario.

The equivalence of a stand-alone LIDAR-based slope analysis with an archaeological sensitivity model based on key environmental factors can be understood when it is considered how those key environmental factors are manifested. The two primary site predictors in an archaeological sensitivity model are slope and distance to water (Altschul, 1988). In the highly dissected terrain typical traversed by the 300-ft direct effects APE, the slope factor correlates directly with the distance to high order perennial streams and their adjacent alluvial landforms. Other sources of potable water, seeps and springs, originate at the geologic contact between sedimentary rocks that occur in steeply sloped areas where the contact is exposed by the agents of chemical and physical weathering. This water can be conveniently collected from the base of the slope or from anywhere along the slope where the slope comfortably allows it. These areas usually coincide with floodplains at the base of a slope, or structural benches that are flatter and thus accurately represented in the LIDAR analysis.

The flatter portions of long linear ridge crests were more effective as transportation routes than the meandering stream valleys. In terms of historic archaeological potential, and dictated by the engineering capabilities of the early historic settler, natural features of the landscape such as floodplains, structural benches and ridge crests were used by necessity (Spencer 2010). The remains of more formal engineering endeavors (the built-environment or infrastructure) are easily identifiable by visual inspection during the Phase I field survey. The LIDAR analysis accurately identifies these flatter areas of floodplains, structural benches, ridge crests, and infrastructure.

Other environmental factors typically used in archaeological sensitivity models include well drained soils and the proximity to procurable natural resources, be they floral, faunal, or lithic.

Soils developed on slopes greater than 20 percent are classified as Inceptisols. Inceptisols are prone to erosion and are less likely to contain *in-situ* archaeological deposits regardless of their drainage classification (USDA 1999). Fauna would have been drawn to the flatter alluvial terraces and wetlands that served as resource procurement areas for the prehistoric and historic inhabitants of the region. These flatter areas are accurately identified in the LIDAR analysis. Cultural features that typically occur in precipitous terrain such as rock shelters and outcroppings of usable lithic material would be identified in the pedestrian survey and the use of the LIDAR model to focus the subsurface testing would not diminish the probability of identifying these resources.

The LIDAR analysis presented in Attachment A was constructed using source data obtained from a flyover of the APE performed by Chesapeake Bay Helicopters. The slope analysis was computed using the 3D Analyst Slope and Reclassify geoprocessing tools in ArcGIS 10.1. The collected data consists of elevation point-data at 5-ft horizontal intervals across a 1500-ft swath along the Project centerline.

Attachment A shows the areas sloped less than or equal to 20 percent shaded in blue, which would require subsurface archaeological testing. The remaining unshaded portions of the APE, sloped greater than 20 percent, would not require subsurface testing. The location of previously recorded archaeological and architectural sites/surveys are also depicted as a GIS layer in the mapping. Although previously recorded resources are scarce within 1-mile of the APE, the mapping, as expected, shows a strong correlation between the distribution of sites and slope.

To summarize, Tetra Tech will conduct pedestrian survey across the entire direct APE, only excluding areas that are inaccessible due to safety considerations. Should inaccessible areas be encountered, their location will be photo-documented. Subsurface testing, however, would only occur in the areas sloped less than or equal to 20 percent as identified in the LIDAR-based slope analysis. Photo-documentation of non-testable areas sloped greater than 20 percent would not take place unless an archaeological or architectural resource was identified in the pedestrian survey, or the area was not safely accessible.

Tetra Tech would implement this methodology by providing the field crews with GPS polygon data that would be used to navigate to each of the areas sloped less than or equal to 20 percent to conduct subsurface testing. The GPS data collected will be post processed to achieve sub-meter accuracy.

3.0 References Cited

Altshcul, Jeffery H

1988 Models and the Modeling Process. In *Quantifying the Present and Predicting the Past: Theory Method and Application of Archaeological Predictive Modeling,* edited by W. James Judge and Lynn Sebastian pp. 61-96. U.S. Department of the Interior, Bureau of Land Management, Denver.

Spencer, Darla S

2010 Indian Trails. e-WV: The West Virginia Encyclopedia. Electronic Document Accessed 16 March 2015.

USDA

1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

ATTACHMENT A

LIDAR-BASED SLOPE ANALYSIS

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 3 miles

0 2.5 5 10 Miles

Mountain Valley PIPELINE

Attachment A
LiDAR Slope Analysis Overview
Harrison and Lewis Counties, WV

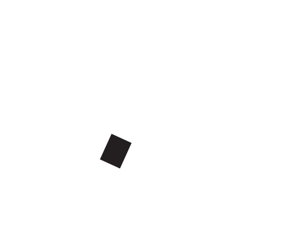
March 2015

Data Sources: ESRI Streaming Data 2015, ESRI 2014.

Legend

Map Sheet

County Boundary



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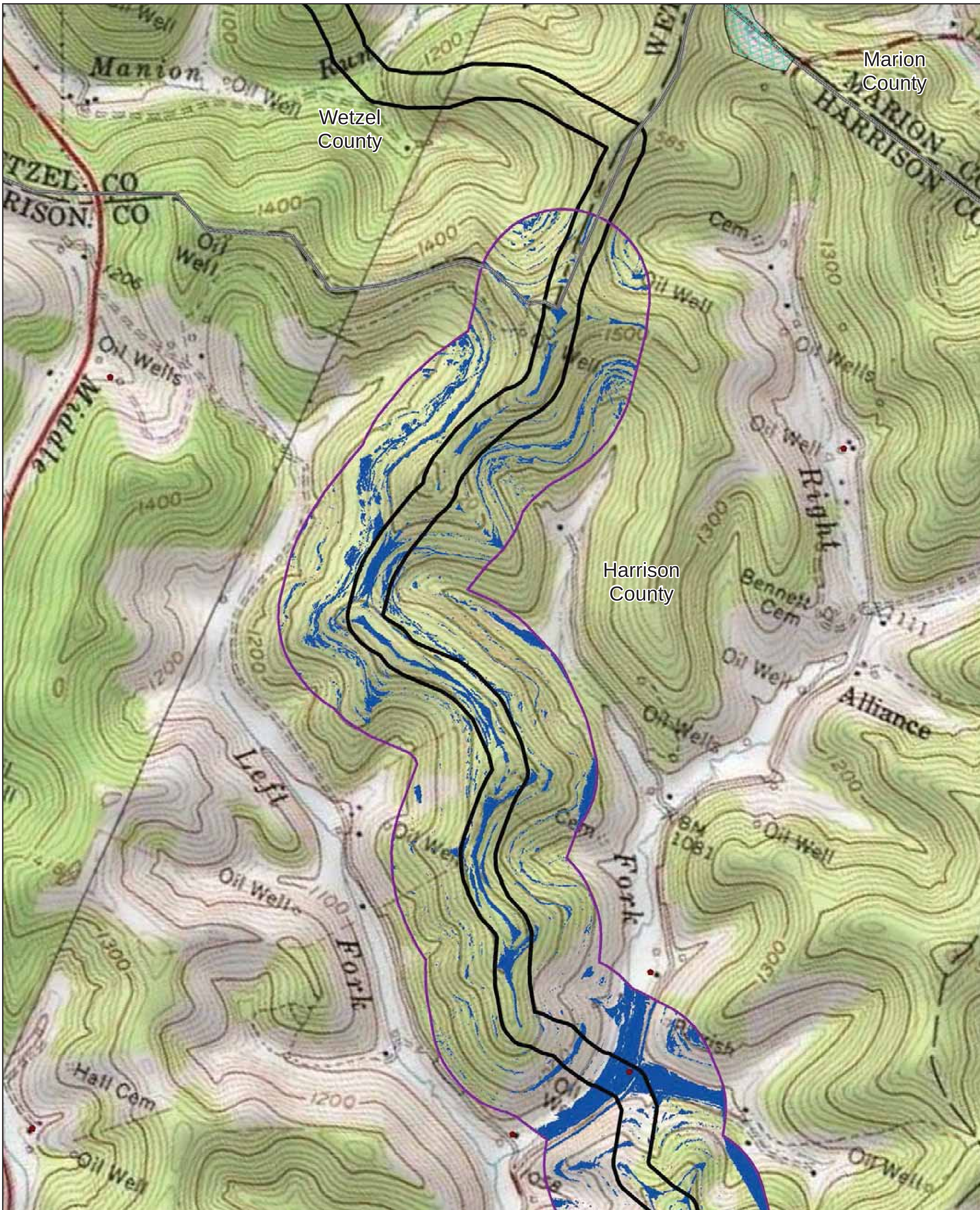


Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

Page 1 of 26
Harrison County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

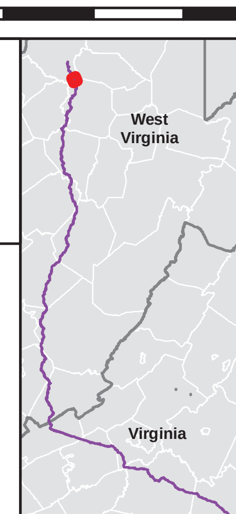
Legend

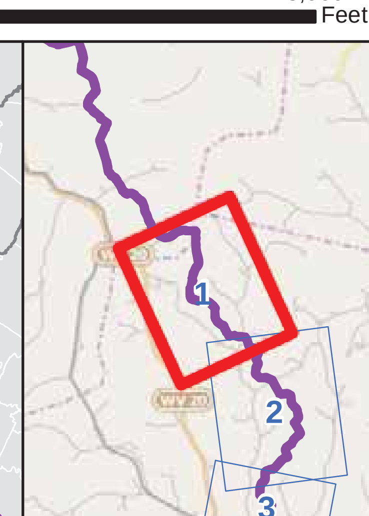
- Architecture
- Archaeological Survey
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data





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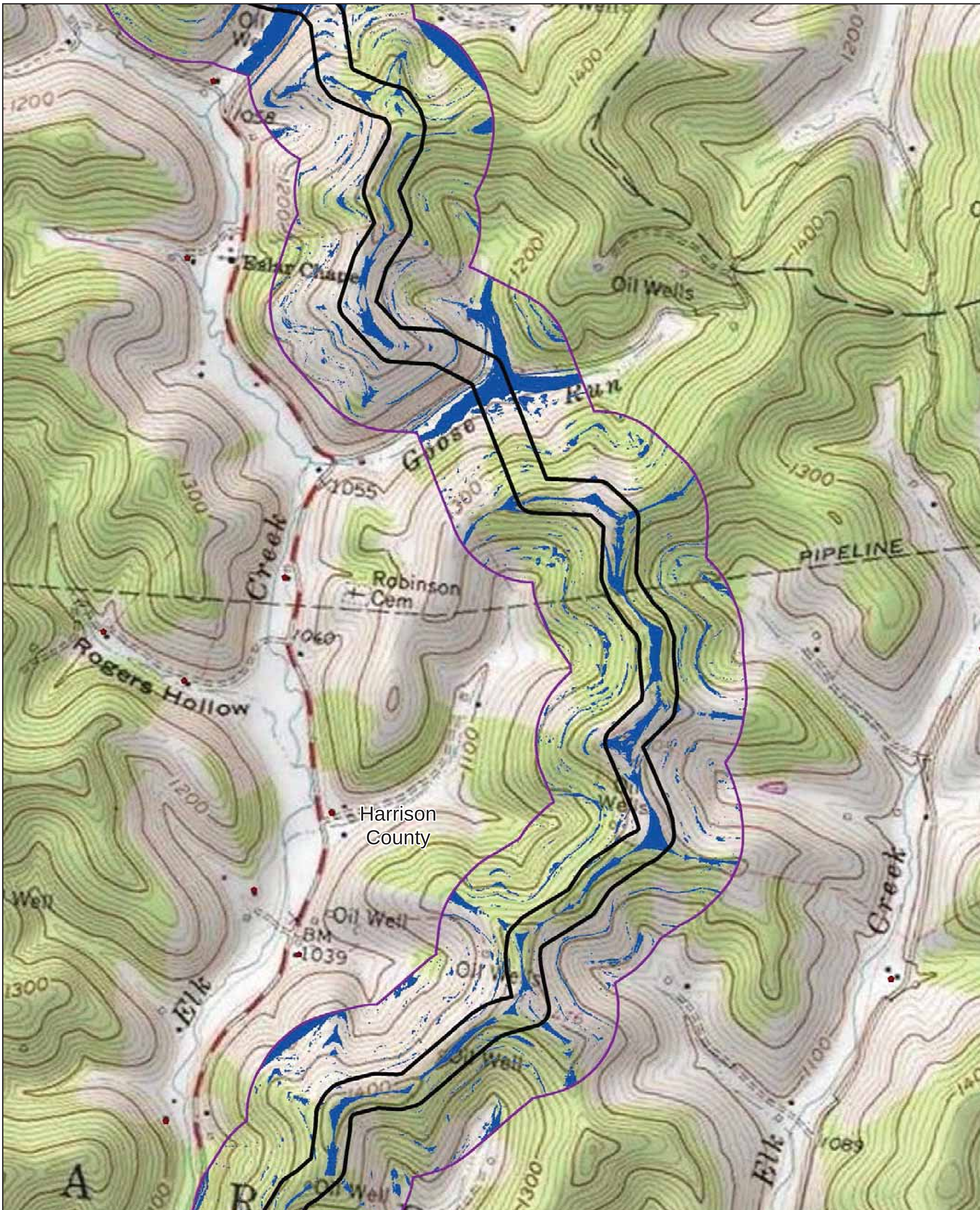

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

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Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Harrison County

March 2015

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Legend

- Architecture
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

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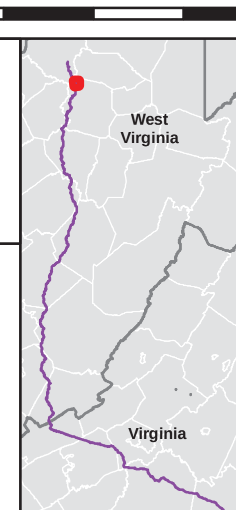

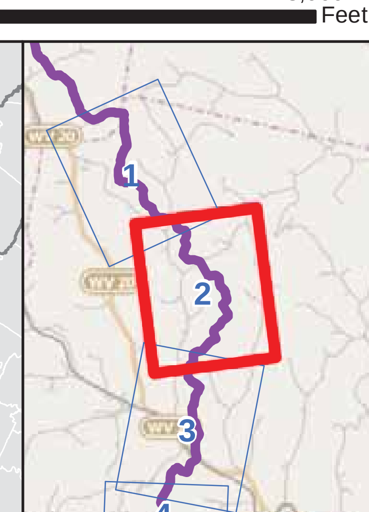

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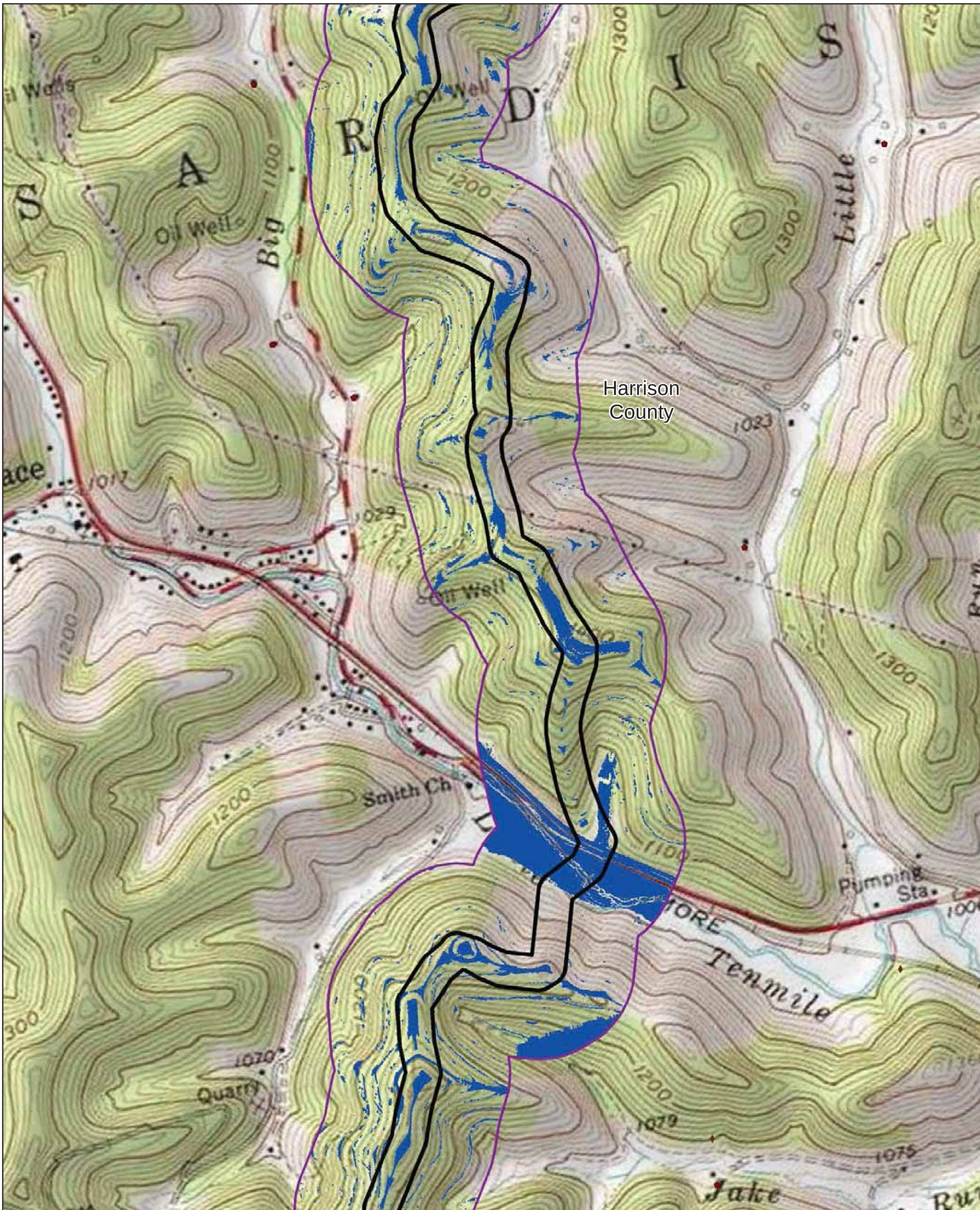

Mountain Valley Pipeline Project

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Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Harrison County

March 2015

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Legend

- Archaeological Site
- Architecture
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

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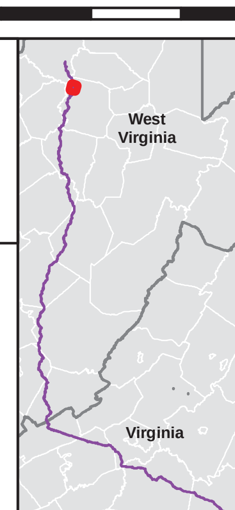

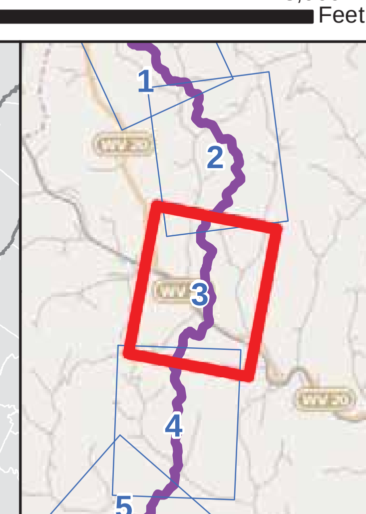

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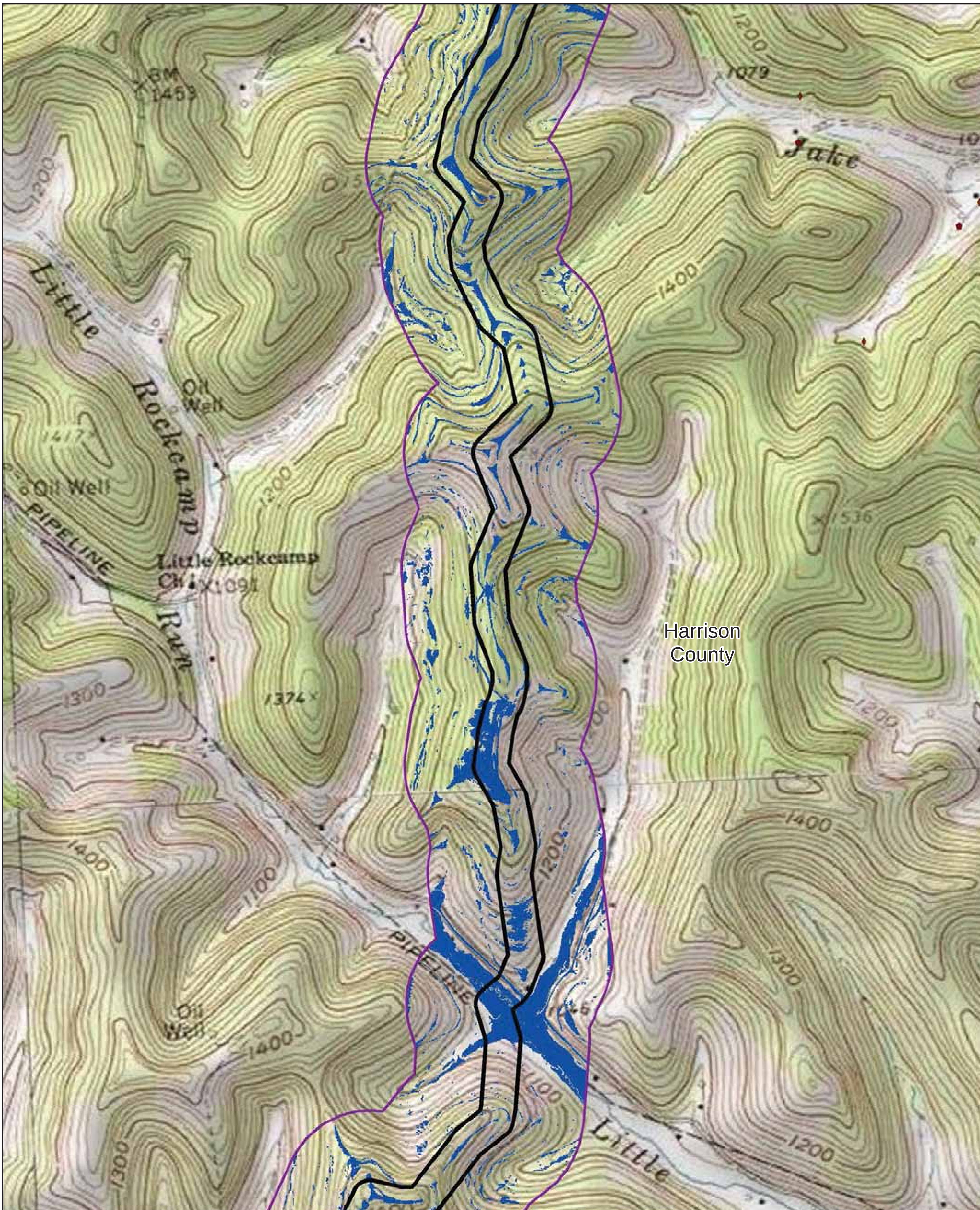

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Mountain Valley PIPELINE

Attachment A
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Harrison and Lewis Counties, WV

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Harrison County

March 2015

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Legend

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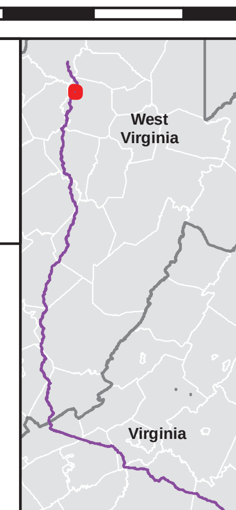

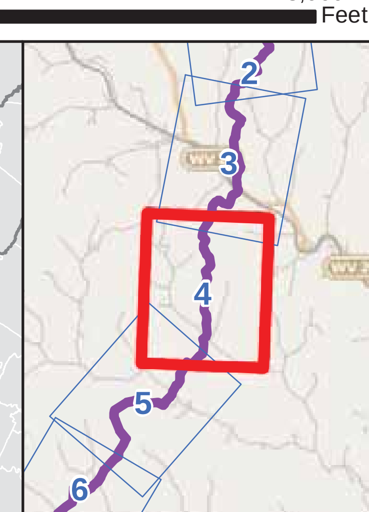

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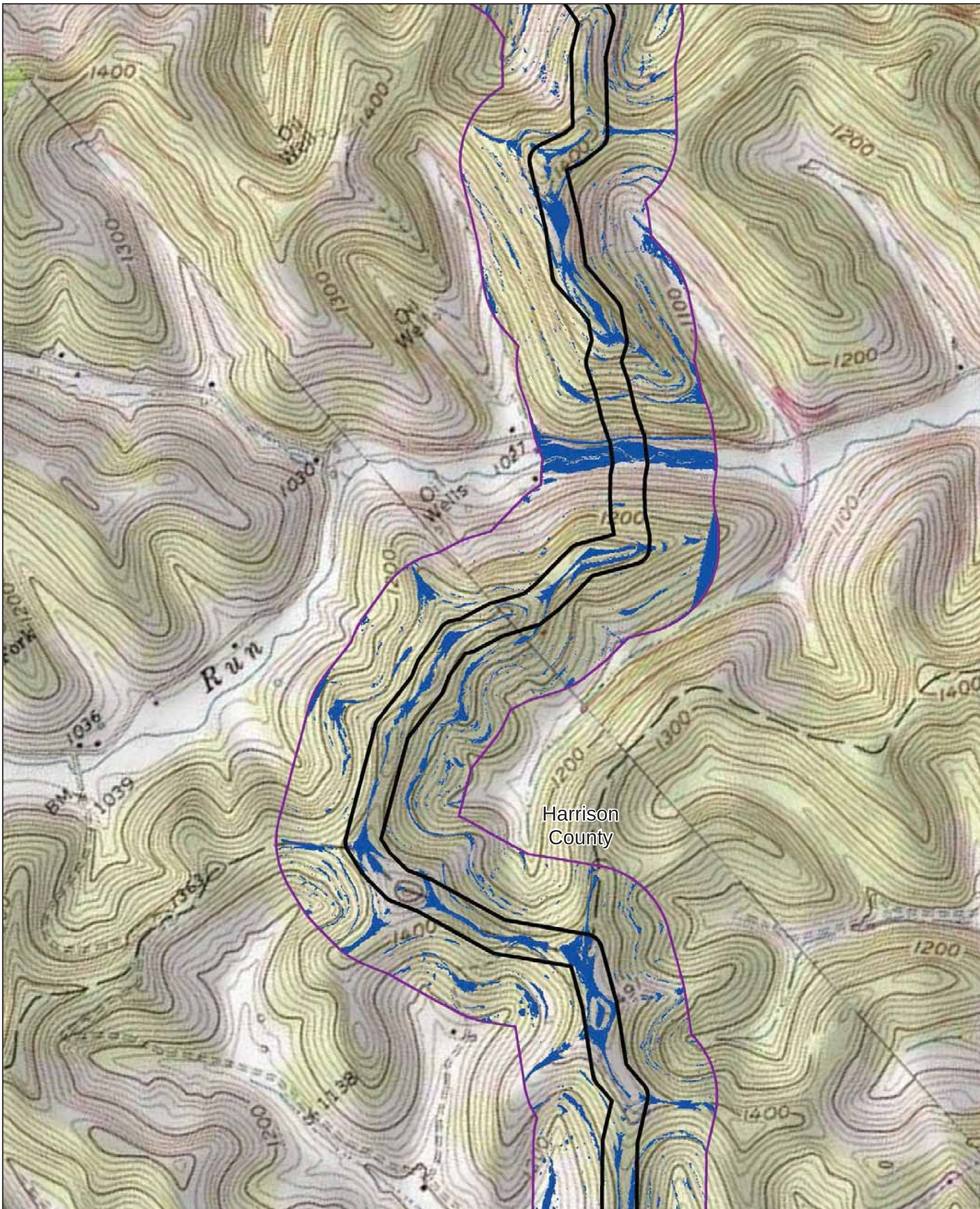

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Attachment A
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Harrison and Lewis Counties, WV

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Harrison County

March 2015

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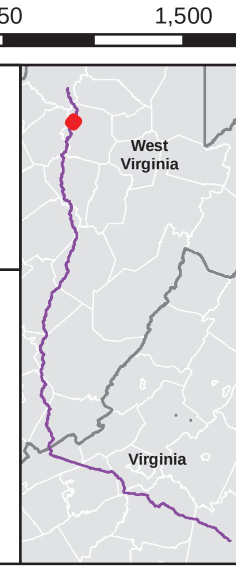

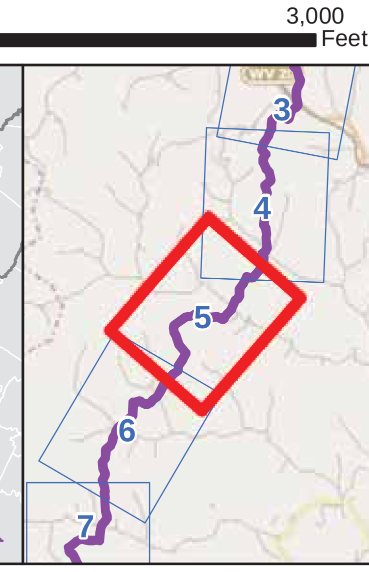

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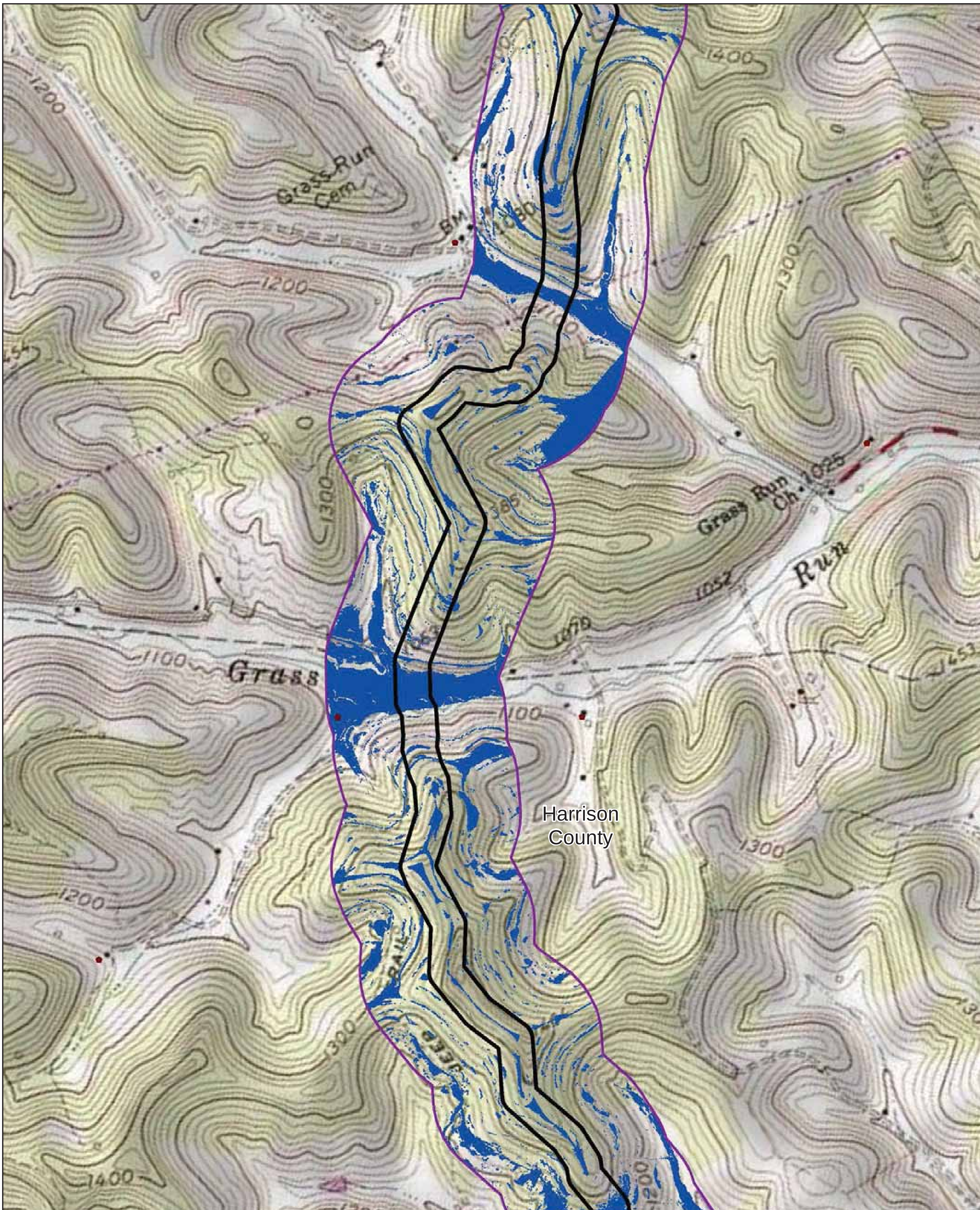

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Attachment A
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Harrison and Lewis Counties, WV

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Harrison County

March 2015

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Legend

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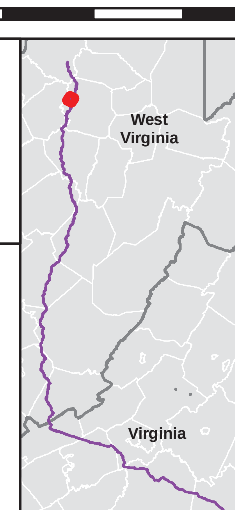

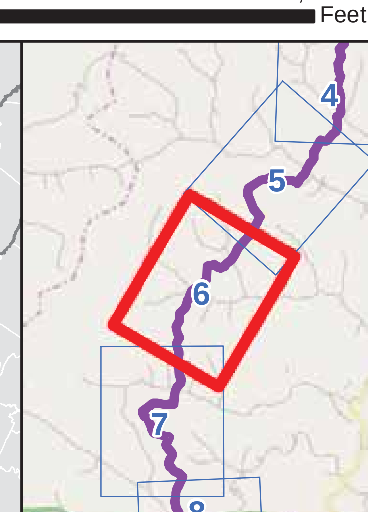

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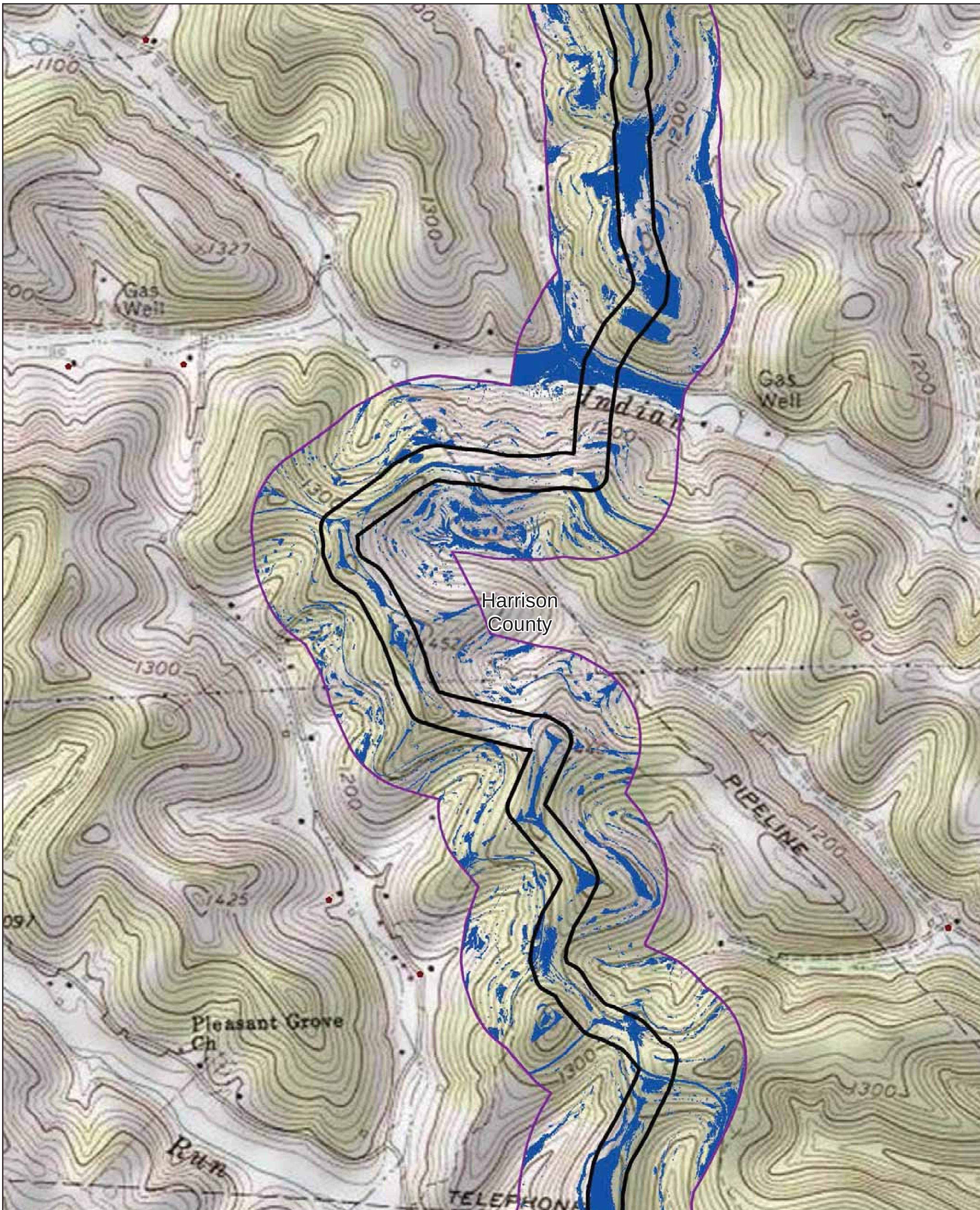

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Mountain Valley PIPELINE

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Harrison and Lewis Counties, WV

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Harrison County

March 2015

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Legend

- Architecture
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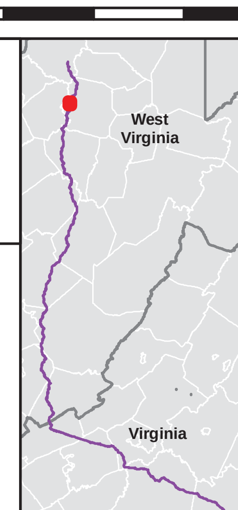

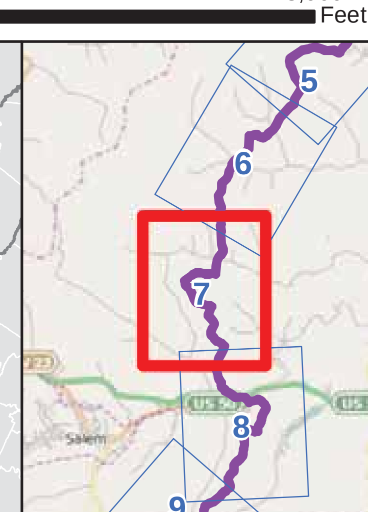

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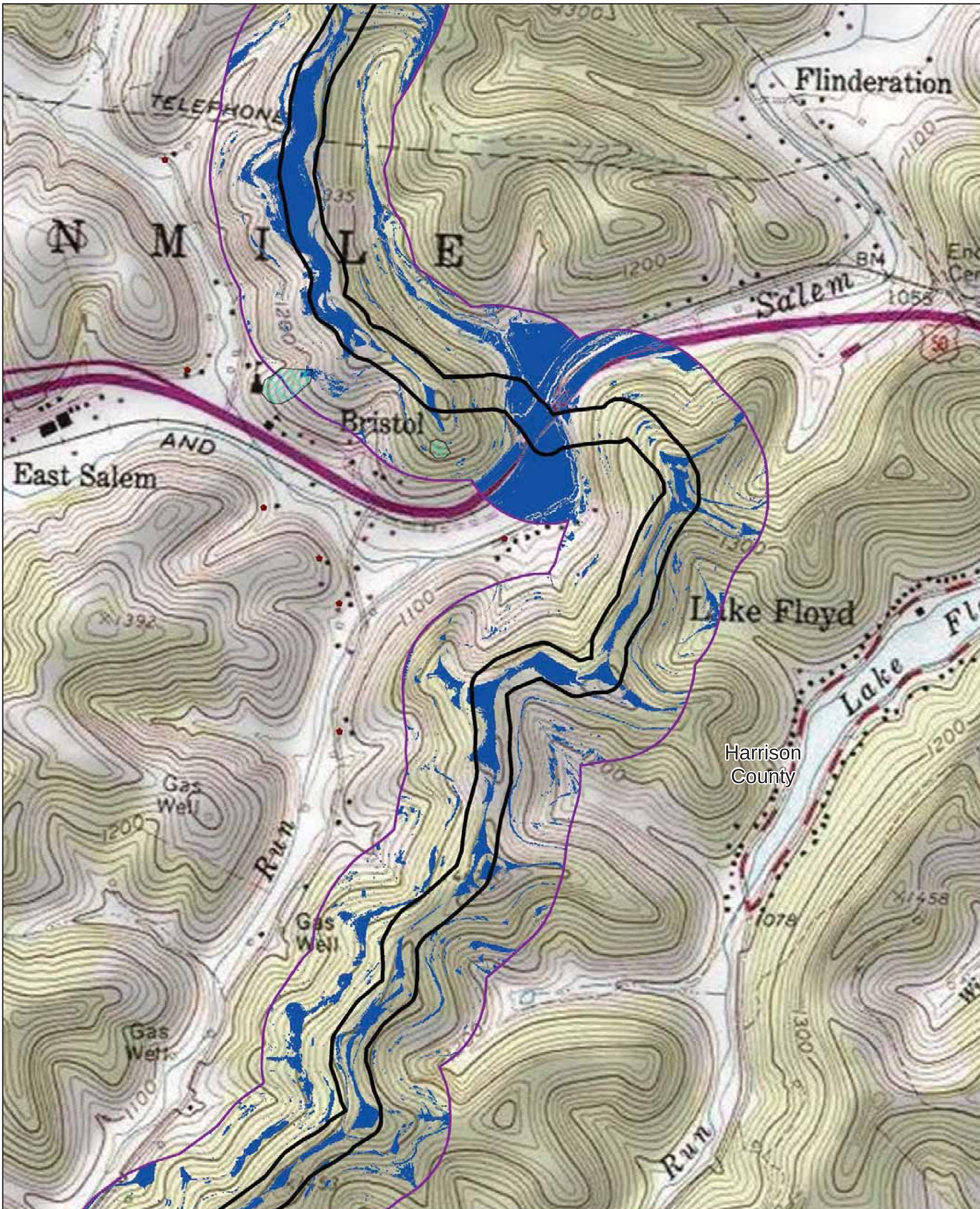

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Mountain Valley PIPELINE

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Harrison and Lewis Counties, WV

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Harrison County

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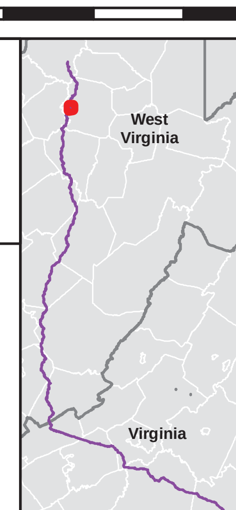

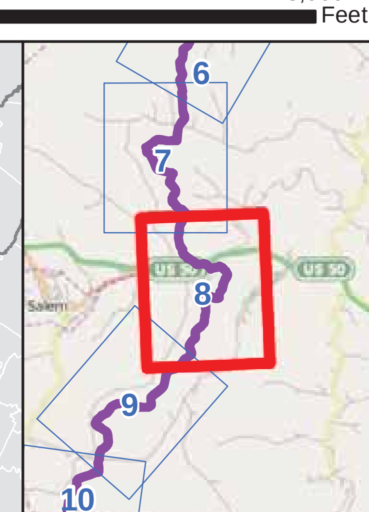

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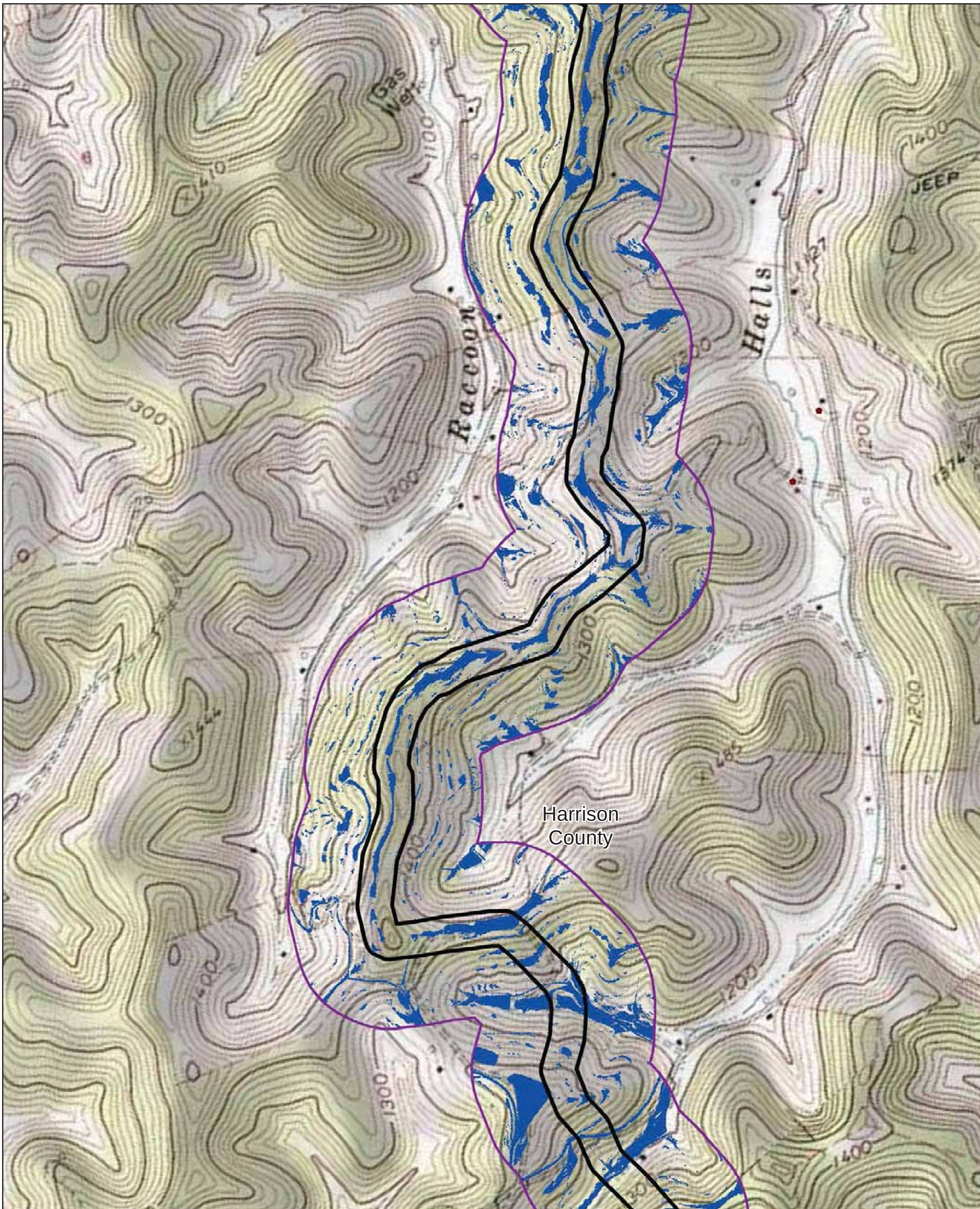

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

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Mountain Valley PIPELINE

Attachment A
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Harrison and Lewis Counties, WV

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Harrison County

March 2015

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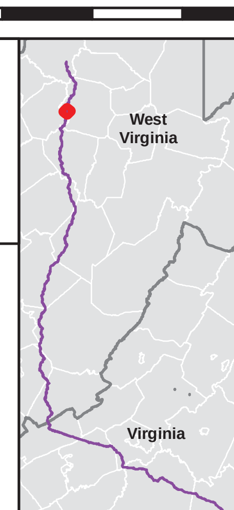

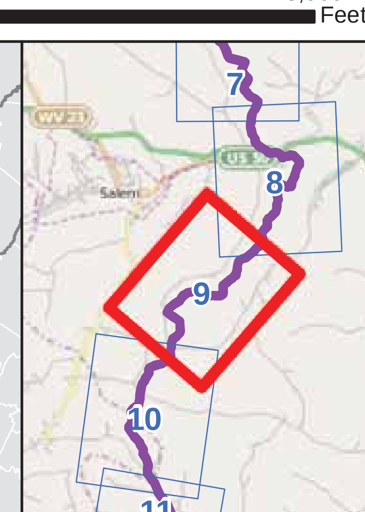

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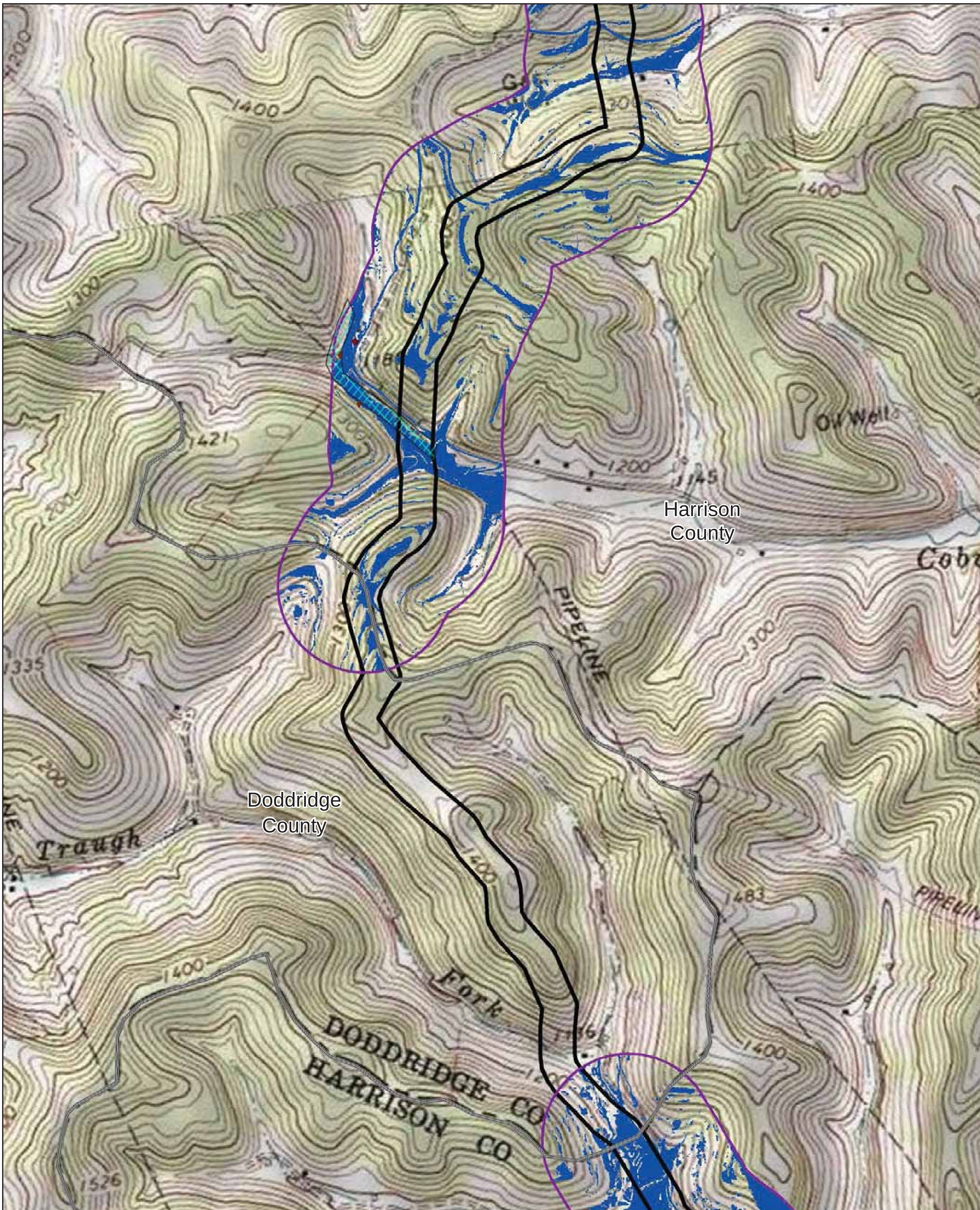

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Harrison County

March 2015

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- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data

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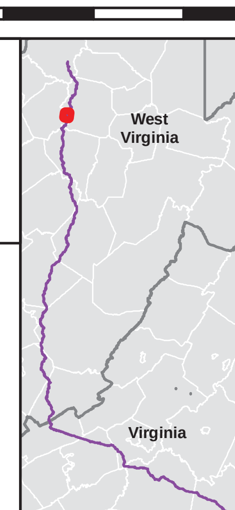

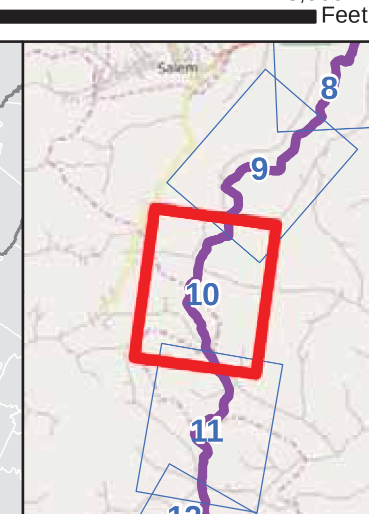

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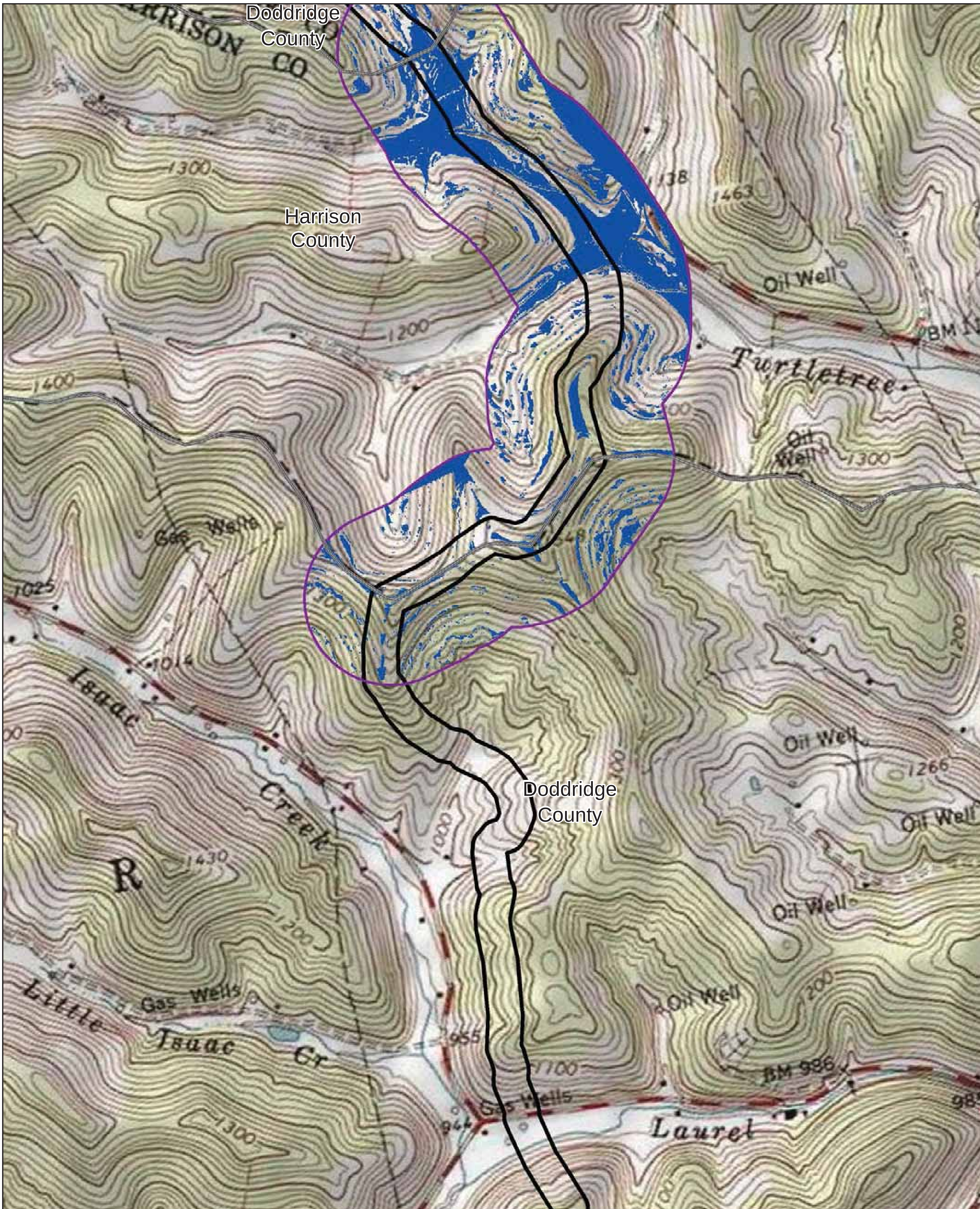

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Harrison County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

Architecture

County Boundary

Limits of LIDAR Data

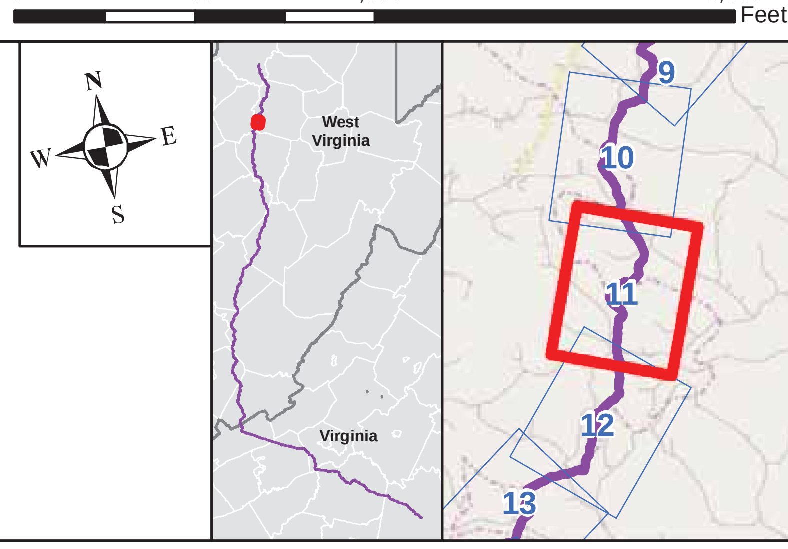
300' Direct Area of Potential Effects

Slope*

Less than or equal to 20%

Greater than 20%

*5 foot resolution LiDAR data



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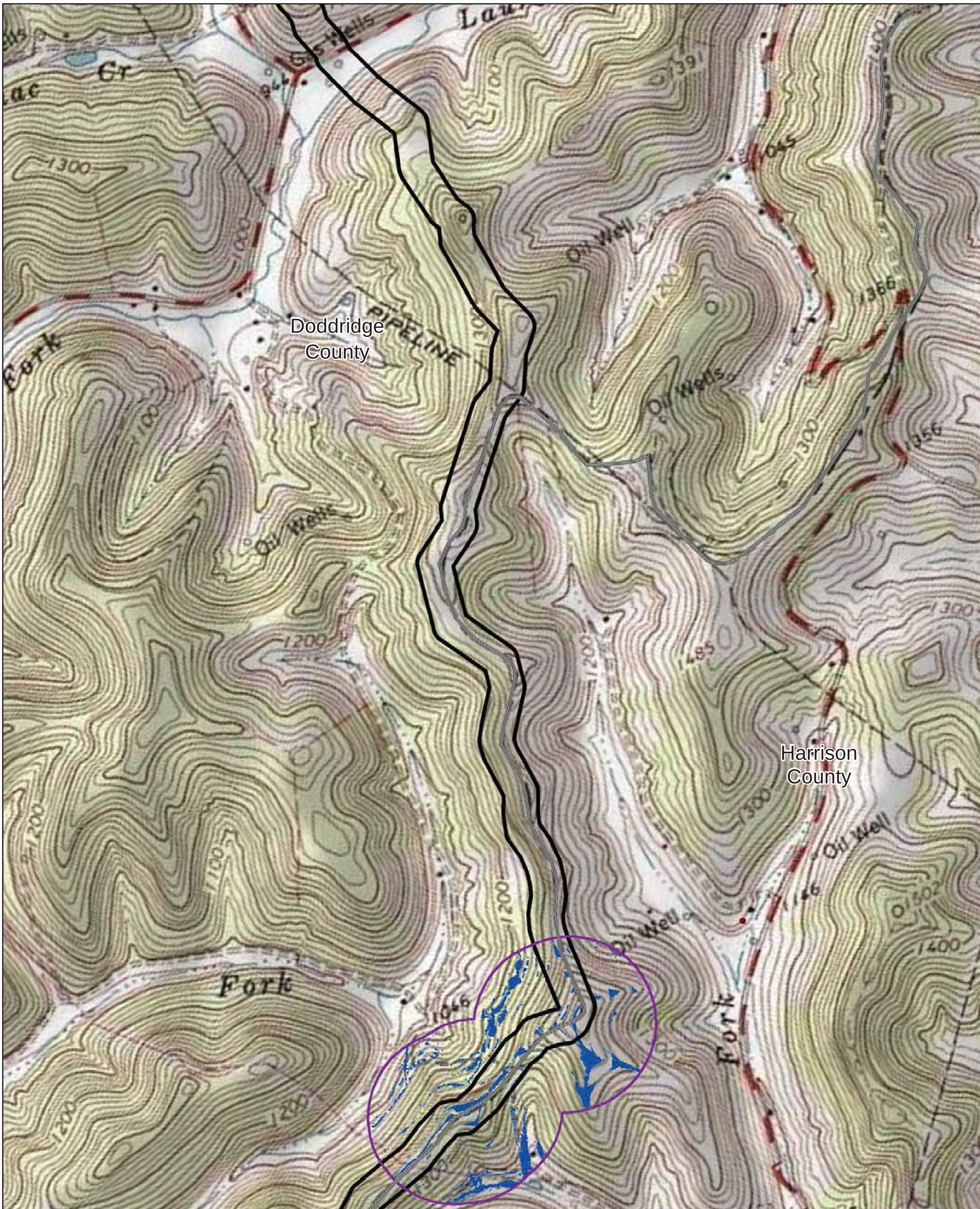

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Harrison County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

Architecture

County Boundary

Limits of LIDAR Data

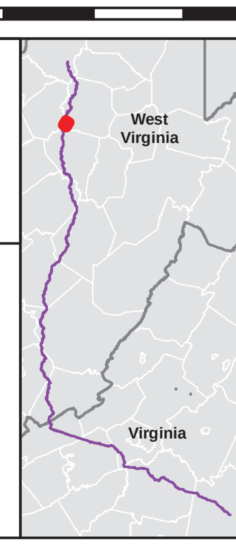
300' Direct Area of Potential Effects

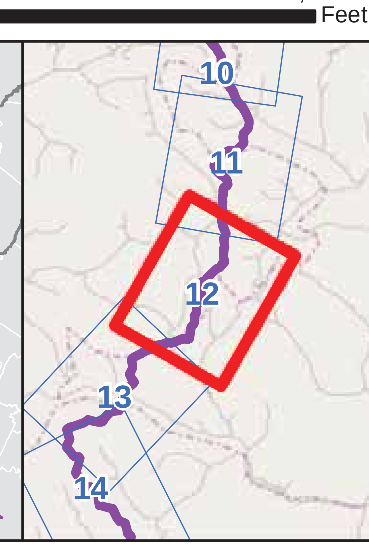
Slope*

Less than or equal to 20%

Greater than 20%

*5 foot resolution LiDAR data





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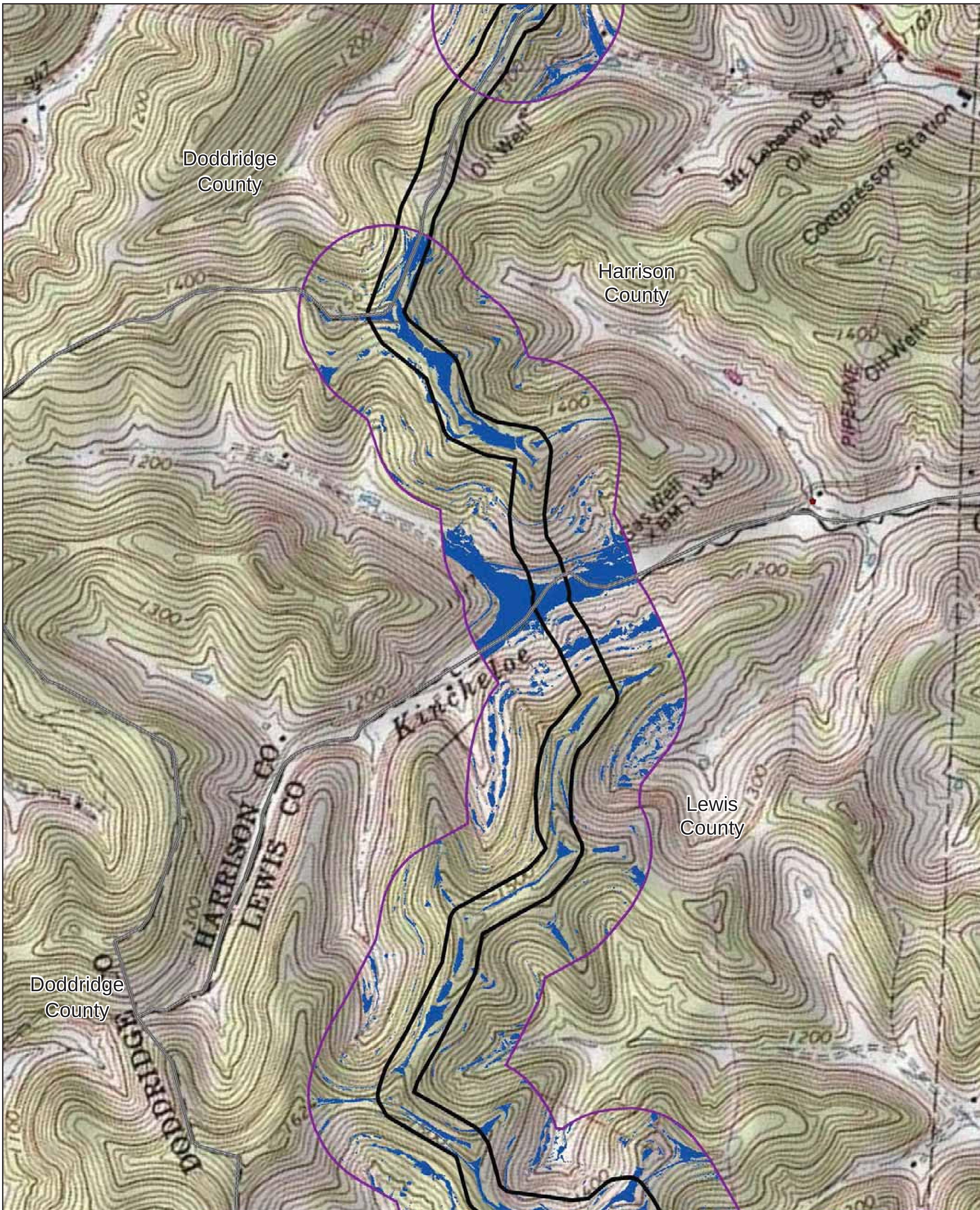

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Harrison, Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

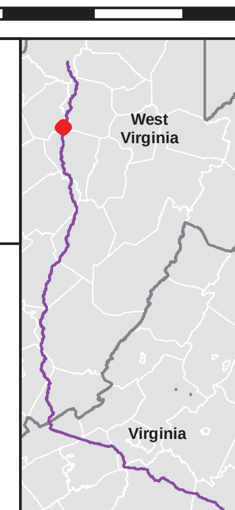
Legend

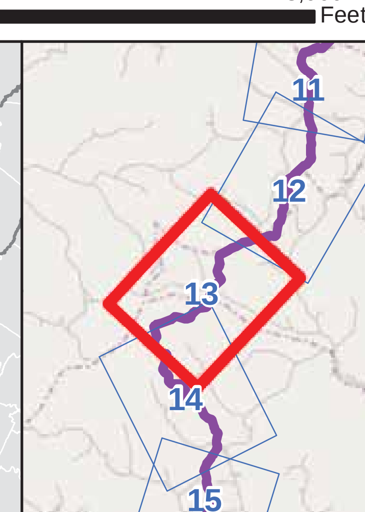
- Architecture
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data





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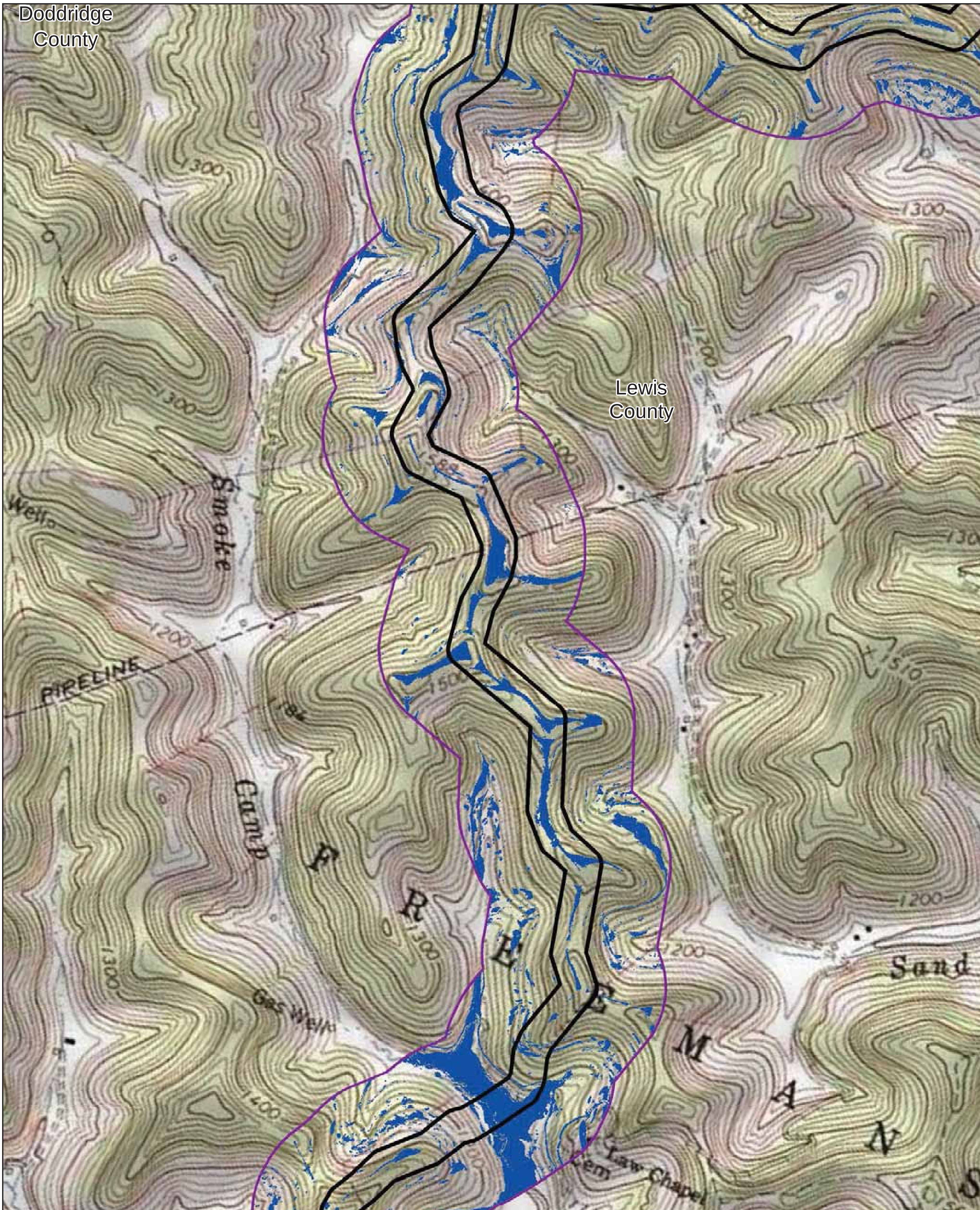

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

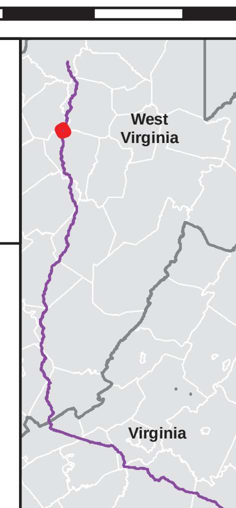
Legend

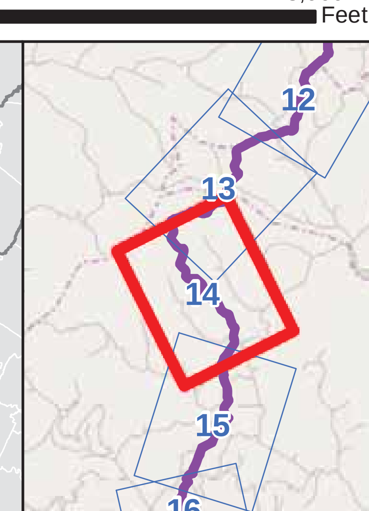
County Boundary
Limits of LIDAR Data
300' Direct Area of Potential Effects

Slope*

Less than or equal to 20%
Greater than 20%

*5 foot resolution LiDAR data





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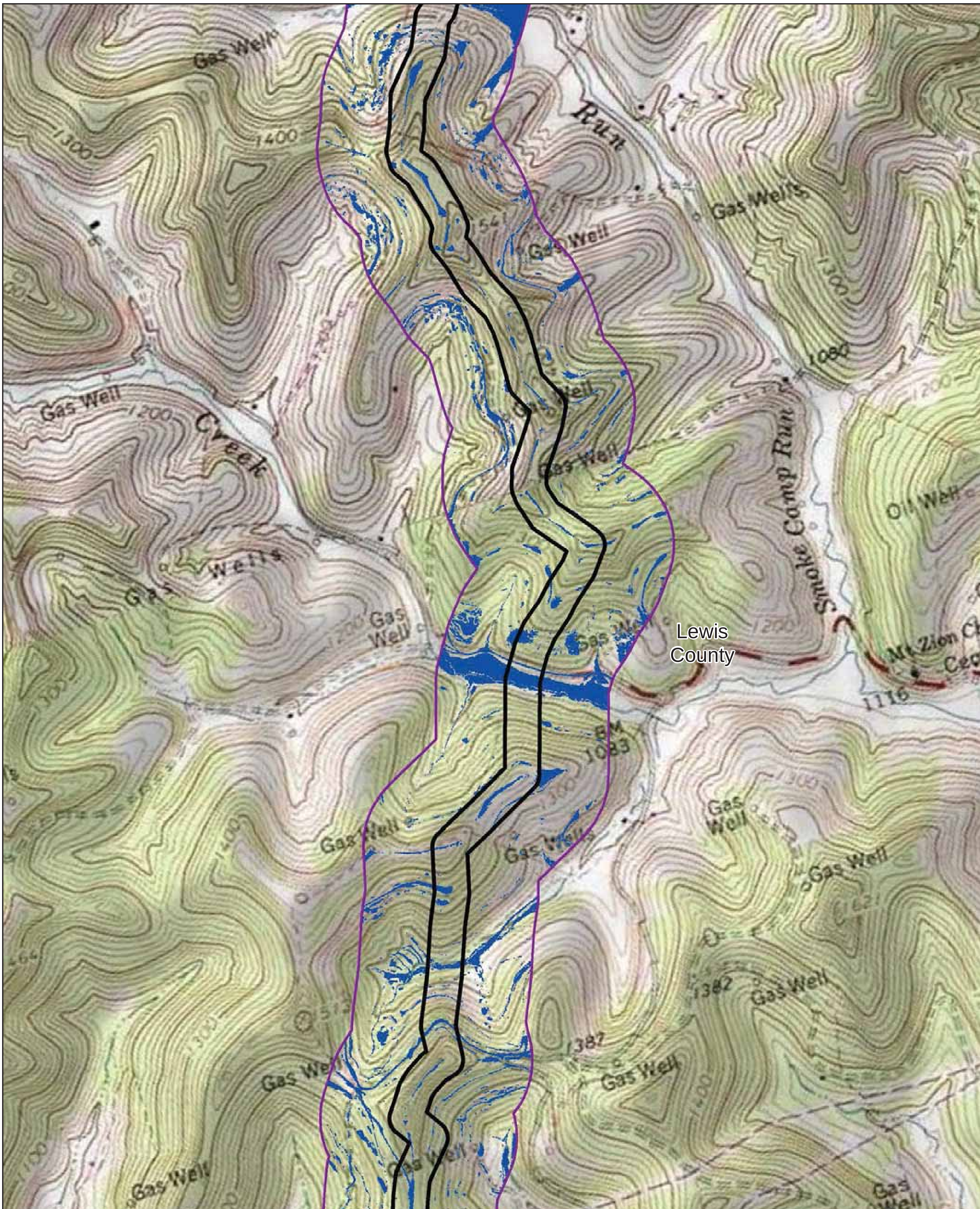

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data

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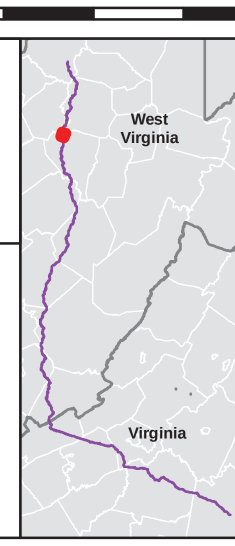

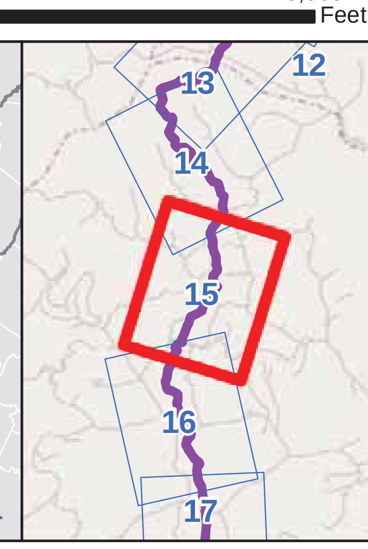

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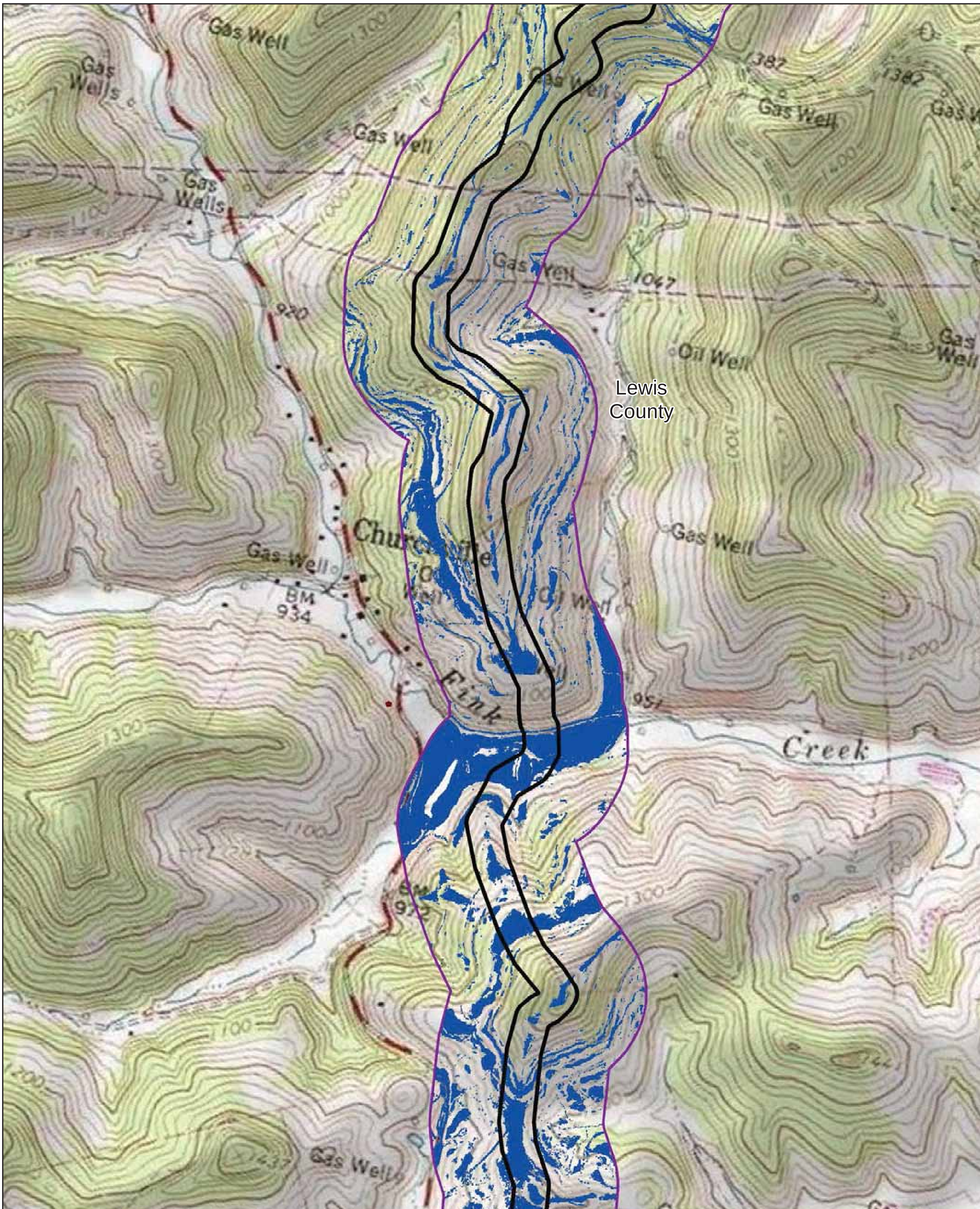

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 | 750 | 1,500 | 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- Architecture
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data

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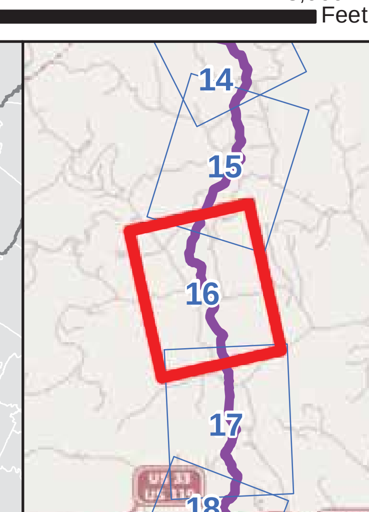

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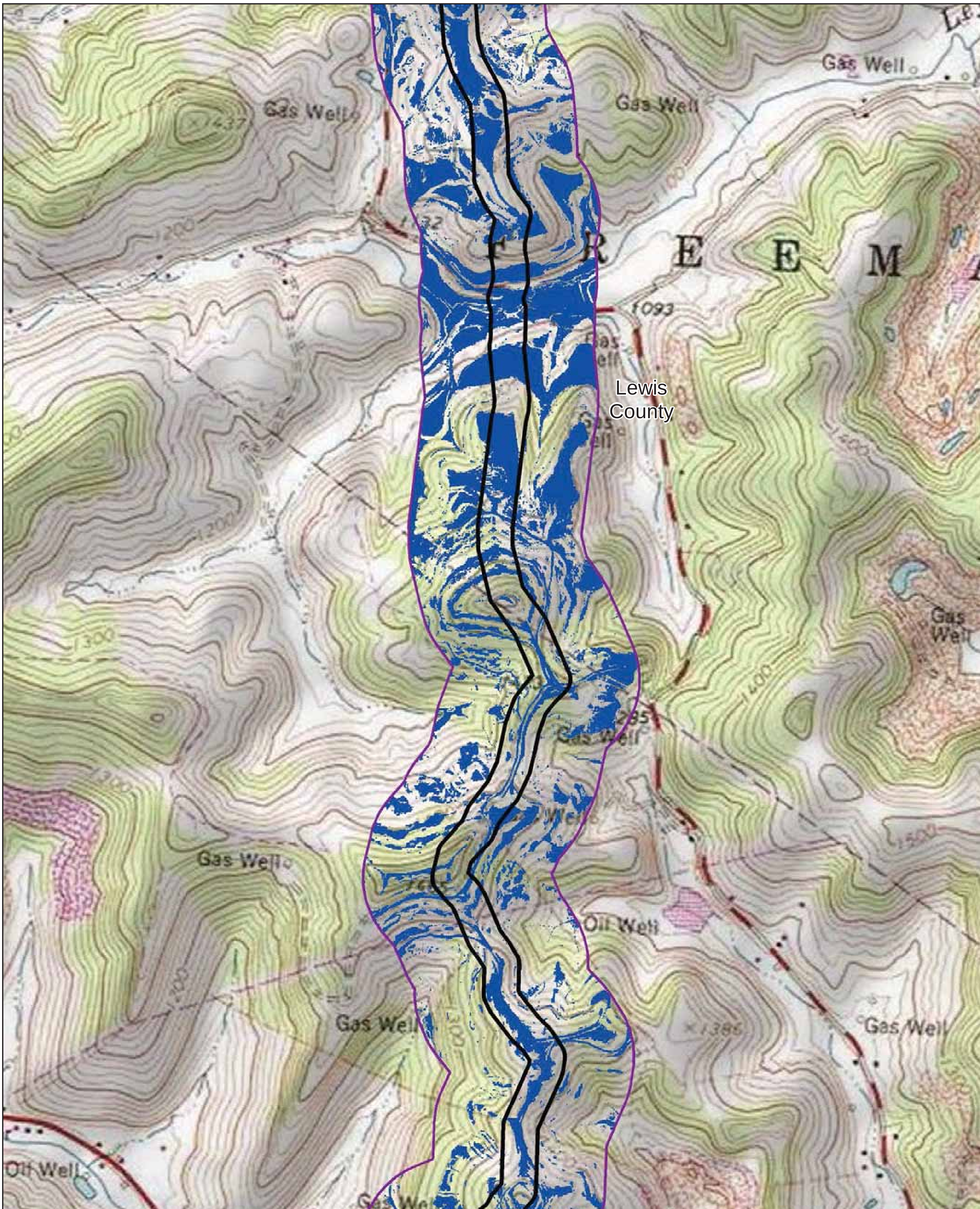

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data

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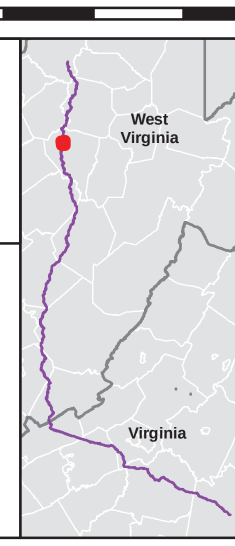

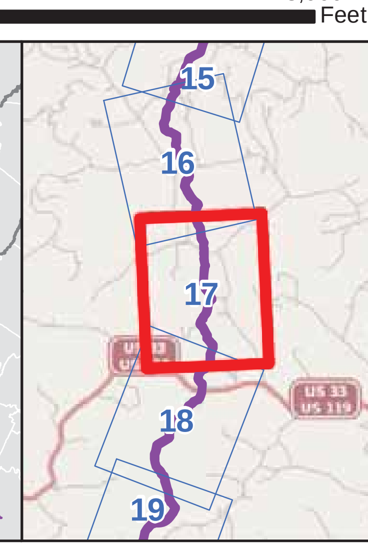

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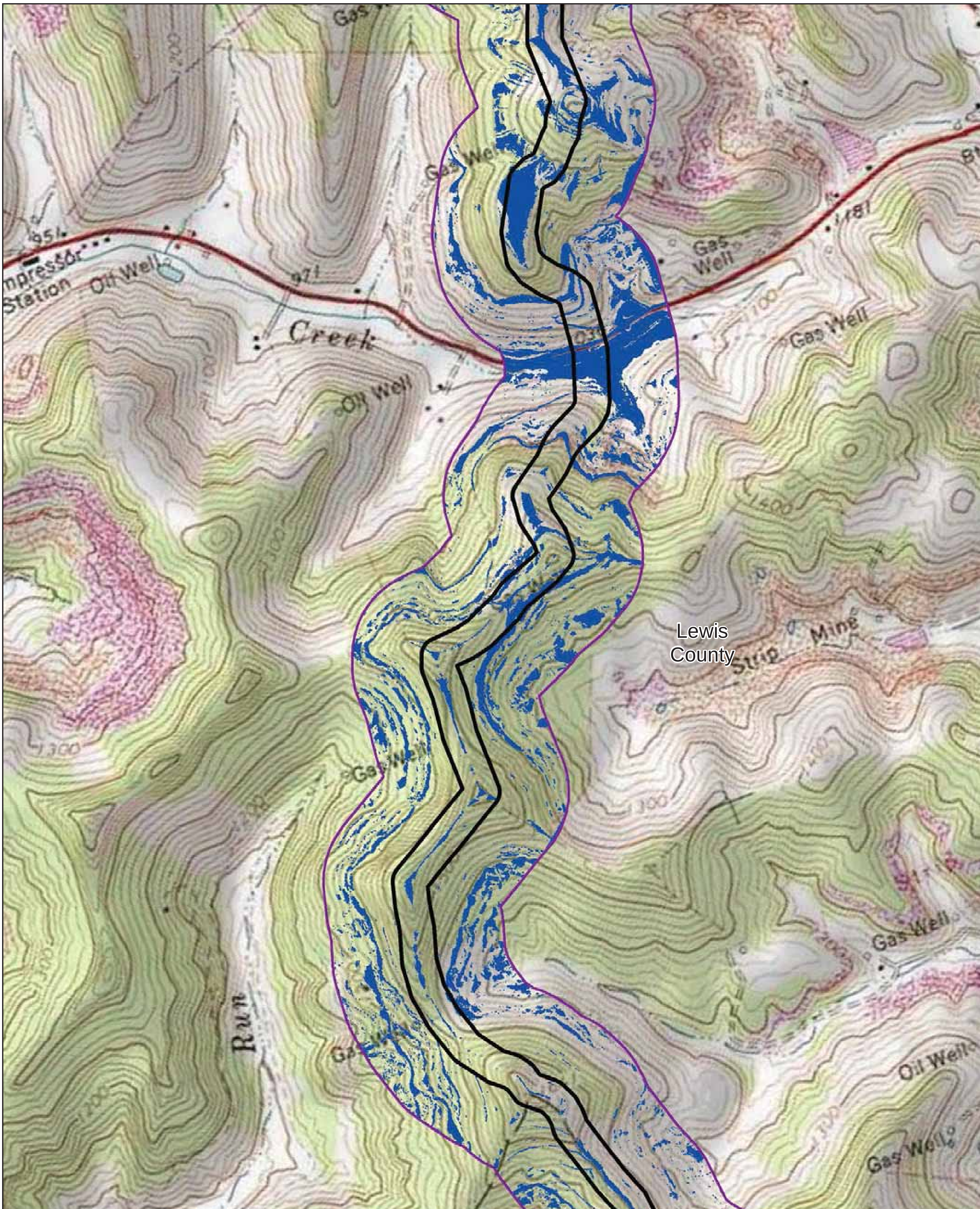

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

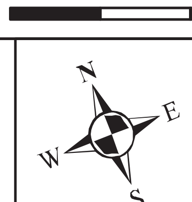
Legend

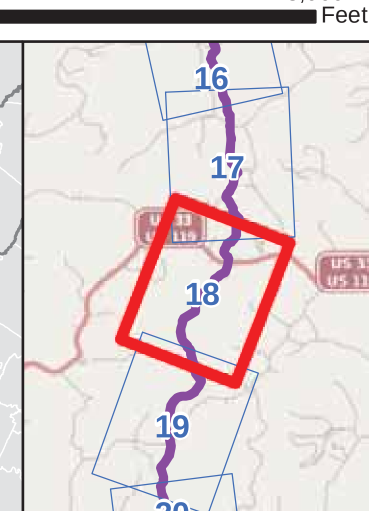
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data





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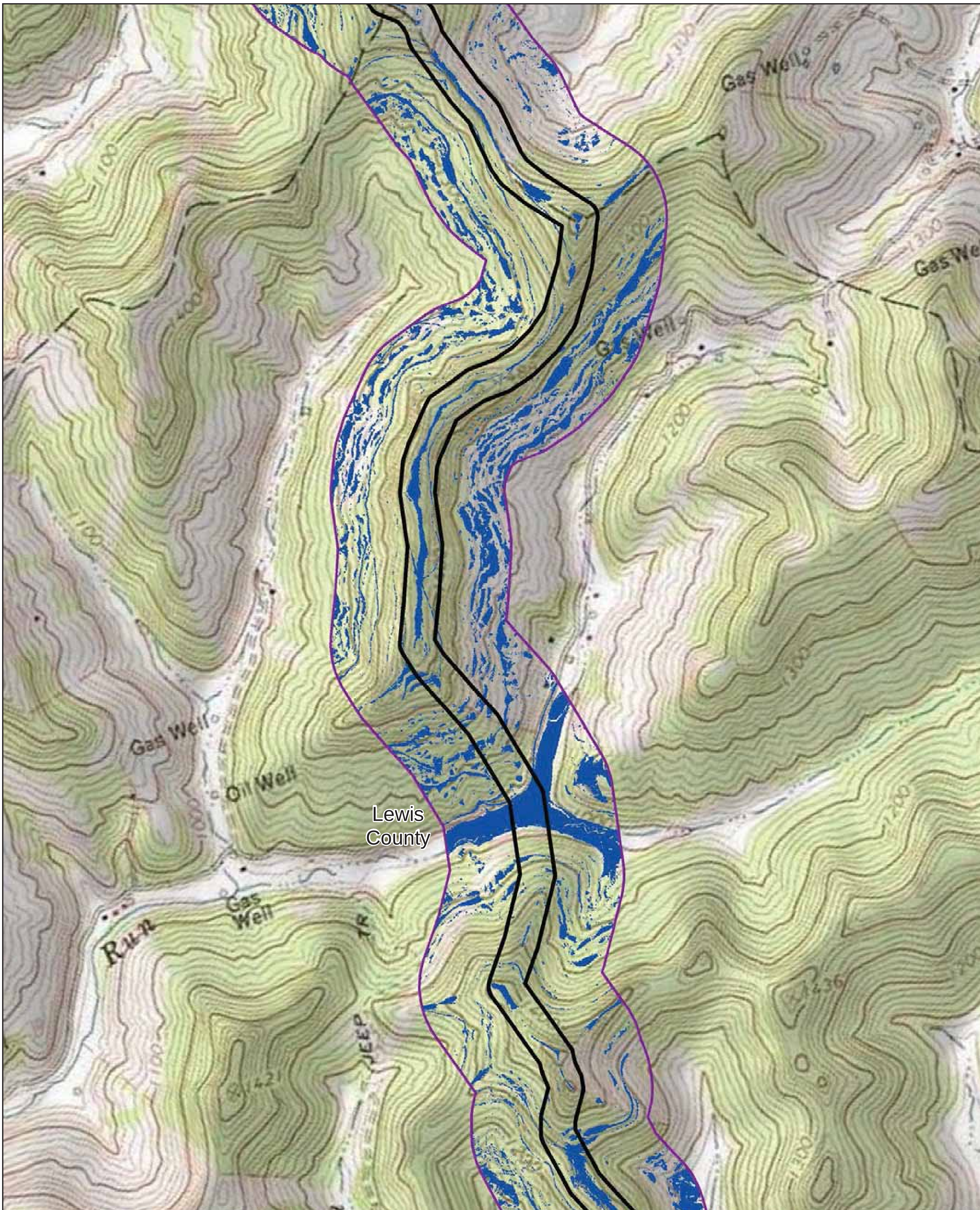

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

County Boundary
Limits of LIDAR Data
300' Direct Area of Potential Effects

Slope*

Less than or equal to 20%
Greater than 20%

*5 foot resolution LiDAR data

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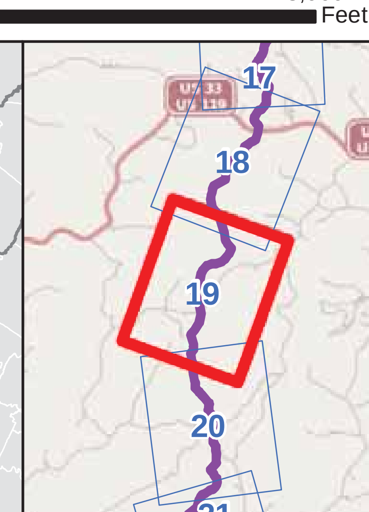

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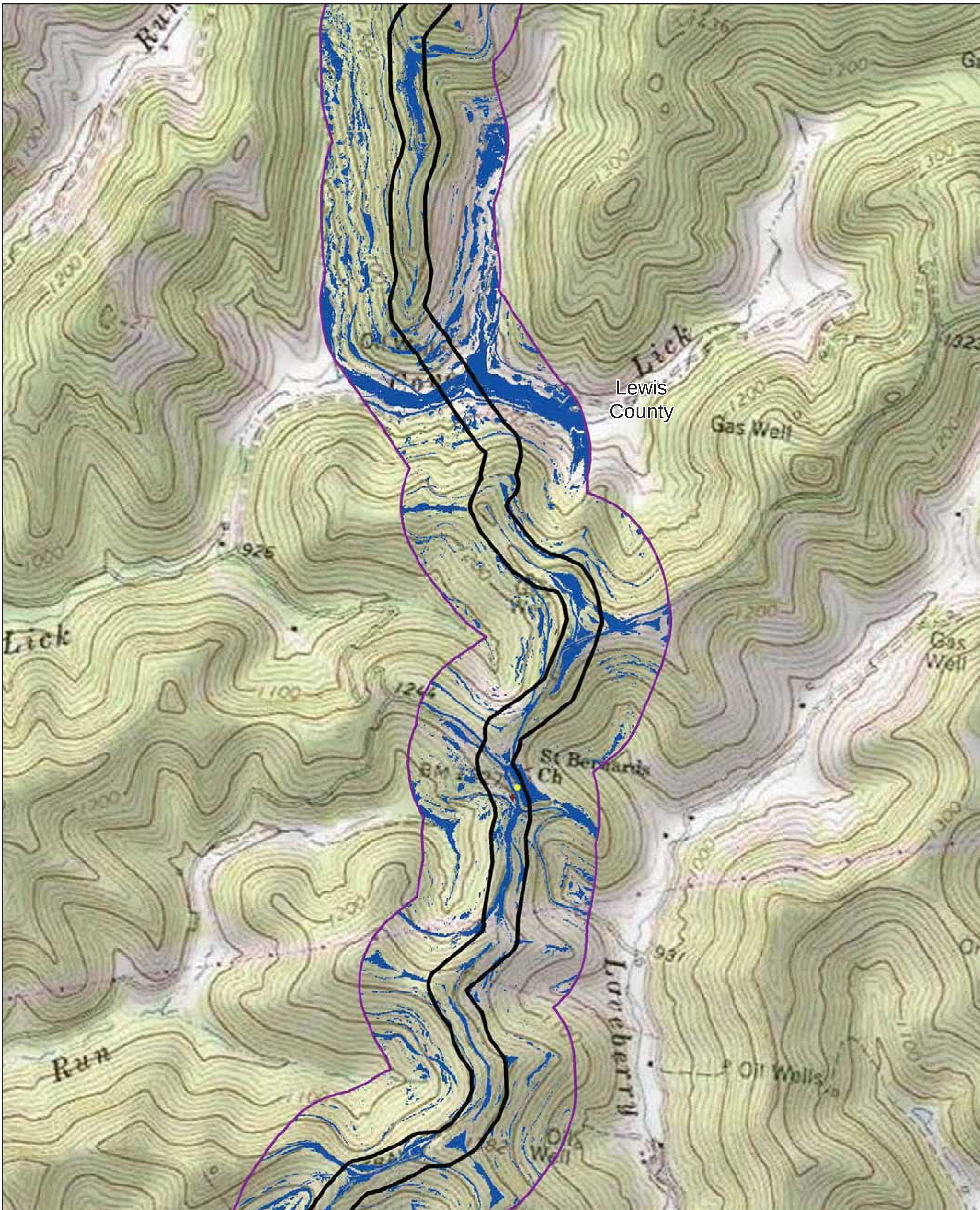

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- Archaeological Site
- National Register
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data

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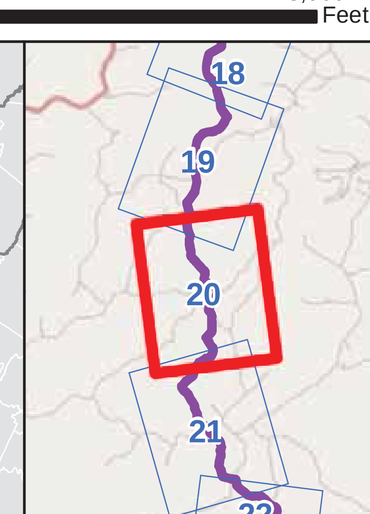

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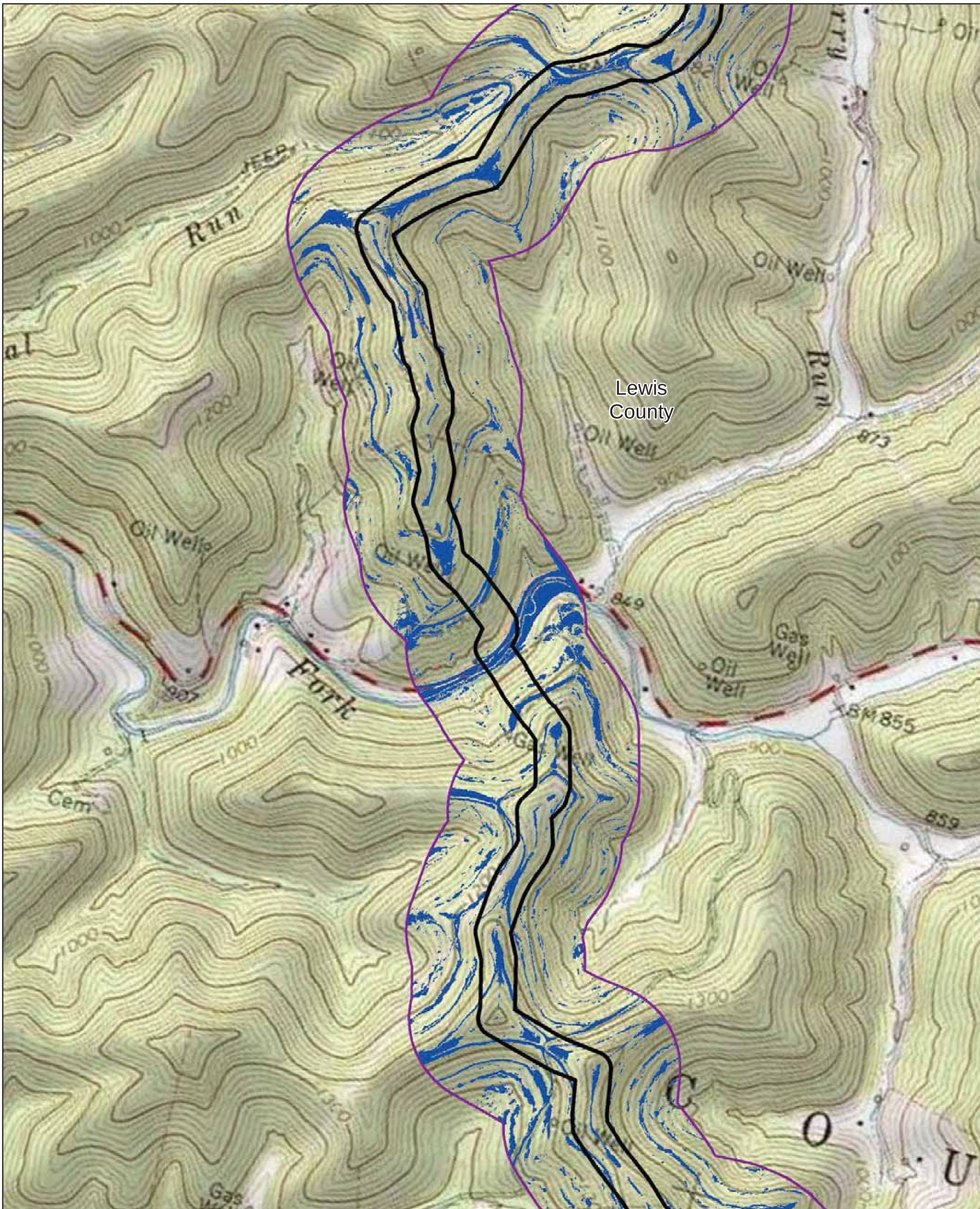

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data

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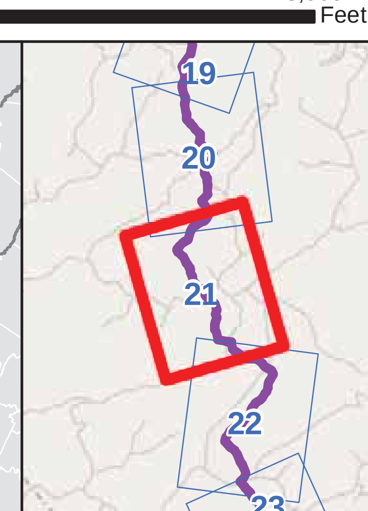

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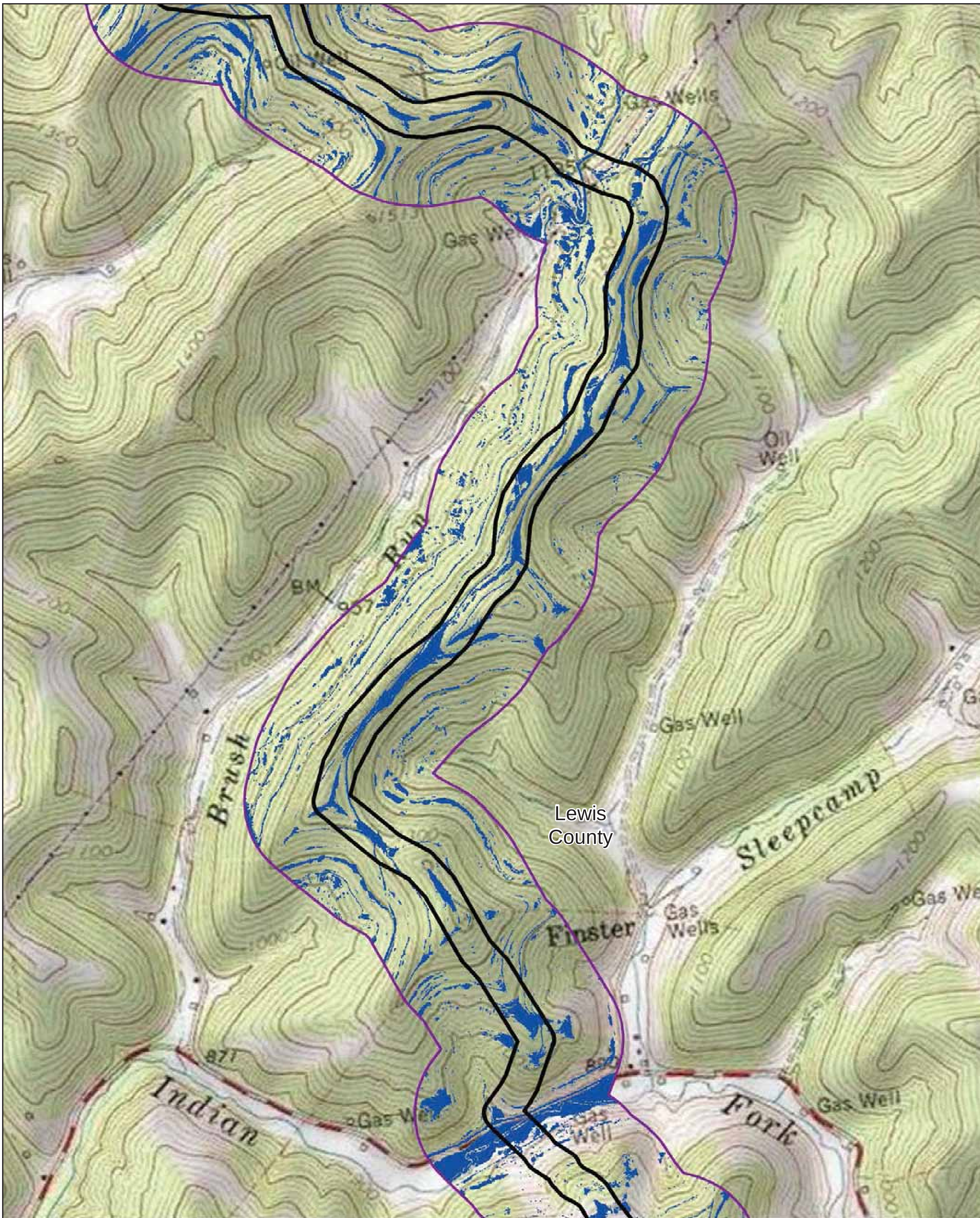

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

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- Greater than 20%

*5 foot resolution LiDAR data

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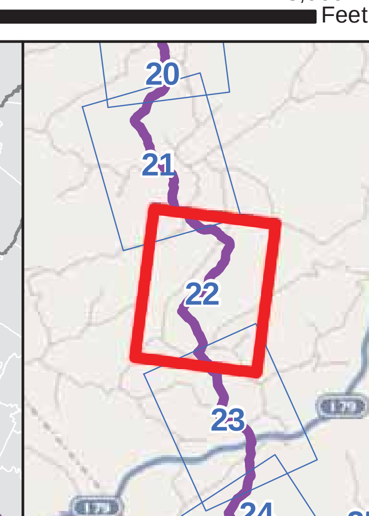

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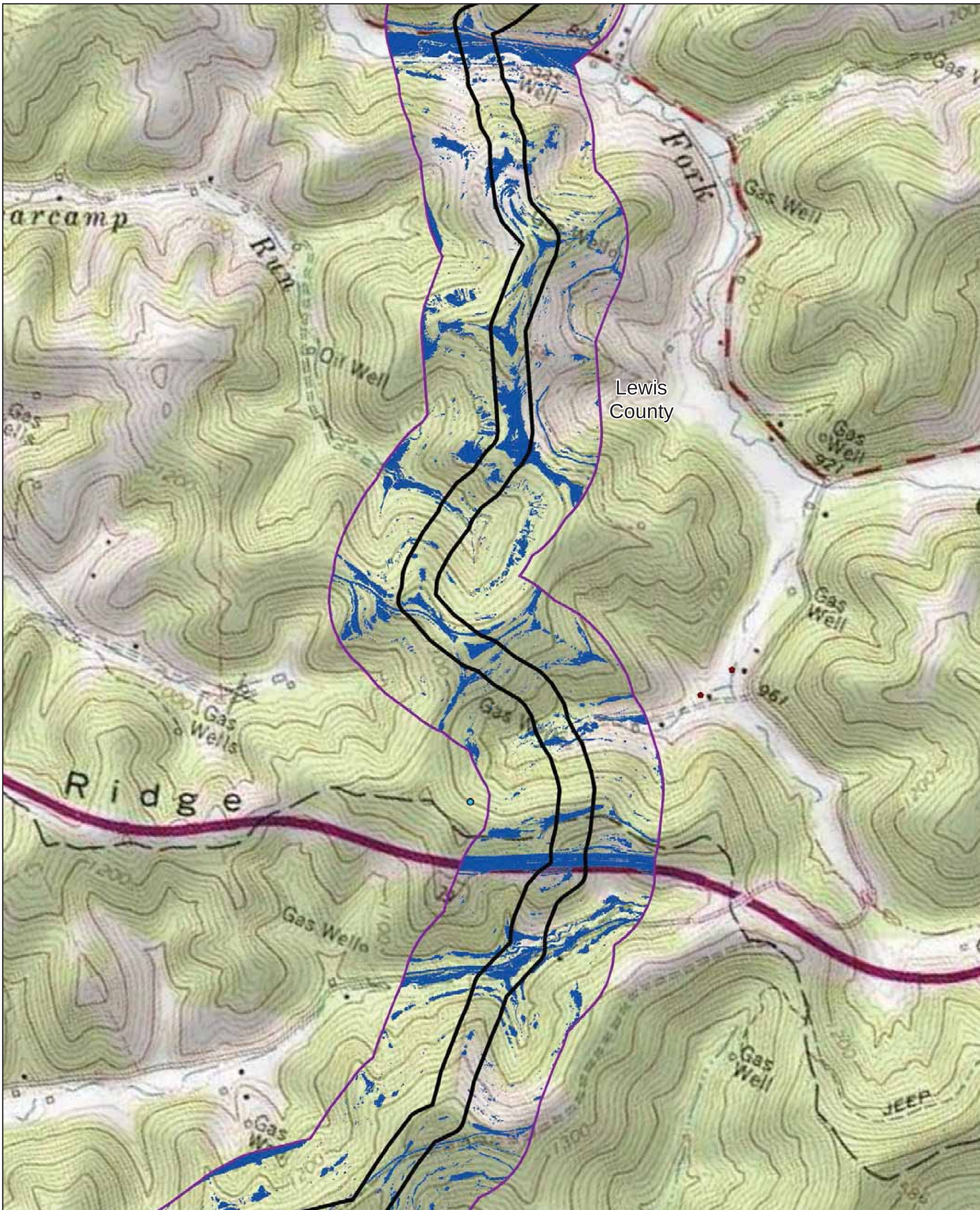

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- Archaeological Survey
- Architecture
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

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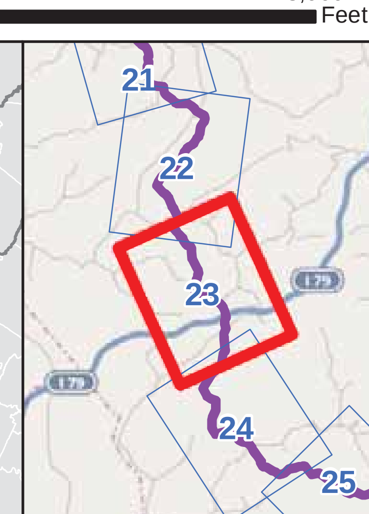
*5 foot resolution LiDAR data



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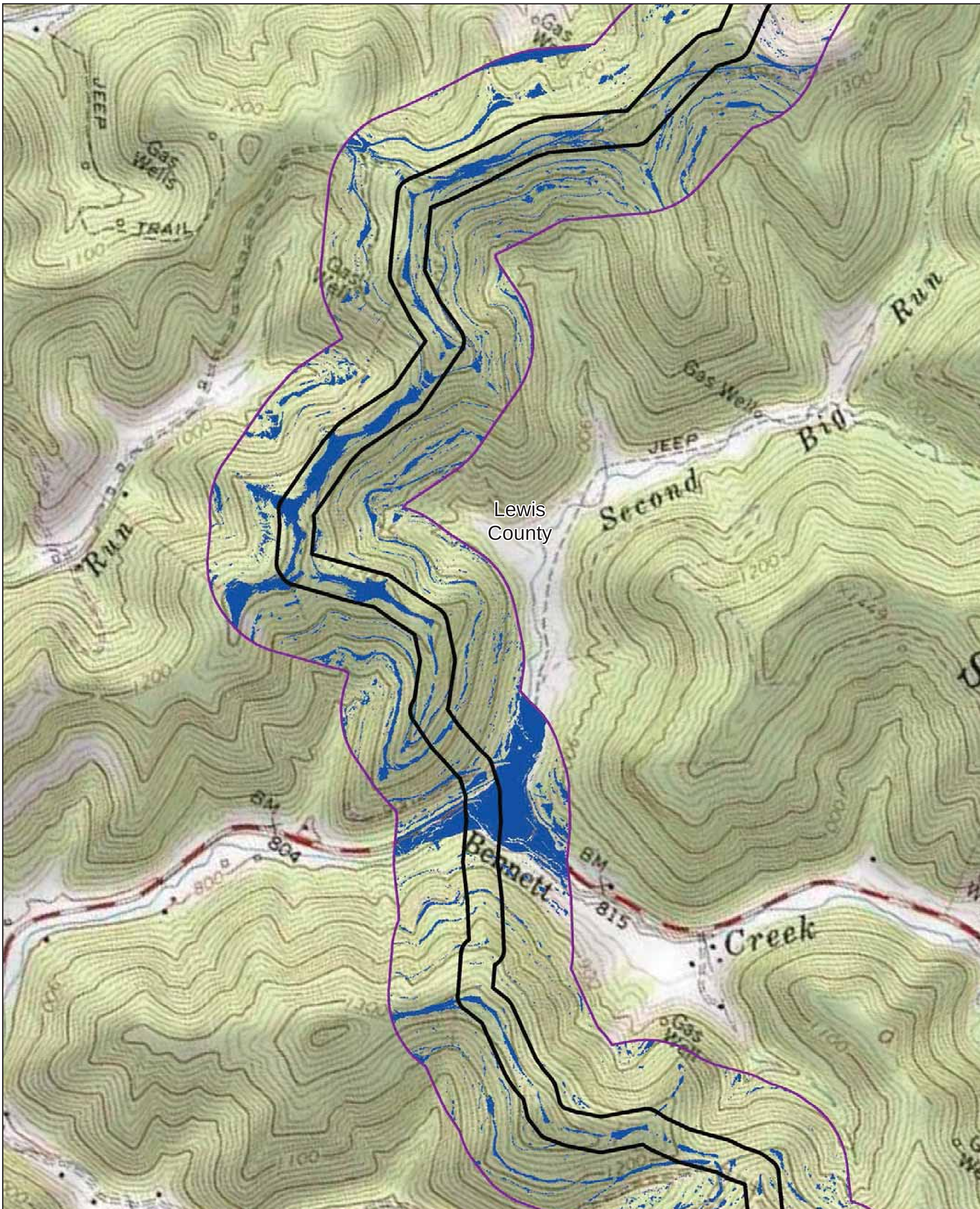

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

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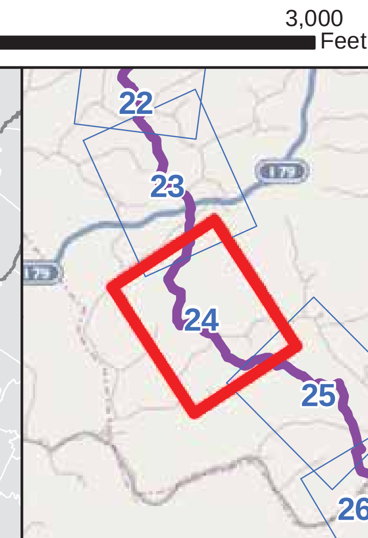

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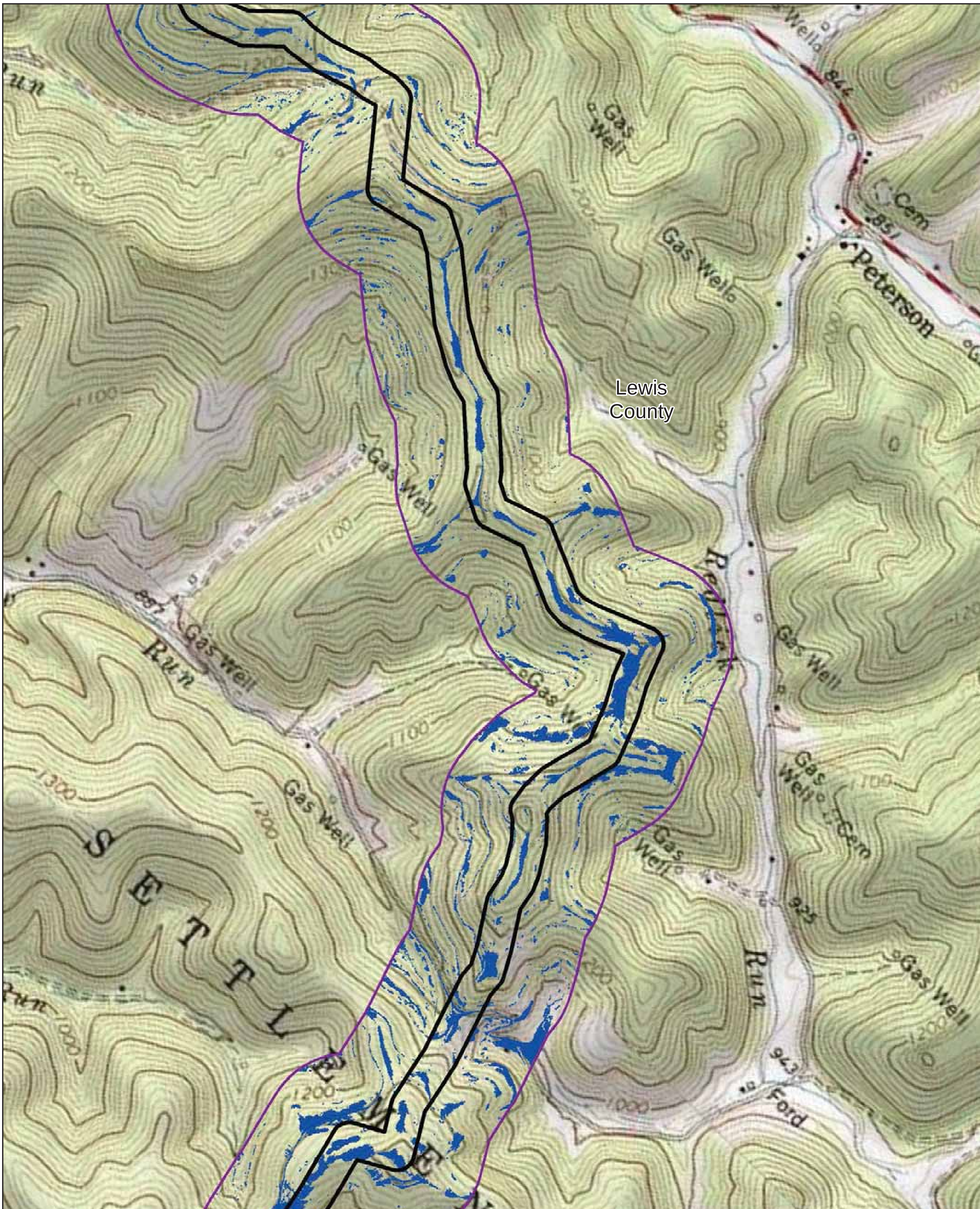

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

Legend

- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

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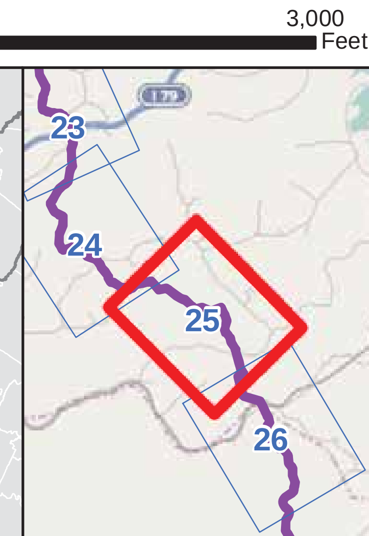
*5 foot resolution LiDAR data



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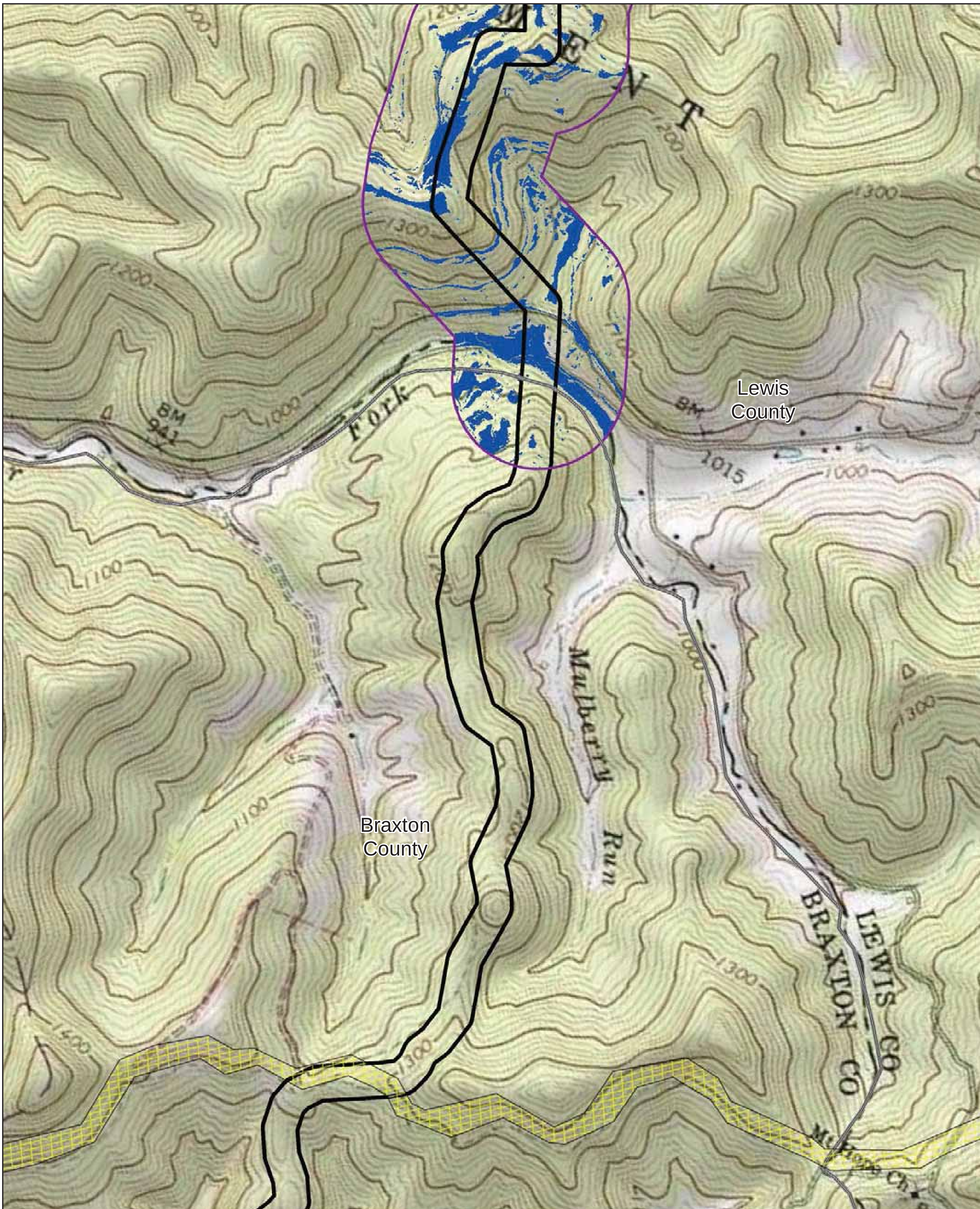

Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 in = 800 ft

0 750 1,500 3,000 Feet

Mountain Valley PIPELINE

Attachment A
LIDAR Slope Analysis
Harrison and Lewis Counties, WV

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Lewis County

March 2015

Data Sources: ESRI Streaming Data 2015, LiDAR data provided by Chesapeake Bay Helicopters, 2014.

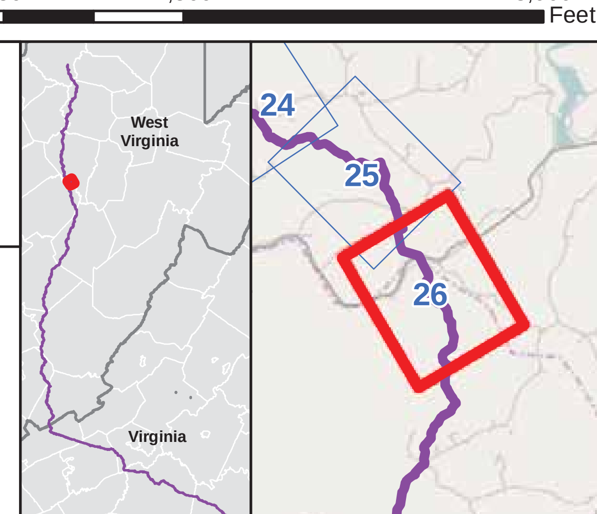
Legend

- National Register
- County Boundary
- Limits of LIDAR Data
- 300' Direct Area of Potential Effects

Slope*

- Less than or equal to 20%
- Greater than 20%

*5 foot resolution LiDAR data



Document Path: P:\EQT-Equitrans\MVP Project\GIS\Spatial\MXD\02_Cultural\20150313_AttachmentA_Lidar_Har_Lew_Counties_9600\20150317_AttachmentA_Lidar_Har_Lew_Counties_9600.mxd