The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 42

February 21, 2023

July 26, 2017

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission (FERC)

Washington, DC 20426

Re: Docket CP16-10
Mountain Valley Pipeline
Comments on Final Environmental Impact Statement (FEIS) – missing responses to RATC comments on Draft Environmental Impact Statement (DEIS)

Dear Ms. Bose,

After reviewing all documents included in the Final Environmental Impact Statement (FEIS) for the proposed Mountain Valley Pipeline, the Roanoke Appalachian Trail Club (RATC) finds that numerous and significant filings and comments made by RATC were neither addressed directly nor handled indirectly by FERC and the cooperating agencies. Although federal enabling legislation specifically mentions maintaining clubs along with the National Park Service and the Appalachian Trail Conservancy (ATC) as key partners in the management of the Appalachian National Scenic Trail (ANST), our comments were barely acknowledged, and our representation was incorrectly attributed to someone who never submitted comments to the DEIS and who has not been a member of the RATC board since early 2015.

The entire process for making comments and for reviewing voluminous, untimely, scattered and poorly described filings from the applicant on a website that was frequently "down" made it impossible for the average citizen to understand what is being proposed by Mountain Valley Pipeline. **RATC joins numerous government agencies, organizations and individuals in calling for a Supplemental Impact Statement that includes all information from the applicant presented in an orderly, easily searchable and well-indexed format.**

We would particularly note that **filings by Mountain Valley Pipeline that were originally filed as public and which are directly relevant to impacts on the Appalachian National Scenic Trail (ANST) have since been reclassified as privileged so that they are unavailable for review by RATC or other members of the public.** For example:

- **20170217-5199**, **Visual Impact study** published by the applicant on February 17, 2017


E-mail this page

File List

Accession Number: 20170217-5200
Description: Response to January 27, 2017 Data Request of Mountain Valley Pipeline LLC under CP16-10.

Type	File Name	Size
All PDF		
	PRIV_MVP 02172017 DRs Cultural Attach Part 14.PDF No description given	42101530
		13761818

(since made Privileged on the FERC eLibrary under **20170217-5200**)

- Numerous portions of **20170630-5393**, that were originally public have now been reclassified under **20170630-5394** as privileged, yet the content is vital for an understanding of planned actions that directly affect the ANST.

With rare exceptions, FERC did not respond to RATC's comments in a thorough or specific manner

FERC states in comments to the Department of the Interior[1] that, "All comments received on the draft EIS were considered by FERC staff in preparing the final EIS. Those received during the comment period, which ended on December 22, 2016, received direct responses by FERC staff in Appendix AA of the final EIS." Unfortunately, this was not true of comments offered by RATC.

We list RATC comments that were ignored in individual detail below. First, we want to summarize overriding weaknesses in both the DEIS and the FEIS:

- **Continual new, lengthy, completely disorganized filings by the applicant, long after the time when they should have been made available to the public, which meant the public did not have a chance to review and comment on them.** For example, the applicant was allowed to post vital information about the ANST very late in what was perceived to be the final day of public comment (December 22, 2016) using extremely vague descriptions that did not correctly characterize the topics being covered. As a result, neither FERC nor the partners that manage the ANST knew what was in the filing (**20161222-5442**).
- **Failure of the applicant to discuss any aspect of impacts to the ANST with RATC from early May 2016 until June 15, 2017**, despite written instructions in the FERC e-Library from FERC to do so.
- **The High Hazard Areas identified in Jefferson National Forest are an unsafe, unsuitable location for crossing the ANST.**
- **Poorly executed and continually changing visual assessments of visual impacts from the project, never in consultation with RATC.**
- **In discussion of alternatives, applicant dismissal of co-location with existing Columbia/Celanese pipeline on Peters Mountain due to use of inaccurate map of ANST.** Applicant stated in June 15, 2017 meeting that the route would be inappropriate because it would involve crossing a "sensitive resource" (presumable the ANST) twice. In fact, only an outdated map of the ANST would show that impact.
- **Location and major impacts of permanent access road (**MVP GI-232 and MVP GI-233) **on Peters Mountain.**
    - The applicant used an outdated map of the ANST and co-located a permanent access directly on the ANST at the base of Peters Mountain.

[1] FERC 20170623-4000(32228895), FA11-2, response to Department of Interior filing.

- Widening of a dirt road that is currently about 7 to 12 feet wide in to a permanent road 25 feet wide with a total impact width of 40 feet is <u>not</u> a minor construction project. It <u>would likely involve a significant amount of blasting and grading</u> on
  - Very steep grades
  - With high water erosion potential
  - And high landslide potential
  - In karst topography
  - In the approximate epicenter of the Giles County Seismic Zone (GCSZ)
- The upper part of the project appears to be located in a High Hazard Zone.
- It appears likely that this portion of the project could only be completed safely by seriously damaging the existing habitat. The applicant seems unconcerned about this prospect.

<u>RATC filings before December 23, 2016 and FERC responses</u>

RATC made 5 filings totaling 56 pages in length by December 22, 2016:

- **20161018-5006** (13 pages). RATC board's scoping comments were Fed Exed to FERC on 6.11.16 and received by FERC on 6.12.16 but were never acknowledged by FERC and could not be found on the FERC e-Library. Resubmitted 10.18.2016, including Fed Ex receipt
- **20161018-5082** (17 pages) - Comments of Roanoke Appalachian Trail Club re the Mountain Valley Pipeline Project under CP16-10.
- **20161019-5044** (4 pages) - Comments of Roanoke Appalachian Trail Club. Cover letter explaining background to RATC board decision to oppose Mountain Valley Pipeline under CP16-10.
- **20161019-5046** (2 pages) - Statement of opposition to Mountain Valley Pipeline as proposed by RATC Board of Directors under CP16-10.
- **20161221-5276** (20 pages) – RATC major response to DEIS.

We did our best to comb through the 36 separate, unindexed online documents in the FEIS that contained responses to DEIS comments (Appendix AA), and as far as we can tell, the only responses from FERC staff were brief and fragmentary discussion to one October 2016 filing (20161019-5046) in APP AA CO3.

Vague references to sections of the FEIS do not constitute appropriate, specific responses to concerns expressed by RATC. The only concern directly addressed was a minor correction to location of the proposed bore pit on top of Peters Mountain. Other responses included:

- CO3-1 contains a resolution from RATC with references to previous letters to FERC in late 2015. FERC's response to the resolution refers the reader to various sections of the EIS (4.7, 4.12, 4.8, 4.3, 4.1 and 4.13). FERC did not update or revise the EIS to address RATC's comments.
- CO3-2 contains comments related to the **<u>proposed boring under the ANST</u>**. FERC's response is as follows: "MVP crossing of the AT was modified in June 2016. The current alignment is now 500 feet west of the October 2015 proposal; is a straight line rather than diagonal; and the undisturbed buffer was increased to from 100 feet to 300 feet." FERC

does not refer the reader to any portions of the EIS where this alignment change is analyzed.

- CO3-3 contains comments related to **compliance with Department of Transportation safety standards related to hikers on the AT**. FERC responds by referring the reader to section 4.12 of the EIS. FERC is responding as if the ANST is a vehicular road rather than a national scenic trail. Elsewhere, FERC has allowed MVP to list the ANST as a dirt road owned by the state of Virginia that would be crossed by an open cut.
- CO3-4 contains comments related to **views from specific places**. FERC's response says the EIS now contains revised visual simulations. FERC did not specify how the revision responds to RATC's comments, which were specific about potential impacts.

FERC staff did not acknowledge or respond to the RATC's major filing on December 21, 2017. (20161221-5276 (20 pages). They did respond in a very fragmentary manner to the Appalachian Trail Conservancy's filing of the same document with a cover letter

- APP A CO 46-1. FERC responded to the cover letter from ATC and one page of the 20-page RATC filing. There was no substantive response to this filing.

RATC filings after December 23, 2016. In response to late filings from the applicant, RATC also filed two further comments (61 pages):

- **20170223-5090** (7 pages) - In response to a **20170217-5199**, **Visual Impact study** published by the applicant on February 17, 2017 (since made Privileged on the FERC eLibrary under **20170217-5200** – and therefore inaccessible to RATC). We are refiling both the RATC comments and the applicant's original Visual Impact study.
- **20170620-5108** (54 pages) – In response to the untimely December 22, 2016 filing **(20170224-5038)** of the **High Hazard report for Jefferson National Forest** under the misleading title, "Attach C_JNF Priority Sites." Even FERC was unaware of this report's location and asked for it in their 1/26/17 query to the applicant. RATC, ATC, and NPS were unaware of this report until May 2017.

We believe that all of these comments are highly relevant to impacts of the proposed project on the ANST and that they have been largely ignored. In addition, FERC continued to list Larry Austin as the contact for RATC (A-33) even though he never filed any comments on behalf of RATC to the DEIS and even though both Roger Holnbrook and Diana Christopulos both since filed comments as Presidents of RATC, 2015-2017.

We are therefore refiling all of our comments to assure that the following points are on the record with accompanying details:

20161018-5006 (13 pages). Original RATC scoping comments from RATC (6.11.15) that were neither acknowledged nor posted to the FERC eLibrary, although sent by Fed Ex. Key points:

- Necessity of compliance with the National Environmental Policy Act of 1970 and the Endangered Species Act of 1973 to examine cumulative impact of all proposed major natural gas pipeline crossings of the Appalachian Trail.
- Avoidance of threats to regional air quality and human health
- Satisfaction of criteria in the Appalachian Trail Conservancy's 2015 Policy on Pipeline Crossings of the Appalachian Trail.

- Avoidance of threats to regional water supplies and to drinking water for Appalachian Trail hikers
- Avoidance of karst topography and active seismic zones in the proposed AT crossing locations
- Avoidance of specific impacts, including scenic impacts, likely with currently proposed AT crossing alternatives

20161019-5044 (4 pages) – FERC did not respond to:

- Negative impacts and safety hazards to hikers presented by the proposed crossing of the ANST on Peters Mountain.
- Negative impacts of Alternate 200 on the ANST.
- Reiteration on all points made in 6.11.15 scoping comments (**20161018-5006**)

20161019-5046 (cover letter and RATC board's Resolution of opposition – 2 pages) – FERC did not respond in any meaningful manner to:

- Concerns about visual impacts in specific locations
- Safety hazard to AT hikers of highly volatile natural gas under 1,440 psig of pressure, located in karst topography near the middle of the Giles County Seismic Zone, scene of the largest earthquake in Virginia's recorded history. The US Forest Service has already expressed deep reservations about construction in this environment in its March 9, 2016 comments to the Federal Energy Regulatory Commission. In addition:
    a. The 2014 edition of the Pipeline Association for Public Awareness "Pipeline Emergency Response Guidelines" minimum evacuation distance for natural gas pipeline leaks and ruptures for pipelines of the size (42 inches – largest shown on the guidelines chart) and pressure (1,440 psig) is approximately 3,600 feet – about 0.68 mile on foot.
    b. AT hikers on Peters Mountain would have to walk miles on steep terrain to evacuate the area around the proposed pipeline. The closest evacuation route – via Pocahontas Road – would take hikers closer to the pipeline rather than away from it. The Groundhog Trail, providing access to the West Virginia side, is over a mile away. There is no sensible evacuation route, and hiker safety does not appear to have been considered in selecting the construction location and method
- Reiteration on all points made in 6.11.15 scoping comments (**20161018-5006**)

It is difficult to provide substantive comment on the DEIS due to the fact that the document is fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way meets the needs of the National Environmental Policy Act or the National Forest Management Act.

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meets the needs of the National Environmental Policy Act or the National Forest Management Act.

20161019-5046 (Detailed RATC comments on DEIS – 20 pages) - FERC did not acknowledge or respond to this filing, including:

Concurrence with the Appalachian T fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way meets the needs of the National Environmental Policy Act or the National Forest Management Act.

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- The DEIS lacks clarity, accuracy and transparency regarding the proposed crossing of the ANST on Peters Mountain,
- The DEIS fails to disclose numerous impacts and threats of the proposed project to almost 100 miles of the ANST in this region, including
    - Visual impacts
    - Geologic impacts and hazards
    - Threats to the safety of ANST hikers, especially if there is an accident or failure of the pipeline. Referring to Department of Transportation Minimum Federal Safety Standards in 49 CFR 192 in no way addresses the predicament of long distance hikers (and there are thousands every year) who might be stranded with no escape route in or near the blast zone or evacuation zone of this pipeline if it were built. This response shows no understanding of the on-the-ground situation.
- The applicant has failed to coordinate with ATC and RATC and to produce visual representations of the proposed pipeline's visual impacts as required in the DEIS and in further comments from FERC.
- RATC objects to the inclusion of four highly destructive proposed changes to the Forest Plan for Jefferson National Forest and the plan to construct the pipeline through an Inventoried Roadless Area.

20161018-5082 (Detailed comments on Alt 200 and on responses to RATC comments of 6.11.15 in DEIS)

- Comments on Alternate 200 as presented by Mountain Valley Pipeline (MVP) and the potential impact of Alternate 200 on the Appalachian National Scenic Trail (the Trail). MVP already proposes to cross the Appalachian National Scenic Trail on Peters Mountain and run the pipeline extremely close to the Peters Mountain Wilderness in that segment. With Alternate 200, MVP almost certainly reenters the viewshed of the Appalachian National Scenic Trail in Sinking Creek Valley, near Newport and Huffman. Details are provided below.
- Comments on Mountain Valley Pipeline's June 30, 2015 responses in regards to our comments of June 11, 2015. We would characterize Mountain Valley Pipeline's responses as perfunctory and highly incomplete. Specifically, MVP ignored our responses in 5 out of the 6 areas where we made comments. Details are provided below.

20170223-5090 (7 pages) - In response to **20170217-5199**, **Visual Impact study** published by the applicant on February 17, 2017 (since made Privileged on the FERC eLibrary under **20170217-5200** – and therefore inaccessible to RATC). We are refiling both the RATC comments and the applicant's original Visual Impact study. Key points:

- Concurrence with ATC comment that "In response to the January 26th data request, the applicant filed hundreds of pages of critical information five months after the publication of the DEIS and over one month after the close of the DEIS comment period. This filing includes the bulk of analysis relative to the Appalachian Trail and topics vital to public health. In many instances, this filing is significantly more substantive than the DEIS itself. ATC asks the FERC and the USFS to clarify to the public how long the comment period will be on this significant filing since it constitutes a de facto re-write of the original DEIS and as demonstrated here, clearly includes incorrect information that must be identified and corrected."
- RATC reiterates that the applicant made no contact at any time with RATC regarding visual analysis by Tetra Tech of the proposed route – despite clear direction from the FERC to do so.
- RATC did independent mapping and research with help from outside experts and RATC volunteers to identify 19 potential Key Observation Points (KOPs).
- Visual simulations conducted for ATC and other organizations in this region shared some characteristics that do not appear to be present in the applicant's report (even though 3D modeling, mapping and other technologies were quite similar). These include:
    - Selecting KOPs that appear to have the highest chance of significant visibility (number of viewers, relative distance of viewer from change, potential sensitivity of the viewer to change)
    - Using a camera lens that would portray what a visitor would actually see
    - Taking photos on a clear day with good visibility
    - Accurately modeling of the likely contrast between the change and the existing environment, with a color palette that accurately reflects how the change might appear
- RATC identified numerous other very specific deficiencies in the applicant's study, including the fact

20170620-5108 (54 pages) – In response to the untimely December 22, 2016 filing **(20170224-5038)** of the **High Hazard report for Jefferson National Forest** under the misleading title, "Attach C_JNF Priority Sites." Even FERC was unaware of this report's location and asked for it in their 1/26/17 query to the applicant. RATC, ATC, and NPS were unaware of this report until May 2017. **RATC submitted three documents**[2]:

- **A text document describing the two PowerPoint attachments** that were shared with the applicant and federal agencies at a meeting in Salem, Virginia on June 15, 2017.

[2] Note that all three documents are corrected to show that the Columbia/Celanese currently in its fourth year on Peters Mountain is a 12" pipeline.

- **Slides taken from Google Earth screen shots of the Columbia/Celanese pipeline currently in its fourth year on Peters Mountain**, showing the massive erosion, despite use of Best Management Practices and direct oversight from US Forest Service in project construction. The ROW is probably wider today than it was immediately following construction. The pipeline can be found on Google Earth: 37.367491° -80.772918°.
- **Analysis of the applicant's study titled "Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Route Of the Proposed Mountain Valley Pipeline Project in the Jefferson National Forest"** (**20161222-5442(31856030**)). Using the best available scientific information, RATC asserts that:
    - Due to cumulative and interactive risk factors, the proposed Peters Mountain crossing is too hazardous for safe construction and operation of a very large natural gas pipeline with a very large impact area.
    - Due to the magnitude of potential impacts, there is no logical basis for mitigation of impacts.
    - Little or no concern has been demonstrated for the safety of the thousands of people who hike this section of the ANST each year.

We are attaching all 7 filings that the RATC placed in the record of the Draft Environment Impact Statement of the Mountain Valley Pipeline as well as the February 17, 2017 Visual Impact assessment filed by the applicant as a public document and since reclassified as privileged.

Sincerely,

Dr. Diana Christopulos
President
Roanoke Appalachian Trail Club

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 43

February 21, 2023


Giles County
VIRGINIA'S MOUNTAIN PLAYGROUND

Celanese Corp. announced Tuesday that the global company's manufacturing plant in Giles County has completed replacing its coal-fired boilers with boilers fueled by natural gas.

Celanese, based in Dallas, Texas, said the $150 million project replaced seven coal-fired boilers with five new boilers fueled by natural gas. The boilers provide steam to generate power and run factory processes.

The plant beside the New River between Narrows and Pearisburg employs about 1,000 people and is Giles County's largest employer and taxpayer. In operation for 75 years, the facility "is one of the world's largest producers of cellulose acetate tow," a product used in filtration applications, including cigarette filters, the company said.

The conversion at the Celanese plant responded, in part, to Environmental Protection Agency regulations designed to reduce emissions of toxic air pollutants, including greenhouse gases. The coal-fired boilers also produced fly ash, which can be a pollution source.

A company statement Tuesday from Jon Mortimer, vice president of manufacturing and capital projects for Celanese, said the change to natural gas boilers demonstrated two of the company's core values — "being sustainable and improving the world."

Mortimer added, "This is a milestone in Celanese's continued growth and an opportunity for us to do our part to create a cleaner environment for the communities where we operate."

Celanese launched the conversion project in August 2013. Natural gas is considered to be a cleaner choice than coal for power generation.

To supply the volume of natural gas needed by the new boilers, Celanese worked with Columbia Gas Transmission and Columbia Gas of Virginia. The gas companies built a pipeline of about 16 miles that used an existing pipeline right-of-way when possible.

Travis Jacobsen, a Celanese spokesman, said the pipeline diameters ranged from 8 inches to 12 inches.

Jacobsen said Columbia Gas "provided the capital, engineers and constructed their pipeline section. Celanese pays their capital recovery as part of the tariff fee for transporting the gas that Celanese buys."

The Celanese statement included comments from Jean Lupinacci, an official with EPA's Energy Star program.

"Improving the power system at the Narrows, Virginia, plant is both a smart business decision and is good for the environment," Lupinacci said.

The project benefited from state and local incentives that totaled about $7 million.

The conversion has been cited by proponents of the proposed Mountain Valley Pipeline as an example of how access to natural gas can help attract and retain manufacturers. One route for that buried, 42-inch-diameter transmission pipeline would take it through Giles County.

Jacobsen declined to speculate about whether Celanese might have closed the Narrows plant had there not been access to a higher volume of natural gas.

In an email, he said, "Celanese does not comment on the ongoing operations or status of its global manufacturing facilities."

Separately, the Virginia Department of Environmental Quality recently imposed a civil charge of $2,795 on the Celanese plant tied to two wastewater discharges last year into the New River that violated the facility's permit with DEQ. DEQ's consent order noted that the agency had not observed related impacts to the New River.

A few miles west of Narrows, the coal-fired Glen Lyn power plant operated in Giles County by Appalachian Power Co. will soon stop generating power. The utility has attributed the closing both to emissions regulations and the age of the plant, which first generated power in 1919. Appalachian has opted to convert some other coal-fired power plants to use natural gas.

Tags: ECONOMIC DEVELOPMENT | GILES COUNTY | GLOBAL | MANUFACTURING | NATURAL GAS | RURAL COUNTY | SOUTHWEST VIRGINIA

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 44

February 21, 2023

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July 31, 2017

Vicki Craft
U.S. Bureau of Land Management
Southeastern State District Office, 273
Market Street, Flowood, MS 39232
Submitted to the record via the BLM e-portal on the e-Planning internet website

RE: Comments on the Notice of Availability of the Final Environmental Impact Statement for the Proposed Mountain Valley Project

Dear Ms. Craft:

Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society ("Parties") submit the following comments in Response to the Notice of Availability of the Final Environmental Impact Statement for the Proposed Mountain Valley Project ("MVP"). The Parties' interests are in the adverse impacts to the Jefferson National Forest from the MVP.

The Parties object to the timing and length of the comment period for the pending special use permit to grant a right-of-way on the Jefferson National Forest for the Mountain Valley Pipeline (MVP). The triggering notice for the BLM comment period was published in the Federal Register on June 30, 2017, only seven days after the Forest Service initiated its 45-day period for submitting objections to the Forest Service Draft Record of Decision. The Forest Service Draft Record of Decision proposes to amend the Land and Resources Management Plan for the Jefferson National Forest to eliminate regulations that the MVP would violate if it were constructed. The BLM comment period is only 30 days, and concludes not only before the period in which to submit objections in writing, but also before the conclusion of the objection process which extends beyond the 45-day written objection period.

The schedule is problematic not only because it is burdensome, but also because the Department of Interior has expressly noted that the BLM decision is based in large part on the Forest Service decision. "The BLM does not directly manage any land involved in the MVP project. In cases that do not involve land managed by the BLM, BLM's analysis of a proposal is based in large part on "'the agencies that are

impacted from the proposal and their review of the proposal in light of the purposes for which the land they administer is dedicated.'" FERC accession number 20170728-5150, Letter to FERC from Michaela E. Nobel, US DOI, Office of the Secretary, July 28, 2017. The Forest Service review is not complete. The Forest Service has released a Draft Record of Decision to amend the Revised Land and Resources Management Plan for the Jefferson National Forest. The Forest Service is conducting the objection process, and the time period for submitting written objections is still open.

This comment letter is accompanied by the Parties' Notice of Objection to the Forest Service and the Attachments that accompany the Notice of Objection. We ask that the Notice of Objection to the Forest Service Draft Record of Decision and the 36 Attachments be included in the BLM comment record. The Attachments are identified by the letters A-Z, and AA-JJ. The grounds and bases for objecting to the Forest Service Record of Decision supply the comments to the BLM in this comment process. The entire environmental assessment process has been flawed and the public has not been provided the opportunity to participate in any meaningful way.

The BLM submitted comments on the DEIS that mirrored many of the Parties' comments on the DEIS. The fact that FERC has since "explained" to the BLM the way FERC treats the NEPA process does not release the BLM and the Forest Service from its independent duties to comply with NEPA. The FEIS may be good enough for FERC but it falls short of the standards to which the Forest Service customarily performs its duties. The Forest Service has requested additional analyses, and the Draft Plan of Development is expansive. Revised versions of these documents were submitted after the publication of the FEIS. As argued in our objections, the process requires a supplemental environmental analysis and comment period because information about construction practices, restoration practices, endangered species, cultural resources, and proposed mitigation measures are still being vetted. The public does not have all of the information available to it in order to meaningfully comment on the grant of a special use permit for a right-of-way.

The agency meeting minutes in the record for the Forest Plan amendment indicate that the proponent is developing a mitigation plan. But for the release of the meeting minutes to counsel, the Parties would have no idea about a mitigation plan. We do know, however, that under NEPA, we should have access to it and be given an opportunity to provide comments on such mitigation plan. *See* Attachment JJ to the Parties' Notice of Objection to the Forest Service, Meeting Minutes, March 2, 2017 ("Bruce noted the BLM would strongly prefer a coordinated, landscape-scale approach to mitigation. Bruce also stressed the BLM needs to have their mitigation plan in their Right-of-way Grant Record of Decision (ROD), so mitigation timing is important.") It has been five months since the agencies had the meeting and the public still knows nothing about a mitigation plan, and yet the BLM was compelled to initiate a premature comment process for the grant of the special use permit.

The Parties question the motivation for the BLM's premature comment period. The motivation seems entirely political given the nature of the press release. Exhibit 1. ("The project, if approved, is an example of the Trump Administration's commitment to putting America back to work through the development of the nation's energy infrastructure. 'As part of its multiple use mission, the BLM is proud to facilitate the responsible development of energy-related projects on public lands,' said BLM Eastern States Director Karen Mouritsen. 'If approved, the Mountain Valley Pipeline project will help fuel America's economy and help support good-paying energy sector jobs.'" The statement by Ms. Mouritsen is particularly troubling because our understanding is that she is the deciding officer for the BLM and the press release casts her in the role of a cheerleader for the project proponent. There is no mention of environmental values or concerns.

The people in Washington, DC seem oblivious to the conservation values in our region, and the fact that people downstream like them drink the water that comes from these mountains. It appears that it would not matter the level or type of resource degradation that would occur. There is no evidence in the FERC record or the National Forest Plan Amendment record that the MVP would create good-paying jobs. Furthermore, the data about "the BLM generat[ing] $4.1 billion in receipts from activities occurring on public lands" is, and should be, irrelevant to the assessment of the environmental impacts associated with the grant of a special use permit for a gas pipeline right-of-way across the Jefferson National Forest.

The governing statute, 30 USC § 185, requires the disclosure of information by the project proponent that is not in the FERC or Forest Service records. We cannot make meaningful comments without the information required by the statute:

> The Secretary or agency head, prior to granting a right-of-way or permit pursuant to this section for a new project which may have a significant impact on the environment, shall require the applicant to submit a plan of construction, operation, and rehabilitation for such right-of-way or permit which shall comply with this section. The Secretary or agency head shall issue regulations or impose stipulations which shall include, but shall not be limited to: (A) requirements for restoration, revegetation, and curtailment of erosion of the surface of the land; (B) requirements to insure that activities in connection with the right-of-way or permit will not violate applicable air and water quality standards nor related facility siting standards established by or pursuant to law; (C) requirements designed to control or prevent (i) damage to the environment (including damage to fish and wildlife habitat), (ii) damage to public or private property, and (iii) hazards to public health and safety; and (D) requirements to protect the interests of individuals living in the general area of the right-of-way or permit who rely on the fish, wildlife, and biotic resources of the area for

> subsistence purposes. Such regulations shall be applicable to every right-of-way or permit granted pursuant to this section, and may be made applicable by the Secretary or agency head to existing rights-of-way or permits, or rights-of-way or permits to be renewed pursuant to this section.

30 USC §185(h)(2). The Parties are not aware that any of the requirements prescribed above have been met, and if they have, we are entitled to an opportunity to review them.

The non-discretionary requirements in 30 USC §185(h)(2) are triggered by a finding of significant impact. FERC concludes, and the Forest Service agrees, that the MVP will have a significant impact on forest resources. There are multitude of additional significant adverse environmental impacts to which mitigation measures are proposed to be applied. The Parties argue in the Notice of Objection to the Forest Service that FERC's conclusion in regard to the effects of mitigation toward reducing impacts is meaningless because there is no measure of the reduction. If compounded, do the residual adverse impacts add up to significance? We do not know because any benefit of the proposed mitigation is not measured or quantified. We also argue that there is no evidence that the proposed mitigation is effective and document that the proposed mitigations have not been effective on other, less hazardous pipeline projects.

We also argue that the Revised Hydrologic Analysis of Sedimentation is flawed, and the conclusions about the impacts to aquatic resources are misleading at best. The proponent has admitted that it does not want to make the modeling more conservative because it would reveal greater impacts than those to which they have already admitted. The project will have significant impacts and the BLM must comply with 30 USC §185(h)(2).

Additional requirements have not been met:

> (i) Disclosure. If the applicant is a partnership, corporation, association, or other business entity, the Secretary or agency head shall require the applicant to disclose the identity of the participants in the entity. Such disclosure shall include where applicable (1) the name and address of each partner, (2) the name and address of each shareholder owning 3 per centum or more of the shares, together with the number and percentage of any class of voting shares of the entity which such shareholder is authorized to vote, and (3) the name and address of each affiliate of the entity together with, in the case of an affiliate controlled by the entity, the number of shares and the percentage of any class of voting stock of that affiliate owned, directly or indirectly, by that entity, and, in the case of an

affiliate which controls that entity, the number of shares and the percentage of any class of
voting stock of that entity owned, directly or indirectly, by the affiliate.

(j) Technical and financial capability. The Secretary or agency head shall grant or renew right-of-way or permit under this section only when he is satisfied that the applicant has the technical and financial capability to construct, operate, maintain, and terminate the project for which the right-of-way or permit is requested in accordance with the requirements of this section.

30 USC §185. The Parties have not been provided the information required in subjections i. and j., and therefore cannot meaningfully participate in the comment process.

The Parties can, however, offer comments in regard to grounds for denial of grant of a right-of-way pursuant to 43 CFR § 2884.23(5). An applicant who "do[es] not have or cannot demonstrate the technical or financial capability to construct the pipeline or operate facilities within the right-of-way or TUP area" may be denied such grant. The managing partner for the proponent limited liability company pleaded guilty to environmental crimes in Pennsylvania. FERC Prefiling accession number 20150616-5189, refiled (referenced/hyperlink) at accession number 20161221-5446. The Parties assert that the criminal environmental record raises serious concerns about the capability of the proponent's limited liability company to perform a construction project that is unlike any that has ever been constructed. If the BLM is going to grant the special use permit despite the criminal record, the Parties argue that it would be more than appropriate to require a bond.

(m) Bonding. Where he deems it appropriate the Secretary or agency head may require a holder of a right-of-way or permit to furnish a bond, or other security, satisfactory to the Secretary or agency head to secure all or any of the obligations imposed by the terms and conditions of the right-of-way or permit or by any rule or regulation of the Secretary or agency head.

30 USC §185.

The Forest Service did not hold any public hearings, and the Parties refer the BLM to the Notice of Objections on this point.

(k) Public hearings. The Secretary or agency head by regulation shall establish procedures, including public hearings where appropriate, to give Federal, State, and local government agencies and the public adequate

> notice and an opportunity to comment upon right-of-way applications filed after the date of enactment of this subsection [enacted Nov. 16, 1973].

30 USC §185. Thousands of people have requested that the Forest Service hold public meetings and the Forest Service has not done so.

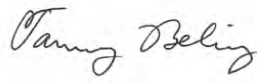
The BLM has the duty to show that the right-of-way will be directed and controlled in the following manner:

> (a)Protects the natural resources associated with Federal lands and adjacent lands, whether private or administered by a government entity;
> (b)Prevents unnecessary or undue degradation to public lands;
> (c)Promotes the use of rights-of-way in common considering engineering and technological compatibility, national security, and land use plans; and
> (d)Coordinates, to the fullest extent possible, all BLM actions under the regulations in this part with state and local governments, interested individuals, and appropriate quasipublic entities.

43 CFR § 2881.2. There are no assessments by the BLM of these regulatory criteria upon which to comment. Once again, the Parties are offered opportunities to comment when there is nothing upon which to base comments.

The procedure is unacceptable. The BLM needs to do its job, wait for the Forest Service to do its job, or perhaps the agencies can prepare a joint supplemental analysis. But there should be no BLM comment period until all of the information on which to comment is available to the public. It is clear from both the Forest Service Draft Record of Decision and the BLM press release for its comment period that the rush to decision and the decisions themselves are political decisions and not based on science or law, and the public needs adequate time to provide substantive and meaningful comments to the BLM and objections to the Forest Service.

Sincerely,



Tammy L. Belinsky, Esq.
Counsel for Objecting Parties

Enclosures

Exhibit 1

Comments on the Notice of Availability of the Final Environmental Impact Statement for the Proposed Mountain Valley Project by Preserve Craig, Indian Creek Watershed Association and the Wilderness Society July 31, 2017

FOR IMMEDIATE RELEASE

Date: June 29, 2017

Contact: Lesley Elser (202) 912-7711

Federal Energy Regulatory Commission Releases Final Environmental Impact Statement for Mountain Valley Pipeline Right-of-Way

WASHINGTON – The Bureau of Land Management Eastern States (BLM-ES) announced today, the Federal Energy Regulatory Commission (FERC) release of its Final Environmental Impact Statement (FEIS) under the National Environmental Policy Act (NEPA). This FEIS analyzes potential impacts associated with the Mountain Valley Pipeline (MVP) Right-of-Way. As proposed, the MVP is a 303.5-mile, 42-inch, buried, natural gas pipeline construction project that would cross public lands in Virginia and West Virginia. **The project, if approved, is an example of the Trump Administration's commitment to putting America back to work through the development of the nation's energy infrastructure.**

"As part of its multiple use mission, the BLM is proud to facilitate the responsible development of energy-related projects on public lands," said BLM Eastern States Director Karen Mouritsen. "If approved, the Mountain Valley Pipeline project will help fuel America's economy and help support good-paying energy sector jobs."

The applicant held a total of 16 Open Houses to share information about this project, followed by six public meetings sponsored by FERC for the purpose of taking public comments. The release of the FEIS begins a 30-day comment period during which the BLM may accept comments on the NEPA document. The FEIS is available on FERC's website: www.ferc.gov. (Select in the following order: Documents & Filings, e-Library, General Search, Input Docket Number CP16-10). A link to the FEIS can also be found in the BLM e-Planning Comment Web Page (provided below). You may use any of the following methods to submit comments: Visit the project's e-Planning Comment Web Page at http://bit.ly/2qByLlw; or mail to: Vicki Craft, U.S. Bureau of Land Management, Southeastern States District, 273 Market Street, Flowood, MS 39232.

The FERC is the lead agency for preparing the FEIS, with the BLM, U.S. Forest Service (USFS), and U.S. Army Corps of Engineers (USACE) as cooperating agencies. BLM staff worked closely with FERC and the USFS, providing data and other information to ensure that the FEIS meets the necessary requirements under the NEPA. Additionally, the FEIS must meet standards established by the Council on Environmental Quality, before the BLM may accept its findings as basis for authorizing the ROW application.

BLM

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's mission is to sustain the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. In Fiscal Year 2015, the BLM generated $4.1 billion in receipts from activities occurring on public lands.

Lesley Elser, External Affairs, Eastern States, 20 M Street SE, Washington, D.C. 20003-3503

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July 31, 2017

Reviewing Officer Tony Tooke, Regional Forester
USDA Forest Service
1720 Peachtree Street
Atlanta, GA 30309
Facsimile 404-347-4821
Email to: objections-southern-regional-office@fs.fed.us

RE: Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest

Dear Regional Forester Tooke:

Preserve Craig, Inc., Save Monroe Inc., and The Wilderness Society ("Objecting Parties") each and all object to the Draft Record of Decision (DROD) for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest (LRMP or Forest Plan) for whom the responsible official is Joby P. Timm, Forest Supervisor.

We have numerous bases for the objections, both procedural and substantive, the combination of which requires the preparation of a supplemental environmental analysis, revised analysis of the implication of the substantive forest planning rules, revised draft record of decision, and public review. In addition, the Forest Service also has an independent duty to develop a Programmatic Environmental Impact Statement. Finally, and objectionably, a sequential reading of the meeting minutes in the Plan Amendment record shows that the Forest Service decided at least eight months ago that it would amend the Forest Plan to permit the construction of a gas pipeline, long before environmental impact analysis was performed and is still incomplete, and for which a need has yet to be documented.

We file these objections despite the fact that it is unclear whether Forest Service staff will read these objections, (*See* Attachment A, December 8, 2016 Meeting Minutes (MVP contractor developing strategy to streamline responses to objections)), ***we object to the delegation of the Forest Service duties to a third-party contractor paid by the proponent to assess the objections, and we demand strict proof that Forest***

Service staff themselves have considered these objections as required by regulation.

We also file these objections well before the objection deadline to meet the irrational BLM comment deadline for the special use permit right of way application that closes today. The BLM comment deadline is irrational because the Forest Service is still receiving written objections and the objection period will not close until sometime beyond the deadline for written objections. The Objecting Parties may therefore find it necessary to supplement these objections before the end of the objection deadline.

The Federal Energy Regulatory Commission (FERC) is the lead agency in the preparation of the environmental impact statements under the National Environmental Policy Act (NEPA). The Forest Service has duties under its forest planning rules which duties are in addition to fulfilling its own NEPA responsibilities. The MVP is a 42-inch gas pipeline proposed to be constructed over ridge and valley terrain that is characterized by highly erodible soils, steep slopes, karst geology with a past and recent history of seismic activity. There is no comparable project that has ever been undertaken in terrain with such high incidence and combination of risk factors. There is no evidence that the project can be undertaken without causing harm to National Forest Resources. Conversely, evidence in the record shows that smaller gas pipelines constructed in areas that pose the same or lesser risks have caused harm. There is no evidence that the proposed mitigations are effective and the conclusions reached by Supervisor Timm to support the DROD have no reasonable basis.

The DROD violates the National Forest planning rules, NEPA, the Revised Land and Resources Management Plan for the Jefferson National Forest (LRMP or Forest Plan), and perhaps most troubling, the DROD stunningly undermines both the planning rule and the Forest Plan. The damage to the planning rule and the Forest Plan are particularly objectionable because tremendous public resources and human effort were expended to achieve adoption of both the planning rules and the Forest Plan in efforts to achieve sustainable and harmonious outcomes.

The Objecting Parties have made comments throughout the process. The following accounting documents the numerous submissions to the FERC docket.

Preserve Craig submitted comments, accession numbers 20160630-5308, 20161222-5512, 20161222-5321, 20161221-5446, 20161221-5353, 20161221-5349, 20161221-5346, 20161222-5321, 20161221-5452, 20161221-5359, 20161221-5361, 20170622-5107,20170329-5053, 20170221-5116, 20150616-5052, 20150616-5222, 20150616-5296, 20150616-5193, 20150616-5349, 20150616-5244, 20150616-5189, 20150616-5335, 20150616-5339, 20150616-5190, 20151019-5374, 20150806-5144, 20150730-5013, 20150709-0021, 20150617-5048, 20150617-5050, 20150618-0029, 20150616-5189, 20150616-5190, 20150616-5193, 20150616-5222, 20150616-5244, 20150616-5335, 20150616-5339, 20150616-5349, 20150616-5359, 20150612-5180, 20150616-5364, 20150615-5296, 20150615-5052, 20150611-5022.

Save Monroe submitted comments, accession numbers 20151013-5159, 20150807-5034, 20150616-5320, 20150616-5321,20151013-5158, 20151125-5076, 20150804-5026, 20160509-5043, 20160603-5162,20160914-5031, 20161019-5061, 20161221-5066, 20170227-5137,20161220-5014, 20150616-5243, 20150807-5034, 20151125-5115, 20151125-5114, 20160505-5090, 20161223-5157, 20161222-5551, 20170622-5107, 20170329-5053, 20170221-5116.

The Wilderness Society submitted comments, accession numbers: 20170622-5107, 20170622-5201, 20170329-5053, 20161223-5062, 20161223-506320170622-5107.

INTRODUCTION

In cooperation with the US Forest Service, Bureau of Land Management, and other agencies, FERC prepared both a Draft and Final Environmental Impact Statement under the NEPA. The conclusions stated in each EIS are those of FERC. *See* Section 5.1, paragraph one of both the DEIS and FEIS. Neither the Forest Service or the BLM adopted the DEIS as sufficient for their independent decision-making processes, and BLM filed comments on December 22, 2016, stating that the DEIS was wholly inadequate. FERC accession number 20161223-5049. At this stage, the Forest Service has adopted the FERC-issued FEIS in its DROD and the BLM has not adopted the FEIS for the purpose of granting a special use permit for a right-of-way for the MVP.

In the FEIS, FERC concludes that the MVP would cause significant adverse environmental impacts including impacts to forest resources. FERC also concludes that impacts, with the exception of impacts to forests, “would be reduced to less-than-significant levels”. FEIS, p ES-16. Impacts to forests remain significant. Impacts to resources are considered reduced because the proponent would use mitigation measures -- on a resource-specific basis -- against impacts to soils, geology, karst, wetlands, surface waters, groundwater supplies, underground mines, sensitive water bodies, cultural and historic resources, air quality, fisheries, and terrestrial, avian and aquatic species of various levels of concern. FEIS pp ES 16-18. FERC isolates each resource from another to write about impacts, using a template for printing environmental impact statements that FERC uses over-and-over again.

FERC has not quantified the level to which impacts will be reduced and only generally asserts that impacts will be reduced to below significance. Is the reduced level of impact just a tad below significance, which would render the comparison meaningless? Is the significance of impact to one resource reduced a lot compared to that of another resource? The concept of scaling the impacts against purported public benefit cannot be utilized because the impacts are not quantified to any level. FERC just says the level of overall impact will be reduced, maybe a tad -- who knows, below significance. Is that a tad per resource? If all of the impacts to which impacts are attributed are put on one scale, will even the “reduced” impacts be so great in combination that the combined impacts are still significant? FERC has not addressed these questions, rather FERC has very carefully, yet meaninglessly, parsed its conclusion to seem like

the conclusion means something when it really means nothing. Many resources are significantly impacted and mitigation measures are proposed, but there is no measure of reduction on either an individual resource level or on the resources combined as they exist in the real world.

Setting aside for now the issue of whether there is any evidence that mitigation measures can be effective in reducing impacts below significance (however that is established), the approach to analyzing impacts resource-by-resource is not credible based on what is known about the interrelationships of the resources. The construction of a 42-inch gas pipeline on this proposed route cannot cause significant long-term impacts on forests without also causing significant long-term impacts on the water resources that flow from the forests and the species that depend on the forests. The Jefferson National Forest was expressly established for the conservation and restoration of water resources. *Revised Land and Resource Management Plan Jefferson National Forest*, p 2-2; *see also* FERC accession number 20161222-5512, pp 6-9.

One example of the absurdity of separating the forest impacts from other resource impacts is buried deep in the proponent's Draft Plan of Development. FERC accession number 20170630-5393. The pipeline is proposed to be constructed on slopes that exceed 50% and are in the 70% range on the National Forest. The soils, if any soil is present at all, are shallow and erodible, the slopes are rocky and landslide prone, and there are always streams at the bottoms of the slopes that are fed by both ground and surface waters flowing from the mountains. During construction, the proponent proposes to separate the soil layers on the slopes and put the layers back the way they found them. The soils will be compacted in the construction process, and then an attempt will be made to de-compact so that grass seed can take root. In the process, water drains will be constructed to divert all water away from the corridor to reduce the risk of erosion and landslides. *See* FERC accession number 20170630-5393, MVP Draft Plan of Development, pp 6-9 to 6-11.

The point here is that water cannot be diverted away from its course without changing the character and qualities of the systems within which the water once flowed. Regardless of efforts to put the soils back the way they found them, the water regime is disturbed. FERC (and the Forest Service) attribute the practice of reconstructing the soil profile as a mitigation of impact to soils, but without the water systems that once flowed through the soil column the soil system is not restored. The question then is, what is the meaning of FERC's conclusion – what exactly is mitigated and by what measure?

FERC generally concludes that mitigation for one resource reduces impacts (perhaps only a tad below significance for that resource) but has not accounted for the cascading impacts to other resources on a systems basis. Purported mitigation for one resource does not equate to mitigation for the system as a whole. FERC's conclusions are not

only meaningless on their face, the conclusions fail to measure the significance of compounded impacts, whether mitigated or unmitigated.

As of March 2, 2017, the Forest Service expressed that the agency itself was still unable to assess residual impacts that remain after mitigation because the DEIS was so inadequate. *See* Attachment B, March 2, 2017 Meeting Minutes ("Grace updated she is still waiting on additional guidance with how to proceed with the environmental consequences/mitigation tracking table. Tim noted he would like it to be very straightforward with regard to what residual impacts exist after mitigations are in place. Grace, Jennifer, and Tim agreed this would be difficult to address as the Draft EIS is not straightforward with regard to impacts, and several analyses are still outstanding.") The straightforward approach described by Forest Service staff has not been presented to the public.

In defiance of NEPA, FERC never intended to be specific. *See* Attachment C, March 9, 2017 Meeting Minutes ("Tim inquired if a proponent's proposed mitigation impacts would be analyzed in the environmental impact statement (EIS). Kevin said a high-level summary of the proposed mitigation would be included but the impacts would not be fully analyzed.")

Nevertheless, the Forest Service has adopted the FERC-directed FEIS in support of its DROD. The FEIS may be a good enough paper exercise for the industry-driven FERC but it falls short of supporting the Forest Service DROD. In fact, FERC has consistently posited that if any cooperating agency finds the analysis inadequate for its purposes the agency may supplement the analysis. DEIS, section 5.1, p 5-1; FEIS, section 5.1, p 5-1. The BLM expressly rejected the DEIS, the Forest Service never adopted the DEIS, and has continually required additional analysis. As argued below, the analysis and mitigation measures are still being developed and vetted with the Forest Service. ***Therefore, it was premature for the Forest Service to adopt the FEIS and a supplemental analysis must be performed and provided to the public for comment after the Forest Service and the proponent have fully developed the construction and operation information, come to agreement on a proper sediment analysis, and all historic resource and protected species consultations have been performed*.**

Furthermore, since the Forest Service has embraced the construction of not one, but two gas pipelines through the George Washington and Jefferson National Forests, the Forest Service now has an independent duty from FERC to perform a Programmatic Environmental Impact Statement. Two more additional pipeline proposals are real possibilities and the Forest Service must take leadership on this NEPA responsibility.

Preserve Craig, Save Monroe, and The Wilderness Society lodge additional objections as follows:

A. The Forest Service Erred in Not Providing an Opportunity for Public Comment on Revised Plan Amendments

The Forest Service did not provide a comment period for information set forth in a Notice that was issued on June 5, 2017. The failure to provide for public participation on information that was first published on June 5, 2017, violates Forest Service Regulation 36 CFR §219.4. ***Nevertheless, the Objecting Parties submitted comments by letter dated June 22, 2017 (FERC accession number 20170622-5107), one day before the release of the FEIS and DROD which were simultaneously released. The Forest Service has not responded to the comments submitted on June 22, 2017, and those comments are incorporated herein as grounds for objection.***

The disregard for the public interest throughout the process might best be summed up by one note in a Plan Amendment record dated October 16, 2016 wherein Forest Service staff committed to performing a task "in order to keep MVP's process moving." *See* Attachment D, Meeting Minutes, October 16, 2016. The same meeting minutes make note that the Forest Service staff is working with the contractor named Galileo to identify from public comments those who would have standing to challenge the Forest Service decision -- which indicates the decision was made long ago and the information developed in the process would never make any difference in the decision. *See* Attachment D.

B. The Forest Service Has Not Provided Timely Public Notice of the Proposed Amendments to all the Parties to the MVP Certificate Proceeding

The June 5, 2017 Notice was published only in the Federal Register. 82 Fed Reg 25761. The failure to also post the Notice on the project's docket at the Federal Energy Regulatory Commission (FERC) violates the standards and procedures set forth by the Forest Service in the Notice of Availability of the Draft Environmental Impact Statement. 81 Fed Reg 71042 ("All comments must be submitted to the FERC, the Lead Federal Agency…"). Under such directive, the public would expect the Forest Service to also electronically file any such notices on the FERC project docket where interested parties would be timely informed of the Forest Service actions.

C. The Forest Service Has Not Provided Adequate Notice of Publication of the Draft ROD

Similarly, the public has not been informed of the DROD by publication on the FERC docket. Based on the Forest Service's previous representations, the Objecting Parties did not anticipate the DROD would be published on the same date as the Final Environmental Impact Statement (June 23, 2017). The Forest Service had rejected the FERC-imposed schedule. By letter dated March 24, 2017, the Forest Service objected to the FERC timetable and described certain prerequisites before the Forest Service could act. FERC accession number 20170324-5024. The Forest Service specified in March 2017 that it could not make a decision until "1. All consultations under the

Endangered Species Act and the National Historic Preservation Act have been completed;" and "2. The Forest Service has all of the information needed to make these decisions. This would include requested data, analyses, and design criteria. All avoidance, minimization, and mitigation measures must have been identified, agreed upon, and disclosed to the public through the NEPA process." FERC accession number 20170324-5024, Timm Letter, March 24, 2017. The Endangered Species consultation process was only recently initiated, and although documents which purport to address mitigation measures were filed on the FERC docket on June 30, the mitigation measures are still in draft form and have not been agreed upon by the Forest Service.

D. All Comments Submitted During the Objection Process Are Timely Because the DEIS Was Inadequate and the Forest Service Failed to Supplement the DEIS

The DEIS was inadequate and the BLM and the Forest Service knew it at the time. Meeting minutes in the Plan Amendment record document the inadequacy of the DEIS. *See* Attachment E, F. The BLM, through the Department of Interior, filed comments that objected to the inadequacy of the DEIS which comments are dated December 22, 2016. FERC accession number 20161223-5049. The DOI said that preparation of a Supplemental Environmental Impact Statement (SEIS) was necessary after the proponent provided information for proper analysis, noting not only the agencies' need for the information but the public need as well. The BLM summarized its rejection of the DEIS as follows which summary (including BLM footnotes to its summary) continues here through page 11 of these Objections:

> Currently, the DEIS for MVP lacks the information and analysis necessary under the National Environmental Policy Act for BLM to adequately consider the project's effects. Because the DEIS lacks information, it precludes meaningful analysis of the potential impacts discussed herein. As explained in the attached comments, the analyses of alternatives, cumulative effects, and cultural, visual, aquatic, geological, and biological resources are deficient because information has not been provided, was provided after the release of the DEIS, or was not incorporated in the DEIS.
>
> The proposed MVP would affect 3.4 miles of the National Forest System lands on the Jefferson National Forest and approximately 125 feet of United States Army Corps of Engineers lands on the Weston Gauley Bridge Turnpike Trail. Pursuant to the Mineral Leasing Act of 1920 and in accordance with 43 CFR 2880, the BLM is the federal agency responsible for issuing Right-of- Way (ROW) grants for natural gas pipelines across federal lands under the jurisdiction of the BLM or of two or more federal agencies. The BLM does not directly manage any land involved in the MVP.

Our full detailed comments are contained in the attached table that follows these general comments. We have identified several concerns regarding the data and analysis, including insufficiencies, which provide cause for concern about the completeness and accuracy of the document. These concerns and insufficiencies are summarized below.

General Concerns:

- The purpose and need for the MVP, adequately explained in the DEIS and based on the agency's purpose and need rather than the applicant's purpose and need.
- Analyses, reports, and mitigation plans referenced in the DEIS (i.e. draft blasting report) are still in draft form or not yet available. BLM is concerned this precludes a thorough analysis and public review and comment on project materials.
- Adequate explanations of why alternatives are dismissed or not carried forward for detailed analysis.
- A final route with updated maps of the final route. The route is not finalized because the applicant has filed multiple changes or variations to the route since the DEIS was published.[3] This poses a challenge to the BLM and the general public in reviewing project documents.
- Clear disclosure of the full Right-of-Way grant width and disturbance area. Clear assessment of impacts to resources, particularly in regard to context, timing, duration, and intensity.

Feasibility and Contingency Plans

- The results of geotechnical and/or geophysical analysis demonstrating that it is feasible to bore under the Appalachian National Scenic Trail and the Weston Gauley Bridge Turnpike Trail.[4]
- Contingency plans for potential failure of the direct bore method under the Appalachian National Scenic Trail or the Weston Gauley Bridge Turnpike Trail.

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3 Of note, the applicant has not filed an updated SF-299 right of way application with BLM that includes the changes to the proposed route through federal lands.

4 See DEIS at 3-46 (noting that the information was unavailable at the time of the DEIS for ANST); U.S. Army Corps of Engineers November 1, 2016 Letter (requesting boring); DEIS at 4-248 (noting that Mountain Valley had not documented communications with the Corps of Engineers about impacts on the trail).

- Analysis of project-induced landslides and specific data on steep slope cuts and fills including analysis of catastrophic hazards related to steep slope construction.
- The results of feasibility studies for water body crossings on federal lands.

Visual Impacts:

- Visual Resource Survey methodology is either incorrect or improperly explained.
- A clear description of how the visual impact assessment was conducted. Visual impacts disclosed in detail, not simply listed.
- A narrative description discussing how the form, line, color, and texture of the landscape are visually impacted.
- Additional analysis and consideration given to the Appalachian National Scenic Trail, including visual simulations to adequately determine impacts to its congressionally recognized scenic value, off-leaf scenarios from Key Observation Points selected in coordination with stakeholders including NPS, BLM, U.S. Forest Service, and ANST management partners including the ATC and local clubs.[5]
- Meaningful analysis and a visual impact assessment of the stated alternative of open cut trenching the Appalachian National Scenic Trail. Include a detailed analysis of the potential "substantial surface disruption
- of the ANST and surrounding area during days to weeks of construction, with likely permanent effects to the landscape during operations." DEIS at 3-46. Provide proof of consultation with the National Park Service regarding this alternative.
- A contingency plan for crossing the Appalachian National Scenic Trail if the current crossing plan fails.
- Additional analysis and consideration needs to include visual impact assessments showing effects to the Jefferson National Forest and a detailed discussion of the relationship of these effects to the scenic integrity objectives of the Jefferson National Forest. Use Key Observation Points identified in coordination with the U.S. Forest Service.
- Visual impact assessments showing that adequate screening can be left on each side of the bore for users of the Weston Gauley Bridge Turnpike Trail and proof of coordination with the U.S. Army Corps of Engineers.
- Updated seen-area analysis and complete surveys.

- The Key Observation Points and existing environment require more description.
- Cumulative impacts to visual resource degradation need to be discussed
- Quantifiable acreage of disturbance for visual impacts.

Need and Alternatives

- Meaningful analysis of the need for the project starting from consumption by end users to capacity usage of existing natural gas pipelines.
- Meaningful analysis of the alternatives of expanding existing systems, using existing utility corridors, and pipeline collocation.
- Meaningful analysis of the alternatives to crossing waterbodies with a dry open-cut method.

Effects Analysis

- Meaningful analysis of the cumulative effects of multiple proposed pipelines on the Appalachian National Scenic Trail, including impacts on the Park and visitors.
- A discussion of impacts to public safety from emissions (especially dust/particulate matter) from the construction of the pipeline, with special focus on sensitive groups

Biological Resources:

- The results of formal consultation with the United States Fish and Wildlife Service (USFWS). Consultation with the USFWS is inadequately characterized, incomplete, and insufficient with respect to several species, including Threatened and Endangered Species and Migratory Birds. Address the several outstanding surveys that preclude effects determinations and impacts analysis.
- The results of surveys for locally rare plant species within the Jefferson National Forest, conducted in August 2016, but not included in the DEIS.
- Analysis of measures and procedures that will minimize or avoid impacts on Tier III and Wild Natural Trout streams.

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5 Visual impact information has been requested for close to two years. For example, in March 2016, the U.S. Forest Service reproached the applicant that leaf-off scenarios are the standard procedure for such simulations. Given the multiple requests over a long period of time from stakeholders and land management agencies, it is perplexing that the DEIS contains one visual simulation from the Appalachian National Scenic Trail taken during a leaf-on scenario.

- Documentation of consultation with NHP and a list of vegetation communities of special concern within the project area.

- Meaningful analysis of the relationship between adverse effects on forests and adverse effects on threatened and endangered species and birds of conservation concern.

- MVP's Mountain Valley's plan describing long term and permanent impacts on migratory birds and documenting consultations with FWS, FS, WVDNR, and VDGIF.

Cultural Resources

- The results of final cultural resource surveys and documentation of consultation with agencies regarding sites potentially eligible for listing in the National Register of Historic Places.

Other

- Soil and erosion plans and mitigation measures on federal lands are needed.

- Analysis of any additional disturbance surrounding the right of way on federal lands, including access to the right of way is required.

- A final blasting plan is needed.

- A mine pool mitigation plan is needed.

- Additional consideration is required to address any outstanding requests for information from the U.S. Forest Service, Bureau of Land Management, U.S. Army Corps of Engineers, and National Park Service.

- Information responsive to each of the concerns addressed in the attached chart must be provided.

A DEIS "must fulfill and satisfy to the fullest extent possible the requirements established for final statements in section 102(2)(C) of the Act (NEPA)". When "a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft of the appropriate portion. The agency shall make every effort to disclose and discuss at appropriate points in the draft statement all major points of view on the environmental impacts of the alternatives including the proposed action." 40 CFR 1502.9(a).

The DEIS fails to analyze much of the information listed above because the applicant did not provide it despite multiple requests, the applicant provided the information after the close of the comment period, or the process had not been completed before the release of the DEIS***. As***

> ***noted above, in some cases, the applicant had been advised of the need for this information over a year before FERC released the DEIS. In order to give cooperating agencies and the public an opportunity to meaningfully consider and comment on such new information, we are considering submitting a formal request to FERC to complete a Revised Supplemental Draft Environmental Impact Statement.*** We look forward to discussing these concerns with the FERC.

FERC accession number 20161223-5049, DOI/BLM Comments and Objections to the DEIS, December 22, 2017, pp 13-16 (emphasis added). All comments submitted during the DROD objection period are timely comments because the DEIS did not contain information sufficient to provide meaningful comments and the Forest Service itself has recognized this as an issue. *See* Attachment G, December 7, 2017 Meeting Minutes (The Forest Service is discussing this internally how to proceed with allowing public comment on outstanding information presented after the Draft EIS comment period.). Furthermore, the Forest Service did not inform the public of the implication of the planning rules until it published a notice, only in the Federal Register and not on the FERC docket, on June 5, 2017, and no comment period was invited by the publication. ***Essentially everything that has been released on the FERC docket since the DEIS comment period ended is all new information, the Forest Service has never provided a comment period for its conclusions about the application of the planning rule, and no comments or objections may be excluded from the process.***

E. The Forest Service Has No Purpose or Need to Amend the Forest Plan So that Interstate Gas Pipeline Construction Can Occur on the Jefferson National Forest, And a Need For a Pipeline Has Not Otherwise Been Supported in the Record

FERC has still not disclosed any need for the project to the public. If the Forest Service has evidence of the need for a gas pipeline, then it is not in the plan amendment record.

Without any authority to do so, FERC has stripped the Forest Service and BLM of each agency's independent authority to determine the need for the activity. The statements of each agency's purpose and need in the Notice of Availability are absurd. "The BLM's purpose and need for the proposed action is to respond to a Right-of-Way Grant application submitted by Mountain Valley on April 5, 2016....The FS's purpose and need for the proposed action is to consider issuing a concurrence to the BLM for the Right-of-Way Grant and to evaluate the amendments to the LRMP for the Jefferson National Forest that would make provision for the MVP pipeline if the FS decides to concur and BLM decides to issue a Right-of-Way Grant." 81 Fed. Reg. 66269 (2016).

The BLM captured the issue succinctly in its comments to FERC on the DEIS when it expressed concern to FERC that the DEIS should have contained "the purpose and need for the MVP, adequately explained in the DEIS, and based on the agency's purpose and need rather than the applicant's purpose and need." FERC accession number 20161223-5049, DOI/BLM Comments and Objections to the DEIS, December

22, 2017, p 13. The Forest Service has no purpose and need to waive the protective management standards in the Forest Plan so that a limited liability company can build a pipeline for private profit. The Forest Service should have objected to the characterization of its purpose and need just like the BLM objected to it. ***We object to the representation that was crafted by FERC that the Forest Service has a purpose and need to waive the standards in the Forest Plan so that the investing members of a limited liability company can use public resources to transport its widgets to the marketplace. There is no lawful basis for the characterization of the purpose and need, and no purpose and need has been demonstrated.***

F. The Premature Draft ROD Precludes Comment and Objection to Consultation Outcomes and Proposed Mitigation, all in Violation of NEPA

The Forest Service Plan Amendment regulations (planning rule) prescribe detailed notification, public comment, and objection procedures that apply to every aspect of a proposed project and the decision-making process. Nothing in the regulations or in NEPA allows the Forest Service to issue a draft decision before all of the information on which the decision is based has been subject to public notice, comment and objection procedures. The Forest Service's compliance with the Endangered Species Act and the National Historic Preservation Act, and the mitigation and monitoring requirements are important components of the decision and must be subject to public review, comment, and objection. ***We object to the premature issuance of a draft decision, and to the failure to publicly disclose the outcomes of consultation and agreed upon mitigation measures prior to the commencement of the objection process.***

The Forest Service relies on a flawed and inadequate environmental impact statement that is based on false and incomplete information. Many comments filed on the FERC docket challenge the information and assertions made by MVP and the government agencies. Few, if any, of the comments on the DEIS have been properly responded to as required by NEPA. In most cases the response refers the reader generally to a section in the FEIS. ***We object to the failure to respond to comments.*** The minutes from a March 28, 2017 meeting with FERC shed light on the failure to respond to comments, as well as the fact that the Forest Service did not have the information it needed from the project proponent to draft or respond to the parts of the FEIS that apply to the National Forest. *See* Attachment H.

Tens of thousands of pages of documents, perhaps one hundred thousand pages of documents have been loaded into the FERC docket by the proponent alone. On more than one occasion, the proponent has filed thousands of pages at one time without identification or labeling of what might be in the files. Unlike the public, the Forest Service receives organized and identified paper copies of documents, and has staff and contracted consultants to assist with review of the documents while the process has been completely unwieldy and overwhelming for the public.

Landowners who know their land better than anyone have challenged MVP's representations about their lands to no acknowledgment. Credentialed scientists with

relevant expertise have been belittled by unidentified writers who work for MVP. FERC has paid only lip service to public participation and the Forest Service followed suit by failing to implement the collaboration goals in the planning rule. Although the Forest Service met with concerned citizens and listened, questions were seldom answered, and there was no dialogue and no collaboration. There are thousands of signatures on a petition requesting a public hearing. FERC accession number 20150616-5190. Instead, the Forest Service merely provided representation at a table while FERC took 3 minute comments from the public at FERC-hosted public hearings on the DEIS. ***We object to the failure of the Forest Service to hold any public meetings or hearings on the proposed Forest Plan amendments, the need for which hearing and meetings are directed by 40 CFR §1506.6 (c)(1) ("Agencies shall: . . . . Hold or sponsor public hearings or public meetings whenever appropriate or in accordance with statutory requirements applicable to the agency. Criteria shall include whether there is: (1) Substantial environmental controversy concerning the proposed action or substantial interest in holding the hearing.")*** The public controversy is so profound and intense that rather than having public hearings as *required* by NEPA, the Forest Service and the proponent instead have been devoting extraordinary resources to the preparation of law enforcement response to anticipated protests. *See* Attachment I, March 14, 2017 Meeting Minutes. The Forest Service is creating an elaborate law enforcement plan to respond to the public's consistent outrage against the lawfulness of the process instead of complying with the law themselves. It is a pitiful indictment of the entire process and the public should be outraged. If the Forest Service would listen to the public and follow the law, then law enforcement intervention would be less likely to be prompted. Instead the Forest Service is complicit in escalating the situation and will be accountable for all of the consequences that flow from its own unlawful decision-making process.

In January 2017, FERC provided a supplemental comment period for a route variation. FERC accession number 20170113-3006. Even though FERC requested additional comments after the close of the DEIS comment period, FERC nevertheless expressly limited the responses to comments to those comments filed by the DEIS comment deadline in December 2016 -- even though almost every comment filed by the December DEIS comment deadline noted that the DEIS lacked sufficient information upon which to provide comments. **The route variation has implications for the Jefferson National Forest, and Preserve Craig and Save Monroe filed comments that have yet to be responded to by either FERC or the Forest Service.** FERC accession number 20170221-5116.

The Plan Amendment record reflects not only the lack of adequate information to support the DEIS, but also the inappropriate control over the Forest Service decision-making processes by the project proponent and FERC. During a BLM and FS Coordination meeting held on September 1, 2016, the Special Project Coordinator for the Jefferson National Forest Jennifer Adams "noted the DEIS is being pushed through quickly without adequate time to gather and review data. FS has asked for more time for

review, which was previously granted by Paul Friedman (FERC project manager) but has since been taken out of the schedule per objection from proponents." Attachment J, Mountain Valley Project Coordination Conference Call Record, September 1, 2016. The DEIS was released by FERC a little over two weeks later. In February 2017, Forest Service staff again expressed concern over the lack of adequate time being afforded the Forest Service to do its job. Attachment K, February 2, 2017 Meeting Minutes ("Jennifer reviewed the current project schedule and updated that FS and BLM are not being given adequate review time or review materials in order to meet their NEPA requirements.")

The FEIS is still incomplete. The FEIS was filed on the FERC docket on June 23, 2017. The Notice of the Forest Service Draft Record of Decision (DROD) was published in the *Roanoke Times* newspaper on June 23, 2017. On June 30, 2017, MVP filed on the MVP docket a collection of documents that purport to be a Draft Plan of Development, with appendices, and a revised Hydrologic Analysis of Sedimentation. Various other documents also were filed related to the Appalachian National Scenic Trail. These are the documents upon which the Forest Service relies to manage MVP's activity on the Jefferson National Forest. None of the documents were accessible on June 30, 2017 because of the size of the files which totals thousands of pages. Since it was a Friday, the material was not available to the public until the following Monday, 10 days after the publication of the notice in the *Roanoke Times*. Even so, many people including counsel for the Objecting Parties have not been able themselves to download the documents from the FERC website, either due to the size of the documents or the working status of the FERC docket.

The Forest Service represents that the proponent's Draft Plan of Development (DPOD) is the primary document for all impacts analyzed and for which mitigation is applied to claim that impacts will be reduced to levels below significance or adverse impact. The DPOD is the document that purportedly is the primary support for the DROD and its findings that the significant adverse impacts will be mitigated. The DPOD is still in draft form including many of the appendices that provide detail on the anticipated practices. The issue is not just that we cannot comment on a DPOD, the issue is that the Forest Service and the proponent have not yet come to agreement on significant aspects of impact and alleged mitigations. The proponent and the Forest Service are still in disagreement about the suitability of the predictive tools that were used in the Analysis of Sedimentation. FERC accession number 20170630-5393.

The proponent also has not agreed to forest restoration measures to reduce the size of the operational right of way. Attachment L, June 14, 2017 Meeting Notes ("John noted MVP has been working to identify alternatives to reducing the permanent Right of Way width on Jefferson National Forest lands in order to address visual impacts. He suggested by not trimming the canopy MVP would be able to maintain the 50 ft ROW in a mowed state to comply with US Department of Transportation' Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations. Jennifer countered

that the FS has worked with FERC to develop the ROW rehabilitation restrictions that would still meet PHMSA regulations. She also said MVP's proposed alternative measure would not work, as trees would be cleared anyway for the construction phase. Jennifer also said this matter relates to the BLM and FS decisions regarding the ROW and plan amendments, respectively, and should not concern discussions with the NPS at tomorrow's meeting. John said the MVP's Visual Impact Assessment concluded that no additional mitigation measures or stipulations, in this case a reduced permanent ROW width, would be needed to meet the FS's Scenic Integrity Objectives. Jennifer clarified the ROW width reduction and subsequent seed mixes and rehabilitation measures requested by the FS are part of the analysis that showed reduced impacts to not only visual resources, but also sedimentation and wildlife impacts. Jennifer restated the rehabilitation measures are approved by FERC and comply with PHMSA regulations. Jennifer concluded that the FS needs to complete internal conversations on the best way to visualize and describe the FS's ROW restriction and rehabilitation methods, and later meet with MVP to clarify FS requests.") ***We therefore object to the DROD on the basis that information upon which the DROD is based is still in draft form and the decision is premature because there is no agreement about the scope of the impacts or the mitigations that will be required.***

Mitigations include time of year restrictions for the protection of various resources and species. The restrictions are noted throughout the DPOD and its voluminous appended documents which total over 1000 pages. Again, the DPOD was among the documents only recently filed on June 30, 2017. There is no practical way for the public to keep track of the time of year restrictions, and in March 2017 the Forest Service noted conflicts among the various restrictions. Attachment M, March 20, 2017 Meeting Minutes ("Carol said the FS and FWS recognizes the need to evaluate and prioritize resource-based (T&E, slope stability, soil movement concerns) seasonal construction restrictions as several of the recommended restrictions are in conflict.") ***The time of year restrictions should be set forth on a schedule so that the public has a guide by which to track when construction may and may not occur, particularly since the managing partner for the proponent limited liability company pleaded guilty to environmental crimes in Pennsylvania.*** FERC Prefiling accession number 20150616-5189, refiled (referenced/hyperlink) at accession number 20161221-5446.

Compensatory mitigation measures are generally described in the DPOD with no detail or facts upon which to base comments. ***These Objecting Parties challenge the Forest Service's legal authority to trade public resource assets on our National Forest by compensatory mitigation and enter such agreements with MVP, and further object to the DROD on the basis that impacts and effects are discounted on the bases of purported plans to perform compensatory mitigation for which there is no legal authority and no information has been provided to the public.***

The FERC requested the initiation of formal consultation with the US Fish and Wildlife Service by letter dated July 10, 2017 due to the following findings:

> We have determined that the Project *may affect* and is *not likely to adversely affect* the Virginia big-eared bat, gray bat, James spinymussel, clubshell, snuffbox mussel, rusty patched bumble bee, and smooth coneflower. We have determined that the Project *may affect* and is *likely to adversely affect* the Indiana bat, northern long-eared bat, Roanoke logperch, running buffalo clover, small whorled pogonia, shale barren rock cress, and Virginia spiraea.

FERC accession number 20170710-3001, p 2. ***Consultation under the Endangered Species Act has not occurred and the Forest Service therefore has not properly considered whether consultation outcomes will implicate the planning rule and the Forest Plan, to which we object.*** As early as November 11, 2016, the Forest Service and the BLM expressed concern that effects determinations would be made before consultation. Attachment N, November 11, 2016 meeting notes ("Wildlife impacts also a concern; formal consultation to be done 'at future time'; effect determinations done without FWS consultation; consultation must be done before DEIS so terms and conditions from Biological Opinion are in the DEIS for everyone to review.").

As these objections are being drafted, on the afternoon of Thursday 27 July, 2017, the proponent filed yet another document related to species consultation. FERC accession number 20170727-5178. The July 27 filing, includes among other matters, new information that the route has been adjusted. *Id*. p 28 of 92. ***We object to this process which mocks the law and the public's right under the law to meaningfully participate.***

A DEIS "must fulfill and satisfy to the fullest extent possible the requirements established for final statements in section 102(2)(C) of the Act (NEPA)". When "a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft of the appropriate portion. The agency shall make every effort to disclose and discuss at appropriate points in the draft statement all major points of view on the environmental impacts of the alternatives including the proposed action." 40 CFR 1502.9(a). ***Based on the opinion and practice of the Forest Service and the BLM, not only was the DEIS inadequate, so is the FEIS because it still lacks information that should have been included and analyzed in the DEIS.***

G. The Proponent's Hydrologic Analysis of Sedimentation Fails to Use the Best Available Science as Required by 36 CFR 219.3, and Reliance on the Assessment is Invalid Under NEPA and the Planning Rule

The proponent submitted the Revised Hydrologic Analysis of Sedimentation to the FERC docket on June 30, 2017. FERC accession number 20170630-5393. The meeting minutes in the Plan Amendment record show that the Forest Service has had consistent concerns with the proponent's initial sedimentation analysis. *See* Attachment O, April 6, 2017 Meeting Minutes (listing a plethora of shortcomings not the least of which is the inability of the Forest Service to use the analysis to reach conclusions

about effects). The Forest Service communicated its concerns to the proponent in writing on April 26, 2017. FERC Accession number 20170426-5200.

The Revised Analysis was accompanied by the proponent's response to the Forest Service's comments on the initial assessment. FERC accession number 20170630-5393. The proponent's comments fundamentally challenge the opinion of the Forest Service of the validity of the initial Analysis of Sedimentation. We argue that the Revised Analysis is not improved.

After the Forest Service filed its written concerns about the analysis, the proponent stated its bottom-line reason for resisting to revise the sedimentation analysis pursuant to the Forest Service's concern in a meeting on May 8: "John [proponent] reiterated previous concerns about the FS's comments on MVP's initial sedimentation analysis. *John said he wants to work with the FS to avoid having to lower the capture efficiency of erosion control measures in the sedimentation analysis as this would fundamentally change impacts to species*." Attachment P, May 8, 2017 Meeting Minutes (emphasis added). Essentially, this is an admission that the Analysis of Sedimentation is biased toward the result that the proponent wanted, and it skewed the results to minimize the assessment of adverse impacts.

The Forest Service is required to use the best available science in its assessment of amendments to the Forest Plan. 36 CFR § 219.3. The Forest Service never had a chance of doing so because it adopted the FEIS as its own and issued its DROD before the proponent submitted the Revised Analysis. In fact, the FEIS and DROD were drafted and went to print more than one month before FEIS and DROD were published. It is no wonder that the proponent withheld the release of the Revised Analysis until after the FEIS and DROD were published.

The Forest Service decision was premature. Not only should the Forest Service have waited to see whether the proponent would properly revise the assessment, the Forest Service had reasonable notice that if the analysis had been done properly the predictive outcomes would have been different. Both the Forest Service and the proponent are playing harmful, if not deadly games with our public resources.

We object to each and every application of the Revised Analysis of Sedimentation for any purpose whatsoever in the DROD and FEIS because it is junk science, and misrepresents the sedimentation impacts and the effects that sedimentation would have on aquatic life. The Objecting Parties accompany their objections with three independent assessments of the proponent's Revised Analysis of Sedimentation. Each of the attached assessments support in detail the conclusion that the Revised Analysis of Sedimentation is fatally flawed. *See* Attachment Q, Comments on MVP Response on Sedimentation Analyses Hydrologic Analysis of Sedimentation – JNF Thomas Adams terrapredictions.org; *see also* Attachment R, FEIS and Forest Service Shortcomings in Assessing Mountain Valley Pipeline Sedimentation Impacts on Streams: a Citizen's Review, Thomas Bouldin, Registered Intervenor, Pence Springs, West Virginia; and *see also* FERC accession number 20170731-5067, Notice of

Objection, Indian Creek Watershed Association, Prepared by Pamela C. Dodds, Ph.D., Licensed Professional Geologist.

Forest Service staff raised the same issues as those raised by Adams, Bouldin, and Dodds in a meeting held on May 9, 2017. *See* Attachment S, May 9, 2017 Meeting Minutes. We imagine that the resource staff objects to the DROD as well, especially since by May 18, 2017, MVP had achieved a workaround from the professionally appropriate demands of the resource staff in Roanoke: "Greg confirmed MVP and FS Washington Office have settled on a consistent and acceptable methodology for the Hydrological Analysis of Sedimentation." *See* Attachment T, Meeting Minutes, May 18, 2017.

H. The Forest Service Falsely Discounts Adverse Impacts by Claiming that Restoration Will Occur in the Right of Way

We describe above and herein the soil segregation proposal upon which the Forest Service relies to claim that the soils will be put back the way they were found, and that this will promote the growth of vegetation to restore the right of way, thereby reducing visual impacts and erosion and stream sedimentation some unmeasured level below significance. However, meeting minutes show that MVP has admitted that such mitigation is not possible on the entire right of way, and in particular on steep slopes. *See* Attachment U, December 6, 2016 Meeting Minutes ("Tom B. stressed concern there could be limitations to slope contour and topsoil restoration due to steepness of slope and removal of vegetation. Tom C. confirmed the FS wants topsoil segregated and replaced everywhere where slope steepness does not prevent it. Tom would like to see MVP analyze and determine the slope gradient at which topsoil would not be stable."); *see also* Attachment V, December 8, 2016 Meeting Minutes ("Tom Bailey (FS) requested detailed representation and analysis of topsoil segregation and stressed concerns on limitations to replacing topsoil and slope contour post construction.").

The Draft POD contains over 1000 pages and was filed after June 23, 2017. The meeting minutes were not provided until July 10, 2017. It is not possible for the public to track the multitude of issues. Nevertheless, the Forest Service has discounted critically adverse impacts to soils, visual impacts, and water resources on grounds that the soil profile and some type of vegetation will be restored. MVP and the Forest Service have admitted that this is not possible on steep slopes but the public has not been informed of the predictions. Rather, the representation to the public is the opposite.

Even if the data requested on December 6, 2016, is somewhere in the tens of thousands of pages that have been filed since the DEIS comment period closed in late December 2016, the conclusion that the mitigation proposed will reduce adverse impacts to less than significance defies reason and logic. The steepest parts of the mountain sides are the highest in elevation. If restoration at the top is not possible, then the rubble and dirt flows downhill, thereby reducing the likelihood that any restoration below is achievable.

The steepest parts of the mountainsides also have northwest aspects with limited sunlight making revegetation an even greater concern, and the time of year restrictions may result in logging in the fall which will further reduce the efficacy of establishing vegetation. This is no mitigation plan, it is a blueprint for the failure of restoration measures and a roadmap to erosion and stream sedimentation.

The Objecting Parties also include herein an objection based on the failure to use sound science in the Analysis of Sedimentation that the Forest Service required, among other grounds. One of the continuing criticisms of the analysis that remains despite revisions is that the analysis fails to capture high intensity episodic events and localized conditions. *See* Attachment W, April 6, 2017 Meeting Minutes. We know that localized storms are becoming more intense and the restoration plan fails to consider the probability that one storm alone could entirely undermine any mitigation offset, and that probability is more likely than not to occur.

So just how is the Forest Service able to quantify irrational mitigation proposals against the significant adverse impacts that will occur?

Mitigation failures on the Rover gas pipeline that recently occurred in both Ohio and West Virginia are documented on the FERC docket. The Rover failures that are relevant here are documented in the enforcement action imposed by the West Virginia DEP. *See* FERC accession number 20170728-5187. The West Virginia enforcement document contains extensive photographic documentation of both the misuse and failure of the same sediment control tools proposed for use by the proponent. The photographs start on page 10 of 82 of FERC accession number 20170728-5187. The West Virginia site is not a steep slope, and it is apparent even to a lay person that the mitigation measures were not effective. The mitigation measures that were used on the Rover pipeline are the same measures that are proposed for the MVP where the slopes are much steeper and the soils are highly erodible.

Construction of the Rover pipeline has been so catastrophic that members of Congress just requested FERC to expand its investigation of the failures and asked very pointed questions about FERC's role. FERC accession number 20170731-5069. Specifically, the members asked FERC to answer the following questions:

> 1) What policies, procedures, and regulations serve to ensure and verify that FERC's assessments of natural gas pipeline certificate applications are based on complete and accurate information?
> 2) How many applications for certificates of "public convenience and necessity" did FERC receive during 2000 - 2017, and how many of those applications did FERC deny?
> 3) What FERC procedures or regulations govern or monitor regional distribution of natural gas pipeline certificate approvals? How do these or other FERC policies or regulations account for the number of existing

pipelines in a given region during FERC's consideration of applications for new natural gas pipeline construction?

Id, p 3. At least in regard to the information on which FERC bases mitigation offsets to discount significant adverse impacts, the answer to question number 1 is "none". *See* Attachment C, March 9, 2017 Meeting Minutes ("Tim inquired if a proponent's proposed mitigation impacts would be analyzed in the environmental impact statement (EIS). Kevin said a high-level summary of the proposed mitigation would be included but the impacts would not be fully analyzed.")

We object to the adoption of the FEIS because the FEIS concludes that adverse impacts will be reduced to less than significance even though the proponent and the Forest Service have admitted that the purported mitigation restoration is not possible at critical locations along the route. In addition, the analysis fails to quantify or identify where the restoration is and is not possible, which is required to effectively weight the contribution of proposed mitigation against the significance of the impacts. The conclusion that significant adverse soil, visual, and erosion and stream sedimentation impacts will be mitigated with these proposed measures is a fiction where the proponent admits that the slopes are too steep to achieve restoration. These are also grounds for objecting to the waiver of Forest Wide Standards in the Forest Plan and the substitution of those standards with mitigation measures that the proponent and the Forest Service admit cannot be successful.

I. The Forest Service Failed to Consider Cultural Attachment as a Significant Issue Under NEPA, and Failed to Complete an Assessment of Cultural Attachment Under the Planning Rule that the Forest Service Itself Initiated

The Forest Service set NEPA precedent on the issue of Cultural Attachment on the Jefferson National Forest when it denied a special use permit for a high voltage power line across the National Forest. Due to the precedent of Cultural Attachment as a significant issue, the Forest Service initiated a professional third-party assessment, but the Forest Service never followed through with the consultant's recommendations to perform a thorough effects analysis.

NEPA Precedent: Over twenty years ago, the Forest Service established Cultural Attachment as significant issue under NEPA as it made its decision about whether to allow an APCO 765kV line to cross the Jefferson National Forest on Peters Mountain. In 1995, the JNF commissioned James Kent and Associates to perform the professional assessment of Cultural Attachment (*Cultural Attachment: Assessment of Impacts to Living*) that was incorporated into both the DEIS (1996) and in the ROD (2002). Cultural Attachment was cited as one of the reasons that the JNF chose the No Action Alternative. The bases for rejecting the route that caused adverse impacts to Cultural Attachment is that the consultant concluded and the Forest Supervisor agreed that the significant impacts to Cultural Attachment could not be mitigated.

During the pre-filing and filing periods for the Mountain Valley Pipeline, the FERC and the JNF received a multitude of comments from individuals and organizations citing this NEPA precedent and emphasizing the importance of considering cultural attachment in prohibiting the pipeline crossing Peters Mountain (for example, Accession nos. 20151023-5124, 20160505-5090, 20160630-5121, 20161205-5227, 20161220-5035, 20161221-5346, 20161222-5551, 20161223-5157, 20150806-5144, 20151125-5117, 20150804-5026, 20160524-0028,20150616-0137, 20150608-0139, 20150306-0028, 20150130-0028, 20150827-0041, 20161216-0008, 20161121-0301, 20151013-5158, 20151013-5206, 20151013-5207, 20150807-5034, 20150616-5243, 20150616-5278, 20150616-5279). Many of these filings include landowner comments about their deep spiritual attachment to Peters Mountain, and their strong cultural identification with its physical and historical presence.

The Forest Service Required the Conduct of a Professional Assessment: On August 11, 2015, at the request of the Forest Service, the FERC directed MVP to "Include a detailed discussion of 'cultural attachment' along the proposed pipeline route crossing the Jefferson National Forest. The study of cultural attachment should be conducted by a qualified professional cultural anthropologist." (Accession No. 20150811-3043, page 21). Mountain Valley hired a professional cultural anthropological consulting firm Applied Cultural Ecology (ACE.) (FEIS, 4-472) which produced the report, *"The Mountain Valley Pipeline Jefferson National Forest Segment Cultural Attachment Report" (Accession No. 20160127-5356, 1-27-16).* In their report, **"**ACE indicated that the people who reside in the Peters Mountain area have a cultural attachment to the land that is unique to this portion of Appalachia" (FEIS, Page 4-474).

The FEIS affirms the consideration of Peters Mountain as a rural historic landscape: "Furthermore, the NPS has indicated that historic rural landscapes may qualify for nomination to the NRHP (McClelland et al., 1999). Likewise, traditional cultural places can also be nominated to the NRHP (Parker and King, 1998). In the opinion of ACE, Peters Mountain could be considered a rural historic cultural landscape (Bengston and Austin, 2016). **We agree."** (FEIS, 4-474) (emphasis added).

No explanation by the JNF of why a professional effects analysis assessment was not performed: The FEIS acknowledges requests for an effects analysis to determine the effect of the pipeline on cultural attachment to Peters Mountain. "A letter to the FERC and FS dated May 4, 2016, from the Border Conservancy, Save Monroe, Preserve Craig, and Preserve Giles presented their comments on the ACE report. The groups requested that the FERC and FS have a cultural anthropologist conduct an effects analysis." FERC Accession number 20160505-5090. No analysis of the effects of the pipeline on cultural attachment was performed.

NEPA requires an analysis of adverse effects on properties listed or eligible for listing on the National Register of Historic Places. Despite the evidence presented by ACE and acknowledged by the FEIS that Peters Mountain might be eligible for nomination as an

historic rural landscape, no analysis was conducted on the adverse effects of the MVP project on those elements that help define and protect its eligibility.

Cultural Attachment is a significant issue that is glaringly absent from the DROD: In spite of the attention paid during the past two decades to the Cultural Attachment to Peters Mountain, including the JNF's most recent commission of the ACE study, the DROD does not include **any** discussion of Cultural Attachment, nor does it present a justification of its exclusion. ***We object to the failure of the Forest Service to address Cultural Attachment as a significant issue under NEPA.***

The Forest Service is required to provide, sustain, and account for spiritual values. 36 CFR § 219.1(c). The Forest Service initiated an assessment of the issue under the Planning Rule. "Plan amendment assessments. Where the responsible official determines that a new assessment is needed to inform an amendment, the responsible official has the discretion to determine the scope, scale, process, and content for the assessment depending on the topic or topics to be addressed." 36 CFR 219.6 (c).

> An assessment is not required to amend a plan (FSH 1909.12, Ch. 20, sec. 21.2.[)] Other documentation, such as a monitoring evaluation report or other source of new information indicating changed conditions in the plan area, may suffice to determine the need for an amendment. However, the Responsible Official may determine that an assessment is useful, to identify relevant available information and evaluate conditions and trends of social, cultural, economic, and ecological systems relevant to the issues that indicate an amendment may be needed. The breadth, scale and complexity of the issues would typically determine the breadth, scale, and complexity of the assessment.

FSH 1909.12 - LAND MANAGEMENT PLANNING HANDBOOK, CHAPTER 10 – ASSESSMENTS, Page 70 of 70. In this case, although not required, the Forest Service initiated an assessment and then abandoned the assessment without grounds or explanation. ***We object to the abandonment by the Forest Service of the assessment of a cultural and spiritual issue without explanation or cause.***

The Objecting Parties adopt by reference the arguments made in comments to the DEIS in the accession numbers noted above, and in particular 20161223-5062, pp 18-19. The analysis in the FEIS is little improved from the DEIS. The Forest Service is required to use the best available science in amending the Forest Plan. In the case of Cultural Attachment, the Forest Service has instead adopted the unprofessional treatment of the issue by FERC which not only disregards the Forest Service precedent, it belittles both the precedent-setting decision maker and those who are culturally attached. ***We object to the failure to use the best available science in the treatment of Cultural Attachment in the DEIS and the FEIS.***

The Objecting Parties also adopt by reference the Notice of Objections submitted by Richard Ettelson, Waiteville, West Virginia which Notice is dated July 7, 2017, and assert the objections as our own.

J. The Forest Service Violated NEPA by Failing to Evaluate Reasonable Alternatives With the Use of the Energy Project Siting Tool and By Adopting a Flawed Analysis of Alternative Hybrid 1A, and Violated the Regulation Requiring the Use of Best Available Science.

Alternatives analysis is the heart of the NEPA process. FERC cannot usurp the Forest Service's independent NEPA duties. "The EIS shall document the examination of reasonable alternatives to the proposed action. An alternative should meet the purpose and need and address one or more significant issues related to the proposed action." 36 CFR § 220.5 (e).

NEPA directs that: "Federal agencies shall to the fullest extent possible: … (e) Use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions ..." 40 CFR §1500.2. The phrase "'to the fullest extent possible' in section 102 means that each agency of the federal government shall comply with that section unless existing law applicable to the agency's operations expressly prohibits or makes compliance impossible." 40 CFR §1500.6.

Supervisor Timm is charged with establishing the scope of analysis, the actions, and the alternatives under Forest Service regulations. "For each Forest Service proposal, the responsible official shall coordinate and integrate NEPA review and relevant environmental documents with agency decision-making as follows: 1. Establish the scope of the environmental analysis, including the scope of the actions, alternatives, and effects (40 CFR 1508.25)."

The FERC docket contains an extensive analysis of the Alternative Hybrid 1A submitted by the Greater Newport Rural Historic District Committee ("Committee"). FERC Accession number 20170510-5023. Both the Committee's analysis and analysis in the FEIS are inadequate because not all of the information about impacts was, or even has been identified and analyzed. Nor does the analysis in the FEIS expressly address the extraordinary features on the National Forest that would be avoided by Hybrid 1A. The tabular, numeric comparison misses the mark.

In regard to new information, cultural heritage surveys have identified a significant cultural resource site on the National Forest that is so significant that it may be National Register of Historic Places (NRHP) eligible. Attachment T, May 18, 2017 Meeting Minutes. The FEIS is premature and there are two additional Historic Districts impacted. So, in addition to the 7 Historic Districts, there is now a cultural heritage site of significance on the National Forest that would be avoided by Hybrid 1A. The Committee highlighted the advantages as follows, which necessarily could not have included the newly revealed site on the National Forest:

The Hybrid 1A is environmentally preferable, and 17 of these are significant, they are:

- 52 miles more collocation, paralleling existing rights of way (ROW)
- 45 fewer residences within 50 feet of the construction work area,
- 4 fewer High Consequence Areas in the Pipeline Impact Radius
- Avoids new greenfield crossings of the ANST
- Avoids new greenfield crossings of the Jefferson National Forest
- 2.5 miles less impacts on a USFS Roadless Area
- Avoids fragmentation of three USFS inventoried Unfragmented forest blocks
- 4.8 acres less effects on USFS designated old growth forest
- Avoidance of 8 state designated conservation sites,
- 7 fewer historic districts crossed
- 16 miles less historic districts
- Avoids impacts on habitat for three TES (Northern long-eared bat, James River spinymussel, Roanoke logperch)
- 125 fewer wetlands crossed requiring mitigation
- 68 fewer wells and springs within 150 feet of the construction ROW
- 84 miles less shallow bedrock crossed
- 9 miles less karst crossed
- 130 fewer karst features within 50 feet of the construction ROW

FERC Accession number 20170510-5023, p 19. The Committee met with the Forest Service and made the Forest Service aware of the filing of the analysis. Hybrid 1A avoids all of the significant adverse impact issues on the National Forest, and beyond, which impacts have required continuing analysis and distasteful negotiation with the proponent. Hybrid 1A avoids Wilderness impacts, impacts to the entrance of the Cascades Recreation Area, impacts to the James and Roanoke River basins entirely and the protected species that are supported in those aquatic systems. Hybrid 1A avoids the Inventoried Roadless Area and the fire management threat to the communities adjacent to the Roadless Area. Hybrid 1A negates the need for extensive and perpetual -- that means forever -- Law Enforcement support to thwart illegal use of the right of way. The list goes on and the Forest Service never analyzed the advantages to public resources, including newly discovered significant impacts of an alternative that has significant environmental and cultural advantages. ***We object to the Forest Service's complete silence on Hybrid 1A and the Forest Service must supplement the analysis in a proper manner so that the public may be informed of the significant advantages to public resources by the Hybrid 1A alternative.***

Hybrid 1A also made the cut as an advantageous route using a government sponsored energy project siting tool. The Wilderness Society (TWS) filed comments about the tool which has been ignored and avoided. The proposed routing of MVP fails to take reasonable steps, including use of the best available science, to avoid conservation and environmental impacts. The failure to use the science based tools and the best

available science to determine routes that would avoid unnecessary environmental impacts violates the Planning Rule.

TWS identified the existence of GIS tools to determine location and routing for energy infrastructure and development that seek to minimize environmental impacts and conflicts. The comments discussed the need for such tools to minimize adverse environmental impacts and the fact that minimizing environmental and conservation impacts is in the public interest. The comments also pointed out the existence of best available science tools specifically designed for this purpose. The Energy Zone Mapping Tool developed by Argonne Labs under contract with the Department of Energy is a GIS based tool specifically designed for this purpose. TWS comments (Accession No.: 20161223-5062 in Docket(s) No.: CP16-10-000, et al.) submitted Dec. 22, 2016 gave details about the Energy Zone Mapping Tool and how it or similar science based tools -- many of which were developed in consultation or collaboration with the very agencies undertaking this NEPA review -- could have been used to avoid and minimize environmental impacts.

In TWS comments submitted June 22, 2017 (Accession No.: 20170622-5201 in Docket(s) No.: CP16-10-000) we reiterated the failure to use such best science methods in the MVP NEPA analysis. TWS further demonstrated in these comments the results of application of the Energy Zone Mapping Tool between stations of the MVP pipeline. We used the default “pipeline corridor model” available in EZMT and used the tool to determine a route between the Stallworth and Transco stations. We displayed the result of this model run which focused on the area crossing Jefferson National Forest, and the fact that it avoided many of the conservation and environmental effects of the proposed pipeline route. The route that avoided environmental impacts identified by the Energy Zone Mapping Tool was very close to the Hybrid 1A alternative and verified the advantages of this route through an independent and separate methodology.

The fact that this or similar best science tools were not utilized in determining proposed routing for MVP to avoid unnecessary impacts to environmental and conservation values is counter to law and Forest Service regulations. Forest Plans, including the Jefferson National Forest Management Plan were developed using best available science to assure that resources of the Jefferson National Forest must be utilized in a combination that best meets the needs of the American people while sustaining productivity and without impairment of productivity. § 219.3 requires “The responsible official shall use the best available scientific information to inform the planning process required by this subpart for assessment; developing, amending, or revising a plan; and monitoring.”

The FERC FEIS and the USFS DROD fail to address how the proposed routing for MVP addresses requirements for best available science. Indeed, a careful reading of the FEIS and ROD make it clear that the primary routing considerations and criteria were to serve MVP interests and not to assure that resources of the Jefferson National Forest were utilized in a combination that best meets the needs of the American people while

sustaining productivity and without impairment of productivity. There is no evidence presented in the FEIS or DROD that any routing considerations were made to minimize environmental or conservation impacts. Although various routing changes were made throughout the MVP NEPA process some of which were made to avoid specific environmental impacts, there was never any science based analysis to design the route to minimize environmental impacts or conflicts. Making specific route changes from an initially proposed route that does not utilize the best available science is very different than designing a route that is specifically designed to minimize environmental impacts and risk. As pointed out in prior TWS comments (Accession No. 20161223-5062 and 20170622-5201), such "best available scientific information" is readily available. ***We object to the complete failure of the Forest Service to use not only the best available science but any science at all in directing the selection of the least environmentally damaging route, and doing so only after all of the information on significant adverse impacts has been identified, analyzed and provided to the public.***

K. The DROD and FEIS Do Not Adequately Analyze the Scope of Use of Herbicides Across the Entire Pipeline Corridor on the National Forest, in Violation of NEPA

The scant presentation of information about herbicide use does not include a cumulative effects analysis or an alternatives analysis. Forest Service staff acknowledged the need to perform additional NEPA analysis in a November 18, 2016 meeting, the notes for which are included as Attachment X ("The FS may require herbicide use to control invasive species along the right of way. Herbicide use on FS lands requires additional NEPA action."). ***We object to the skinny NEPA approach to assessing the use of herbicides in highly erodible terrain, karst geology and in the vicinity of both terrestrial and aquatic communities that support TES***.

L. The Forest Service Has Denied Public Access to the Plan Amendment Record in its Form to Date, in Violation of 36 CFR § 219.14(b)

Counsel for the Objecting Parties made an appointment to review the Plan Amendment Record at the Supervisor's Office for the George Washington and Jefferson National Forests on July 10, 2017. The appointment was requested by electronic mail in early June 2017 but the request was not responded to until late June 2017. The Forest Service staff had previously informed counsel that the record was being stored electronically "in the cloud." Counsel learned on July 10, 2017 that a third-party contractor was hired by MVP to manage the documents, record meeting minutes, and perform administrative tasks for the Forest Service. The contractor, a business entity called Galileo, prepared a three-page document to guide the Forest Service on the contents of the Forest Plan Amendment Record. Attachment Y. Agency staff are responsible for forwarding documents to the contractor for inclusion in the administrative record. Counsel learned that the contractor has a contract with the project proponent and not the Forest Service to maintain the plan amendment record. A copy of the

contract was requested on July 10, 2017, and to date the contract has not been provided to counsel. ***We object to the proponent being in control of the plan amendment record by contract with a third-party contractor, and to which contract the public is denied access.***

Counsel also was provided with a table that described meeting records for which the contractor had summarized the discussion and outcomes of certain meetings. Attachment Z. It is notable that on the list in Attachment Z there are two meeting minute records that are not labeled as privileged records, but that are not yet in the record because MVP has not released them from the editing process; the meetings were about the Appalachian National Scenic Trail. *See* Attachment Z, Entries for March 14, 2017 and April 11, 2017, p 2. ***It is improper for the project proponent to have control over the release of agency records and the withholding of the records based on the proponent's feelings about the records violates the planning rule.***

The meeting minutes also show a progression of increased authority being assigned to the third-party contractor while on MVP's payroll. Attachment G, December 7, 2016 Meeting Minutes (Grace updated Galileo will be writing a contract modification to include efforts to help identify commenters who have standing for the FS's regulatory objection process and to help the FS and BLM respond to comments identified by Cardno as relevant to respective agencies.). On December 8, 2016, it had been decided that the third-party contractor hired by MVP would be "coordinating with Cardno and the FS to come up with a strategy to track comments and to streamline response to objections (if received) during the FS 218 and 219 objection processes." Attachment V, December 8, 2016 Meeting Minutes. ***We object to a contractor paid by MVP performing the duty of identifying commenters with standing for this process and assisting in streamlining the response to objections process. Furthermore, the planned practice suggests that the Forest Service has no intent of granting any requests to meet for the purpose of resolving objections to which we object.***

By January 11, 2017, the proponent's contractor was tasked with responding to the comments on the DEIS, and again the contract was expanded, to which we lodge a continuing objection. Attachment AA, January 11, 2017 Meeting Minutes ("Grace clarified Galileo is working with the FERC's contractor Cardno to help FS to review and respond to comments received on the DEIS. Galileo is also tasked with using a keyword search to make sure all FS-relevant comments are identified and addressed.") By June 2017, the contractor was performing technical edits on the Draft Plan of Development.

The only records that were made available to counsel on July 10 were provided on a CD. Counsel was told that the information provided on the disk was not up to date; the disk contained only select documents from the Plan Amendment record. Many of the documents were obsolete versions of documents that had been filed on the FERC docket that have been revised or updated, or working drafts of such documents. The record contained meeting minutes that indicate that there must be additional records. There were very few electronic mail messages included in the documents, some of

which indicated that the person who received the message had replied to the message but the reply was omitted from the documents. There were very few internal assessment documents. There were no check sheets that had been described to counsel as a tool that the Special Project Manager had used to direct the resource staff on its tasks. Very little of what the agency knows to be record-documents and of the type that the contractor describes in the form of record-development guidance is currently being maintained in the official plan amendment record even though the documents exist.

The meeting minutes describe a great deal of on-going activity, meetings, and communications that are not otherwise documented in the record. There are references to the development of various memoranda of understanding between and among the proponent and the agencies. None of the MOU's are in the record, including an MOU in regard to mitigation authority. Attachment BB, March 17, 2017. ***We object to the denial of access to the plan amendment record during the written objection period*.** Not only is the plan amendment not currently available, when counsel asked whether electronic mail messages would be available before the end of the written objection period, Forest Service staff responded, "I doubt it." The staff member then stated that the contract with the third-party contractor stipulates the completion of the record by two weeks after the final decision is made. Regardless of the age of any plan amendment documents, even if they are three years old, the plan amendment record will not be available until after the decision is made. The Forest Service is interpreting the contract between the third-party contractor and the project proponent as releasing the Forest Service's regulatory obligations to make the plan amendment record available to the public, which it cannot do.

As a result of access to the plan amendment record being denied, counsel for the Objecting Parties then requested certain documents by FOIA. The request was met with the response of whether counsel was willing to pay the fees for responding to the request for documents that should have been available in the plan amendment record upon visiting the office on July 10, 2017. Requiring fees for records in this process violates NEPA and Forest Service directives. "2. It is Forest Service policy to: . . . c. Make documents available to the public free of charge to the extent practicable (40 CFR 1506.6(f))." Forest Service Manual, Section 1950.3, citing NEPA regulations. ***We object not only to the denial of access to the plan amendment record during the written objection period, we object to the imposition of fees for obtaining the records.***

***We further object to the relationship formed by the payment of litigation support fees to the federal government by the proponent of the pipeline*.** *See* Attachment CC, Meeting notes, November 30, 2016 (also indicating that a Power Point presentation accompanied the meeting notes which presentation is not included in the plan amendment records provided to counsel on CD on July 10, 2017). The fact that the project proponent is paying the government's litigation support costs signals that the government will make any decision for which the proponent will pay the costs. If the Objecting Parties had known that offering to pay the government's litigation costs would

make a difference in the outcome of the decision, perhaps we would have offered the same. ***We object to being denied the same quid pro quo. We also object to the implication from this business deal that as early as November 30, 2016, the decision was already made to amend the Forest Plan and concur with the grant of the special use permit.***

The evidence that the government does not take seriously the purpose of environmental assessment process is stunning. The meeting minutes from an executive meeting held on April 21, 2017, reveals not only that the decision of the Forest Service to concur on the grant of a right of way permit had already been made, but the proponent also attempts to extort a rushed decision by threatening to attribute purported financial loss to government delay. Attachment DD, April 21, 2017 Meeting Minutes. ***There is so much wrong about the statements captured in these minutes that there are no words. We object to everything that the statements in this meeting represent, it all violates NEPA and the planning rule. Furthermore, we object to the BLM acting in the place of the Forest Service on matters that are related to the plan amendment process where records of those activities are not included in the Forest Plan amendment record because the Forest Service did not perform the activities, and therefore it may not be considered a Forest Service record.***

M. The Environmental Analysis Documents Fail to Disclose Law Enforcement Impacts in Violation of NEPA.

In the comment process, the Objecting Parties raised the matter of costs and burdens of increased law enforcement if the pipeline is authorized to be constructed. The Forest Service has admitted the same, and yet the information has not been disclosed in the analysis. See Attachment EE, December 12, 2016 Meeting Minutes ("FS expressed concerns about public exploitation of ROW to access the forest from sites not approved for public access, if pipeline projects are approved and constructed. This could result in damage to existing cultural, heritage, and archaeological sites; poaching; encroachment on wilderness areas; and unauthorized access via off-road vehicles. Mike emphasized concern about potential for archaeological sites to be raided stating significant monitoring would be needed. Mike also expressed concern for unapproved access to important sites during surveying or project implementation. Mike stated he is extremely concerned with the forest service Heritage team absorbing monitoring and ARPA related costs for this project long after potential project implementation. Cost recovery for long term heritage monitoring, site stabilization, etc. Katie noted that there will be long term effects from the potential pipeline construction long after it is completed. Increased levels of illegal activities will occur on pipeline route right-of-way requiring increased patrolling-monitoring by law enforcement (LEI) and increase the potential for other LEI costs that have occurred in similar environs (I.E. dumping of methamphetamine chemicals and lab equipment requiring clean up, illegal atv use requiring repair, poaching, etc.) These activities will increase costs for LEI not covered by forest budgets. . . . The Forest Service noted that any closure orders will require

additional NEPA documentation and analysis before they could be approved. The NEPA procedures for closure orders will be outlined in MVP's Plan of Development and the ACP COM Plan. Miriam stated the BLM will make sure FS law enforcement stipulations are in the ROW grant written by BLM. Katie stressed the FS is not equipped to handle protests and/or emergencies on its own. Allocation of law enforcement responsibilities, including cost recovery, in the short and long terms needs further discussion. James expressed a need for the proponent to identify needed safety measures for dangerous areas along the ROW if the pipeline if constructed. This includes road closures, extra enforcement, and proper regulations. James also noted the proponent needs to outline a plan to coordinate with agencies to make sure proponent employees/contractors know relevant regulations and restrictions during and after construction, if approved.") ***We object to the failure to assess and disclose law enforcement impacts to the public during the NEPA process which are significant adverse impacts for which no mitigation is analyzed or proposed.***

N. The Forest Service Failed to Recognize the Introduction of Nonnative Invasive Plant Species(NIPS) Species as a Significant Issue, Failed to Address the Best Available Science, and Disregarded Comments About these Threats in Violation of NEPA and the Plan Regulations

The substance of our objection on this issue are included in Attachment FF.

O. The DROD Does Not Comply with All Requirements for Forest Plan Amendment

We object to Supervisor Timm's conclusion that the substantive provisions within 36 CFR §§219.8 through 219.11 are not implicated by the Forest Plan amendments to the Jefferson National Forest Plan. The Forest Service never provided a comment period on the implication of these regulations to the proposed Forest Plan amendments. The first time the Forest Service even mentioned the planning regulations was in the June 5, 2017 Federal Register notice for which the public was not given an opportunity to comment. ***The proposed amendments to the Forest Plan undermine the achievement of the Goals, Objectives and Direction in the Forest Plan and we object to the omission of any assessment of these impacts.*** The plan amendment record includes one document, attributed to the proponent that conforms with and supports the objections made by the Objecting Parties. *See* Attachment GG, *Plan Amendments to the Jefferson National Forest LRMP Associated with the Mountain Vally [sic] Pipeline*, December 2015. On page F2-7, the proponent states: "Option 2: develop a separate amendment for each inconsistency. Effects on Goals and Objectives: *Discuss how the proposed amendment(s) would affect meeting Forest Plan Goals and Objectives for each resource affected*." *Id*. (emphasis added). We argue that complying with the Planning Rule is not an "option" and note that the issue was identified as early as December 2015.

The Objecting Parties incorporate by reference, as objections, the comments at FERC accession numbers 20170622-5107 and 20161222-5512, pp 5, 9, 11-13. Furthermore, the unsupported conclusion that the regulations are not implicated is based on "mitigation" for which there is no evidence that any mitigation can be effective in the extraordinarily steep terrain with geologic hazards, and fragile soil and water systems. ***The failure to show that mitigation is effective violates the National Environmental Policy Act and we object.***

We fundamentally challenge the authority of the Forest Service to waive protective riparian standards that are required to be included in forest plans, and the regulatory requirements certainly are implicated by the proposed action. The plan amendment waivers implicate §§ 219.8, 219.9, 219.10, 219.11, and 219.12, and we object to the contrary conclusion in the DROD.

First, it is patently absurd to replace measurable standards with mitigation measures for which there is no evidence of their efficacy (in violation of NEPA), and for which the analysis of the use of the measures fails to conform to the use of best available science as argued throughout these objections. ***We object to the failure of the Forest Service to use best available science in the blind acceptance of unproven mitigation measures and in the determination that the planning regulations are not implicated in this action.*** The waiver of the standards undermines the Direction, Goals and Objectives in the Forest Plan, and no assessment has been performed. And as argued herein, the FEIS, the DPOD, and the Revised Hydrologic Analysis of Sedimentation do not support the DROD, and instead are representative of the worst environmental impact statements, and abused available science.

As recently as April 2017, the Cooperating Agencies met to discuss which Forest-Wide and Management Standards are still violated by the MVP project and which plan amendments are still necessary to the MVP Project. Most notable from the meeting is the statement by the Forest Planner on the Jefferson National Forest: "Karen [Overcash] reiterated that the Proposed Amendments for the Proposed MVP projects were based on scant information in the Draft Environmental Impact Statements (EIS). She updated the Proposed Amendments need to follow the updated 2012 planning rule." Attachment HH, Cooperating Agency Conference Call Notes, April 6, 2017. Despite the fact that the Forest Plan amendment decision was being based on scant information, the same meeting minutes further disclose that "the FS deadline for final plan amendments to include in the Final EIS are due April 21st", which deadline was a mere two weeks after the date of the meeting.

In regard to the waiver of the Old Growth standard, the Forest Service has intentionally misquoted the regulation in order to force the waiver. The complete statement of the regulation is:

> Except as provided in paragraph (d) of this section, the plan may include plan components to allow for timber harvest for purposes other than timber production throughout the plan area, or portions of the plan area, as a tool to assist in achieving or maintaining one or more applicable desired conditions or objectives ***of the plan*** in order to protect other multiple-use values, and for salvage, sanitation, or public health or safety.

36 CFR 219.11 (c) (emphasis added to the words that the Forest Service omitted in the DROD.). This is what we have been arguing. The desired conditions and objectives expressed in the plan must be strived to be achieved and maintained, and in the case of the old growth standard, the timber harvest must support the objectives of the plan itself not the objectives of the project which is what the Forest Service attempts to imply with its tricky omission of three critical words from its quotation of the regulation. Ignoring those words means that the Forest Service did not perform the required assessment, and rather is authorizing an activity that will violate the plan without the required analysis and amendment to the desired conditions, goals and objectives. ***The objecting parties set forth the legal framework for the objections to the plan amendments in the June 22, 2017 letter cited above, and we assert the June 22, 2017 as objections as supported by the comments made on the DEIS.*** **FERC accession numbers 20170622-5107 and 20161222-5512, pp 5, 9, 11-13.**

Page 12 of the DROD suggests that the MVP also would violate other Standards in the Forest Plan -- but for certain route variations -- and then promises to mitigate. The DROD improperly omits the analyses for such assertions because it fails to offer the public an opportunity to comment on the assertions, fails to inform the public of these potential violations of the plan if mitigations are not successful, and fails to provide contingencies if the mitigations are not successful. Examples of these are the Forest Wide Standards for the conservation of the listed endangered Indiana Bat, and FW-75: "In order to maintain future restoration opportunities, do not cut live Carolina hemlock. Exceptions may be made to provide for public safety, protection of private resources, insect and disease control, or research." ***We object to the above described omissions, and we also object to the omission of assessment of the implication of the following Forest Plan Standards, and the related Direction, Goals, and Objectives in the Forest Plan as well as the Standards cited in the June 22, 2017 letter*****:**

FW-2: Locate all facilities (e.g. trails, trail shelters, restrooms, designated campsites, etc.) in a manner that minimizes the possibility of contamination of water sources. Educate users on "leave no trace" camping practices, including sanitation practices that minimize the potential for contamination of water sources.

FW-3: Prior to authorizing or re-authorizing new or existing diversions of water from streams or lakes, determine the instream flow or lake level needs sufficient to protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values.

FW-4: Water is not diverted from streams (perennial or intermittent) or lakes when an instream flow needs or water level assessment indicates the diversion would adversely affect protection of stream processes, aquatic and riparian habitats and communities, or recreation and aesthetic values.

FW-6: Locate and design management activities to avoid, minimize, or mitigate potential erosion.

FW-14: Up to 50% of the basal area may be removed down to a minimum basal area of 50 square feet per acre. Removal of additional basal area is allowed on a case-by-case basis when needed to benefit riparian-dependent resources.

FW-17: The removal of large woody debris is allowed if it poses a risk to water quality, degrades habitat for aquatic or riparian wildlife species, impedes water recreation (e.g. rafting), or when it poses a threat to private property or Forest Service infrastructure (e.g. bridges). The need for removal is determined on a case-by-case basis.

FW-20: When crossing channeled ephemeral streams, culverts, temporary bridges, hardened fords, or corduroy are used where needed to protect channel or bank stability.

FW-21: Construction of crossings is completed on all channeled ephemerals as soon as possible after work has started on the crossing. Permanent and temporary roads on either side of crossings within the channeled ephemeral zone are graveled.

FW-33: Potential black bear den trees will be retained during all vegetation management treatments. Potential den trees are those that are greater than 20” diameter breast height. Potential den trees also include those that are hollow with broken tops or those with limbs greater than 12 inches diameter broken near the bole of the tree.

FW-35: Control non-native invasive species where they are causing negative effects to threatened, endangered, or sensitive species. Do not intentionally introduce non-native species that are known or suspected of causing negative effects to federally listed threatened and endangered species in or near sites supporting these species.

FW-41: Known occurrences of Virginia spirea, small-whorled pogonia, northeastern bulrush, and Virginia round-leaf birch are allocated to Management Prescriptions 4D or 9F to ensure protection and maintenance of their current populations and surrounding habitat conditions.

FW-214: Locate and design facilities and management activities to avoid, minimize, or mitigate negative effects on geologic resources with identified values (scientific, scenic, paleontologic, ecological, recreational, drinking water, etc.).

FW-46: In order to promote potential summer roost trees and maternity sites for the Indiana bat throughout the Forest, planned silvicultural practices in hardwood-dominated forest types will leave all shagbark hickory trees greater than 6 inches d.b.h.3 and larger, except when they pose a safety hazard. In addition:

- Clearcut openings 10 to 25 acres in size will also retain a minimum average of 6 snags or cavity trees per acre, 9 inches d.b.h. or larger, scattered or clumped.

• Group selection openings and clearcuts less than 10 acres in size have no provision for retention of a minimum number of snags, cavity trees, or residual basal area due the small opening size and safety concerns.

All other harvesting methods (and clearcut openings 26-40 acres in size) will retain a minimum residual 15 square feet of basal area per acre (including 6 snags or cavity trees) scattered or clumped. Residual trees are greater than 6 inches d.b.h. with priority given to the largest available trees, which exhibit characteristics favored as roost trees by Indiana bats.

FW-76: During silvicultural treatments, retain all live butternut with more than 50% live branches. Record the approximate location of these trees and notify the Forest Silviculturist.

Wilderness - The Forest Service has not provided any assessment for the implications of the above listed Forest Plan standards and the direction, objectives and goals with which these are associated, all in violation of the Planning Rule.

The failure of the Forest Service to assess the impacts to the Peters Mountain Wilderness and the Brush Mountain Wilderness areas violates the Planning Rule. The corridor is not physically located within the Wilderness areas but will be adjacent to the Wilderness Areas forever. There is no evidence in the Forest Service records for the proposed Plan Amendments that an assessment was performed. The FERC record contains numerous comments about the spiritual value of Wilderness, and in particular the spiritual connection of Peters Mountain. The pipeline would destroy Mystery Ridge on Peters Mountain and the name suggests the spiritual qualities that are felt in the areas. ***The Forest Service has failed to assess impacts to the spiritual and cultural qualities of the Peters Mountain Wilderness, in violation of the Planning Rule, and we object.***

The Objecting Parties filed comments on the DEIS that have not been addressed and which support and serve as grounds for our objections. FERC accession numbers 20161222-5512, p 15 and 20161223-5062, pp 10-12.

The willingness of the Forest Service to sabotage the Planning Rule and the Forest Plan for the benefit of a limited liability company is alarming and disturbing. If waiving the Forest Plan standards for the MVP does not implicate the Planning Rule, no project ever will. And the question remains whether any other future proposed project on the Jefferson National Forest -- even a timber sale -- will ever be required to comply with what was a pretty good Forest Plan that established a blueprint for water resource restoration and protection.

P. Failure to Monitor in Violation of Planning Rules

As of July 28, 2017, the record does not include any proposed monitoring requirements for the purpose of monitoring impacts caused by the waivers from the Forest Plan standards on the attainment of plan direction, goals, and objectives. 36 CFR § 219.12.

There are loose references to monitoring the implementation of certain conditions but nothing specific and nothing enforceable, and no means to relate impacts to the waived standard or any other component of the plan. The monitoring that is mentioned in the POD is intended to be compliance monitoring and not monitoring related to the effects of the pipeline development on implementation of the Forest Plan. Furthermore, there is no analysis to defend the absence of such Forest Plan implementation impact and assessment monitoring requirements. ***We object to the failure to establish and/or revise the monitoring program in the Forest Plan.***

Q. The Forest Service Has Not Stated Whether All Practicable Means to Avoid or Minimize Harm Have Been Adopted and If Not, Why Not, and Has Not Established a Compliance Monitoring and Enforcement Program for the MVP, All in Violation of NEPA

NEPA requires the Forest Service to "State whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation." 40 CFR § 1505.2 (c). The DROD does not contain such a statement.

The following indecipherable statement is in the DROD: "Measures to avoid or minimize environmental harm that are incorporated in this decision include forest-wide standards and guidelines, which at a minimum, meet all requirements of applicable laws, regulations, State standards, and additional standards and guidelines for the affected NFS lands." This DROD proposes to waive forest-wide standards and substitutes mitigation measures that cannot be measured. The Objecting Parties object to this conclusory statement because it makes no sense.

Furthermore, the Forest Service has not established, or even proposed for public comment, a compliance monitoring and enforcement program for the construction and operation of the MVP. The Forest Service and MVP crafted a Plan of Development, still in draft form, throughout which DPOD some monitoring activities are mentioned; however, the suggestion of monitoring does not establish a monitoring program, and no enforcement mechanisms are described at all. The authority to impose compliance and pursue enforcement has already been an issue on the Rover interstate gas pipeline. *See* FERC accession numbers 20170523-5020 and 20170728-5187.

R. The DROD Violates the Roadless Area Conservation Rule

The Objecting Parties commented on the DEIS at FERC accession numbers 20161222-5512, 20161223-5062, and 20170329-5053. MVP proposes to route a 42-inch gas pipeline through an Inventoried Roadless Area (IRA). The management of IRAs is prescribed by the Roadless Area Conservation Rule (RACR), 36 CFR Part 294 (69 Fed Reg 3244 (2001), and ***we object to the routing of the pipeline through the IRA***

because it violates the RACR and would degrade wilderness characteristics, making the area less eligible for Wilderness Designation.

The scant case law interpreting the RACR make clear that the agency has discretion to interpret and apply the Rule, including what constitutes a road. Most importantly, the courts have stressed that each case is fact specific, resource specific, and that the overlaps between uses and management prescriptions are important in applying the facts to the regulation, including the interpretation of what constitutes a road under the Rule. We argue that the pipeline corridor will become an unclassified road.

Wilderness Workshop v. United States BLM, 531 F.3d 1220 (10th Cir. 2008) involved a decision to grant a right-of-way for a pipeline through an IRA, Bull Mountain. The definition of a road is at issue in the case of the MVP just as it was in the Bull Mountain decision. In this case, however, the Forest Service has both the facts and the discretion to interpret the rule to determine that the construction of the MVP in the IRA would create an unclassified road.

> Road. A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary.
>
> (2) Unclassified road. A road on National Forest System lands that is not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.
>
> (3) Temporary road. A road authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be part of the forest transportation system and not necessary for long-term resource management.

36 CFR 294.11. The definition of an unclassified road includes off road vehicle tracks that have not been designated or managed as a trail. The pipeline corridor for the MVP is destined to become an unclassified road.

The relevant case-specific and resource-specific facts include that the Jefferson National Forest is plagued by illegal off-road-vehicle and ATV use. Our understanding is that there are more miles of unclassified roads than classified roads on the GW&Jeff. Agency meetings about the proposed project included Law Enforcement whose officers expressed access concerns as follows:

> FS expressed concerns about public exploitation of ROW to access the forest from sites not approved for public access, if pipeline projects are approved and constructed. This could result in damage to existing cultural,

heritage, and archaeological sites; poaching; encroachment on wilderness areas; and unauthorized access via off-road vehicles. Mike emphasized concern about potential for archaeological sites to be raided stating significant monitoring would be needed. Mike also expressed concern for unapproved access to important sites during surveying or project implementation.
• Mike stated he is extremely concerned with the forest service Heritage team absorbing monitoring and ARPA related costs for this project long after potential project implementation. Cost recovery for long term heritage monitoring, site stabilization, etc.
need to be addressed looking not only at current issues but also those encountered much later on.
• Peter I. stressed proponent construction/development plans need to be updated to reflect law enforcement responsibilities along the entire proposed ROW, and not just at crossroads and likely access points, to ensure recreation only happens on appropriate roads and trails. Katie noted this will include surveillance camera work and increased FS law enforcement patrols.
• Katie noted that there will be long term effects from the potential pipeline construction long after it is completed. Increased levels of illegal activities will occur on pipeline route right-of-way requiring increased patrolling-monitoring by law enforcement (LEI) and increase the potential for other LEI costs that have occurred in similar environs (I.E. dumping of methamphetamine chemicals and lab equipment requiring clean up, illegal atv use requiring repair, poaching, etc.) These activities will increase costs for LEI not covered by forest budgets.

Attachment EE, Meeting Minutes, December 12, 2016. One of the concerns is looting of cultural heritage sites, and a new site has been found in this area that is potentially eligible for listing. *See* Attachment T.

Videos of illegal ATV use on new pipeline corridors in West Virginia are easily found on the internet. Counsel's UPS driver calls the proposed pipeline corridor a "red-neck highway" and admitted that he would use it for ATV use. Such users cannot wait for the corridors to be left unattended. The IRA proposed to be crossed by the MVP is in a populated area, and the access roads built on adjacent private lands will make the pipeline corridor even more inviting and accessible.

The FEIS admits that the pipeline corridor will provide illegal access. The Forest Service and the proponent have crafted a plan to put up barriers, and signs, and increase law enforcement presence the cost of which will be charged to the proponent. Neither illegal use or the additional signs, barriers and law enforcement presence is considered in the impacts to the recreational experiences offered by the IRA and its companion Brush Mountain Wilderness Area. But make no mistake, the Forest Service acknowledges the high probability of the corridor becoming an unclassified road even if not stated in writing.

The other relevant component of the RACR is the prohibition against timber cutting. *Hogback Basin Preservation Ass'n v. United States Forest Serv*., 577 F. Supp. 2d 1139, (W.D. Wash. 2008) the logging prohibition in the context of a ski area. This case, too, makes it clear that the agency has discretion to interpret the Rule together with the relevant facts surrounding the issue.

Removal of timber is prohibited by the RACR with certain exceptions. The only potentially applicable exception is "(2) The cutting, sale, or removal of timber is incidental to the implementation of a management activity not otherwise prohibited by this subpart;..." 36 CFR 294.13(b)(2).

First, and obviously, construction of a pipeline is not a management activity. The judge in the *Hogback* aptly noted the comments in the preamble that is a less-than-clear list of examples of what incidental logging might be:

> Paragraph (b)(2) allows timber cutting, sale, or removal in inventoried roadless areas when incidental to implementation of a management activity not otherwise prohibited by this rule. Examples of these activities include, but are not limited to trail construction or maintenance; removal of hazard trees adjacent to classified roads for public health and safety reasons; fire line construction for wildland fire suppression or control of prescribed fire; survey and maintenance of property boundaries; other authorized activities such as ski runs and utility corridors; or for road construction and reconstruction where allowed by this rule.

66 Fed. Reg. at 3258.

A reasonable interpretation is that this is again a list of activities that are management in nature, not construction in nature. Removal of incidental trees, but not for full on construction. The district court ultimately ruled that the Forest Service had the discretion to interpret the timber cutting as incidental to the ski development project because the IRA at issue must also be managed for developed recreation, in combination with the efforts the FS had made to minimize the timber losses in reaching its dual management purposes.

The logging exception does not apply in the case of the MVP because construction of a utility line is not the implementation of a management activity under the Forest Plan. Pipeline construction is not covered in the LRMP as a “management activity” on the national forest. Indeed, the pipeline would require amendment of the Forest Plan to change management allocation as well as exceptions for visual quality, old growth cutting, and riparian impacts.

Nor is the proposed timber cutting for the MVP “incidental”. As the district court explained in *Hogback Basin Preservation Association v. U.S. Forest Service*, 577 F.Supp. 2d 1139, 1153 (W.D.Wash. 2008), the scale of timber cutting may be so

"disproportionate" that it cannot qualify as merely incidental to other activities under the Roadless Rule. In that case, the court found that cutting on two percent of the land area of an authorized project qualified as incidential. In contrast, here MVP would cut one-hundred percent of the proposed right-of-way for one mile through the Brush Mountain Roadless Area. Finally, the timber cutting and establishment of a permanent, cleared right-of-way through the roadless area is the primary impact and purpose of gas pipeline construction. To categorize it as "incidental" minimizes the severity of its impacts and undermines the conservation objectives of the Roadless Rule. *See* 36 C.F.R. 294.11 (2001).

In light of the conservation objective of the RACR, we also note that the exemptions for certain timber cutting activities primarily involve "pre-existing contracts or decisions; the satisfaction of legal or treaty rights; and environmental preservation, public safety, or the public interest." *See Hogback Basin Pres. Ass'n*, 577 F.Supp. 2d at 1147. The MVP does not easily fit within any of these general categories, and the Forest Service should be wary of compromising the integrity of the Brush Mountain Roadless Area without a thorough review of alternatives. In fact the preamble in the Roadless Rule states: "Other, new non-recreation special uses may be limited in the future as well. Such special uses include communication sites and energy-related transmission uses (such as ditches and pipelines, and electric transmission lines)."[1]

The Forest Service and the proponent have been negotiating over the restoration plans that are the subject of considerable objection above and herein. The proposed corridor through the IRA has the steepest slopes and the most risk prone geology and soils. As argued above, to apply any sort of discounted impacts due to mitigation has no basis. The developer has already admitted that the proposed restoration will not work on the terrain in the IRA. Furthermore, to say that the developer prefers this route because it avoids karst is false. There is a karst field on the east side of Brush Mountain that is so significant, complete with caves, that it is managed as a State Conservation Area. The proponent did not avoid this area by routing the corridor through the IRA. The Objecting Parties met with the Forest Service staff in Roanoke and Atlanta to discuss the threat on the east side of the mountain, and followed up with documentation of the meetings in writing.

In the case of the MVP, there is nothing in the RACR that gives a brand new utility corridor a free pass to violate the RACR. The rulemaking discussion instead makes it clear that the rights under existing grants of utility corridors are preserved; it does not make it clear that new utility corridors may be authorized. In the case of the MVP, the timber removal is not incidental -- the timber will be removed not only for the permanent right-of-way but also for the construction easement.

[1] Part VI; Department of Agriculture Forest Service; 36 CFR Part 294; Special Areas; Roadless Area Conservation; Final Rule; Federal Register / Vol. 66, No. 9 / Friday, January 12, 2001 / Rules and Regulations. 3272. p. 3268

Again, fundamentally, the Forest Service has both the duty and the authority to interpret the RACR in the case of the MVP in the manner that is true to the implementation of the RACR.

The Bull Mountain case is only precedential in the context that it gives the agency discretion. The case is not precedential for allowing gas pipelines in any IRA, any time, any where.

Furthermore, allowing a new pipeline corridor that bisects the IRA from its companion Wilderness Area, inviting illegal off road vehicle use, putting up barriers and signs, all intrudes on the Wilderness values in both areas. Reducing the Wilderness values risks the loss of the IRA's eligibility as a Wilderness Area and makes an irretrievable commitment to resources without adequate analysis.

The FEIS cites to the ROD for the Plan Amendment to clarify that the RACR has superseded the 4J Management Prescription for the area in the Forest Plan. It is common knowledge that the reason the 4J prescription was assigned in the Forest Plan was to give assurance to residents on the east, south-east side of the IRA that risk of fire would be reduced when they opposed a Wilderness designation when the Forest Plan was revised. The area will face increased risk from fire both because of illegal ORV use as well as the risk of pipeline explosions. However, the rationale for the 4J prescription and the implications to that consideration of amending the Plan are ignored in the DROD and FEIS.

S. The Forest Service Has an Independent Duty to Comply with NEPA

The meeting notes chronicle a broken process. *See* Attachment II, Meeting Minutes from the plan amendment record that were provided to counsel on July 10, 2017. Despite the obligation to cooperate via FERC's interagency memorandum of agreement, FERC performs only cursory NEPA analyses that would never survive a court challenge if an intervenor could ever get a judge to rule on the merits of a claim before a gas pipeline is constructed.

The records of meetings show that FERC is cavalier with its NEPA responsibilities and does not tolerate an attempt by a land management agency to perform its own duties under FERC's umbrella NEPA process. *See* Attachment JJ, March 30, 2017 Meeting Minutes, (FERC belittles the Forest Service's expert geologist and disregards the Forest Service's interest in developing the proper geologic analysis for construction on hazardous slopes, asserting that maintaining the project schedule precludes proper analysis and that the material drafted by the geologist was too long to include in the DEIS and that's why it was omitted).

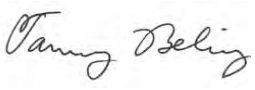
Nevertheless, the Forest Service understood its duties. The meeting minutes document over and over again that FERC was not waiting for anyone, and if any cooperating agency found the FEIS lacking for its own purposes, that agency

could perform its own supplemental analysis. The Forest Service chose not to prepare supplemental analysis despite the incomplete process, the inadequate FEIS, and the clear signals in the progression of the meetings that was the direction in which the process was heading.

Requested Relief

The Forest Service must withdraw the DROD, provide notice on the FERC docket of the information in the June 5, 2017 Federal Register notice, supplement the environmental analysis complete with an assessment of impacts, mitigations, planning rule and Forest Plan implications that fully account for impacts that cannot be mitigated, and provide a public comment period on the information in the notice, the final plan of development and mitigation measures before reissuing a draft decision. We also request a meeting with Regional Forester Tooke for the purpose of resolving objections.

Sincerely,



Tammy L. Belinsky, Esq.
Counsel for Objecting Parties

ATTACHMENT A

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline Project Coordination
Date/Time: Thursday, December 8, 2016 @ 12:00-1:00pm (PT)/ 1:00 – 2:00 pm (MT) 2:00-3:00pm (CT)/3:00-4:00pm (ET)
Location: Conference Call

Attendees	BLM	Vicki Craft, Kimberly Melendez-Rivera, George Matzke
	Forest Service	Jennifer Adams, Alex Faught, Jim Twaroski, Jess Saroka, Mitchell Kerr, Karen Overcash, JoBeth Brown
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** forwards government entities comment tracking table to Karen, Rebecca, Jennifer, and JoBeth. *Complete.*
- **Galileo** adds petition and form letter tracking to comment and objection process tracking.
- **Jennifer** emails Lavinia DiSanto (Cardno) requesting information on petition and form letter tracking in the Federal Energy Regulatory Commission (FERC) process. *Complete.*
- **Galileo** submits comment and objection process tracking strategy to FS next week.
- **Jennifer** submits Visual Resources information request to the FERC project Docket.
- **Galileo** compiles BLM comments on the Draft Environmental Impact Statement (DEIS) and drafts transmittal letter for BLM DEIS comments. *Complete.*
- **Vicki** submits BLM DEIS comments to the Office of Energy policy Compliance (OEPC) by December 12.

DISCUSSION/DECISIONS

- Vicki reiterated the BLM is concerned with the lack of data and analysis in the visual resources section of the DEIS. BLM is also concerned with the lack of contingency plan for crossing the Appalachian National Scenic Trail (ANST) and potential for open-trenching. BLM biologists have expressed concern over incomplete survey data and consultation with the United States Fish and Wildlife Service.
- FS reiterated concerns regarding the still outstanding updated Craig Creek crossing and overall lack of information in the DEIS. The new FS hydrologist is still reviewing the relevant data for accuracy and completion. Alex cited general concern from agencies and the public on the lack of analysis in the DEIS.
- Jennifer stated FS is expecting Mountain Valley Pipeline (MVP) to file a response to their information request for topsoil segregation and herbicide use to get both in the FERC proposal and in the EIS for analysis.
- Jennifer noted the FS met with MVP and contractors to discuss their progress on site-specific stabilization designs. Tom Collins (FS) was pleased with the drawings and requested additional information regarding analysis of potential for project-induced slope, analysis of trench variability based on slope steepness, achievable levels of slope

restoration post-construction, and mass balance accounting for spoil piles. Tom Bailey (FS) requested detailed representation and analysis of topsoil segregation and stressed concerns on limitations to replacing topsoil and slope contour post construction.

- Jennifer noted MVP expects to file updated slope-stability analyses in the coming weeks.
- Karen updated the FS is still discussing the threshold for requesting supplemental analysis due to information missing from the DEIS. The concerns are specific to availability of data and analysis relevant to the FS decision for public comment.
- Mitch provided an update from this week's boundary/survey calls. FS is working with MVP's contractor to assist in identifying property corners and provide the FS with plan drawings that include impacted acres on FS lands if the project is approved and constructed. Mitch cited minor tweaks to the proposed pipeline route but stated the study area and proposed and temporary easements have been adequately marked. He does not recommend monumenting the Right of Way (ROW) at this point.
- Jennifer clarified the pipeline route has minor variations on National Forest System lands however the variations are within the initial study corridor. The main concern at this point for the FS is the lack of acceptable alternative for the Craig Creek crossing.
- Grace summarized Galileo's tasks for helping the FS identify and respond to FS-relevant comments on the MVP project. Galileo is coordinating with Cardno and the FS to come up with a strategy to track comments and to streamline response to objections (if received) during the FS 218 and 219 objection processes. Karen requested Galileo submit a strategy for identifying whether or not objectors have standing once the objection process begins. Grace confirmed Galileo will also search for comments not captured by Cardno which contain FS-relevant information. Jennifer noted she would as Cardno for assistance in identifying commenters on petitions and form letters.

UPCOMING MEETINGS

Internal Law Enforcement Call: Monday, December 12 @ 12:00 ET
External Law Enforcement Call: Tuesday, December 13 @ 10:00 am ET
Visual Resources Call: Tuesday, December 13 @ 3:00 pm ET
Next FS/BLM Coordination Call: Thursday, January 12 @ 3:00 pm ET

ATTACHMENT B

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Thursday, March, 2 2017 @ 3:00-4:00pm (E)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Bruce Dawson, Kimberly Melendez-Rivera, Nicole Virella, George Matzke
	Forest Service (FS)	Jennifer Adams, Job Timm, JoBeth Brown, Tim Abing
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Bruce** touches base with Karen Mouritsen (BLM Eastern States) re timeline for including MVP in mitigation discussions.
- **Job** follows up with FS regional foresters re timeline for including MVP in mitigation discussions.
- **Jennifer** touches base with Clyde Thompson (FS), Lesley Kordella (US Fish and Wildlife Service, FWS), and Kevin Bowman (Federal Energy Regulatory Commission, FERC) re participation in the next mitigation team call. *Complete.*
- **Karen Overcash** and **FS specialists** complete review of Galileo's environmental consequences/mitigation table soils example.
- **Tim** continues Memorandum of Understanding (MOU) development.

DECISIONS/DISCUSSION POINTS

- Tim updated that he needs more time to author a sample MOU for mitigation development and eventual implementation.
- Jennifer noted that for natural gas pipeline projects there is no law, such as the Federal Power Act for hydropower projects that requires FERC to consider management requirements of resource-managing agencies. Jennifer said FERC has never required compensatory mitigation. Jennifer suggested reaching out to Kevin Bowman (FERC) to answer mitigation and regulatory authority questions.
- Jennifer suggested inviting Lesley Kordella from the FWS headquarters to discuss the FWS MOU with FERC regarding mitigation and the Migratory Bird Treaty Act.
- Job, Tim, and Bruce agree there is value in bringing state agencies into the mitigation discussion, and that it is encouraging that MVP has committed to developing a Habitat Equivalency Analysis and associated mitigation plan for the entire pipeline route.
- Bruce noted the BLM would strongly prefer a coordinated, landscape-scale approach to mitigation. Bruce also stressed the BLM needs to have their mitigation plan in their Right of Way Grant Record of Decision (ROD), so mitigation timing is important.
- Grace updated that on the Ruby Pipeline Project (Ruby) the proponent sent a letter to the FERC noting they planned on working with land and resource management partners at the state and federal levels to develop a mitigation agreements, which didn't have to be finalized until the ROD was signed. This allows more time for mitigation development. Grace also suggested she could reach out to Gene Seidlitz (BLM) as needed for more insight into the specifics of how the Ruby mitigation MOUs and plans took form.

- Bruce noted that BLM still has not yet heard back from the US Army Corps of Engineers Norfolk, Huntington, and Pittsburgh districts, or the National Park Service regarding participation in the mitigation meetings.
- Tim sent contact information for Jennifer Stanhope (FWS) and Troy Morris to the FS's Southern Research Center to assist in review of the Virginia Commonwealth's mitigation methodology.
- Grace updated she is still waiting on additional guidance with how to proceed with the environmental consequences/mitigation tracking table. Tim noted he would like it to be very straightforward with regard to what residual impacts exist after mitigations are in place. Grace, Jennifer, and Tim agreed this would be difficult to address as the Draft EIS is not straightforward with regard to impacts, and several analyses are still outstanding.

Next Mitigation Meeting: Thursday, March 9 @ 12:00 – 1:00 PT/ 1:00 – 2:00 MT/ 2:00 – 3:00 CT/ 3:00 – 4:00 pm ET

ATTACHMENT C

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Thursday, March 9, 2017 @ 3:00-4:00pm (E)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore, Bruce Dawson, Kimberly Melendez-Rivera, Nicole Virella, George Matzke
	Federal Energy Regulatory Commission (FERC)	Kevin Bowman
	US Fish and Wildlife Service (USFWS)	Liz Stout
	US Army Corps of Engineers (USACE)	Todd Miller, Joshua Shaffer
	Forest Service (FS)	Jennifer Adams, Job Timm, JoBeth Brown, Tim Abing, Kent Karriker, Beth LeMaster
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Tim** continues Memorandum of Understanding (MOU) development.
- **Bruce** follows up with Tim for an update on the MOU framework.
- **Bruce** follows up with Grace re Galileo participation in upcoming BLM-MVP high-level coordination meetings.
- **Bruce** discusses meeting format for bringing in MVP to the mitigation discussions with Karen Mouritsen (BLM).
- **Job** and **Tim** continue briefing FS regional foresters on mitigation development.
- **Galileo** assists BLM with briefings for Karen Mouritsen (BLM).
- **Karen Overcash (FS)** and **Ava Turnquist (FS)** continue review of and additions to the MVP environmental consequences/mitigation table.

DECISIONS/DISCUSSION POINTS

- Job reviewed that the purpose of these meetings is to discuss how federal land management agencies and state-level stakeholders could work together to develop a project or landscape-level mitigation framework. Final participants and their authorities for mitigation, as well as an overarching agreement are still in flux. Bruce noted the BLM is discussing how best to bring the applicant into mitigation discussions, which would likely need to happen soon to accommodate BLM's new mitigation guidance.
- Kevin stated that, because FERC does not manage any lands or have any easements under their authority, they do not have management plans to meet. FERC relies on other federal laws (i.e. the Environmental Species Act, Section 106) to require some type of mitigation plan, which they put the onus on the proponent to propose. FERC stated if they require mitigation as part of their certificate for a particular resource, the mitigation applies to the entire project. It is FERC's expectation the federal land management agencies will supply necessary mitigation measures in their records of decision and associated grants/easements that go above and beyond, and possibly duplicate any mitigation in FERC's orders. Mitigations required by other federal agencies would only apply to those agencies' jurisdictional lands.
- Tim and Joby questioned whether FERC could ask proponents for any additional mitigation beyond what the proponents initially propose. Kevin said FERC has been pushing applicants to provide mitigation plans for impacts to forested and interior forest lands, but

cannot provide additional recommendations regarding those mitigation plans per their legal authorities. FERC cannot tell applicants how to formulate their mitigation plans or estimates for compensatory mitigation (nor can they require compensatory mitigation).

- Kevin stated the FERC does not have a clear answer as to whether another federal agency's statutory policy (i.e. mitigation policy in FWS for effects to migratory birds) with regards to resource management and mitigation plans for a specific resource provides grounds for FERC to require mitigation. Kevin stressed if another agency wants to require mitigation, including compensatory mitigation, for a specific resource, that agency must tie the mitigation to its project-related permit(s).
- Kevin stated the proponents with the most projects approved propose a certain amount of mitigation from the start of the application process to try and offset project impacts from the start. FERC can ask for mitigation plans through data requests, but the requests are not binding and responses are not necessarily contingent upon approval.
- Tim inquired if a proponent's proposed mitigation impacts would be analyzed in the environmental impact statement (EIS). Kevin said a high-level summary of the proposed mitigation would be included but the impacts would not be fully analyzed.
- Joby and Tim met with the regional foresters last week to discuss how an interagency mitigation framework would look, when mitigation should be brought into the NEPA framework, and authorities to require mitigation, including compensatory mitigation. Tim said it's BLM's policy to achieve no net loss of a resource, which would include compensatory mitigation efforts. It is unclear how to determine what resources have residual impacts, or what constitutes a residual impact.
- The team acknowledged they need to know more about what the residual impacts are in order to determine what will need compensatory mitigation. Jennifer said Ava Turnquist (FS) and Karen Overcash (FS) are coordinating review and additions to the MVP environmental consequences/mitigation table in order to try and determine appropriate mitigations.
- Tim said that upon their initial review, the FS's Southern Research Station specialists feel that the Commonwealth of Virginia's methodology for determining impacts that will need compensatory mitigation is reasonable. They are still working on a full report.
- Joshua stated in an email during the meeting that, *"any stream/wetland (Waters of the U.S.) permanent impacts will be mitigated per the 2008 Mitigation Rule found at 33 CFR 332. I have a revised set of information for MVP dated February 2017 and it has a revised mitigation plan for stream and wetland losses. I have no areas of concern regarding mitigation efforts with this project and plan on moving forward as things progress. Not sure that the Corps really has any value to bring to the table for this working group as we already have a mitigation frame work to follow."*
- Tim updated that he needs more time to author a sample MOU for mitigation development. Grace offered to get Tim into contact with Gene Seidlitz (BLM) as a resource. Tim is reviewing MOUs from the Ruby Pipeline Project as a starting point.

Next Mitigation Meeting: Friday, March 17 @ 12:00 – 1:00 PT/ 1:00 – 2:00 MT/ 2:00 – 3:00 CT/ 3:00 – 4:00 pm ET

ATTACHMENT D

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline: FS | 2016

Mountain Valley/Forest Service Update call
Date/Time: Tuesday, October 25, 2016 @ 11:00 am ET
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams
	Mountain Valley (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

Action Items

- **Jennifer** forwards preliminary acceptable seed mix list to Megan. *See discussion below.*
- **Jennifer** follows up with FS wildlife biologists to finalize seed mix list.
- **MVP** updates Plan of Development (POD) with new seed mix data.
- **Jennifer** confirms FS availability for POD page-turn in December.
- **Jennifer** follows up with FS team leads to clarify what's needed in Draft Environmental Impact Statement (DEIS) Biology review.
- **MVP** updates DEIS biology section to highlight needed data.
- **Jennifer** forwards FS POD comments to Galileo.
- **Galileo** sorts, formats, and removes duplicate comments from FS POD comments.
- **Galileo** drafts pending documents/data tracking sheet for FS.
- **Jennifer** confirms visual resource team availability for joint FS/MVP visuals update.
- **Jennifer** coordinates with Galileo to clarify comment and objection tracking process.

Decisions/Discussion

- In an effort to keep MVP's process moving Jennifer said she will forward preliminary seed mixes, organized by slope, soil type, etc. to Megan, with the caveat that FS wildlife biologists may provide updates.
- Jennifer noted the FS does not intend to comment on the Slusser's Chapel Alternate Route.
- Jennifer noted the FS plans to submit a data request for site-specific stabilization design methods to the FERC docket today.
- In future meetings with MVP and the FS, Jennifer requested MVP provide any meeting materials five business days in advance so the right FS team members can attend meetings and complete reviews on time.
- Jennifer requested any on-the-ground mitigations measures not in the DEIS or Biological Evaluation (BE) be highlighted in the next iteration of the BE. Jennifer requested MVP fill in any needed avoidance and mitigation measures based on their own research and/or past experience into the BE, so FS can edit them as needed and make sure the correct information gets into the EIS.
- Jennifer requested MVP list any missing documents and/or data so Jennifer can track what FS and MVP need to provide. This is an effort to make sure the FEIS is complete.
- Megan noted MVP wants to be sure they address all Appalachian Trail Conservancy (ATC) concerns, but ATC filings with FERC have not been specific. Jennifer encouraged Megan to reach out to ATC to address their concerns. Megan suggested a potential FS/MVP visual resources meeting, with follow up to ATC as appropriate.
- Jennifer noted Galileo will be helping organize FS comments, documents, and tasks in an effort to help FS identify public with standing to object to FS Land and Resource Management Plan (LRMP) amendments. Jennifer also said the FS is will be developing a Memorandum of Understanding (MOU) to clarify Galileo's relationship with FS and MVP.

ATTACHMENT E

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

MVP Call Agenda **Monday 21 November 2016**

Attending: Mary, Pete, Frank, John H, Barry, Mark, Vicky, Andrew, Wendy, Denise, Lindy, Miriam, Nicole, Leta, John C, Jennifer, Dan, Justin, Carol, Nicole, Haninah, Alison

Please note: BLM and the Forest Service are cooperating agencies; NPS is not.

Agenda:

- Crossing of the Appalachian National Scenic Trail: Authority for Forest Service
- Overall Concerns about the MVP DEIS
  - Impact of WV Court Decision
- How Does the NPS Position on the DEIS Figure in BLM/FS Concerns about the DEIS
  - Open Trenching
  - More Info Needed
- Role of OEPC
- Next Steps

Notes: **Due dates are in red below so they are easy to find.**

1) **FS Authority for AT Crossing:**
   a. FS and BLM have authority for lands bought by the FS separately
   b. Writing a legal memo
   c. No disruption to current process
   d. Some MOA changes may occur (NPS/ FS MOA)

2) **Overall Concerns about the MVP DEIS:**
   a. BLM: inadequate DEIS, missing info, not enough info to adopt as is
      i. Next steps:
         1. Get data
         2. Considering deficiency notice to applicant, letter to FERC
   b. WV Supreme Court decision:
      i. MVP not in public interest, no connection in WV, no eminent domain for surveys until have certificate
      ii. Could affect routing
      iii. Additional info needed: would this include private property?
   c. Does the FS need info from private land? e.g. persistence of species
   d. FS/BLM: missing info: both along the pipeline and on FS land
      i. Soils, water crossings, geology, but every resource needs info on the FS and COE lands
      ii. Visual impact analysis also a concern

iii. Wildlife impacts also a concern; formal consultation to be done "at future time"; effect determinations done without FWS consultation; consultation must be done before DEIS so terms and conditions from Biological Opinion are in the DEIS for everyone to review.

3) NPS Position:

a. Visuals, cumulative effects, Section 106
b. Cumulative effects section missing any analysis: see EPA comments on Atlantic Sunrise for a good analysis
c. Construction method in question; inconsistencies in the DEIS
d. BLRI:
    i. Crossing not in the DEIS
    ii. Cultural resource concerns
e. AT:
    i. No consultation on visuals
    ii. Continuous tweaking of the route and the information provided
    iii. MVP contacted the BLRI, but not the AT.
f. Overall, the FERC DEISs have come out too early, missing critical information. MVP is 3rd of the big pipeline DEISs to come out.
g. Section 106 consultation missing from all of the three pipelines (and a host of others).
h. Construction method: conventional boring or open trench

4) Role of OEPC:

a. Filing comments for DOI? Role of BLM (FS, COE), NPS, FWS
b. What is FWS doing?
c. Reduce confusion. Will a joint Departmental letter do this?
d. OEPC would like to review comments beforehand, even if not joint Departmental letter. Won't need much time for review.
e. OEPC deadlines: 1 or 2 weeks for review in normal procedure, but some flexibility and can start with drafts.
f. Dec 7 deadline; could be the 15th? But need to coordinate on what we are saying (BLM, NPS). See below.
g. Tentative agreement (pending internal discussions at each bureau):
    i. Drafts to OEPC (and each other, NPS, BLM and FWS if applicable) by Dec 7 COB
    ii. Final versions to OEPC and each other by Dec 15 COB
    iii. Send to Lindy Nelson at OEPC: lindy_nelson@ios.doi.gov
    iv. Let the group know if these deadlines can't be met after internal discussions.
    v. Mary will send MVP FAST-41 info to Lindy.

5) Next Steps / Questions:

a. If BLM issues a deficiency notice, how does that affect the Dec 22nd deadline?
    i. Haven't decided for sure on the notice, but would be as soon as possible. Not sure how it would affect the Dec 22nd deadline for comments.

    ii. BLM in strong position, but FERC may issue certificate anyway.

b. Deadlines:
    i. See above tentative agreement on due dates
c. MVP may change route to avoid BLM involvement.
d. NPS concern over Forest Service Forest Plan amendments.

ATTACHMENT F

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination – Special Discussion
Date/Time: Friday, Nov. 18, 2016 @ 10:30 – 11:30 am ET
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Nicole Virella John Sullivan, George Matzke, Carol Zurawski, Justin Katusak
	Forest Service (FS)	Jennifer Adams, Alex Faught, Dawn Kirk, Jess Soroka, Dan McKeague, JoBeth Brown, Ted Coffman, Tom Collins, Russ McFarlane, Carol Croy, Mike Madden, Pauline Adams, Fred Huber, Karen Overcash, Tom Bailey, Rebecca Robbins
	Galileo Project	Grace Ellis, Lauren Johnston

Meeting Objectives:

- ✓ Identify any outstanding data and analysis gaps that need to be addressed for FS and BLM to comply with their National Environmental Policy Act (NEPA) process.
- ✓ Discuss a coordinated path forward for complying with NEPA.

Path Forward:

- ➢ FS continues to compile a list of outstanding data and submits necessary data requests to the Federal Energy Regulatory Commission (FERC) docket.
- ➢ BLM drafts official letter noticing FERC of deficiencies in the Draft Environmental Impact Statement (EIS) and requesting a Supplemental EIS.
- ➢ BLM and FS follow up with DOI and OGC, respectively, in addition to FS and BLM management, for continued coordination.
- ➢ BLM and FS explore coordination with proponent to request more time for complete analysis and review.

Decisions/Discussion

In an effort to ensure both parties meet specific agency and regulatory requirements for NEPA, BLM and FS agreed to further discuss and pursue a request to FERC for a Supplemental EIS.
Agency Action Item

BLM and the FS have the following criticisms and concerns that warrant this request.

General:

- Upon review of the Draft EIS, Plan of Development (POD), and other NEPA analysis documents the FS and BLM both identified significant deficiencies and inconsistencies in the data, analyses, and conclusions presented in the document. BLM and FS are concerned these problems preclude their agencies' making an informed decision and fully complying with NEPA. To date, the BLM has not yet received the updated SF-299

right of way grant application that includes changes to the proposed route through federal lands.

- An additional point of concern is public access to and ability to comment on additional data, analyses, and plans presented after the closing of the Draft EIS public comment period. While FS acknowledges stakeholders can object to the FS actions before the FS issues their final project decisions, on the whole BLM and FS agree the FERC's EIS is inadequate for BLM and FS NEPA requirements. The volume and severity of data inadequacies would prevent BLM and FS from adopting the FERC Final EIS.

Cultural Resources:

- Cultural resource surveys are constantly under revision and not up to date. Permits to survey have not included a complete record of sites to be surveyed, and mitigation measures have been inadequate or absent in reports.
- Agency staff need to be consulted in process of identifying which sites are potential for listing in the National Register of Historic Places (NRHP).
- BLM is in the process of reaching out to tribes the FERC had potentially missed in their consultation process, including reaching out to the Ponca Tribe. ***Agency Action Item***

Visual Resources:

- The proposed pipeline route has been under revision since the first visual analyses were completed in 2015. FS has requested the proponent re-run the seen area analysis and complete surveys at leaf-off. FS stressed new Key Observation Points (KOPs) still need to be identified for new route variations (***Agency Action Item)***, and the proponent needs to complete initial narrative and photographical visual surveys to determine if additional visual simulations are needed.
- Both BLM and FS note the lack of contingency plan for potential failure of the direct bore method under the Appalachian National Scenic Trail (ANST). BLM and FS cannot support an open cut contingency plan. FS has requested, in writing and verbally, an adequate contingency plan. Jennifer will follow up on this request. ***Agency Action Item***
- FS would also like to point out the ANST is under consideration for listing on the NRHP. This has not been discussed or reflected in the Draft EIS.
- FS and stakeholders are concerned the proposed route maps do not contain the most updated route of the ANST.

Waterbody Crossings:

- FS, contractors, and proponents have discussed the crossing of Craig Creek and its unnamed tributaries on multiple occasions, have met to review proposed crossings, and FS has filed requests in the FERC docket concerning the Craig Creek crossing. FS is still not satisfied that the latest proposed crossing is consistent with the forest plan for the Jefferson National Forest and is waiting for an updated proposed crossing of Craig Creek.
- FS is still missing an updated alignment for the Craig Creek Crossings and Mystery Ridge portions of the proposed route.
- The number and type of waterbody crossings on forest lands is inconsistent throughout the Draft EIS and resource reports. Modifications to waterbody crossings are incomplete as feasibility studies have not been finalized.
- FS is concerned actions taken on FS lands can nearly directly affect water flow and supply to adjacent non-FS lands and wants to be sure these concerns are addressed.

Mountain Valley Pipeline	2016

Geology and Soils:

- Schematics for soil and erosion plans are generalized and incomplete. Mitigations are not explained in full detail in the Draft EIS or the POD.
- FS requires plans for topsoil segregation along the entire route of the pipeline. These are not reflected in the proponent's application for a right of way grant or in the Draft EIS.
- Potential rerouting around the Slusser's Chapel Conservation Site could place the proposed pipeline route through karst terrain on FS lands, which would require additional analysis.
- FS has requested multiple times to see analysis of project-induced landslides and specific data on steep slope cuts and fills. This data is still outstanding and vital to FS review of potential debris flow outside of the right of way and other catastrophic hazards related to dangerous steep slope construction.

Biological:

- Biological analyses, including an updated Biological Evaluation and Biological Assessment, are still outstanding. Numerous biological surveys have not been completed, precluding completion of analyses and conclusions.
- Analysis and surveys for threatened and endangered species do not include species likely to be listed as endangered by the United States Fish and Wildlife Service.
- The FS may require herbicide use to control invasive species along the right of way. Herbicide use on FS lands requires additional NEPA action.

ATTACHMENT G

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Wednesday, December 7, 2016 @ 11:00am – 12:00 pm (Pacific)/ 12:00-1:00 pm (MT/AZ)/ 1:00-2:00 pm (CT)/ 2:00 – 3:00 pm (ET)
Location: Conference call

Attendees	BLM	Miriam Liberatore, Vicki Craft
	Forest Service	Jennifer Adams, Alex Faught
	Mountain Valley Pipeline (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Megan** reviews objection process procedures and reviews with internal legal team
- **Karen Overcash** (FS) forwards any other useful objection process regulations as needed.
- **Galileo** forwards objection process tracking methodology options to Jennifer for review.
- **Galileo** develops objection process tracking scope/contraction modification for MVP.
- **Galileo** emails Megan with interim use of general agency support hours to start objection process and comment tracking.
- **Megan** sends list of outstanding documents and target delivery dates to Jennifer
- **Jennifer** forwards Galileo's Nondisclosure Agreement and MVP-FS Memorandum of Understanding to FS legal team.
- **Megan** works with Jennifer to discuss submitting sedimentation analysis to FS before submitting the updated Biological Evaluation.
- **Jennifer** follows up with FS Biologists re: herbicide use on forest lands.
- **Galileo** schedules meeting for visual resources as needed.
- **Megan** forwards visual aids from Dec 6. Boundary/Survey call to Galileo. *Complete.*
- **Vicki** extends internal and external law enforcement call invitations to BLM law enforcement.
- **Megan** updates team re: visual resources after call with Tetra Tech (proponent contractor).
- **Vicki** invites **Peter DeWitt** (BLM Southeastern States) to Dec. 8 visual resources call.
- **Galileo** sends compiled Draft Environmental Impact Statement (EIS) comments to Vicki.

DISCUSSION/DECISIONS

- Grace summarized Galileo's Dec. 5 call with Cardno, the Federal Energy Regulatory Commission's (FERC) EIS contractor. Grace updated Galileo will be writing a contract modification to include efforts to help identify commenters who have standing for the FS's regulatory objection process and to help the FS and BLM respond to comments identified by Cardno as relevant to respective agencies.
- Galileo will need to identify comments from scoping and the Draft EIS comment period to establish a full list of commenters with objection standing. Megan approved in concept Galileo using current "General Agency Support" hours to continue developing a strategy for these efforts, but asked that Grace send an email making a formal request to that effect. The request should also include out of scope work to support response to comments and draft updated EIS text to address agency-relevant comments.

- Jennifer explained that in addition to commenters who have standing based on specific comments, any person can comment on the Final EIS and obtain standing based on missing information in the Draft EIS. Jennifer explained this is because the public needs an opportunity to provide comments on relevant studies and NEPA documents during an official public comment period.
- The Forest Service is discussing this internally how to proceed with allowing public comment on outstanding information presented after the Draft EIS comment period.
- Megan clarified MVP does not need to add an extra 25 feet to their Right of Way grant and proposal with FERC to accommodate topsoil segregation. Jennifer said MVP should submit a document to the FERC docket stating they plan to provide topsoil segregation (so it can be analyzed in the EIS). Jennifer also instructed MVP to explain in detail why their construction plans will not require extra width for topsoil segregation. Given FERC's Plan allows for the extra 25 feet and most companies use the extra space, the FS will need assurance from MVP that topsoil segregation could be accomplished without the additional workspace.
- Megan noted MVP explicitly stated in the October 2015 Resource Report #3 they would use herbicides on national forest lands at the direction of the forest service (text from October 2015 Draft Resource Report #3 pgs. 3-22 to 3-23 below).

"MVP has committed to not use pesticides or herbicides during routine right-of-way maintenance, unless requested by a land management agency. In its comments on draft Resource Report 3, the USFS notes there may be situations where using pesticides or herbicides will be desirable, for example control of nonnative invasive plants and treatment of insect infestations within Jefferson National Forest. If during project operation control of invasive species is requested by a landowner or land-managing agency, MVP will work with the respective landowner or agency to develop an agreed upon approach for control."

Megan stated this was not listed in the EIS. She plans to add the language back in to the EIS per the FS request. Jennifer noted that the language "*MVP has committed to not use pesticides or herbicides during routine right-of-way maintenance, unless requested by a land management agency" states that MVP will not use, though MVP's statement says it would address an agency's request, it doesn't specifically ask FERC to include herbicide use. It is MVP's responsibility to close this loop with FERC*

- Megan indicated MVP is working on updated visual analyses. Megan requested a call with Tetra Tech and FS resources specialists to discuss visual resources analysis. BLM will also attend the call.

ATTACHMENT H

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

Mountain Valley Pipeline: FERC & Cooperating Agencies Call
Date/Time: Tuesday, March 28, at 1:30-3pm (E)
Location: Conference Call

Invitees	Forest Service (FS)	Troy Morris*, Jennifer Adams, Karen Overcash
	Bureau of Land Management (BLM)	Miriam Liberatore, George Matzke, Nicole Virella
	Federal Energy Regulatory Commission (FERC)	Jim Martin, Paul Friedman*
	Cardno	Lavinia DiSanto, Doug Mooneyhan
	Galileo Project	Grace Ellis, Lauren Johnston

*Partial Attendance

ACTIONS

- **Karen** identifies which comments FS needs to adequately answer the comments designated by FERC as requiring a FS response. *Complete*.
- **Karen**, **Lavinia**, and **Galileo** coordinate any future document and coding needs for comment responses. *In Progress.*
- **FS** continues writing comment responses for inclusion in the Final EIS.

DECISIONS/DISCUSSION POINTS

- FERC confirmed the Administrative Final Environmental Impact Statement (EIS) will not include FERC's Response to Comments (RTC) table or side-by-side comment response appendix. These documents will only be available electronically at a later date.
- FS and BLM noted some of the comments to which FS has been asked to respond reference responses FERC will provide or has provided partway into the comment response process. FERC clarified FS is welcome to include additional responses to comments FERC has already addressed.
- FS and BLM noted some of the comments to which FS has been asked to respond include information MVP has yet to provide or provided very recently (i.e. the Biological Evaluation, Hydrological Analysis, etc.). This makes writing complete comment responses difficult.
- FS reiterated their need to know what changes FERC plans to make to the Administrative Final EIS (AFEIS) in order to properly respond to some comments. FERC clarified FS and BLM can have additional time after the AFEIS to complete their portions of the RTC. A final RTC due date was not specified.
- Karen reviewed the FS did a spot check of comments and identified an additional 72 comments FS feels should have been assigned to FS for comment, but were not. FS stressed their concerns over litigation based on some of these comments. FERC said FS is welcome to respond to these additional letters, including letters submitted outside of FERC's comment period.
- Cardno agreed to code any additional letters the FS needs, which were not initially included in the master RTC table. FERC will cross-reference their own responses with FS responses as needed to produce a final RTC appendix to the Final EIS.
- FS said they are concerned the comment responses they have from Cardno were written in January, and that some of Cardno's answers may have changed. Paul assured

he has not edited any responses and Lavinia said the edits Cardno has made were minor and not substantive.

- FS asked how much of the AFEIS the FS would be expected to update for National Forest System (NFS) Lands. Lavinia said FIS is welcome to edit NFS-related sections of the AFEIS. Lavinia does not anticipate her team updating those sections.
- Jennifer noted MVP has yet to submit for review analyses and reports that meet FS needs. She is concerned FS will be finished with AFEIS review before FS receives necessary documents from MVP. FS is battling a heavy work load and inadequate work submitted by MVP. BLM and FS reiterated they need to be able to make sure the analysis complies with their standards and cannot rely on FERC to make sure the National Environmental Policy Act (NEPA) documents meet these standards. FS needs time to evaluate project documents as they relate to Forest Plan standards, especially as the MVP project as proposed necessitates several Forest Plan amendments.
- Jennifer expressed FS concerns regarding future litigation due to inadequate analyses and NEPA documents. At this time the FS does not feel they have enough information from MVP to properly edit the FS-relevant sections of the AFEIS. FS and BLM are concerned about the breadth of new information that still needs to be incorporated into the Final EIS. New information is a key point of litigation.
- Jennifer suggested additional issues-based meetings and continued coordination in an effort to assure the Final EIS meets FS needs to assess their NEPA requirements for the proposed MVP project.

ATTACHMENT I

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

Internal FS Law Enforcement (LE) Call
Date/Time: Tuesday, March 14 @ 3:00-4:00 pm (E)
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Kent Karriker, Alex Faught, James Willet, Katie Ballew, Joe "Tony" McGallicher
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTION ITEMS

- **James** & **Katie** develop a law enforcement operations plan, clarifying especially that the George Washington and Jefferson National Forest (GWJNF) Forest Supervisor, Job Timm, wants authority, in coordination with LE, to make decisions on pre-construction law enforcement and safety for the Forest Supervisor's Office. *In progress*
- **James** & **Katie** develop separate lists of pre- and post-construction equipment needs to assist in FS comments on the Plan of Development (POD). *In progress*
- **Jennifer** forwards updated project timeline out to call participants.
- **Alex, Kent, Katie, James,** and **Public Affairs Officers (PAOs)** review the draft schedule for potential protest and other trigger points for LE needs.
- **Katie** and **Tony** send estimate to Jennifer for hours spent developing a LE operations plan as well as for reviewing the proponent's LE materials.
- **Jennifer** informs Megan that enforcement and closure & security measures will be considered on a case by case basis and samples don't need to be included in the POD.
- **Jennifer** reaches out to LE officers to assist in review of LE sections of the POD.
- **Katie** forwards cost recovery agreement contact for Virginia State Police to Alex.
- **Alex** confirms that cost-recovery allows for protest response billing.
- **Jennifer** contacts MVP to figure out what coordination they have already completed with local law enforcement.
- **James** coordinates with Jennifer and local crime analysts to plan LE needs.

DISCUSSION/DECISIONS

- Katie and James met with the GWJNF forest supervisor, Job Timm, to discuss how LE would work with the forest to decide on a law enforcement/security plan. Job would have authority, with LE help, to make decisions regarding safety at the forest supervisor's office. Line officers have authority to close facilities they supervise.
- Katie noted the PAOs had a plan in place in the case of peaceful protests, however it would not be sufficient for the paid protests the FS law enforcement anticipates. Katie said LE is planning for significant protests.
- Tony stressed the protests will be given an adequate first amendment site that takes safety, traffic, movement into consideration. Tony said worker safety is handled on a case by case and site specific basis with regards to protests during business hours. How the forest deals with a particular protest is determined, at least in part, by what intelligence the FS gathers up front. Jennifer stated the FS has received notification up front that FS stakeholders are planning protests on the forests. James notified that he is working with the Virginia Fusion Center to monitor potential protests and other activities related to pipelines on National Forest System lands.

- Jennifer restated there are multiple cultural sites of concern on the GWJNF that FS wants to be sure to protect and monitor long term. Katie said this has been well discussed and long term monitoring plans will be included in the POD.
- Katie said LE personnel could come from several sources, with FS federal officers providing last minute planning to protect FS resource, similar to the arrangement with fire enforcement. LE options for the GWJNF include State Police, Troopers in riot gear on two week rotations, FS LE personnel, and, county response teams. Katie plans to rely on tactical field forces for any problems on the GWJNF. Additional roving troopers can also provide support. Katie said FS is coordinating with Virginia regarding available law enforcement personnel and their fees. Virginia State Police also work with local landowners.
- Alex stated it would be helpful for LE planning purposes to know the schedule of FERC and FS decisions and objection/appeals processes. She noted FERC's practice is to publish their decision without warning or notice to FS. Jennifer said FS would issue its draft decision shortly after the FERC. Alex said he would expect protestors to start showing up shortly after the FERC decision.
- Alex said he is nearly done with a cost recovery agreement with the proponent from now until the FS's final decision. Participants discussed the possibility of reimbursement vs. upfront payment from the proponent to cover LE needs for such events as protests. The agencies also need to work with local LE to determine how they would like to be compensated for their work on the project, whether through cost recovery with FS or with the proponent. Alex stressed that for the current cost recovery agreement he needs to know how many hours the LE officers are spending writing and reviewing operations plans. Equipment needs, review needs, and additional LE personnel cost recovery for construction phase is all addressed in a separate cost recovery agreement for after the FS signs their decision, if the project is approved.
- James updated that the proponent has already been working with other local LE entities and it would be beneficial to coordinate with them. Jennifer said she has previously asked the proponent to provide a list of their LE coordination activities to FS.
- Jennifer stated the proponent is expected to pay for and manage security for its own equipment and personnel. This has been documented in conversations with the proponent. Jennifer said she would like to have a list of what law enforcement needs specified in the POD so the proponent can update the POD.
- Tony, Katie, and Jennifer discussed the potential need for closure orders during construction, if approved. Tony stated the FS might be able to make use of emergency closure orders on a rolling basis.
- Tony and Katie agreed barriers and closure notices, etc., will be determined on a site by site basis. At this time the proponent does not need to have samples in their POD.

ATTACHMENT J

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination
Date/Time: September 1, 2016 10:30 pm CT
Location: Conference call

Attendees	BLM	Vicki Craft, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Karen Overcash
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** sends project schedule and any objection period info to Grace.
- **Galileo** updates project schedule and flow chart using Forest Service (FS) decision and objection requirements. Forwards to FS for review, then to BLM when complete.
- **Galileo** drafts joint communication/coordination plan.
- **Galileo** develops a draft decision file strategy based on BLM guidance and forwards to FS to incorporate their specifications.
- **Galileo** schedules conference call and GoTo meeting to review the FS Notice of Availability (NOA) language with BLM and FS on ***September 6th, 2016***. (*complete)*
- **Vicki** confirms NOA strategy with BLM Solicitor.
- **Karen** forwards draft NOA to Vicki and Miriam for review. (*Complete*)
- **Jennifer** forwards FS comment filings on Mountain Valley Biological Evaluation (BE) to Vicki with cc to Grace. (*Complete*)
- **Galileo** coordinates with FS on handout for upcoming Draft Environmental Impact Statement (DEIS) public meetings.

DECISIONS/DISCUSSION

- The Federal Energy Regulatory Commission (FERC) is the lead agency preparing an Environmental Impact Statement (EIS) to issue a certificate of public convenience and necessity for the project.
- BLM's decision is whether to issue a Right of Way grant (ROW) for the Pipeline with concurrence from the FS and the United States Army Corps of Engineers (USACE or ACE). FS must concur with the BLM Record of Decision (ROD) before it is issued. The Secretary of the Department of the Interior can issue a ROD without FS concurrence.
- FS will decide on whether to issue plan amendments, so the 218 and 219 objection processes are in effect. The Notice of Availability (NOA) for the Draft Environmental Impact Statement (EIS) accommodates a 90-day comment period for the forest service plan amendments.
- Jennifer noted the FERC project schedule does not necessarily include time for correct sequence of the objection process, concurrence, and decisions.
- Jennifer noted the DEIS is being pushed through quickly without adequate time to gather and review data. FS has asked for more time for review, which was previously granted by Paul Friedman (FERC project manager) but has since been taken out of the schedule per objection from proponents. FS noted that completing the DEIS without adequate data could slow down progress from the DEIS to the Final EIS (if FS receives numerous comments from the public).

- FS has asked Dominion to request more time on the DEIS to avoid needing a supplemental EIS, but FERC denied the request to amend the schedule.
- FS and BLM will be reviewing FERC's NOA to make sure it adequately represents the decisions to be made by the agencies. FS plans to issue their own NOA (and will allow BLM to review text pertaining to the decision). BLM is not inclined to issue an NOA. While a BLM NOA would be more easily accessed by their constituents, the review process is prohibitive and the NOA(s) that add clarifying language on the BLM decision should be adequate. Vicki will confirm.
- Bi-Weekly Cooperator meetings do not require documentation from Galileo.
- Paul Friedman will send the FERC NOA for publication on September 16th. FS will send their NOA for publication as close to September 16th as possible; however, FS doesn't want to be published before FERC.
- All public comments on the Pipeline are submitted to the FERC.
- All communications with FS will go through Jennifer and not directly to the IDTeam.
- Sequence of BLM and FS concurrence and Decisions:
  - FERC NOA for DEIS and FS amendment
  - 90-day DEIS and FS amendment comment period
  - Update EIS and respond to comments
  - FERC Final EIS and FS draft Record of Decision (ROD)
  - FS objection period.
  - FS concurrence with BLM ROD
  - BLM issues ROD, FS issues final ROD on plan amendments.
  - 30-day ROD waiting period. FS ROD does not have 30-day waiting period but plan amendments are not in effect until BLM issues the ROW
  - BLM issues ROW (if project is approved)
  - BLM issues Notice(s) to Proceed (if project is approved).

Upcoming Meetings			
Participants	**Objective**	**Date**	**Time (P/C/E)**
BLM/FS/GP	Review comments on NOA	9/6/16	12:00/2:00/3:00
BLM/GP	Decision File Review	9/28/16	12:00/2:00/3:00
BLM/GP	PM Coordination (in MS)	8/5/16	8:30/**10:30**/11:30
BLM/GP	BLM IDT Kick-Off (in MS)	8/5/16	11:00/**1:00**/2:00
FS/GP	PM Coordination/Kick-Off	*TBD*	
BLM/FS/FERC	Bi-Weekly Cooperator Calls	Ongoing	

ATTACHMENT K

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

MVP FS-BLM Coordination Pre Meeting

Date/Time: Monday, February 27, 2017 @ 11:30am-12:00pm (PT)/12:30 – 1:00 pm (MT)/1:30-2:00pm (CT)/2:30-3:00pm (E)

Call-in: 866.906.9888 Code 9493642#

Invitees	BLM	Miriam Liberatore, Bruce Dawson
	Forest Service	Jennifer Adams, Joby Timm, Karen Overcash, Troy Morris, Ted Coffman
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **Jennifer** and **Karen** discuss DEIS comment response and keywords. Coordinate with Galileo.
- **Jennifer** forwards house bill proposing changes to BLM mitigation policy to Bruce, Vicki, and Galileo.
- **Galileo** includes a link to the BLM mitigation manual for MVP in the High Level Meeting coordination notes.

DECISIONS/DISCUSSION POINTS

- Karen stated the FS needs additional information from MVP, including the updated Plan of Development (POD), SF-299, and Biological Evaluation (BE) before they can provide full comment responses.
- Joby cited a proposed change to BLM's mitigation policy circulating in the government. Bruce stated the policy was developed as a response to an executive order. Bruce stressed one of the stated purposes of the policy is to start considering mitigation early on in the EIS process. FS and BLM agree it is prudent to start including the proponent in mitigation discussions as soon as they provide essential missing project documents – for example the BE, POD, and SF-299.
- Jennifer reviewed the current project schedule and updated that FS and BLM are not being given adequate review time or review materials in order to meet their NEPA requirements.
- Jennifer reviewed MVP's proposed Craig Creek Crossing route and reiterated the FS cannot complete its review of the updated alternatives until they receive the full sedimentation analysis. Jennifer also said MVP has identified their preferred route for the Craig Creek Crossing. The FS has not yet identified the FS's preferred route. Jennifer notes this may be a Forest Supervisor decision based on specialist recommendations
- Jennifer said MVP has requested meetings with the FS and other Appalachian National Scenic Trail (ANST) managing partners, including the National Park Service (NPS) and the Appalachian Trail Conservancy (ATC). Jennifer reiterated it is not the job of the FS to consult with these groups on behalf of the proponent. Jennifer has also requested MVP provide a purpose and agenda for the meeting to determine what, if any, FS participation would be required.

ATTACHMENT L

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP FS BLM Coordination Call
Date/Time: Wednesday, June 14, 2017 @ 11am-noon (P)/noon-1pm (M)/1-2pm (C)/2-3pm (E)
Conference Call: 866-906-9888; code 1603852#

Attendees	Bureau of Land Management (BLM)	Vicki Craft
	Forest Service (FS)	Jennifer Adams, Karen Overcash, Mike Madden
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofanti
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **MVP** completes and uploads Plan of Development, Biological Evaluation, Habitat Equivalency Analysis, and Sedimentation Analysis to Galileo's FTP site. *In Process*
- **Lauren** notifies agencies when MVP documents are available on the FTP site, including review deadlines (June 21) and instructions.
- **Jennifer** works with **Galileo** to schedule resource-specific POD meetings.
- **MVP** submits final Phase II Archaeological Report after meetings with the National Park Service (NPS) and BLM Executive Team.
- **Galileo** sends meeting invite for the Executive and Biweekly agency proponent calls to Mike. *Complete*.
- **Galileo** distributes agenda for Executive Call on **Monday, June 19, 2017 @ 2 pm ET**.
- **Galileo** sends updated Culvert Site Visit meeting invite (**6/19 @ 10-2 ET**). *Complete*.
- **FS**, **BLM**, **MVP**, and **Galileo** send representatives in person or via phone to tomorrow's Appalachian National Scenic Trails meeting with the NPS and Appalachian Trail Conservancy.

DECISIONS/DISCUSSION POINTS

- Megan updated the HEA and Sedimentation Analysis are all going through final review. The POD and BE are ready for distribution to FS and BLM. Jennifer reminded Megan the files should be word documents for ease of editing.
- Mike complimented MVP on SEARCH's preliminary Phase II Cultural Report. He stated the report is very well done and will only potentially require closer review of a few small details. FS agreed they plan to share the final Phase II report with the State Historic Preservation Officers and Tribal Historic Preservation Officers once received. Jennifer requested MVP remove references to Federal Energy Regulatory Commission (FERC) transferring National Historic Preservation Act Section 106 (Section 106) responsibilities to the FS for Jefferson National Forest lands. This is no longer accurate (see accompanying email).
- John noted MVP has requested FERC to provide more finite information regarding Section 106 consultation completion. All agreed the best course forward is to talk about Section 106 on the upcoming call Executive Team call. Vicki noted BLM is working internally with their solicitors and with the Advisory Council on Historic Preservation to identify an appropriate path forward. BLM hopes to have more solid answers for MVP next week.

- John and Megan noted MVP did complete a study of the Weston and Gauley Trail, included in the West Virginia Criteria of Effects Report.
- Jennifer said the FS is planning on resource-specific grouped meetings to address final edits to MVP's latest POD, once delivered. Jennifer is assessing staff availability.
- John noted MVP has been working to identify alternatives to reducing the permanent Right of Way width on Jefferson National Forest lands in order to address visual impacts. He suggested by not trimming the canopy MVP would be able to maintain the 50 ft ROW in a mowed state to comply with US Department of Transportation' Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations.
- Jennifer countered that the FS has worked with FERC to develop the ROW rehabilitation restrictions that would still meet PHMSA regulations. She also said MVP's proposed alternative measure would not work, as trees would be cleared anyway for the construction phase. Jennifer also said this matter relates to the BLM and FS decisions regarding the ROW and plan amendments, respectively, and should not concern discussions with the NPS at tomorrow's meeting.
- John said the MVP's Visual Impact Assessment concluded that no additional mitigation measures or stipulations, in this case a reduced permanent ROW width, would be needed to meet the FS's Scenic Integrity Objectives. Jennifer clarified the ROW width reduction and subsequent seed mixes and rehabilitation measures requested by the FS are part of the analysis that showed reduced impacts to not only visual resources, but also sedimentation and wildlife impacts. Jennifer restated the rehabilitation measures are approved by FERC and comply with PHMSA regulations.
- Jennifer concluded that the FS needs to complete internal conversations on the best way to visualize and describe the FS's ROW restriction and rehabilitation methods, and later meet with MVP to clarify FS requests.

ATTACHMENT M

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP FS-FWS Coordination
Date/Time: Monday, March 20, 2017 @ 12-1:00pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Alison McCartney, Miriam Liberatore, Vicki Craft
	US Fish and Wildlife Service (FWS)	Jennifer Stanhope, Sarah Nystrom, Sumalee Hoskin
	Forest Service (FS	Carol Croy, Dawn Kirk, Fred Huber, Jennifer Adams, Jesse Overcash, Steve Croy
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **FS** and **FWS** continue review of MVP's most recent Biological Assessment (BA).
- **FS** completes its review of MVP's most recent Biological Evaluation (BE) and Sedimentation analysis.
- **Jennifer** confirms with Karen Overcash (FS) whether or not the FS needs additional biological surveys or review of the Slussers Chapel Conservation Site alternative proposed by the Virginia Department of Conservation and Recreation (VDCR).
- **Jennifer** coordinates with Karen Overcash (FS) and Ava Turnquist (FS) to update the FS's environmental effects chart as FS specialists review new MVP documents.
- **Jennifer** emails Job with FS and FWS input on mitigation.
- **Federal Energy Regulatory Commission** (FERC) finalizes the BA and initiates consultation with the FWS.
- **FWS** meets with MVP to review MVP's Habitat Equivalency Analysis (HEA).
- **BLM and FS** meet with MVP to review MVP's HEA.
- **FWS** anticipates requesting an Environmental Constraints Map for MVP to help resolve potentially conflicting seasonal restriction recommendations.

DECISIONS/DISCUSSION POINTS

- Carol said she wants to be sure MVP is not missing any priority birds covered under the Migratory Bird Treaty Act (MBTA). Carol also stated the FS recommends MVP have a biological monitor onsite during winter construction. In addition Carol said she wants MVP to know that golden and bald eagles could be found anywhere along the route and bald eagles could start breeding activities early in the calendar year.
- Carol said the FS and FWS recognizes the need to evaluate and prioritize resource-based (T&E, slope stability, soil movement concerns) seasonal construction restrictions as several of the recommended restrictions are in conflict.
- Dawn noted Craig Creek is considered potential Threatened and Endangered (T&E) Species habitat for the James spinymussel, although the documented occurrence of the species is located 21km downstream of the project. Jen S. expressed concern that in the draft BA, MVP did not look at species occurrence for the James spinymussel in the Natural Heritage Database, which puts the closest occurrence of the mussel at approximately 7 kilometers downstream from the project action area (Note: this includes the area where MVP modeled sedimentation impacts). MVP did not conduct mussel habitat assessments within the original action area from the draft sediment analysis. However, MVP has indicated to FWS that they have reduced the sediment impacts to within the mussel survey area. Jen S. said she needs to read through MVP's recent filings, including the revised BA, to determine if their sedimentation load assumptions

and construction window make sense. Jen S. noted she thought MVP would be constraining their construction window to 8 weeks around Craig Creek.

- Dawn and Jen S. stated they need to review MVP's sedimentation analysis before they can determine if the analysis is complete, and, if so, which alternative represents the preferred crossing for the agencies. Dawn said upon preliminary review, the FS recommends different alternatives based on which resource (i.e. biology, hydrology, geology, etc.) is being considered.
- Jen S. requested Dawn keep her in the loop re FS's sedimentation analysis. Dawn stressed she wants to be sure the sedimentation load from the different alternatives is properly assessed, and that the sedimentation analysis considers construction on private lands that would have an impact on FS lands.
- Jen S. confirmed she asked MVP to include the Candy Darter and Yellow Lance as well as other petitioned species in the BA analysis. FWS will make sure these species are adequately addressed.
- Sarah updated that the Rusty Patched Bumblebee will not be listed in Montgomery County, however FWS has stressed to proponents that pesticide use and widespread herbicide use on the right of way is of concern. Sarah said FWS prefers MVP use targeted herbicides in order to promote early successional habitat that encourages pollinator occupancy. Sarah stressed FWS does not anticipate the Rusty Patched Bumblebee returning to the MVP project area before it is complete, and as such the proponent should not have to worry about the bee becoming a regulatory species for their project, even if pollinator habitat is encouraged and develops.
- Sarah confirmed there is no need for FS to consult with FWS regarding the Rusty Patched Bumblebee.
- Steve said the bat surveys turned up evidence of a small footed bat (a FS sensitive species) but no evidence of federally listed bats. Sumalee confirmed MVP has done their due diligence with mist net bat surveys and that she believes where bats are concerned the project is in good shape. Sumalee added she will review the BA to confirm.
- Vicki recounted that BLM and FS are coordinating with the Commonwealth of Virginia on mitigation, and that MVP has now been looped into the conversations. Vicki said MVP is working on a HEA to evaluate direct and indirect impacts to federal lands, and will be scheduling a meeting with FS and BLM to review the analyses. Jesse stressed he is in favor of a landscape scale mitigation plan that substitutes affected landscape features accordingly. Jesse said he is concerned an edge effects analysis of acres is inadequate to determine impacts, especially to shellfish.
- Sumalee? said the FWS is requesting an environmental constraints map to look for potential impacts to migratory birds due to fragmentation and early seasonal impacts. These impacts and environmental constraints will also need to be addressed for other species.
- Sumalee confirmed MVP has a meeting with FWS to review the HEA. She said FWS is open to looking at edge effects and fragmentation and in assisting FS in mitigating habitat effects on FS lands.
- Sarah confirmed there is no authority for FWS to issue or enforce a permit for incidental take of certain species under the MBTA.

- Jen S. confirmed FERC has not finalized the BA to initiate formal consultation, but that FERC is currently developing a consultation timeline.
- Steve, Jesse, and Carol asked whether there were any outstanding surveys the FS needed, especially in regard to the VDCR's Slussers Chapel alternative route.

ATTACHMENT N

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

MVP Call Agenda **Monday 21 November 2016**

Attending: Mary, Pete, Frank, John H, Barry, Mark, Vicky, Andrew, Wendy, Denise, Lindy, Miriam, Nicole, Leta, John C, Jennifer, Dan, Justin, Carol, Nicole, Haninah, Alison

Please note: BLM and the Forest Service are cooperating agencies; NPS is not.

Agenda:

- Crossing of the Appalachian National Scenic Trail: Authority for Forest Service
- Overall Concerns about the MVP DEIS
  - Impact of WV Court Decision
- How Does the NPS Position on the DEIS Figure in BLM/FS Concerns about the DEIS
  - Open Trenching
  - More Info Needed
- Role of OEPC
- Next Steps

Notes: **Due dates are in red below so they are easy to find.**

1) **FS Authority for AT Crossing:**
   a. FS and BLM have authority for lands bought by the FS separately
   b. Writing a legal memo
   c. No disruption to current process
   d. Some MOA changes may occur (NPS/ FS MOA)

2) **Overall Concerns about the MVP DEIS:**
   a. BLM: inadequate DEIS, missing info, not enough info to adopt as is
      i. Next steps:
         1. Get data
         2. Considering deficiency notice to applicant, letter to FERC
   b. WV Supreme Court decision:
      i. MVP not in public interest, no connection in WV, no eminent domain for surveys until have certificate
      ii. Could affect routing
      iii. Additional info needed: would this include private property?
   c. Does the FS need info from private land? e.g. persistence of species
   d. FS/BLM: missing info: both along the pipeline and on FS land
      i. Soils, water crossings, geology, but every resource needs info on the FS and COE lands
      ii. Visual impact analysis also a concern

iii. Wildlife impacts also a concern; formal consultation to be done "at future time"; effect determinations done without FWS consultation; consultation must be done before DEIS so terms and conditions from Biological Opinion are in the DEIS for everyone to review.

3) NPS Position:

a. Visuals, cumulative effects, Section 106
b. Cumulative effects section missing any analysis: see EPA comments on Atlantic Sunrise for a good analysis
c. Construction method in question; inconsistencies in the DEIS
d. BLRI:
    i. Crossing not in the DEIS
    ii. Cultural resource concerns
e. AT:
    i. No consultation on visuals
    ii. Continuous tweaking of the route and the information provided
    iii. MVP contacted the BLRI, but not the AT.
f. Overall, the FERC DEISs have come out too early, missing critical information. MVP is 3rd of the big pipeline DEISs to come out.
g. Section 106 consultation missing from all of the three pipelines (and a host of others).
h. Construction method: conventional boring or open trench

4) Role of OEPC:

a. Filing comments for DOI? Role of BLM (FS, COE), NPS, FWS
b. What is FWS doing?
c. Reduce confusion. Will a joint Departmental letter do this?
d. OEPC would like to review comments beforehand, even if not joint Departmental letter. Won't need much time for review.
e. OEPC deadlines: 1 or 2 weeks for review in normal procedure, but some flexibility and can start with drafts.
f. Dec 7 deadline; could be the 15th? But need to coordinate on what we are saying (BLM, NPS). See below.
g. Tentative agreement (pending internal discussions at each bureau):
    i. Drafts to OEPC (and each other, NPS, BLM and FWS if applicable) by Dec 7 COB
    ii. Final versions to OEPC and each other by Dec 15 COB
    iii. Send to Lindy Nelson at OEPC: lindy_nelson@ios.doi.gov
    iv. Let the group know if these deadlines can't be met after internal discussions.
    v. Mary will send MVP FAST-41 info to Lindy.

5) Next Steps / Questions:

a. If BLM issues a deficiency notice, how does that affect the Dec 22nd deadline?
    i. Haven't decided for sure on the notice, but would be as soon as possible. Not sure how it would affect the Dec 22nd deadline for comments.

ii. BLM in strong position, but FERC may issue certificate anyway.

b. Deadlines:
    i. See above tentative agreement on due dates
c. MVP may change route to avoid BLM involvement.
d. NPS concern over Forest Service Forest Plan amendments.

ATTACHMENT O

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

MVP Sedimentation Discussion

Date/Time: Thursday, April 6, 2017 @ 7-8 am PT /8-9am MT /9-10am CT /10-11am ET

Location: Conference Call

Attendees	Forest Service (FS)	Dawn Kirk, Pauline Adams
	GAI Consultants	Joshua Noble, Kevin Bortz
	Galileo Project	Lauren Johnston

Objectives:

- ✓ Discuss whether MVP's Sedimentation and Hydrological Analyses are sufficient to accept as part of the Final Environmental Impact Statement, or if more analyses are warranted.
- ✓ Discuss whether MVP's Sedimentation and Hydrological Analyses can be appropriately translated for Biological impacts assessment.

ACTIONS

- **Dawn** and **Pauline** check Environmental Protection Agency 2003 article reference to determine adequacy of 10% sedimentation load impact threshold.
- **Dawn** and **Pauline** confirm aquatic biota sediment standards.
- **Pauline** and **Dawn** complete and send Sedimentation and Hydrological Analysis comments to Jennifer.
- **GAI** starts review and modifications of MVP's sedimentation analysis section in the Administrative Final Environmental Impact Statement (AFEIS) as it becomes available.

DECISIONS/DISCUSSION POINTS

- Kevin Summarized his comments with MVP's analysis as follows:
  - MVP uses broad mapping and a large, watershed-scale with averaged input values across the landscape and lack of localized conditions.
  - MVP's use of analysis model is appropriate to predict erosion due to construction, but he hasn't before seen it applied to a linear project.
  - MVP's analysis may not adequately capture episodic higher intensity events and their effects on the landscape.
  - It is unclear how MVP estimated where 10% increase in sediment load would occur, without more specific analysis of stream characteristics.
- Dawn and Pauline agreed they are concerned MVP's analysis doesn't capture high intensity episodic events or localized conditions. In addition, Dawn expressed concern that cumulative effects are not evaluated far enough off of National Forest System (NFS) lands to address biological concerns and impacts downstream. Dawn emphasized aquatic species the FS is concerned about are mostly found off NFS lands, yet FS need to manage activities on NFS lands to reduce or impacts off Forest.
- Dawn and Pauline expressed concern about MVP's use of sediment threshold increase of 10% to determine where impacts would occur. Kevin said the usual standard in Virginia is to keep sediment load less than 2 tons/acre/year in order to obviate the need for mitigation. Kevin stated this standard is used to prevent impacts to downstream neighbors, and is not specific to Biology. Dawn stressed organisms respond differently to increases in sedimentation, and a 10% impact threshold to determine when impacts would occur is likely

not relevant. Dawn expressed concern that because impacts are at the watershed level, localized impacts will be hard to determine.

- Dawn expressed concern MVP's analysis might not meet her needs to estimate biological impacts, as the cumulative effects area doesn't include Stony Creek and Craig Creek.
- Pauline clarified inspection of erosion control measures and sedimentation mitigation measures needs to be specified in the FS's Special Use Permit and/or Bureau of Land Management's Record of Decision.
- Joshua, Kevin, Pauline, and Dawn agree the following points in MVP's Sedimentation and Hydrological Analyses need to be addressed:
    - Lack of background data to confirm analysis results.
    - How cumulative effects analysis areas were determined and why.
    - Potential over- and underestimate of impacts from construction activities on sedimentation.
    - Clarification on construction starting point and timeline throughout the analysis area; instruction to make sure analysis includes data for 5-7 years post-construction.
    - Clarification on whether MVP included all disturbance within the watershed, even if it was off NFS lands, in impacts analysis as previously instructed by FS.
    - Whether MVP needs to run a limited disturbance scale model to adequately address effects to smaller scale areas in addition to a whole watershed analysis.
    - Accuracy of analysis of efficacy of erosion control measures
- Pauline clarified there has not previously been a sedimentation analysis analyzed in the AFEIS, and that FS has been waiting for a sedimentation analysis for over a year.

ATTACHMENT P

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP FS BLM Biweekly Coordination Call

Date/Time: Monday, May 8, 2017 @ 1:30 – 2:00 pm EST

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Mark Mackiewicz
	Forest Service (FS)	Jennifer Adams, Ginny Williams, Tim Abing
	MVP	Megan Neylon, John Centofanti, Joe Dawley
	Galileo Project	Lauren Johnston, Grace Ellis

Objectives:

✓ Discuss critical analyses missing in the Final Environmental Impact Statement (FEIS)

ACTIONS

- **MVP** completes the Habitat Equivalency Analysis (HEA) and shares FS-related sections with FS and BLM as soon as possible.
- **MVP** completes Visual Impact Assessment (VIA) addendum/amendment by May 10, 2017.
- **FS/BLM** start next steps for National Historic Preservation Act Section 106 (Section 106) consultation compliance.
- **FS/BLM**, and **MVP** meet to discuss**:**
  - VIA – Tuesday, May 9, 2017 12:00 – 2:45 pm
  - HEA - TBD
  - Sedimentation analysis – Tuesday, May 9, 2017 3:00 – 4:00 pm

DECISIONS/DISCUSSION POINTS

- Mark said he has been coordinating with FERC to get more time for MVP to submit additional analysis, especially the VIA, for inclusion in the FEIS. BLM and FS stressed it is imperative to complete the VIA as soon as possible, preferably by Wednesday, May 10, so it can be included in the FEIS.
- Joe reiterated MVP feels they have completed the necessary analysis and are frustrated that the bar for the level of detail, format of analyses, etc. keeps changing. He said it is MVP's perspective that they are following the law, and that FS and BLM are asking for a higher level of detail than required by law. Tim said it's the FS's and BLM's job and obligation to follow their respective agency standards and help develop a defensible FEIS to ensure a defensible decision for each agency. He also said FS is willing to work with MVP to update the analysis documents to FS's standards but that it's an iterative process that requires collaboration and thorough review and feedback.
- Tim and Mark stressed they feel MVP has been responsive to data requests and that most of the analysis work has been completed, but that final polishing work still needs to be done. Mark said BLM and FS are working with FERC in an attempt to get MVP's outstanding analyses into the FEIS after the deadline so BLM and FS can use the FEIS for their purposes.
- Joe updated that MVP's consultant is eager to start review of the Phase II Cultural Surveys for sites on the Jefferson National Forest (JNF). Joe stated MVP's concern that FS has not been working with MVP's contractors to do incremental review of the cultural surveys. Jennifer said this is incorrect, and that FS has been working through incremental review. Jennifer said FS has been actively providing written and verbal feedback to MVP throughout the process with myriad environmental and cultural documents.

- Tim said the next step for Section 106 consultation is to complete review of the Phase II reports and then develop a Memorandum of Agreement (MOA) with the affected parties. Mark and Tim stressed the MOA does not need to be completed until the FS and BLM sign their final records of decision, but that the process should be on MVP's radar as it takes significant review time to develop an appropriate MOA.
- John reiterated previous concerns about the FS's comments on MVP's initial sedimentation analysis. John said he wants to work with the FS to avoid having to lower the capture efficiency of erosion control measures in the sedimentation analysis as this would fundamentally change impacts to species. Jennifer said FS comments on MVP's analysis were prepared by FS's own resource experts and are written to help guide MVP on how to structure analysis for FS's needs to address impacts. Jennifer suggested scheduling an additional call with resource experts to discuss John's questions on the sedimentation.
- Tim and Ginny clarified there are only a few additional points in the VIA that FS still wants to see MVP analyze. John confirmed MVP's contractor added additional photo locations on Craig Creek Road and WV 219 roadway. John said the photo simulations take roughly 8 hours to complete per photo. Ginny agreed to review pre-simulations to help MVP determine which photo locations require complete simulations. Ginny updated that her comments on MVP's most recent VIA are specific and brief and should be quick to incorporate into a complete VIA. Jennifer suggested a page-turn meeting to edit the final VIA would be the most efficient path forward.
- Joe updated that MVP has completed a HEA for the entire proposed pipeline route and is awaiting feedback from several agencies and state governments, not including BLM and FS. MVP has not yet shared the VIA with the FS or BLM, and has not solicited comments from the FS or BLM on the HEA development or report. Joe said MVP is willing to pull out the sections of the HEA pertaining to JNF lands and share it with the FS. He also said the HEA is being used to help create a Migratory Bird Conservation Plan. Joe stressed that given the recent changes in mitigation directives and policy across federal agencies it has been difficult to finalize and apply the HEA.
- Tim said it's encouraging that MVP has used the FWS's methodology to develop the HEA model. Tim reiterated the FS is mainly concerned with how the project will impact core forest and how MVP would plan to mitigate those impacts.

ATTACHMENT R

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Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

FEIS and Forest Service Shortcomings in Assessing Mountain Valley Pipeline Sedimentation Impacts on Streams: a Citizen's Review

In working through FERC's treatment of stream-related impacts in the FEIS for the Mountain Valley Pipeline, I have discovered what I believe are seriously compromising failures of reasoning and procedure in FERC's handling of the MVP-commissioned study by ESI of streams in the Jefferson National Forest. Although the ESI study is itself flawed, some of the valid issues it raises call into question the validity of all the FEIS conclusions concerning possible impacts from sedimentation on affected streams. Problems in the FEIS include drawing generalized conclusions based on limited or deeply flawed studies that are inadequate proof of FERC's conclusions, ignoring relevant data from available studies, and 'cherry picking' information and statements that are supportive of agency conclusions—even while ignoring other conclusions from the same studies that are not supportive of the application's claims. The issues addressed below are damaging to the FEIS, to the 401 Water Quality permits based on the FEIS, and to the Forest Service comprises with and approvals of the MVP project.

The following discussion includes evidence of a number of failings and irregularities in the handling of the MVP application by FERC. My focus is on the project's potential effects on more than 1000 streams. FERC and the US Forest Service share responsibility for seriously deficient evaluation of information submitted by MVP and its subcontractors.

Among the problems identified here are the following:

- Both the Forest Service and FERC have accepted, without comment, data that is acknowledged by its source (ESI, Inc.) to be invalidated by researcher error; both agencies appear to accept the studies in question as a valid basis for decisions they announce—without requesting any correction of the study in question.

- Based on Forest Service discussions of the procedures for estimating sedimentation, FERC's approach to evaluating stream impacts—which depends almost exclusively on sediment resulting from stream crossing methods—is wholly inadequate and unprofessional. The sources presented by FERC in support of their claims about dry ditch crossing procedures are inadequate as a basis for generalizing about the MVP route's impacts: one study involved a single stream and its tributary, the other collected no data on long-term sedimentation impacts resulting from anything but the crossing method.

- FERC failed repeatedly to require that appropriate research data on stream impacts be submitted by MVP and also failed to make use of such relevant data as was submitted, despite clear indications from Forest Service analyses of the kinds of information required for valid studies of sedimentation impacts, and despite valid evidence from the ESI study that there were likely to be serious impacts to numerous water resources. The latter source suggests that up to half the streams crossed by the MVP could incur serious

sedimentation increases of 15% or greater. FERC nonetheless states in the FEIS that no significant or long-lasting impacts are anticipated.

- FERC appears to have utilized data favoring the Project that was drawn from an outdated and severely inadequate study while ignoring the revised data contained in a later reporting of the material. There is also evidence of 'cherry picking' from MVP submissions that data least damaging to the Project, while ignoring or obscuring information in the reports that reveal substantial impacts to streams.

1. The FEIS Assesses ONLY the Crossing Method—an Inadequate Basis for Estimating Sedimentation Impacts

To understand the centrality of the ESI study, it is important to note first that FERC's argument in the FEIS is grounded on two other studies of sedimentation that purport to show that impacts will be minimal. These studies are referenced in the FEIS on page 4-120. The first was a 2009 study by Moyer and Hyer of sedimentation over 24 months resulting from the dry-ditch crossing in Tazewell County, Virginia of a single stream (Indian Creek) and one of its tributaries. While such a limited sample was adequate for the study's purpose of evaluating continual sediment monitoring, clearly, a single stream does not provide a scientific basis for generalizing effects to all the 1000+ streams affected by the MVP (there is too much potential variation in such relevant variables as soil types, the steepness of surrounding slopes, maximum discharge rates and so forth). The second study was published in 2004 by Reid, Ade, and Metikosh; the authors compared "sediment entrainment" resulting from various crossing methods on several streams, but they included no long-term examination of sedimentation, some of which would result from other aspects of construction in affected areas.

From these two studies, FERC staff conclude that *the use of the dry-ditch crossing method ensures that the MVP will have minimal impact on streams.* They claim that sediment increases will be short term—mostly no more than a few hours or possibly 1-4 days following the construction of the crossing—and will be limited in extent to "a few hundred feet" downstream of the crossing site (FEIS, pg. 4-120). FERC staff attempt to bolster this argument by enumerating the types of plans that FERC and MVP have in place for construction and mitigation. These plans, however, do nothing to resolve the illogic of asserting that the only significant source of sedimentation will be the crossing method used at the crossing site. In fact, the ESI study clearly refutes the claims of "minimal impact", duration of effect, and extent of downstream sedimentation. While such claims may be true for a single crossing examined in the abstract, they do not hold for a crossing in its actual context of occurrence.

In fact, **assessing only the crossing method as a source of sedimentation defies basic principles of environmental assessment as articulated by the Forest Service's response to early studies of potential MVP impacts** to the Jefferson National Forest (the relevant documents will be discussed in greater detail in subsequent sections of the present comment). To properly estimate

increases in sedimentation, a study must assess at least the potential sediment loads generated by all the areas of disturbance in a stream's drainage areas (including the ROW, access roads, staging areas and any other areas cleared or graded in the drainage), area slopes (both of the ROW and of side slopes in the general area that would tend to lead run-off to the stream), soil types, and distance of disturbance from the affected stream.[1]

2. What FERC Staff Say—or Fail to Say—about the ESI Study

FERC staff had access to another body of research, studies that addressed geographical areas directly affected by the MVP Project, specifically the crossing of the Jefferson National Forest (JNF). MVP commissioned Environmental Solutions and Innovation, Inc. (ESI) to conduct two studies of the JNF which were submitted to FERC on March 1, 2017, almost four months prior to the release of the FEIS. The studies are included in the FEIS as Appendix O; O-1 is entitled *Biological Evaluation for Threatened, Endangered, and Sensitive (TES) Species*; O-3 is entitled *Hydrologic Analysis of Sedimentation.* The two studies utilize much of the same basic data and even share verbatim a few entire paragraphs of discussion. The versions included in the FEIS Appendix O are significant revisions of studies submitted to the Forest Service much earlier in the application process—which at that time were forcefully rejected by Forest Service personnel as inadequately designed and executed research.[2]

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[1] This information can be found in Docket CP16-10, Document #20160408--5318, Document file containing narrative responses to Forest Service requests which includes transcriptions of Forest Service commentary on MVP's original submissions of impacts on streams in their Resource Report 2. The FS response includes the following:
"There is no sediment analysis for comparison of effects described or performed in the document. For purposes of analysis and assessment of impacts, the applicant should use a sediment modeling program that includes the delivery estimates of sediment to streams through evaluation of the following variables at a minimum:
a) Proposed disturbance area: including the disturbed area of the pipeline corridor, access roads, staging areas, and any other ground disturbance associated with the installation and maintenance of the pipeline and associated facilities. Any sedimentation from illegal use by ATV's, horses, vehicles, or other unauthorized activities that are possible as a direct result of the pipeline construction should also be estimated and modelled. The decision to include these activities in monitoring should be based on the existing legal and illegal uses of FS and adjacent lands in the immediate vicinity;
b) Slope (both the slope of the disturbed surface and the side slope in the vicinity of the proposed disturbance)
c) Soil type (to include the fine fraction of the soil)
d) Distance to a sediment delivering channel (for the FS, this is equivalent to the flow path that begins at an 11-acre watershed" (JNFS Narrative Response file pg. 66)

[2] See Docket CP16-10, Document #20160816—5247. The Forest Service review of the original ESI studies includes the following objection: **"In the first sentence, the applicant makes the statement that the actions proposed would "temporarily" increase sediment yields. This is an incorrect premise and unfortunately is the foundation of the effects discussion. The applicant states that pipeline construction will generate sediment loads well above background, but treats the disturbance as a single-year occurrence. The reality is that the sediment yields will continue to be elevated, decreasing over subsequent years to a new normal that is dependent on the persistence of the waterbars and other structural BMPs and the cover and type of revegetation of the pipeline corridors. The pipeline corridors will likely be maintained in a shrub/grass/forb state for the life of the pipeline. As Table 2 (p. 7) shows, this kind of land cover would have a different Management Factor that will be more than three times the current condition."**

In contrast to the two studies of the dry-ditch crossing method, the ESI studies of the MVP in the Jefferson National Forest were intended to evaluate all sources of sedimentation resulting from the project (FEIS, Appendix O-1—pg. 9: "Taking into account the USFS comments and recommendations, ESI re-conducted the analysis to include all aspects of the Project."). In the same vein, **the Hydrologic Analysis study's intention was to project a reliable estimate of the impact of the *Project*—not just crossings—on area streams.**

The FEIS refers to this hydrological study's results in only the most selective and cursory way on page 4-146. The ESI studies provide a good deal of information: the Hydrologic Analysis is 29 pages, the Biological Evaluation is 142 pages long, but the FEIS presents only 4 major propositions relative to the study, all compressed into a single paragraph addressing effects to the Jefferson National Forest. **In the sections that follow I present these propositions and analyze their weaknesses.**

2.1 The FEIS claims that the ESI studies show that impacts will be temporary.

The first FEIS proposition is this: "Three subwatersheds would exhibit temporary increases in sediment loads and yield due to project construction (year 1-2 of construction of each respective subwatershed)."

This claim of "temporary increases" extends the pattern of assertion, already discredited above, that sedimentation from the crossing will last no more than 1-4 days: but here, the term 'temporary' is now extended to a period of 1 to 2 years. The statement minimizes impacts in some other ways as well. First, the statement implies that impacts are restricted to only three subwatersheds. The FEIS neglects to say where the figure for only three affected watersheds appears in the Hydrologic Analysis, *and I was unable to find such a statement there*. ***In another source, I did, however, discover that such a claim appears in MVP's early responses to Forest Service criticisms of their sediment studies. There, MVP also identifies the three subwatersheds as being Clendennin Creek, Craig Creek, and Stony Creek."[3] It is troubling, though all too revealing, that the FEIS might depend in part on a document that was subsequently extensively revised and corrected after severe criticism from the Cooperating Agency which reviewed the MVP submissions.***

In fact, the Hydrologic Analysis Table 1 (Appendix 0-3—pg. 8) lists five subwatersheds studied—not three. Table 5 (Appendix 0-3—pg. 24) lists streams projected to suffer greater than 10% increases at some point in the 5 years of the study's projections—and it includes streams in all five subwatersheds described in Table 1. Tables 3 and 4 in the Hydrologic Analysis both examine changes over 5 years and include streams in all five subwatersheds: in the first year (which involves active construction, clearing of forest canopy, etc.) Table 3 reports that 1st-year percentage increases for JNF catchments range from .40% to 361%, with 17 of 29 areas seeing a greater than 10% increase. ***By year 5, according to the same Table, the 17 has risen to 20—which contradicts the FEIS implication that impacts drop as the environment reaches equilibrium***.

[3] See Docket CP1610, Document 20160408—5318, file of narrative responses to Forest Service, file page 67.

Still, the common-sense FEIS claim that sedimentation damage is likely to be worst in the period closest to construction receives some empirical support in the Hydrological Analysis: Table 4 states that in the first year (i.e., during active construction) *downstream* segments of affected streams will probably see increases between .83% and 63.5%, with 4 stream segments above 10% (by year 5, there are only three streams still suffering a greater-than-10% increase over baseline, all in the same subwatershed). But in other dimensions, the FEIS statement clearly understates and misrepresents the impacts described—much to the benefit of the applicant.

2.2 The FEIS says that the highest reported impacts are exaggerated.

The second FEIS proposition is this*: "Approximately 29.3 miles of stream segments downstream of the MVP area within the Jefferson National Forest and within the study area are expected to have a 10% increase in sediment loads or more (Appendix 0-3). However, a large portion (nearly 13 miles) of stream impacts can partially be attributed to the pre-existing Pocahontas Road, the presence of which, due to several modeling factors, led to an underestimation of existing sediment loads."*

I've identified four issues (a-d below) about this proposition which undermine the FEIS implication that there is no serious problem raised by the impacts described in the ESI studies.

(a) The data reported by ESI offer a serious objection to FERC's FEIS claim that there will be no significant impacts to streams. By the point where this statement is made on page 4-146, the FEIS has already asserted that sediment damage will be limited to "a few hundred feet" downstream of crossings (FEIS, pg. 4-120). In Hydrological Analysis Table 5, **the ESI study projects that sediment impacts will carry *for miles* downstream of a crossing—even assuming that the dry-ditch method and all proposed mitigation techniques are used.** Thus, **the ESI study refutes the assertion that impacts to streams will be limited to "a few hundred feet". It also suggests the need for a more systematic estimate of the extent and duration of sediment plumes generated by every one of the 1000+ crossings along the route—and in many cases these will be further enlarged by other construction factors such as access roads or ATWS's.**

(b) FERC staff do not react to the admission in the ESI study that a methodological error invalidates conclusions for approximately 44.3% of the stream impacts evaluated; however, the FEIS does makes good rhetorical use of this error in an attempt to dismiss the severity of projected sedimentation increases. An examination of the ESI material shows that neither the *Pocahontas Road nor Mystery Ridge Road* were included when estimating baseline data on existing sediment loads—a hugely damaging methodological error "likely due to a combination of cell resolution or forest canopy" (according to the Biological Evaluation report, Appendix O, page O1-12).[4] **Without accurate and reliable baseline data, no conclusions about increases can be**

[4] The reference to "cell resolution or forest canopy" indicates that the study depended largely on desktop information rather than on-site observation of the terrain being analyzed.

drawn for those segments of the study affected by the error. Streams involved in the area of the two roads include some of those with the highest estimated increases: Kimbalton Branch (69.75% increase), Clendennin Creek (29.15% increase), and Curve Branch (48.76% increase) – as well as Stony Creek (9.11% increase). **FERC and the Forest Service seem eager to discredit these large reported increases—while accepting the flawed report's evidence that the most severe impacts will endure for only two years--despite the errors in method. This is hardly a rigorous, scientific response.**[5]

(c) Impacts expected from Access Road construction are obscured and confused. The FEIS statement obscures the complexity of the data on access roads in the JNF area. The Table of Access Roads (FEIS Appendix E-1) describes MVP's plans for Pocahontas Road and for Mystery Ridge Road (see file pages 52/53). While the ESI study asserts that improvements to Pocahontas Road will be minimal, and that upon completion of the project the road surface "will be returned to original or better conditions" (ESI Biological Evaluation, pg. O-1-12), the tables in Appendix E on Access Roads and Appendix F-1 describing stream crossings create a different impression. Pocahontas Road appears to be what the Access Road table calls "MVP GI 232", a permanent access road which will intersect the pipeline ROW at Milepost 197.8. While the 2000 edition of the Delorme Atlas for Virginia describes this road as a "Jeep Trail," FEIS data show Pocahontas Road is 6.24 miles in length, with a gravel surface on a roadbed 12 feet wide. MVP intends to extend this roadbed to 25 feet involving land disturbance 60 feet beyond the roadbed footprint. The Access Road Table also indicates that only 10% of the road will require improvements which will result in a disturbance of only 3.02 acres.

Despite these reassurances in the Access Road Tables, the Appendix F-1 listing of waterbody crossings seems to describe a somewhat different scenario. The listings depicting crossings in the JNF begin on file page 80 of the Appendix. Here the table entry for Kimbalton Branch lists an ROW crossing (permanent easement and workspace) followed by an Access Road crossing for GI 232. Following this initial mention, there are 21 listings for access road crossings by GI-232 (i.e., Pocahontas Road.) In 8 instances the entry includes a first crossing described as culvert/fill, followed by a second entry listing a crossing described only as "TF"—an abbreviation that remains undefined in either the Appendix or the FEIS text, but which I take to indicate some form of temporary workspace or temporary fording of the stream needed to install the culvert and fill. Streams crossed by Access Road GI 232 include Kimbalton Branch and 5 UNTs, Clendennin Creek and 6 UNTs, Curve Branch and 1 UNT, and a UNT to the New River. I assume that the crossing table's listing of both a culvert/fill construction method and the accompanying TF needed for installation implies that **all these crossings are to be built during the project**. If so, they

[5] In analyzing the earlier versions of MVP Resource Reports, Forest Service commentators were especially concerned with developing accurate sediment assessments and estimated increases, Document #20160311—5013 (submitted on 3/10/16), esp. pp. 5-7.

constitute something considerably more damaging than the minimal work claimed in the ESI discussion.

Confusions abound: by my calculations, to extend a 12-foot road surface to 25 feet over a length of 6.24 miles would result in something close to 10 acres of disturbance, not 3.02. Similarly, if land disturbance beyond the current footprint will extend 60 feet, then disturbed acreage would total 46.45 acres—and even if only 10% of this is to occur, disturbed acreage is in excess of 3.02. For the permanent conversion of Mystery Ridge Road, my calculations are somewhat less problematic: the 1.4 mile-long, dirt road is said to be 10 feet wide and will be extended to 25 feet, which will result in 2.79 acres of new land disturbance. However, the table states that newly disturbed land will extend 30 feet from the current footprint—which could result in as much as 5.2 acres of disturbance, but only 50% of the road is thought to need work: so 2.79 acres seems a reasonable estimate. **It seems quite important to clarify these issues since total surface of disturbed land is a major factor in predicting sedimentation.**

(d) A final note on this second FEIS statement**: while the FEIS acknowledges there may be sediment load increases greater than 10%, FERC staff do <u>not</u> note why that 10% figure is significant.[6] The ESI study acknowledges that the 10% increase is used as a standard because**—in the absence of some nationally-defined standard for sedimentation limits—**it is a widely accepted MAXIMUM increase acceptable given the vulnerability of aquatic organisms to increased sediment**. This is stated in the ESI Biological Evaluation, FEIS Appendix O-1, pages 10-11 where the claim is referenced to the USEPA, 2003. For the Moyer and Hyer study, US Fish and Wildlife Service established that a 15% increase would be the highest acceptable. This provides us with our first statement of a measured 'minimal impact,' a quantified definition that FERC has resisted formulating. **By this standard a large number of the impacts described in the ESI study are NOT minimal or insignificant.** FERC, on the other hand, has shown a preference for highly elastic definitions of "minimal" and "temporary". The FEIS on page 120 refers to "insignificant" amounts of sediment as "temporary impacts" that will endure only a few minutes or possibly 1-4 days—and will affect only a few feet downstream of a crossing. But by page 4-146, the definition has been stretched to include sediment increases greater than 10% which may occur over a period of 1-2 years. Clearly, for FERC, whatever negative impacts will occur will be judged by the staff to be "minimal".

[6] In an earlier comment to FERC **I pointed out that the agency has systematically refused to quantify or even to define a 'minimal' impact—that is, the greatest acceptable impact from sedimentation beyond which the agency would withhold approval.** This fits the regular pattern of their argument: the stream crossing method minimizes impact, so whatever effect it has will be 'minimal'. From FERC staff's point of view, apparently, this argument renders detailed data on sedimentation unnecessary.

2.3 The FEIS states that most impacts would last no more than 5 years.

The third proposition the FEIS bases on the ESI study is this: *"Sediment loads and yields would reach a new equilibrium within 4 to 5 years after completion of the project that for most streams would represent a 1 percent or less increase in sediment load over baseline conditions, with the exception of Kimbalton Creek, Curve Branch, and Clendennin Creek."*

Again, the FEIS fails to reference the source of this information (possibly Table 4 in the Hydrologic Analysis?), and there are a number of objections to the claim**. First, note that this statement omits the extremely high levels of increase projected for these three streams (Kimbalton: 68.9%, Curve: 48.76%, Clendennin: 29.5%). Second, note that the three "exceptions" mentioned are all part of the subwatershed where data is invalidated by the *Pocahontas Road* problem.** So the claim implies that there will be no streams with effects as high as those attributed to the three exceptions, although FERC protects itself with the accommodating phrase "most streams".

In fact, the ESI study indicates that there may be further exceptions to the "less than 1% increase" claim, affecting stream catchments in areas where the estimates are not invalidated by that error—but these data are effectively hidden from the reader. While it appears to be true that, by year five in the projections, sediment increases above baseline have subsided in most downstream segments, the same is not true of the JNF *catchments* in which the stream segments are located. As I previously noted, for the catchments listed in Table 3 of the Hydrologic Analysis, there are 20 instances (out of 29 catchments listed) where land disturbance from construction is predicted to result in increases above the 10% standard to as high as 320% -- even in year five. **These range from a low of 11.58% for a segment of Craig Creek, to a high of 320.55% for one segment of Kimbalton Branch.** Of the 29 areas listed, 12 are projected to see increases above 50%. Nothing in the FEIS treats of these figures—or explains what will be done to assure that such sediment loads do not enter the streams draining these catchments. **Even if the ESI study's projected 79% success rate proves accurate for sediment mitigation (see the ESI Biological Evaluation study, FEIS Appendix O1, note to Table 4. Pg. O1-12), we have to wonder how far this can reduce a 320% increase in sediment load for the Kimbalton segment described. And if it turns out that the 79% success rate is exaggerated who can say what the effects would actually be?**

2.4. The FEIS concludes the ESI study shows that any unavoidable impacts can be mitigated.

In their final proposition, the authors of the FEIS concede there will be impacts but that they don't really matter: "*Although sedimentation is unavoidable during in-stream construction, associated impacts would be minimized by the use of temporary and permanent sediment and*

erosion controls designed to avoid the movement of upstream sediment into downstream portions of watersheds."

The disingenuous first clause is typical of FERC's reduction of the problem of sedimentation to the issue of crossing construction alone (i.e., "during in-stream construction"). **The building and operation of access roads, and construction and operation of workspaces (ATWS) are equally problematic, and may be of longer duration.[7] Similarly, a cleared ROW on steep terrain is likely to increase run-off to streams simply as result of cleared fields shedding larger amounts of rain than did the previously forested terrain.**

In response, one wants to quote the Forest Service's early critique: "**Needs supporting independent research citation to back up this statement or remove it. Simply stating that mitigations are effective is not sufficient."** The Hydrologic study attempts some further discussion of this issue, having committed itself to the 79% figure referenced above as being the basis for some of their calculations. The Hydrologic Study includes a brief discussion of sediment control rates referencing USEPA studies which register ranges of success between 10% and 90% (USEPA 2009) with success rates for construction sites as high as 85% if care is taken in implementing all best practices (FEIS Appendix O, page O3-15). However, what is needed is a detailed examination of success rates for the various techniques as established in terrain similar to that in which the MVP would be constructed if approved. **The failure to document claims of mitigation effectiveness was a continuing sore point in Forest Service earlier critiques of MVP submissions[8], and the FEIS does not fully escape from such a concern despite such passages as that cited here.**

So, in the end, it appears that the authors of the FEIS did not really learn that much from the ESI studies. **Instead, they extracted from the reports only those statements that would confirm what MVP and FERC have claimed all along:** *All impacts from the proposed construction will be temporary, limited to a year or two. Even the worst predicted impacts may not actually reach significant levels. Impacts that do occur will subside within 5 years. All unavoidable impacts can be resolved through mitigation.*

3. What can the FEIS and ESI materials tell us?

Obviously, some parts of the ESI studies are largely invalid as data on specific stream impacts within the JNF: **both the US Forest Service and FERC must admit that a substantial**

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[7] This point is forcefully made in the Forest Service responses to early MVP data: see Docket CP16-10, Documents #20160311—5013 and #20160816—5247.

[8] See for example, Docket CP16-10, Document 20160408—5318, which includes MVP's narrative responses to Forest Service Requests filed March 9, 2016. The exchange begins on page 42 of the document with this terse comment from the Forest Service: **"Applicant states "Impacts will be minimized or avoided by implementation of the construction practices outlined in the FERC Plan and Procedures… Needs supporting independent research citation to back up this statement or remove it. Simply stating that mitigations are effective is not sufficient."**

number of the conclusions about percentage increases in sediment must be rejected. Once ESI recognized the error in their procedures, they should have recalculated baselines for the affected subwatersheds—and the Forest Service and FERC should have demanded no less of MVP's subcontractor. **It was irresponsible of either FERC or the Forest Service to have tolerated the flaws, and dishonest to draw from the study only those statements that favored the applicant.** At the very least, there must be some quantified estimate of the probable impact on the baseline data and any resulting estimates of increase: **it is clearly not scientifically acceptable to state that "a large part" of the increases (though who could say how large) can "partially" be "attributed" to a procedural error. Instead, much of the data in essentially half of the study should be discarded.**

However, the data that are not implicated in the procedural failure should be examined more seriously than has so far been the case. We should avoid the proverbial mistake of throwing out the baby with the bathwater, no matter how muddy the little whisker may be. **The ESI studies do directly challenge conclusions stated in the FEIS, which seems to have ignored the implications of these bodies of research although the ESI studies are all we have to draw upon in terms of local data.** Moreover, there are some results from the studies that are immediately useful estimates of potential damage to JNF water resources (even if the Forest Service has decided to reduce its standards so these can be ignored). And, most importantly, **the ESI studies should have motivated FERC staff to develop (or locate) a matrix for streams assessment that would have informed effective research on predicted impacts outside the Jefferson National Forest.**

3.1. There will be significant impacts to streams along the entire MVP route.

If we assume that at least some of the ESI materials are, in fact, acceptable, they provide a basis (admittedly rather limited) for asserting that the **FEIS has ignored evidence which flat-out contradicts their claim that all impacts on streams will be insignificant and short term. If we accept the ESI assertion that a 10% increase in sediment load is the maximum acceptable, then the ESI studies do document some significant impacts.** For example, the tables of **data in the Biological Evaluation reveal that Craig Creek, Mill Creek, and Rich Creek drainages—none of which is implicated in the Pocahontas Road fiasco—share an important structural similarity which is also a common feature of most of the affected streams in the discredited subwatersheds:** in each case there are multiple tributaries, many of which suffer substantial increases and could pass along these increases to their mainstem stream as well. Moreover, Table 5 in the Hydrological Analysis identifies 12 stream segments that are said to have a greater than 10% increase in sediment load at some point in the 5-year period needed to establish a new equilibrium—including entries for multiple Unnamed Tributaries (UNTs) to mainstem streams. In total, these 12 units account for as many as 20 of the 29 catchments identified in Table 3 of the same study. **That is, up to 68.9% of the Jefferson Forest streams studied are threatened with a 10% or greater impact from sedimentation.** This includes, for example, 3 UNTs to Craig Creek, 3 for Stony Creek, 3 for Clendennin Creek, and 2 each for Kimbalton Branch and Curve Branch, as

well as most of these mainstem streams. **On the basis of the studies, then, we can affirm that there ARE some significant impacts to streams that will probably result from MVP construction.**

3.2. Accumulating (Cumulative) impacts are likely in at least 84 local watersheds.

A responsible response to the ESI studies could have provided **a means by which to identify more clearly how many such streams there are along the route of the MVP.** As already suggested, the ESI study shows that the vast majority of affected streams are, in fact, part of a branching system of tributaries that, in addition to the mainstem stream, are also crossed by some element of MVP construction. The prevalence in this list of a pattern involving both UNTs and mainstem stream suggests that serious effects are highly likely where multiple crossings occur within a single local watershed.[9] The first step in projected research on impacts could start with this question: **how many instances of this multi-branched stream pattern occur along the route?**

The FEIS does not make it easy to answer this question. The FEIS provides no detailed maps of the affected watersheds (a feature I requested repeatedly throughout the application process). The Project Maps provided in Appendix B make the larger streams visible only at 200% magnification, and they entirely exclude many of the ephemeral and intermittent tributaries that become an important dimension of the stream systems we need to view. Moreover, the Appendix F Table of Waterbodies Crossed by the Project fails to indicate when a given stream complex is actually a tributary to another listed complex. For example, "Stonelick Branch" in Summers County West Virginia is listed as having both its mainstem and several UNTs crossed by the MVP, but nothing in the table acknowledges that Stonelick Branch flows into--and may contribute accumulated sediments to--Hungards Creek, which itself is crossed multiple times along with its numerous UNTS. And, of course, in the absence of effective mapping, readers must draw on any firsthand knowledge they may have of the hundreds of streams involved--or else use a more thorough atlas of the waterbodies in affected counties.

Despite these irritations, I have been able to assemble some information on the number of 'local watersheds' endangered by the MVP. I have assumed that significant damage is likely to occur for any local watershed with crossings on 5 or more tributaries. [In the listing below, I report figures derived by *hand-counting* the entries in the FEIS Appendix F-1 so numbers may not be absolutely correct. Appendix F-1 is not entirely consistent about listings, including as a 'crossing' a large number of entries bearing the undefined designation "TF"—which appears to be some form of temporary crossing, ford or workspace which usually accompanies a more clearly-defined crossing such as an Access Road or the ROW. I did not try to separate these TF crossings from the others. However, I excluded from my counts any stream complex with fewer than 5 identified UNTs contributing to a mainstem stream, using the Appendix designation (e.g., "UNT to Hungards Creek") as my guide.]

[9] I have pointed out to FERC that this pattern of multiple crossings within a single stream complex is quite common, affecting the vast majority of the stream crossings described in the Table of Waterbodies Crossed (FEIS Appendix F.) In fact, **there is evidence in the Table that there are over to 100 instances of such multiple crossings.**

	# of Watersheds w/ 5+ UNT's	Crossings in Watershed/ Total Crossings Listed	% of Total Crossings
WEST VIRGINIA	54	640/923	69.3%
VIRGINIA	30	376/421	89.3%
TOTAL	**84**	**1016/1344**	**75.1%**

This data, I believe, clearly demonstrates FERC's lack of environmental due diligence in assessing impacts to watersheds, a failure resulting from the Agency's insistence on considering only the effects of a single stream crossing in isolation from any other factors. **This falsification by exclusion of relevant contradictory data is, quite simply, the only way to make a claim of minimal impact.** Of course, a single stream crossing by open-cut dry-ditch methods may have minimal impact on a stream—assuming, at least, that the crossing was originally sited in such a way as to avoid serious complications such as steep surrounding slopes, heavily-silt-based soils and so forth. **However—as best I can determine— in 75% of the crossings required by the present route, there is the additional factor of accumulating (i.e., "cumulative") impacts within the local watershed, the unavoidable effects of multiple crossings.**

In some cases, the number of crossings for a single watershed is quite shocking. As shown in the following data, in both WV and VA there are fairly large numbers of streams where the number of crossings exceeds 10 for a single watershed. [In Virginia especially, a number of mainstem streams (e.g., the Roanoke River and others) have multiple sections listed, with the mainstem watershed apparently interrupted by some other tributary complex. In these cases I treated all the contributing UNTs to that mainstem in a single count for the stream in question.]

	# of Watersheds with 10 or more crossings	High numbers of crossings/watershed 10-20 crossings	>20 Crossings
WEST VIRGINIA	25	19	6 (22, 23, 30. 31, 36, 47)
VIRGINIA	16	11	5 (21, 24, 24, 24, 34)
TOTAL	**41**	**30**	**11**

Clearly, if the kinds of impacts identified in the Jefferson Forest may predictably occur outside the Forest lands, then significant impacts are not just possible but likely to be widespread.

3.3 Typical stream characteristics could further narrow the focus of needed research.

Once we know more clearly the watersheds that should be examined, we would need to develop more specific focus on streams with particular characteristics. A review of FERC's Appendix F-1 Waterbodies Crossed could provide further details on the streams in the ESI study set: their width, the number of crossings proposed, the flow regime (perennial, intermittent, or

ephemeral). Drawing on other compendiums of MVP data contained in the FEIS appendices, FERC could also have established such relevant variables as surrounding slopes, soil types in the crossing context, and possibly even typical precipitation patterns for the area. **The resulting stream profiles could have helped predict just how many streams along the route would be similar to those JNF streams most likely to be damaged. An agency interested in evaluating stream impacts would surely have required such research be carried out before announcing any far-reaching conclusions.**

For example, FEIS Appendix F-1 *"Waterbodies Crossed by the MVP"* allows us to identify the number of streams along the entire MVP route that are similar to the streams studied by ESI within the vicinity of the Jefferson National Forest in terms of width and flow regime (e.g., "7'-wide perennial streams"), and the number of such streams that also had multiple UNT crossings (as did most of the streams in the ESI study). To illustrate the process, I have prepared such a presentation of information in Table 1, Appendix II to this document. It shows that there are at least 64 streams along the MVP pipeline route that are similar enough to streams in the ESI study to deserve individual evaluation.

While stream width, flow regime, and watershed structure are significant variables that indicate the need for additional evaluation, there are other factors that should be considered as well. Table 1 suggests that 64 streams along the MVP route qualify for further assessment because of their similarity to the ESI study set. But FERC might also have pursued an approach based on a general set of variables known to be crucial to sedimentation issues. **As noted in "Pipeline Stream Crossings: A Risk-based Approach to Minimize Aquatic Impacts" (Janine Casto, Geomorphologist with the US Fish and Wildlife Service)[10], desktop review of other properties could lead to a far more detailed assessment of those streams most at risk. Variables include an evaluation of the floodplain and stream characteristics such *as valley width, width and condition of the riparian corridor, stream types, stream slopes, and bed and bank materials.* It is troubling that such analytic tools are available—but were not utilized by either MVP or FERC to do the kind of analysis that would aggregate impacts into a scientific and fact-based assessment of potential impacts to streams.**

3.4 FEIS data can correct and expand on the ESI presentation.

We can also use the Appendix F-1 *Table of Waterbodies Crossed* to confirm, correct or expand on information provided by ESI or the text of the FEIS. For instance, we can identify all those streams that might be assumed to be "in the vicinity" of the JNF. This turns out to be rather more than the ESI study included. **Such research can reveal the sources of sedimentation in Rich Creek, which is said by ESI to mark the Western limit of effects for MVP's work in the JNF: *the ESI study does not identify the two tributaries (Dry Creek and Painter's Branch) which***

[10] An abstract of this article is available at https//acwi.gov/sos/pubs/3rdJFIC/Contents/8F-Casto.pdf

presumably must be primary sources of the heavy sedimentation predicted for Rich Creek, since they are the only two such tributaries directly crossed by elements of the MVP.

We can also describe streams omitted from the ESI study, but which the MVP must cross in reaching the Eastern-most branch of the Jefferson National Forest. The ESI study ignores these streams—although they are heavily impacted by construction and are clearly in the "vicinity" of the Jefferson, lying between Milepost 201.9 (just East of Curve Branch, which is analysed by ESI) and Milepost 217.9 (just west of the Craig Creek Drainage which resumes the treatment by ESI). **These miles of crossings include multiple impacts on the watersheds of Dry Branch (7 crossings), Doe Creek (6 crossings), Little Stony Creek (11 crossings), and Sinking Creek (35 crossings).** It should be noted that *both Little Stony Creek and Sinking Creek are described in the FEIS Appendix F-1 as coldwater streams supporting reproducing populations of wild trout.* In addition, Little Stony Creek is the primary access to Cascades Falls, a popular tourist destination attracting up to 500,000 visitors a year, many of whom come to fly fish as they hike their way upstream to the falls. These streams are therefore likely to have some considerable economic value to local communities in Giles County—a fact that makes their exclusion from the ESI study harder to explain.

Table 2 (**Appendix II**) of this comment provides an illustration of this use of FEIS data as a check on ESI accuracy. In summary, the results show that there are 126 crossings of 106 individual streams between the Rich Creek drainage on West and Dry Run/North Fork of the Roanoke River subwatershed to the East of the Jefferson National Forest. The Table includes 75 crossings not addressed in the ESI study—and which therefore escape the notice of both the Forest Service and FERC, despite the importance of these watersheds to the region. The table also includes an abbreviated indication of the 'type' of crossing (ROW, Access Road, etc.) involved.

This Table allows us to see more fully the dimensions of the pipeline's impact on the region around the National Forest. The fact that the ESI study excluded such a large number of streams is cause for concern, especially in light of the Forest Service directive that the study must be sensitive to effects that might originate on JNF land but impact the general public by affecting private holdings in the area. **The effects on Little Stony Creek and Sinking Creek—46 crossings in all—are unavoidable effects of routing across the JNF in the way MVP has chosen.** It is an added reason for assessing impacts on these 2 streams which provide environmentally sensitive coldwater habitat and are economically significant to the region as well.

A further benefit of this examination of the ESI data is that it also allows us to consider another significant question by providing some information on crossing type, a valuable additional variable in characterizing the proposed project. As shown in Table 3 on the following page, combining the data with information from Table 1 concerning the % increase in watersheds suggests that there is a tendency—although no close correlation—for heavy concentrations of Access Road and ATWS crossings to be associated with higher % increases. Streams with lower predicted increases tend to have a higher concentration of ROW crossings.

However, this association is not exact, and the ESI sampling is too small to support any firm conclusion.

For the data from the ESI study, we can say that the FEIS claim that dry ditch crossings minimize impacts is given some support: both the watersheds that remain below a 10% increase involve mostly (over 90%) ROW crossings. **The data also suggest that housing a temporary workspace (as in the case of Rich Creek, Mill Creek, or the North Fork of the Roanoke River) is likely to move a watershed into dangerous territory in regard to sedimentation.** This makes a good deal of sense given the fact that a temporary workspace serving the construction process for up to 29 months would remain a constant source of disruption and increased soil impermeability leading to sediment run-off. As shown in Table 2, had the ESI study been extended to include data on other streams in the area, the overall picture might be clearer: **Dry Branch is about 50% ROW, Little Stony Creek is almost 91% ROW, and Sinking Creek is only 43% ROW.** Had the Forest Service or FERC insisted on including these 3 streams in the ESI study, we might have had more persuasive evidence of the impact of workspaces and access roads on sedimentation increase. Given the fact that both elements of the pipeline are likely to see continued use throughout the 29 (or more) months of the construction period, it makes intuitive sense that they might contribute to continuing renewal of sediment releases to streams. But FERC and the Forest Service seem determined not to entertain such a hypothesis.

TABLE 3. Association of Sediment Increase with Crossing Type

% increase	Mainstem Watershed	# UNTs	% ROW	% ATWS	% Access
69.75%	Kimbalton Branch	4	28%	0%	72%
48.76%	Curve Branch	1	0%	0%	100%
34.07%	Rich Creek	9	72%	18%	9%
29.42%	Mill Creek	5	83%	17%	0%
29.15%	Clendennin Creek	7	0%	0%	100%
19.43%	N. Fk. Roanoke River	9	42%	8%	50%
9.11%	Stony Creek	1	100%	0%	0%
8.71%	Craig Creek	5	85+%	0%	14+%

I trust this exercise shows that FERC had suggestive evidence requiring far more extensive research into potential stream impacts. Flawed though the ESI study may be, it was surely sufficient warning that MVP's proposed route and construction techniques might well pose substantial threat to area water resources. Why would FERC not have used the ESI study, despite its limitations, as a clear motivation to demand further research? **In light of the results of the study of the Project's *overall impacts* on the Jefferson National Forest, how can the FERC staff**

have relied on only two studies restricted primarily to crossing methods to conclude there will be no significant impacts? While some of the ESI results must be rejected, the remaining data are troubling indicators that FERC's conclusions in the FEIS are likely to be not just unwarrantedly optimistic but simply wrong.

4. Streams FERC Ignores: Two Examples of Predictable Damage

I want to further illustrate why FERC should have made better use of the implications of the ESI study. Obviously, the agency is charged with the responsible assessment of the environmental impacts of the projects proposed by the gas industry—and obviously these impacts go far beyond directly observable damages to valuable natural resources. Such direct impacts also affect the uses human beings have for these resources. In the case of water, these indirect impacts include such things as the effect of turbidity on municipal water supplies, and effects of construction and operation of the pipeline on recreational use of the streams and riparian areas affected. In this section of my comment I use the ESI study as the basis for further exploring these indirect impacts.

4.1 MVP-linked sedimentation of the Roanoke River Watershed

An article in the *Roanoke Times* in the spring of 2017 (Duncan Adams, "Pipeline Passage through the region would add sediment to the Roanoke River," March 12, 2017) clearly expresses the regional anxiety about the problem sedimentation originating with the MVP poses for municipal water supplies**.** The author points out that a major crossing of the Roanoke River is proposed for a site only 1.2 miles above the intakes for the reservoir that serves the city's water supply. He also quotes the ESI study as asserting that "Sediment loads are likely to continue downstream until the sediment is arrested behind the first dam…or is deposited in Smith Mountain Lake." The article continues: "From the pipeline's crossing of the upper Roanoke River to the Niagara Dam is a distance of about 20 miles…" (which places the dam somewhat downstream of the city of Roanoke).

While municipal water uses receive no particular attention in the ESI study, there are some important connections to be made. Increased turbidity increases the costs of water treatment for municipalities, and in cases where sedimentation is especially pronounced it can, as suggested in the Roanoke Times article, temporarily close down use of a water source altogether. And the MVP does have potential impacts on such resources. Rich Creek, for example, is the secondary water source for the Red Spring Public Service District—and ESI estimates potential increases of sedimentation for Rich Creek may run as high as 44%. The ESI study also touches on impacts to the North Fork of the Roanoke, but these occur far upstream from the crossings mentioned in the Roanoke Times.

And yet, in truth, the impacts of MVP construction and operation on the **Dry Run/North Fork of the Roanoke River subwatershed** are almost impossible to a calculate from either the ESI study or related materials in the FEIS. The documents disagree on what streams in the watershed are affected, and on the percentage of the increases in sedimentation to be expected, and they

are inconsistent in estimating the physical extent of sediment impacts. Evaluation is further complicated by the inadequate mapping provided by the FEIS.

First, the ESI study neglects to provide any data on impacts to the Dry Run, a small stream that lends its name to the subwatershed designation. According to the Appendix F Table (in the FEIS), Dry Run is a perennial stream, only 5' wide, with a single unnamed tributary that is also impacted by the MVP. However, Dry Run flows about 3.8 miles from the mountain ridge down to the North Fork of the Roanoke River, their confluence lying about half a mile above the pipeline crossing of the North Fork at Milepost 227.2. At no point does the ESI study attempt to estimate an impact to the Dry Run watershed, although the FEIS Appendix F-1 Table shows that it is affected by 2 crossings for Access Road MN-266.02 and by ATWS 1458—which suggests the possibility that sedimentation problems may be considerable.

Such an omission, however, is not uncommon in the ESI materials. For example, Table 5 in the Hydrologic Analysis reports the length in miles of impacts on stream segments expected to exceed 10% as a yearly maximum. This table states that the *Dry Run/North Fork of the Roanoke River subwatershed* is impacted in only two ways: by a single UNT to Mill Creek (1.57 miles) and by Mill Creek itself (3.22 miles). In creating Table 1, I therefore combined these figures as an impact on 4.8 miles of the subwatershed. I then consulted the ESI study tables estimating impacts of increased sediment: Table 4 in the Hydrologic Analysis states that impacts to Mill Creek (no UNT is mentioned) in the first year will result in a 26.28% increase (which then declines over the next 5 years). **However, Table 5 in the Biological Evaluation Study (which reports the "Maximum Yearly Sediment Loads in Downstream waterbodies") indicates the maximum impact to Mill Creek (again without its UNT) as 29.42%.**

A similar disparity exists between the Hydrologic Analysis and the Biological Evaluation data on the North Fork of the Roanoke River itself, although the two reports agree on a formal segmentation of the stream. The length of the impact on the North Fork is not mentioned in either study (both Table 4 in the Biological Evaluation and Table 5 in the Hydrological Analysis mention only the Mill Creek portions of the subwatershed). However, tables in both studies reporting sediment loads in downstream segments of steams identify percentage increases for four North Fork segments—although they disagree about the percentages:

Segment	Hydrologic Table 4	Biological Table 5
(1) above the confluence with Indian Run	6.16%	7.17%
(2) above the confluence with Slate Lick	5.36%	6.24%
(3) above the confluence with Wilson Branch	5.11%	5.94%
(4) above the confluence with Laurel Branch	.05%	.08%

There is one further twist to these estimates. If the Roanoke Times article is correct in stating that upstream sediments will be stopped by the first dam, then the ESI estimates may need

some revision. The North Fork of the Roanoke enters Willow Springs Lake about ½ mile above Indian Run and is therefore a possible check on sediment levels reported by ESI.

I was unable to locate any mapping in the FEIS or the ESI study that traced the North Fork of the Roanoke River as far as a confluence with Slate Lick, Wilson Branch, or Laurel Branch. Therefore I turned to the mapping resources of the Indian Creek Watershed Association Interactive Environmental Map (available online at http://dss.maps.arcgis.com/apps/webappviewer/index.html?id=19dfe207eb9846b2be42228d79b68d7b). Using the measuring tools available at the site and the USGS National Map as a base, I was able to estimate the following mileages for the impacts to 3 of the 4 segments of the North Fork:

(1) Stream crossing at Milepost 227.2 to confluence with Indian Run	3.9 miles
(2.) Stream crossing at Milepost 227.2 to confluence with Slate Lick Run	7.2 miles
(3.) Stream crossing at Milepost 227.2 to confluence with Wilson Creek	8.4 miles

I was unable to locate any mapping for Laurel Branch, which I presume ESI is representing as the point furthest downstream where impacts can be attributed to the MVP construction in the Jefferson National Forest. **Therefore, in Table 1 I have indicated that the impact on the North Fork of the Roanoke River extends for 8.4+ miles—a figure large enough to explain why it might seem desirable to obscure the data.**

But no matter how far downstream sediment from JNF construction will carry, we are still left with the question: **How great an increase is to be expected overall in this 8.4+ miles of the stream?** The ESI study contains no total load or total percentage increase for the 4 segments combined. Nor does anything in the study suggest how one might compute this number. If we total the percentage increase for each of the 4 segments we get 19.43% increase (the figure I used in my own Table 1). If we average those individual-segment increases, we get 4.83% increase overall. If we add the tons-beyond-baseline for the four segments and divide that total by the total baseline measures for the four segments, we get an increase of 5.85%. **A range of possible increase between 4.83% to 19.43% is hardly the basis for confidence.** There may be hydrologic assessment conventions for arriving at projected estimates which would verify ESI's tallies. If so, they should be made explicit.

We might assume that the ESI study is a complete catalog of impacts to the North Fork of the Roanoke River drainage, but it is not. The online map shows that there are about 22 river miles between the crossing at Milepost 227.2 and the last crossing of the Roanoke at Milepost 237.1 just outside the town of Salem (probably the crossing to which the article in the *Roanoke Times* is referring). The MVP does not follow the river closely, but **in the 9.9 miles of ROW construction and associated access roads and workspace, according to FEIS Appendix F-1, there are at least 28 crossings of mainstem and UNT streams that feed into the Roanoke River system.** These include small UNT's, larger-scale tributaries such as Flatwood Branch and Bradshaw Creek,

UNTs to the South Fork, the North Fork mainstem, and the Roanoke mainstem downstream of the Fork's confluence. **Thus, even if the dam at Willow Springs Lake would stop sediment from JNF construction, a whole new load will be added, which would be of legitimate concern for the citizens of Roanoke. This is a substantially greater number of crossings than are included in the upstream portion of the watershed.**

So we see that the ESI study could have instigated a review of the possible damages to the North Fork of the Roanoke River and to municipal water supplies of a major regional city. But it appears that no one at FERC saw any compelling reason to collect the data needed to project an estimate of the damage.

4.2 MVP Impacts on the Region's Trout Streams

As I hope to have demonstrated, taking the ESI data as a starting point—even when that data is incomplete—can lead to important investigations that FERC has had no inclination to undertake. **One major service of the nation's water resources is to provide water for municipalities—and the MVP poses a potential threat to that function, as well as to private wells and springs. The proposed pipeline also poses considerable threat to another function of our water resources: recreational fishing.** Within the Tables of the ESI study are streams especially valued as providing coldwater habitat for trout. These species require cold water temperatures year round, and low sediment levels especially in spawning season when sediment can seriously lower spawning success. A review of the Appendix F listing for the stream crossings in the JNF reveal that 29 are identified as coldwater streams, that 26 of these provide habitat for reproducing populations of wild trout, and that 4 of these also provide habitat for stocked fish. A further review of the appendix shows that there are approximately 41 streams along the entire MVP route with similar descriptors, 6 in West Virginia[11] and 35 in Virginia.

What can the data in the ESI study reveal about the possible impacts on such streams? First of all, among the streams in the area of the JNF, the FEIS Appendix F identifies 6 mainsteams and 17 UNTs which have populations of wild trout. The table also identifies 2 of these mainstems and 2 UNTs that are also stocked by the State of Virginia. The streams involved range considerably in size: 9 are 5' or less, 6 are between 6' and 15', and 7 range between 20 and 55.' And also, 2 of the 6 streams that hold trout have substantial numbers of tributaries that also hold trout, a fact that might make these streams especially vulnerable if multiple tributaries are crossed by pipeline construction. Clearly this sample suggests that trout populations can be adapted to a wide range of streams in terms of size and tributary status, although it is likely that some of the smallest streams in this sample are not year-round habitat.

[11] It is deeply saddening for me to have to reveal that in recent months the West Virginia legislature systematically stripped from numerous streams any indication of their function as trout streams. This became clear to me as I attempted to research trout streams for a presentation on 401 Water Quality issues and discovered that many streams along the MVP that had been listed as trout water earlier in the application process were no longer officially recognized in that capacity.

The ESI projections of sediment increase for some of these streams suggest that multiple crossings are a concern. Kimbalton Branch/Stony Creek watershed (some 9.3 miles in length) provides an example. Kimbalton and its 5 tributaries face a combination of 7 crossings (2 for ROW, 5 for an Access Road—the mainstem being crossed twice), and Stony Creek and one UNT face 4 crossings (all for the ROW). Kimbalton is projected to suffer an ongoing increase of slightly over 69%, while, downstream, Stony is thought to see no more than a 9.11% increase, confined primarily to the first two years. From this data it would appear that the smaller stream and its tributaries are more vulnerable than the larger stream into which it flows: while Stony Creek is 40' wide, Kimbalton is only 14-15' wide (and its tributaries range from 3.5' to 15'). It also appears that Kimbalton transports its sediments downstream to Stony Creek. And, indeed, the ESI data predict that while above the confluence with Kimbalton, Stony Creek's increase will be run to only 1.81% above baseline, below Kimbalton that number rises to 7.30%, suggesting the main source of trouble for Stony Creek may lie with its named tributary stream and its multiple crossings by Access Road construction.

Besides the Kimbalton/Stony watershed, the ESI study provides data on two other drainages that hold wild trout: Mill Creek and the North Fork of the Roanoke River. As already shown, the study's data on the latter stream are a bit hard to follow—seemingly incomplete in some important details. The treatment of Mill Creek, however, is a bit more consistent. Like Kimbalton, the mainstem stream is about 14' wide, and also like Kimbalton it is fed by 5 UNTs with almost as wide a range of widths (between 5' and 14' compared to Kimbalton's 3.5’ to 15’). And yet the two very similar streams suffer somewhat different impacts as projected by ESI: where Kimbalton faces a long-term increase of over 69%, Mill Creek is predicted to see no more than 29.42% increase as a high measure over the first 5 years following construction. This difference may be related to the fact that Mill Creek's 6 streams involve 5 ROW crossings and a single ATWS, where the similar Kimbalton watershed involves 5 Access Road crossings and only 2 crossings of the ROW.

These, then, are the characteristics of ESI trout streams for which there are sedimentation data. How do the other trout streams in the immediate area compare? The Little Stony Creek watershed involves 2 crossings of the 25'-wide mainstem and 9 crossings of UNTs that range in width from 2' to 12', with most being smaller streams 5' wide or less. This far, Little Stony looks like a somewhat enlarged Kimbalton Branch—wider and with more UNTs. But where Kimbalton is dominated by Access Road crossings, Little Stony is 91% ROW crossings with the only Access Road crossing of the mainstem occurring at the same point as one of crossings for the ROW. It would seem probable that damages to Little Stony would be far less severe than those to Kimbalton—assuming that other factors such as slopes and soils did not increase the stream's vulnerability. But this hardly guarantees that the effects of 11 stream crossings would result in sediment increases less than 10%.

Sinking Creek on the other hand presents a very different picture. For one thing, at 55' Sinking Creek is much wider than any other stream in the ESI study except the lower end of the

North Fork of the Roanoke River. **But while it is larger, Sinking Creek also suffers a larger number of crossings: the watershed involves 31 streams which will be crossed 35 times**. These are almost evenly divided between ROW and Access Road crossings (17 and 16 respectively) with an additional 2 crossings by ATWSs. **This combination of large numbers of crossings and a high percentage of non-ROW crossings should pose a red flag for Sinking Creek: responsible agencies would surely demand a more complete and revealing assessment of the stream's vulnerability to sedimentation.** It is not clear why the Forest Service did not direct ESI to evaluate this watershed when performing their research.

This kind of exploratory diagnostic assessment can be extended to any other of the 41 trout streams outside the vicinity of the JNF. Take Hominy Creek in central West Virginia as an extremely distressing example. Hominy Creek is about 20 miles long from its headwaters to its confluence with Summersville Lake, and it is known to shelter some breeding populations of trout descended from earlier stockings. The drainage is large—approximately 23 square miles (by my inexpert calculation using the Indian Creek Watershed map measuring tools), and involves numerous tributary streams, from small UNTs to larger tributary complexes in much the same relation as Stony Creek and Kimbalton. The mainstem of Hominy Creek is crossed three times, once as a 55' perennial stream, and twice, further along as a 65' perennial. **Of the 58 UNT crossings listed in Appendix F, 41 are for Access Roads (of these, 22 involve both a culvert/fill and a "TF" crossing), 2 for workspaces, and 15 for ROW crossings. The major tributary, Sugar Branch, adds 1 ROW crossing and another 6 Access Road crossings to this horrifying brew of sedimentation damage.**

Based on these numbers, it would seem miraculous if Hominy Creek would survive as a trout stream in the face of the MVP. But FERC has chosen not to acknowledge the problem of accumulating (cumulative) impacts within a local watershed. **The Agency's definitions involve impacts from other construction projects, other pipelines, that sort of thing—but not the additive effect of crossing a single watershed 58 times with procedures that may assure 58 units of damage added one to the other.** I have seen nothing that acknowledges that Hominy Creek's MVP route faces a serious "cumulative impact" in the form of a major strip mine at Leivasy very close to the juncture of the mainstem with several significant tributaries, and in the immediate vicinity of one of the major MVP crossings. This mine and its structures are clearly visible on the Indian Creek Map, using the "Imagery with Labels" base map and scanning the area in Nicholas County between Leivasy and the Pipeline ROW: the mine appears to be almost immediately adjacent to the ROW. **If sedimentation is, in part, a function of the extent of soil disruption in the watershed, the addition of the MVP to the environmental agony that is this strip mine demonstrates why "cumulative impact" is such an important concept for the planning process.**

As with the earlier exploration of the dimensions of damage to the Roanoke River watershed, this picture of MVP's impacts on trout streams in Virginia and West Virginia is just one aspect of **research that the ESI study should have motivated at FERC**. **One wonders about the mind-set of the FERC staff given that the ESI studies clearly provide substantial challenge to**

some of the basic claims and orientation of the FEIS, even though the procedures of the JNF studies may be less than perfect. Did those flaws provide the perfect excuse to reject the studies? Well, not really: FERC staff drew from the studies those details that benefitted the MVP proposal. The FEIS even absorbs and uses the demonstration that a 10% increase is an acceptable objective measure of minimal impacts—although FERC staff continue to deny that a long list of increases greater than 10% represents anything significant. Information that can discredit damaging evidence is presented as persuasive, even as its damage to the larger argument of the studies themselves is ignored. All-in-all, the FEIS is hardly a model of intellectual rectitude or intellectual conscience.

In this paper I have tried to demonstrate just how damaging such complacent attitudes can be to the general environment, to the streams within it, and to the creatures—including people and communities—who depend on that environment for so many functions vital to survival.

CONCLUSION

The application process for MVP has included numerous instances of public commentary leading to corrections in MVP's materials. Two of these instances include public comments that addressed essentially spurious 'scientific' reports related to impacts to streams: MVP's original discussion of stream scour, and the first ESI studies of the impacts on the Jefferson National Forest. In both cases FERC staff sat silently tolerant of the flawed submission until an outside commenter—a citizen in the first case, the Forest Service in the second—required that the reports be re-researched and re-written. **In both cases the revised reports were submitted to FERC after the Draft EIS had already been released for comment.** And in both cases, substantial new information has been reported, information that complicated the evolving understanding of the MVP.

It seems clear that the data FERC has used in the FEIS to support the claim that impacts to streams will be minimal does not, in fact, support that claim, and further demonstrates that the need for citizen oversight of the process is still called for—and that FERC's process of evaluation must be called to task for refusing to deal responsibly with evidence already in its possession. Given the information provided by ESI in March 2017—months before the agency declared their assessment complete—it appears that FERC staff were profoundly negligent in issuing assurances to the Commissioners and to the public that there would be no significant impacts to streams. As shown here, a reflective reading of the ESI reports will not—cannot—support such a conclusion. At most, the ESI reports cry out for further study—a necessity which the agency has forcefully rejected.

A similar reproach must go out to the Forest Service. The rigorous standards they articulated in the summer of 2016 seem to have evaporated entirely with the release of the Draft Record of Decision. Where they previously demanded precise data reflecting careful and systematic science, they are now apparently satisfied with a report that freely acknowledges the

invalidity of some of its most significant data. ***And where the Forest Service previously demanded an assessment of impacts to both private and public lands and interests that might be affected by construction, including any impacts to water resources beyond the JNF,*** [12] ***they later proposed a utility corridor that would almost guarantee substantial disruption of private and public lands and water resources in areas leading to and from the crossing of the JNF, and more recently have suggested approval of the Project even without substantial evidence of its impacts on either the JNF or private and public resources surrounding the forest.*** It is a violation of intellectual and procedural integrity to use the present ESI study to approve the relaxation of Forest Service standards for protection of water quality. Even in its current disordered state, the study does not support such a decision.

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Registered Intervenor

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[12] The original Forest Service responses to MVP's earliest sedimentation study in Docket CP16-10, Document #20160408--5318, file of narrative responses, contains the following demand: ***"Cumulative effects of associated activities and pipeline construction on private property in the analyzed watersheds, past activities, and anticipated future activities in the modeled watersheds on public and private property must be considered and included in the estimated disturbance as is appropriate."*** *(file page 67)*

APPENDIX I: ESI Tables used in this Comment

FEIS Appendix O contains the ESI revised studies of the JNF. There are two studies, App. O-1 Biological Evaluation and O-3 Hydrologic Analysis, with file pages numbered consecutively through the entire appendix. The following are tables in each that I have used in my comment.

Appendix O-1. Biological Evaluation

Table 3. Subwatersheds in West Virginia and Virginia with Limits of Disturbance within the JNF*

File Page 14

* This is identical to Table 1 in the Hydrologic Analysis (file page 166).

Table 4. Waterbodies with an expected increase in sediment load of 10 percent or greater from the proposed MVP within the Vicinity of the JNF**

Although the title does not emphasize this fact, the figures here are for the highest load estimate over the five year period covered by the study's projections.

File page 15

** This table is essentially identical with Table 5 in the Hydrologic Analysis below except that the distances are expressed in Kilometers here, in Miles in Hydrologic Analysis.

Table 5. Maximum yearly sediment loads above baseline in downstream waterbodies and associated percent increases from the proposed MVP in the JNF

This table reports the highest level of sediment increase for numerous streams in the study, and also provide information about stream order (headwater streams being order 1, 2 or 3). The data here is slightly different from the maximums reported in the Hydrologic Analysis Table 4, but no explanation for the difference is offered.

File page 16-17

Appendix O-3. Hydrologic Analysis of Sedimentation

Table 3. Predicted yearly sediment yields for baseline and proposed conditions for the MVP intersecting catchments within the JNF ***

This Table seems to report the amount of sediment generated in the drainages of streams in or near the JNF, segmented by their relation to various tributaries. As many of the increases are immense, and endure throughout the 5 years pf the study's projections, *it is unclear how to compute the relation between the catchments and the sediment loads for related stream segments.*

File page 179

*** This table offers significantly different data from Table 5 In the Biological Evaluation**.**

Table 4. Total expected sediment loads for downstream stream and associated per cent increase in sediment loads expected from MVP in the JNF****

This Table provides the 5-year picture of sediment increases in stream segments downstream from the JNF.

File page 181

**** This table provides somewhat different data from Table 5 in the Biological Analysis, which provides stream order designations missing from the Hydrologic table, and some differing maximum yearly percentages.

Table 5. Stream lengths in miles for streams with expected increase in sediment load of 10 percent or greater from the proposed MVP within the vicinity of the JNF

As with the similar data in Table 3 of the Biological Evaluation, the "10% increase" reported here is the highest increase for the particular stream or stream segment projected to occur at any point in the five year study.

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APPENDIX II. TABLES 1 and 2 for ESI-RELATED DATA

This Appendix includes the two Tables referenced in the text of this comment that assemble data from the FEIS and the ESI studies of the Jefferson National Forest. In both cases I was attempting to show that neither the FERC nor the Forest Service exercised the sort of critical curiosity that would have investigated significant connection between existing data sets, or might have extended the implications of that data to clarify larger issues.

Both Tables involve some material that is the result of "hand-counting" the endless list of crossings contained in the FEIS Appendix F-1 Table of Waterbodies Crossed by the MVP Project—and there is some possibility that an electronic count would reveal some inaccuracies. I apologize for any errors in this regard. However, as noted in the text, the FEIS Appendix does not reveal such information as the inter-connections that may exist between UNTs: 2 (or more) may flow together to form a third—but all 3 may be labelled UNTs to the same mainstem. Furthermore, the FEIS does not indicate when one mainstem with its associated UNTS flows into another mainstem. As a result—and without mapping to clarify the actual situation—I cannot guarantee that all the counts are completely accurate. What I counted was a mainstem name and any UNT that contained that name.

Other data in **Table 1** originated in the following sources and involves certain limitations:

* **FEIS Appendix F-1**: stream ID, # of UNTs (except for Stony Creek, where I added the input from Kimbalton, a named tributary), width at bank height, and flow regime.

* **ESI Hydrological Analysis Table 5**: "length of impact": I added mileage listed for UNTs to the Mileage for the mainstem streams listed. However, mileage listed for the North Fork of the Roanoke River, as stated in the text, and for its tributary Dry Run, was calculated using the **Indian Creek Watershed Association online mapping tool**.

* **ESI Biological Assessment Table 5**: "% Increase of sediment": In cases where a single entry referred to mainstem, I used that figure (the highest estimated for the 5-year study period); in cases where there were multiple segments, or a mainstem and its UNTs were listed separately, I added the percentages listed (although as acknowledged in the text, this may not have been appropriate.)

Data for Table 2 was drawn from FEIS Appendix F-1, but the span from Rich Creek to the North Fork of the Roanoke River reflects the distribution of the streams discussed by the ESI studies.

APPENDIX II

TABLE 1. Number of Streams on MVP Route with Profiles Similar to JNF Streams in ESI Study

Stream Name	ID #	# of UNTs	Width (W) at Bank Height	Flow (F) Regime	Miles of Impact	% Increase of Sediment	# Streams w/ Same W&F	# Streams w/ Multiple UNTs
Rich Creek	N/A	10 (2 crossed by MVP)	20'	Per.	4.3	44.07%	26	14
Kimbalton Branch	S-PP14	5	14'/15'	Per.	3.7	69.75%	27	16
Clendennin Creek	S-HH16	8	5'	Per.	5.6	29.15%	22	2
Curve Branch	S-PP18	1	4'	Int.	3.4	48.76%	77	6
Stony Creek	S-HH16	7 (with Kimbalton's input)	40'	Per.	1.16	9.11%	1	1
Craig Creek	S-RR13	5	35'	Per.	2.2	8.71%	5	5
Dry Run	S-EF49	1	4.5'	Per.	3.8	N/A	47	2
Mill Creek	TTVA-S201	6	14'	Per.	4.8	29.42%	13	4
North Fork of the Roanoke River	S-G36	9	20'	Per.	8.4 +	19.43%	26	14

APPENDIX II

TABLE 2. Stream Crossings In the Vicinity of the Jefferson National Forest

Abbreviations used: **Flow Regime** designations: **Per**. = Perennial; **Int**. = Intermittent; **Eph**. = Ephemeral; **Crossing type**: **ROW**= a crossing for the pipeline right of way with associated workspace; **ATWS** = temporary workspace which presumably involves crossing of the stream indicated; **AR** = crossing for the Access Road indicated, with '**cul**' = installation of culvert and fill; **TF** = is undefined in Appendix F, but presumably indicates accompanying temporary workspace and/or ford.

RICH CREEK WATERSHED: Dry Creek and Painter's Branch: 11 crossings, 10 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT Dry Creek	S--E43	191.7	7'	Eph.	ROW
UNT Dry Creek	S--E45	191.7	3'	Eph.	ROW
Dry Creek	S--E40	192.0	12'	Per.	ROW
UNT Dry Creek	S--E41	192.0	2'	Int.	ATWS
UNT Painters	S--C38	194.5	7'	Int.	ROW
Painter's Run	S--C39	194.6	5'	Per.	ROW
UNT Painters	S--C40	194.6	3'	Per.	AR MO 231.01
UNT Painters	S--C41	194.6	3'	Int.	ROW
UNT Painters	TTWV--S131	194.6	3'	Int.	ROW
UNT Painters	TTWV--S200	195.1	5'	Int.	ATWS 1060
UNT Painters	TTWV--S200	195.1	5'	Int.	ROW

CLENDENNIN CREEK-TO-BLUESTONE LAKE SUBWATERSHED: 28 Crossings, 20 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT Kimbalton	S--SS3	196.7	3.5'	Eph.	ROW
Kimbalton Br.	S--PP14	196.7	14'	Per.	AR GI-232 Cul.
Kimbalton Br.	S--PP14	196.7	14'	Per.	AR GI-232 TF
UNT KImbalton	S--PP15	197.2	6'	Per.	AR GI-232 Cul.
UNT Kimbalton	S-PP15	197.2	6'	Per.	AR GI-232 TF
UNT Kimbalton	S--PP13	198.9	15'	Per.	ROW
KImbalton Br.	S--PP14	198.9	12'	Int.	AR GI-232 Cul

UNT Stony	S--P6	200.1	6'	Eph.	ROW
Stony Creek	S--S5	200.3	40'	Per.	ROW
Stony Braid 1	S--S5B1	200.3	4'	Eph.	ROW
Stony Braid 2	S-S5B2	200.3	3'	Eph.	ROW
UNT. Clenden.	S--HH11	197.8	4'	Eph.	AR GI-232 Cul.
UNT. Clenden.	S--HH11	197.8	4'	Eph.	AR GI-232 TF
UNT. Clenden.	S--HH12	197.8	3'	Eph.	AR GI-232 Cul.
UNT. Clenden.	S--HH13	197.8	8'	Per.	AR GI-232 Cul.
UNT. Clenden.	S-HH13	197.8	8'	Per.	AR-GI-232 TF
UNT. Clenden.	S--HH14	197.8	3'	Eph.	AR GI-232 Cul.
UNT. Clenden.	S-HH14	197.8	3'	Eph.	AR GI-232 TF
UNT. Clenden.	S--HH15	197.8	5'	Per.	AR GI-232 Cul.
UNT. Clenden.	S--HH16	197.8	5'	Per.	AR GI-232 Cul
UNT. Clenden.	S--HH16	197.8	5'	Per.	AR GI-232 TF
UNT. Clenden.	S-SS2	197.8	10'	Int.	AR GI-232 Cul
Clendennin Creek	S--UU9	197.8	5'	Per.	AR GI-232 Cul
Clendennin Creek	S--UU9	197.8	5'	Per.	AR-GI-232 TF
UNT New River	S--PP16	197.8	2'	Int.	AR GI 232 Cul.
UNT New River	S--PP17	197.8	2'	Int.	AR GI-232 TF
Curve Branch	S--PP18	197.8	4'	Int.	AR GI-232 Cul.
UNT Curve Br.	S--PP19	197.8	3'	Int.	AR GI-232 TF

DRY BRANCH WATERSHED: 7 crossings, 6 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT Dry Br.	S--G29	201.9	4'	Eph.	ROW
UNT Dry Br.	S--G30	202.0	8'	Eph.	ROW
Dry Branch	S--G32	202.3	6'	Int.	ROW

Dry Branch	S--G32	202.4	7'	Int.	AR GI 241.04 TF
UNT Dry Br.	S--AB13	202.6	2'	Eph.	AR GI-241.04 TF
UNT Dry Br.	S--AB14	202.6	2'	Eph.	AR GI-241.04 TF
UNT Dry Br.	S--G33	202.6	8'	Per.	ROW

LITTLE STONY CREEK (LSCr) WATERSHED: 11 crossings, 10 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT LSCr	S--SS4	203.6	3'	Eph.	ROW
UNT LSCr	S--Z9	203.6	4'	Per.	ROW
UNT LSCr	S--Z7	203.9	3'	Int.	ROW
UNT LSCr	S--Z7braid	203.9	3'	Eph.	ROW
UNT LSCr	S--Z10	204.2	12'	Per.	ROW
UNT LSCr	S--Z11	204.3	5'	Per.	ROW
UNT LSCr	S--Z12	204.3	6'	Int.	ROW
Little Stony Cr	S--Z13	204.3	25'	Per.	ROW
Little Stony Cr	S--Z13	204.3	25'	Per.	AR GI-241.02 TF
UNT LSCr	S--Z15	204.3	2'	Eph.	ROW
UNTLSCr	S--Z14	204.4	4'	Int.	ROW

DOE CREEK WATERSHED: 6 crossings, 5 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT Doe Cr.	S--YZ1	204.7	10'	Eph.	AR GI-241.03 TF
UNT Doe Cr.	S--A33	205.3	7'	Eph.	ROW
UNT Doe Cr.	S--A34	205.3	7'	Eph.	ROW
UNT Doe Cr.	S--A32	205.8	16'	Per.	ROW
Doe Creek	S--Y2	206.7	25'	Per.	ROW
Doe Creek	S--Y2	206.7	10'	Eph.	ROW

SINKING CREEK (SC) WATERSHED: 35 crossings, 31 streams (including Sinking Creek twice)

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT SC	S--E24	207.8	20'	Per.	ROW
UNT SC	S--E25	207.8	8'	Per.	ROW
UNT SC	S--MN11	207.8	3'	Eph.	AR GI-242.01 TF
UNT SC	S--MN11	207.8	2'	Eph.	AR GI-241.01 TF
UNT SC	S--E25	207.9	10'	Per.	ROW
UNT SC	S--RR4	208.3	3'	Per.	AR GI-243.01 TF
UNT SC	S--RR5	208,3	10'	Per.	ROW
UNT SC	S--RR3	208.4	7'	Eph.	AR GI-243.01 TF
UNT SC	S--IJ15	208.5	3'	Int.	AR GI-244 TF
UNT SC	S--IJ19	208.5	2'	Eph.	AR GI-244 TF
UNT SC	S--IJ19	208.5	2'	Eph.	ATWS 1146
UNT SC	S--IJ16b	209	5'	Eph.	ROW
UNT SC	S--IJ17	209	3'	Eph.	ROW
UNT SC	S--IJ16a	209.3	4'	Eph.	AR GI-245.02 TF
UNT SC	S--QQ3	209.9	2'	Eph.	AR GI-245.02a TF
UNT SC	S--QQ3b	209.9	4.5'	Eph.	AR GI-245.02a TF
Sinking Creek	S--NN17	211	55'	Per.	ROW
UNT SC	S--MM17	213.6	2'	Per.	AR GI-253.02 TF
UNT SC	S--MM16	213.6	5'	Eph.	ROW
UNT SC	S--MM17	213.7	2'	Per.	AR GI-253.02 TF
UNT SC	S--NN12	214.2	2'	Eph.	ROW
UNT SC	S--NN13	214.6	2'	Int.	AR GI-256.02 TF
UNT SC	S--NN11	214.7	5'	Int.	ROW
UNT SC	S--NN14	214.7	5'	Int.	AR GI-256.02 TF

UNT SC	S--NN9	214.8	5'	Per.	AR GI-256 cul.
UNT SC	S--NN9	214.8	5'	Per.	AR GI-256 TF
UNT SC	S--KL43	214.9	8'	Per.	ROW
UNT SC	S--OO14	216.5	4'	Per.	ROW
UNT SC	S--OO12	216.6	2'	Eph.	ROW
UNT SC	S--OO13	216.6	20'	Per.	ROW
UNT SC	S--CD14	216.9	1.5'	Eph.	ATWS
UNT SC	S--PP1	217.3	3'	Int.	ROW
UNT SC	S--PP3	217.7	3'	Per.	ROW
Sinking Creek	S--QQ2	217.7	35'	Per.	AR CR-258.02 TF
UNT SC	S--PP4	217.9	2’	Int.	ROW

CRAIG CREEK WATERSHED: 7 crossings, 7 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT Craig Ck	S--PP22	218	2.5'	Int.	ROW
UNT Craig Ck	S--PP21	219.1	4'	Eph.	ROW
UNT Craig Ck	S--PP20	219.2	6'	Int.	ROW
Craig Creek	S--OO6	219.5	35'	Per.	ROW
Craig Creek	S--RR13	219.7	35'	Per.	AR MN-258.05 TF
UNT Craig Ck	S--RR14	219.7	7'	Eph.	ROW
UNT Craig Ck	S--MM15	219.9	6'	Per.	ROW

DRY RUN/NORTH FORK OF THE ROANOKE RIVER SUBWATERSHED: 21 crossings, 17 streams

Stream Name	Stream ID	Milepost	Width	Flow Regime	Crossing Type
UNT Mill Cr.	S--ST1	221.3	5'	Per.	ROW
UNT Mill Cr.	S--ST3	221.3	8'	Per.	ROW
UNT Mill Cr.	TTVA S--200	221.9	8'	Per.	ROW

Mill Creek	TTVA S-201	222.4	14'	Per.	ROW
UNT Mill Cr.	TTVA S-202	222.4	14'	Per.	ROW
UNT Mill Cr.	TTVA S-203	222.4	14'	Int.	ATWS
Dry Run	S--EF49	225.3	4.5'	Per.	AR MN 266.02
Dry Run	S--EF49	225.3	4.5'	Per.	ATWS 1458
UNT Dry Run	TTVA 204	225.5	3'	Eph.	AR MN 266.03
UNT NFRR	S--EF21	226.6	2'	Eph.	AR MN 266
UNT NFRR	S--EF22	226.6	4'	Eph.	AR MN 266
North Fork of the Roanoke River (NFRR)	S--G36	227.2	20'	Per.	AR MN 268
NFRR	S--G36	227.2	20'	Per.	ROW
UNT NFRR	S--NN8b	227.4	5'	Eph.	AR MN 268 cul
UNT NFRR	S--NN8b	227.4	5'	Eph.	AR MN 268 TF
UNT NFRR	S--NN8b	227.4	5'	Eph.	ATWS 1160
UNT NFRR	S--G38	227.5	3'	Eph.	ROW
UNT NFRR	S--G39	227.8	6'	Int.	ROW
UNT NFRR	S--G40	227.9	3'	Per.	ROW
UNT NFRR	S--PP23	227.9	2.5'	Eph.	ROW
NFRR	S--GH16	231.8	70'	Per.	AR MN 276.03

RIVER RESEARCH AND APPLICATIONS

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RISK-BASED APPROACH TO DESIGNING AND REVIEWING PIPELINE STREAM CROSSINGS TO MINIMIZE IMPACTS TO AQUATIC HABITATS AND SPECIES

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ABSTRACT

Extensive new pipeline systems proposed to transport natural gas and oil throughout North America will potentially result in thousands of new stream crossings. The watercourses encountered at these crossings will range from small, ephemeral headwater streams to large, perennial mainstem rivers; from dynamic gravel-bed streams to stable bedrock channels; and from steep, source reaches to low gradient, response reaches. Based on past experience at pipeline crossings, the potential for both short and long-term negative impacts on aquatic habitat and species is substantial. In assessing potential hazards to aquatic habitat and species, the diverse physiography and ecology of the stream affected, combined with the number and range of new pipelines proposed, pose significant challenges for project developers charged with collecting, stratifying, evaluating, analysing, interpreting, and presenting stream crossing data in formats that are accessible, usable and useful. It is equally challenging for project reviewers to detect, distill and summarize potential project impacts and then identify reasonable options for their avoidance, minimization, and mitigation. To address these concerns, the US Fish and Wildlife Service, in conjunction with Ruby Pipeline, LLC, developed a pipeline crossing framework and risk analysis approach to stratify potential aquatic impacts, based on both stream characteristics and project types. In this approach, pipeline crossings are ranked in terms of relative short and long-term risk to aquatic habitat and are then analysed, designed, and monitored in ways appropriate to their risk. This approach allows project developers and reviewers to focus resources and monitoring on the crossings that present the highest risks to aquatic habitat and species, while expediting design and construction, and minimizing the monitoring of low-risk crossings. Published 2014. This article is a U.S. Government work and is in the public domain in the USA.

KEY WORDS: aquatic habitat; impact analysis; pipelines; risk analysis; risk screening matrix

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INTRODUCTION

Background

New discoveries of natural gas and oil fields, together with increasing use of hydrocarbons, are driving the demand for more extensive pipeline networks not only throughout North America (Figure 1) but also globally. In the Pacific Northwest (PNW), at least five separate pipeline projects have been proposed in the last 5 years. Only one, the Ruby Pipeline that traverses Oregon, Nevada, Utah, and Wyoming, crossing over 1200 waterbodies, has been completed to date, but several others are in the planning and permitting phases. For example, the Enbridge Northern Gateway Pipeline in Western Canada would cross approximately 780 waterways in three key salmonid watersheds (Levy, 2009). The need for increased oil and gas transmission is not only being addressed using new pipelines; existing pipelines are also being upgraded for this purpose. An example of a recently refurbished pipeline is the Western Route Export Pipeline that traverses Azerbaijan and Georgia, linking the Caspian Sea to the Black Sea (Hydrocarbons-Technology, 2014).

Linear transmission systems cross cut the landscape and thus intersect a wide variety of sensitive aquatic habitats that will potentially be affected by these pipeline crossing activities (Reid and Anderson, 1999). These include both short-term, construction-related impacts, such as increased turbidity, direct modification of aquatic habitat, and the potential for hydrocarbons to enter the stream through equipment failures and spills (Reid and Anderson, 1999; Reid *et al*., 2002a, 2002b), and long-term impacts that are more directly associated with the stream's response potential, such as channel incision and lateral migration (Thorne *et al*., 2014). Additionally, stream crossings constructed decades ago are being rebuilt or repaired to reduce the risk of rupture and extend pipeline design life. In other cases, the stream channels themselves have moved laterally or vertically, exposing an existing pipeline. Clearly, the effects of proposed and existing pipeline crossings on aquatic systems are significant because each pipeline may have hundreds, or even thousands, of stream crossings (Levy, 2009) and because each pipeline is a permanent infrastructure that

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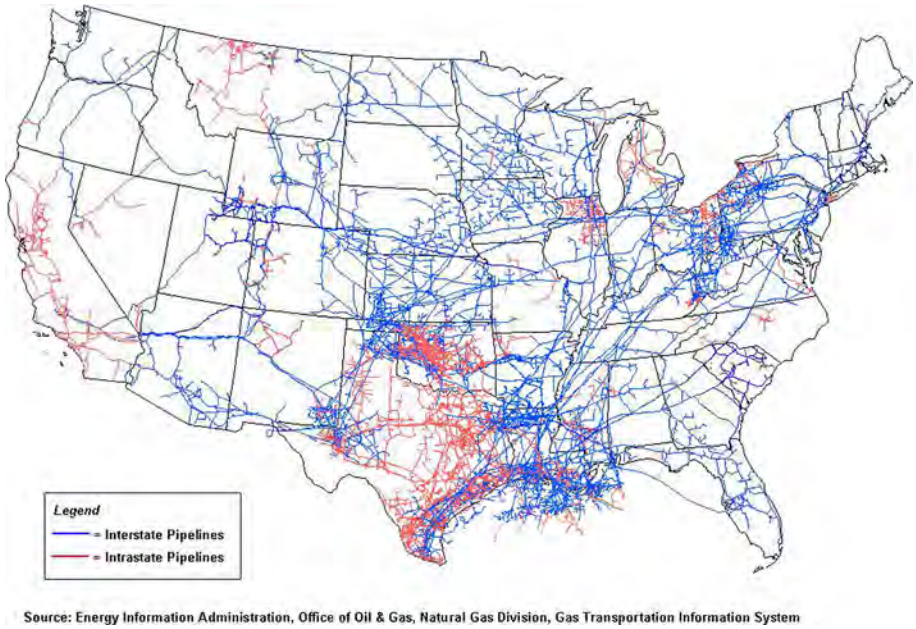

Figure 1. US natural gas pipeline network in 2009, not including the recently completed Ruby Pipeline from http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/ngpipelines_map.html. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

must be maintained over time. Past risk evaluation efforts have focused primarily on the short-term, construction-related impacts, especially to fisheries resources (Reid and Anderson, 1999; Reid *et al*., 2002a, 2002b; Reid *et al*., 2004; Lévesque and Dubé, 2007; Rempel and Porter, 2008), while the approach reported here concentrates more on long-term, physical effects to the aquatic environment.

While pipeline failures are relatively uncommon, the impacts to aquatic habitats and species can be substantial. For example, during a 25- to 50-year flood event in 2011, Exxon Mobil's Silvertip Oil Pipeline in Montana was exposed because of stream bed erosion and then ruptured, releasing an estimated 50 000 gallons of oil into the Yellowstone River (Atkins, 2012). In 1994, extreme flooding along the San Jacinto River in Texas resulted in eight pipeline ruptures during a single event, including ruptures because of the formation of new channels in the floodplain, and releasing 1.47 million gallons of petroleum into the river (NTSB, 1996). A broader study of pipeline failures in Alberta, Canada, over a 15-year period found an average of 762 pipeline failures per year, for a total of 12 191 failures (Levy, 2009). Predicting stream crossings that are at the highest risk for failure is, therefore, of primary importance to government agencies charged with protecting aquatic habitats and species, as well as water quality.

Existing frameworks and tools

A variety of pipeline evaluation tools have been developed and exist primarily in the form of conference proceedings and agency or consultant reports (Reid *et al*., 2008; Rempel and Porter, 2008) or are for a specific pipeline project (Atkins, 2012). Examples include the following:

(1) the Canadian Fisheries Risk Assessment Tool that is under development by Fisheries and Oceans Canada (Rempel and Porter, 2008);
(2) CROSSING—a decision support tool for pipeline crossings and construction impacts (Reid *et al*., 2008) that focuses on suspended sediment concentrations and deposition rates;
(3) the Yellowstone River Pipeline Risk Assessment that was developed as a result of the pipeline rupture in 2011 (Atkins, 2012); and
(4) the Performance Measurement Framework for Pipeline Water Crossing Construction developed to evaluate completed crossings (Reid *et al*., 2002a).

One of the most extensive and complete risk assessment methodologies currently available was developed in 2005 by the Canadian Association of Petroleum Producers, the Canadian Energy Pipeline Association, and the Canadian Gas Association (CAPP, 2005). Through this collaborative effort, the Risk Management Framework for Development Projects Impacting Fish Habitat was developed for pipeline projects. This has two components: the Pathways of Effects and the Risk Determination Matrix (CAPP, 2005). The framework and tools developed by CAPP, 2005 are excellent for reducing short-term impacts because of pipeline construction but differ from the proposed methodology in that it is narrowly focused on fisheries resources; the current effort is more widely focused on all aquatic resources and

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longer term, cumulative impacts. Hence, the CAPP, 2005 framework and tools and this current effort are complimentary resources.

US regulatory framework

Each country has different regulatory requirements and controls. It is not within the scope of this paper to address the different regulatory environments found within North America or globally; however, we present the US federal regulatory environment as a case study.

For interstate and major US intrastate pipelines, the US Federal Energy Regulatory Commission (FERC) is the lead federal agency managing environmental impact minimization, while the US Department of Transportation is responsible for pipeline safety once pipeline construction is complete, regardless of the product carried in the pipeline. FERC both issues licenses and provides guidance for interstate and intrastate pipeline projects. FERC guidance attempts to balance the requirements of a fixed feature (the pipeline) in a landscape that is subject to both human and natural dynamic conditions. However, the geologic, ecologic, and climatic complexity of the USA makes it impossible to provide crossing design guidance that is applicable to all streams in all landscapes; hence, the capability to modify guidance depending on regional and local needs is essential.

For example, current FERC guidance for Wetland and Waterbody Construction and Mitigation Procedures (Procedures; FERC, 2013) is national in scope and general in nature and therefore does not provide sufficiently detailed and specific information at a regional level to adequately protect aquatic systems with numerous species in complex geographic and ecologic settings. Specifically, within the FERC (2013) Procedures, streams are designated into three broad categories—major, intermediate, and minor—based on wetted channel width at the time of construction, with progressively more latitude in design, construction, and oversight as channel size decreases. Hence, relatively large rivers may be identified as intermediate or even minor streams, especially in the arid west. Further, FERC Procedures allow some streams to be treated as uplands under the following conditions:

> *Crossing of waterbodies when they are dry or frozen and not flowing may proceed using standard upland construction techniques…* (FERC, 2013, page 6)

A few components of the FERC Upland Erosion Control, Revegetation, and Maintenance guidance (FERC, 2003) pertain to all waterbody crossings, including the following: (i) vegetation removal within right of way (RoW) during construction, except for streambank buffers; (ii) perpendicular stream crossings to the extent possible; and (iii) pipeline burial depth sufficient to maintain pipeline safety (FERC, 2013, 2003; CFR § 192.317), generally resulting in pipeline burial of 3 to 5 ft.

While the FERC Procedures do address some predictable pipeline impacts, especially during construction, the guidance does not address the longer term stream response potential, which is highly dependent on characteristics of the stream system rather than the pipeline. Therefore, depending upon the crossing location, stream and catchment characteristics, timing, extent of activities, and application of Best Management Practices (BMPs—construction conservation measures intended to reduce impacts to the environment), impacts to aquatic species will vary but may include simplification of habitat, loss of aquatic species passage, removal of spawning gravel, increased suspended sediment and turbidity, loss of side channels, disconnection from the floodplain, or change in hyporheic flow patterns (Reid *et al*., 2002b). These impacts may occur at the project site or may propagate upstream, downstream, or laterally into the floodplain.

It is the ability of a stream system to adjust over time and space in response to changes in flow, sediment, and vegetation that creates and maintains aquatic and riparian habitat (Skidmore *et al*., 2011). Hence, promoting this adjustment is of interest to federal, state, and local resource agencies. It is this same adjustability that may result in pipeline exposure, substantially increasing the potential for pipeline rupture, which is of prime importance to pipeline companies. Pipelines are strong in compression and weak in tension; thus, an exposed, unsupported pipe is at unacceptably high risk of rupture. Balancing the necessary level of stream stabilization to avoid pipeline exposure, while allowing for stream adjustability to provide habitat for species, is the challenge faced by pipeline companies and the agencies issuing permits for pipeline projects.

Because specific, detailed information about individual site conditions, construction implementation, BMPs, site restoration, and monitoring and maintenance is not required by FERC, it is currently impossible to predict the potential impacts of a proposed crossing on the aquatic environment based solely on the information provided to FERC (FERC, 2013, 2003) by the pipeline applicant. To address this need, the US Fish and Wildlife Service (FWS), in cooperation with Ruby Pipeline, LLC, developed the Waterbody Crossing Framework (herein referred to as the Framework) and the Pipeline Risk Screening Matrix (Risk Matrix). The Risk Matrix focuses on potential physical changes that may affect aquatic species and their habitats, especially in the long term.

FRAMEWORK

Pipelines often cross hundreds or thousands of streams and wetlands. Thus, for the purpose of design by project proponents and review by permitting agencies, it is helpful to first organize data sets and then stratify the crossings into relative

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levels of risk to aquatic resources so that the time allocated to designing each crossing is scaled on the level of risk. To facilitate the organizational process through which crossings are (i) evaluated for risk, (ii) allocated to the appropriate level of design, (iii) implemented, and then (iv) monitored, the FWS developed a generic waterbody crossing risk analysis framework (Framework; Figure 2). The risk categories established by the proposed Framework include low-risk crossings that may be addressed by prescriptive designs and subsample monitoring, medium-risk crossings where standardized designs and stratified subsample monitoring are appropriate, and high-risk crossings requiring bespoke designs and individual monitoring. To group crossings by risk indicates the need for a minimum level of data and assessment at each crossing; otherwise, it is impossible to assess risk to habitat and species.

The Framework is composed of four linked phases:

(I) Basic Stream Data,
(II) Risk Matrix (described below),
(III) Site Restoration, and
(IV) Implementation Monitoring,

with several subphases. While the Framework is represented as a linear process in Figure 2, there are feedback loops between the four phases, and the process iterates as more data become available. In this context, Phase I is key to the success of the later phases and provides the benchmark against which everything else is measured.

The Framework has a progressive design that builds from a basic stream database for all proposed crossing sites. Once the basic data have been compiled, a qualitative, comparative risk assessment is completed and stream crossings are assigned to a preliminary risk category. As additional data become available, from either remote sensing or field data collection, the risk initially assigned may be adjusted. Where data are sparse or lacking, the Risk Matrix is designed to default to the highest category of risk. Hence, gathering additional data should always result in a relative decrease in the risk assigned to a crossing—an important point of principal discussed further in subsequent sections. The design approach and specificity of BMPs appropriate are designated for each risk category. Following the selected design and BMPs, the pipeline stream crossings are constructed, and the sites are restored to their pre-disturbance condition (site restoration). Site selection for monitoring is also based on the stream data (baseline data for monitoring) and the assigned risk category, with high-risk crossings requiring individualized monitoring and low-risk crossings needing only subsample monitoring.

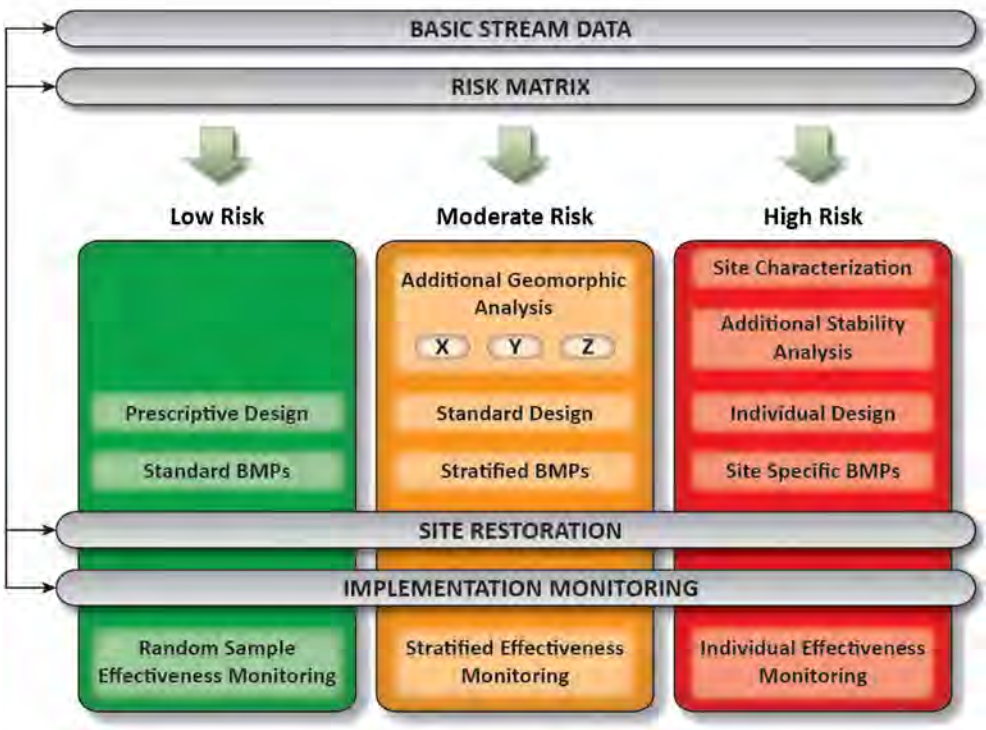

Figure 2. Generic waterbody crossing framework developed by the FWS. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

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BASIC STREAM DATA

Evaluation of environmental impacts at each waterbody crossing occurs within the wider context of permitting, construction, and maintenance decisions based on consideration of pipeline integrity, constructability, and impacts to fish and wildlife, water quality and other protected resources. Decisions must be supported by data, and a comprehensive project data set is often generated for this purpose. We have outlined an integrated data set recommended for stream crossings that includes the data typically required for major categories of permits [e.g. Clean Water Act sections 401 (water quality) and 404 (wetlands)], for crossing design and construction, site reconstruction and revegetation, and long-term pipeline maintenance in the vicinity of dynamic stream crossings (Table I).

The recommended data set is intended to provide the information necessary to establish baseline conditions for site restoration and monitoring and to support risk analysis and crossing design. Baseline data are also necessary for geomorphic analysis, estimation of impacts, and selection of crossing-specific methods or BMPs. Each of these considerations is included to some degree in the application of the Risk Matrix. Data are further separated into site versus reach-scale properties, and whether the data can be obtained or generated through a desktop study or require field observations and measurements. While collection of data in the field is usually expected (and guidance on this is provided), we recognize that advances in remote-sensing and geographic information system technologies are quickly increasing both the amount of environmental data that is available remotely and our capacity to analyse it. Furthermore, professional experience and expert judgment regarding data quality, reliability and resolution, combined with local knowledge of site conditions, may alter the approaches, technologies and resolutions recommended for data collection.

RISK MATRIX

The 'Pipeline Screening Risk Matrix' is an outgrowth of a broader effort sponsored by the US federal government to more efficiently and effectively evaluate risk associated with stream management and restoration projects. The River Restoration Analysis Tool (RiverRAT) provides a thorough and comprehensive approach to the review and evaluation of proposed stream actions and projects (Cluer *et al*., 2010; Skidmore *et al*., 2011). As a part of this effort, a risk screening tool was developed to help National Oceanic and Atmospheric Administration (NOAA) Fisheries and US FWS reviewers to match the time and effort spent in reviewing project proposals to the risk to listed species (Skidmore *et al*., 2011; Thorne *et al*., 2014). In a similar manner, the Pipeline Screening Risk Matrix described here is intended to facilitate a qualitative analysis of relative risk to aquatic habitat at stream crossings.

During the initial stages of pipeline project development, the Risk Matrix can be applied as a desktop exercise. However, as project development progresses, and certainly before construction, the risk analysis must be refined using site-specific, field observations and measurements.

Description of the pipeline risk screening matrix

The screening tool takes the form of a two-axis matrix (Figure 3) in which the

x-axis =risk to resource as a result of stream response potential
y-axis =risk to resource as a result pipeline crossing impact potential

The principle underlying the Pipeline Risk Screening Matrix (adopted directly from the RiverRAT Project Screening Risk Matrix) is that pipeline crossings should do no long-term harm to aquatic habitat on-site, upstream, or downstream and that short and long-term negative impacts will be avoided where possible, minimized to the greatest extent possible, and mitigated where necessary (Thorne *et al*., 2014).

Explanation of the axes

The *x*-axis represents the risk to natural resources associated with the stream's sensitivity to disturbance and response potential (Knighton, 1998). Disturbances may be natural, such as those caused by a flood or drought, or anthropogenically driven—engineering interventions, land use modifications, management actions or restoration projects (Thorne *et al*., 2014). Using catchment, landscape, stream and channel indicators, reviewers make an initial assessment of the overall risk to resources because of the intrinsic sensitivity of the fluvial system within which the pipeline is to be implemented (Sear *et al*., 2010). Risk is considered to be greatest at crossings where disturbance and instability are widespread, the flow regime is flashy, the riparian corridor is damaged or missing, and the erosion resistance of the bed and/or bank materials is low. Additionally, impacts at high-risk crossings are more likely to persist for long periods because of the intrinsic sensitivity of the stream. Because the level of risk is associated with the stream's inherent sensitivity, risk along this axis cannot be reduced unless the pipeline is moved to another, more resilient, location.

The proposed action is represented by the *y*-axis. When implementing a pipeline project in or near a stream system, some level of habitat disturbance is inevitable (Sear *et al*., 2010). This axis gauges the degree of disturbance using the level of floodplain and channel disruption, selected construction method, and presence of artificial bed and bank

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Table I. Basic data needs

Basic data needs for risk-based design and review of waterbody crossings			
Data type	Where obtained	When needed	Intended use
Brief description of the data needed and the appropriate scale/resolution Reach—stream length of at least 20x channel width Site—within the project area of interest (e.g. corridor and regulatory buffers)	Office—GIS, lidar, photos, maps, reports Field—on-the-ground site visits	Permit review—at the time of permit application and/or initiation of consultation Pre-construction—up to the time of ground disturbing activities covered by a permit	Risk Matrix—data are needed to complete a risk analysis; the specific evaluation factor(s) is listed Geomorphic analysis—data are needed to perform (1) project stratification based on channel width, valley width, and channel slope, and (2) appropriate channel types for moderate-risk projects Design—more detailed data are needed to perform specific technical analyses on high-risk projects Site restoration—data are needed to ensure the project site is restored to pre-project conditions, herein referred to as 'stream simulation' Implementation monitoring—baseline data are needed for shorter term monitoring to determine if designs, BMPs, construction specifications, and performance criteria were adhered to during construction Effectiveness monitoring—baseline data are needed for longer term monitoring to determine if the desired physical/biological outcomes were achieved
Drainage area	Office	Permit review	Risk Matrix: flashiness index (discharge estimate) Design: hydrologic analyses to determine channel size, frequency of out-of-bank flow, elevation of the floodplain where applicable, flow and sediment rating curves
Stream type (reach)	Office or field—observation of bedrock, colluvial, or alluvial	Permit review	Risk Matrix: landscape sensitivity/stream type, bank characteristics, bed characteristics, and construction method Geomorphic analysis: appropriate channel types Design: threshold versus mobile bed channel, boundary conditions
Stream slope (reach)	Office Field	Permit review Pre-construction	Risk Matrix: landscape sensitivity factor, bed characteristics (vertical scour potential) Geomorphic analysis: appropriate channel types Design: hydraulics, sediment transport Site restoration: stream simulation Implementation monitoring
Channel dimensions (site)	Office—estimate of channel width at ordinary high water Field—measurement of channel width, average depth, cross-sectional area at OHW. One cross section per aquatic habitat unit	Permit review Pre-construction	Risk Matrix: channel disturbance, riparian corridor, landscape sensitivity/stream type Geomorphic analysis: channel confinement, appropriate channel types Design: hydraulics, sediment transport, channel stability Site restoration: stream simulation Implementation monitoring Effectiveness monitoring
Valley width (reach)	Office	Permit review	Risk Matrix: riparian corridor, landscape sensitivity/stream type, floodplain disturbance Geomorphic analysis: channel confinement, appropriate channel types Design: sinuosity and slope range

(*Continues*)

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Table I. (Continued)

Basic data needs for risk-based design and review of waterbody crossings			
Data type	Where obtained	When needed	Intended use
Floodplain dimensions (reach)	Office—estimate of floodplain width	Permit review	Risk Matrix: riparian corridor, landscape sensitivity/stream type, floodplain disturbance
	Field—measurement of floodplain width and elevation	Pre-construction	Geomorphic analysis: channel confinement, appropriate channel types Design: hydraulics, sediment storage Site restoration: stream simulation and floodplain connectivity
Bed materials (site)	Field	Permit review	Implementation monitoring Effectiveness monitoring Risk Matrix: bed characteristics, artificial bank/bed stabilization Geomorphic analysis: appropriate channel types Design: sediment transport, hydraulics, channel stability Site restoration: stream simulation Implementation monitoring Effectiveness monitoring
Bank materials (site)	Field	Permit review	Risk Matrix: bank characteristics, artificial bank/bed stabilization Geomorphic analysis: appropriate channel types Design: bank stability, channel stability, channel migration zone, hydraulics Site restoration: stream simulation Implementation monitoring
Grade controls (reach)	Field	Permit review	Risk Matrix: bed characteristics, landscape sensitivity/stream type, artificial bank/bed stabilization, construction method Geomorphic analysis: appropriate channel types, incision potential Implementation monitoring: to ensure that natural grade control has not been effected
Riparian corridor (reach)	Office—estimate of riparian width for each side of the channel	Permit review	Risk Matrix: riparian corridor, bank characteristics, artificial bank/bed stabilization Geomorphic analysis: appropriate channel types Design: channel and floodplain roughness, hydraulics, channel stability, streambank stability Site restoration: typical species, density, structure of riparian vegetation and planting plan Implementation monitoring: species composition, stocking levels Effectiveness monitoring: survival rates and invasive species
	Field—composition, density, and distribution	Pre-construction	
Discharge (site)10-year2-yearbaseflowconstruction	Office—regression equations or similar	Permit review	Risk Matrix: flashiness index, channel disturbance, landscape sensitivity/stream type Design: hydraulics, sediment transport, channel size, floodplain elevation, aquatic species passage Site restoration: stream simulation, stability of bed and bank materials Implementation Monitoring
Channel sinuosity (reach)	Office or field	Permit review	Geomorphic analysis: appropriate channel types Design: hydraulics, sediment transport, channel slopeSite restoration: stream simulation Implementation and effectiveness monitoring

(*Continues*)

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Table I. (Continued)

Basic data needs for risk-based design and review of waterbody crossings			
Data type	Where obtained	When needed	Intended use
Large wood loading (site)	Field—measurement of size class and configuration	Pre-construction	Geomorphic analysis: appropriate channel types Design: channel and floodplain roughness, channel stability, vertical scour, flood elevations Site restoration: stream simulationImplementation and effectiveness monitoring
Streambank erosion (reach)	Field	Pre-construction	Geomorphic analysis: appropriate channel types Design: sediment transport, channel stability, streambank stability, channel migration zone Implementation and effectiveness monitoring
Mass wasting (reach—upstream only)	Field	Pre-construction	Geomorphic analysis: appropriate channel types Design: sediment transport, channel stability, channel migration zone Implementation and effectiveness monitoring
Aquatic habitat units (site)	Field	Pre-construction	Site restoration: stream simulation Design: hydraulics, channel roughness Implementation and effectiveness monitoring

stabilization. Because the degree of risk is related to project design and decision-making, reduction of risk on the *y*-axis is possible through, for example, realigning the crossing, modifying construction techniques, and, where possible, avoiding the need to introduce artificial constraints on the stream. There may, however, be trade-offs between mitigating the risks on the *y*-axis and design requirements for crossings on streams that are intrinsically sensitive to disturbance (that is, with high *x*-axis risks). It follows that increased risk of reducing resource values that depend on natural adjustments in dynamic, alluvial channels may be unavoidable because of the need to reduce or eliminate the potential for vertical and/or lateral instability at crossings.

Explanation of the risk factors

X-axis risk factors related to stream response potential. A full explanation of the *x*-axis risk factors can be found in Thorne *et al*. (2014). However, a brief explanation is provided herein to allow this paper to stand alone.

Scale of problem. The spatial extent of existing stream-related problems causing instability, whether it is site, reach or catchment in scope, affects the level of risk both to natural resources and the effectiveness of an intervention. Addressing a reach-scale problem with a site-scale restoration treatment may temporarily improve habitat, but the long-term viability of the project is reduced.

Landscape sensitivity/stream type. This risk factor is relevant at the reach scale and should be evaluated in the context of the geomorphology of the surrounding landscape unit (i.e. a stream reach having a similar channel pattern, slope and degree of valley confinement). At this scale, the stream's sensitivity to disturbance depends largely on its capacity to accommodate abrupt changes in the flow regime and/or sediment supply without abrupt or disproportionate morphological responses that destroy habitat. This factor is of overriding importance in bedrock and colluvial channels, where the influence of the remaining risk factors is small because the channel is substantially less responsive to disturbance over engineering timescales. Conversely, if the channel is on an alluvial fan, the site response potential is likely to be high even if the other risk factors are all rated low.

Riparian corridor (for streams with slopes <4%). The riparian corridor defines the area within which the stream interacts with the natural vegetation on its banks and floodplain in adjusting its channel morphology in response to natural or artificial disturbance (Rapp and Abbe, 2003). The capacity to adjust within dynamic equilibrium allows an alluvial stream to accommodate disturbances without abrupt changes in channel morphology, but this requires that the channel is hydraulically and geomorphologically connected to a floodplain. Consequently, this risk factor is

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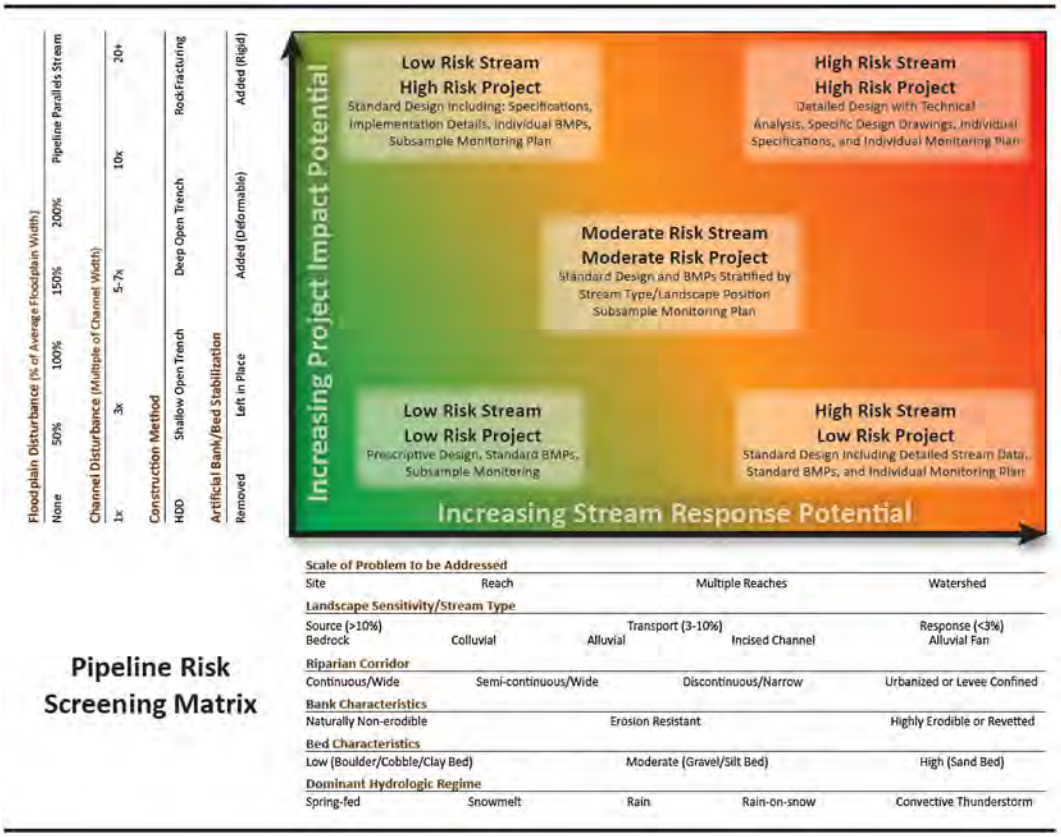

Figure 3. Pipeline risk screening matrix. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

only applicable to stream reaches with average channel slopes of less than 4% as steeper channels naturally lack functional floodplains (Castro, 1997; Montgomery and Buffington, 1998).

Bank characteristics (lateral scour potential). Streambanks may be naturally erosion resistant (because of the character of the native bank materials and the binding effects of dense vegetation) or highly erodible because of weak soils, geotechnical instability, or the removal of riparian vegetation (Thorne and Osman, 1988). In this context, streambanks that have been artificially revetted are classed as high risk because the presence of artificial protection indicates past bank retreat and naturally erodible/unstable bank materials (which prompted the need for a revetment).

Bed characteristics (vertical scour potential). The potential for rapid reductions in bed elevation through local scour, general scour and degradation is naturally limited in boulder and gravel-bed streams because of the low mobility of the bed particles and propensity for bed armouring. Conversely, channels with erodible bed materials such as sand and silt are naturally prone to rapid vertical adjustments. Channels featuring artificial grade controls are also ranked as high risk because the introduction of such measures is evidence of the potential for vertical channel instability (Little and Murphey, 1982).

Dominant hydrologic regime. The range of discharges experienced in a reach depends on the hydrologic regime, which is controlled by climatic and catchment conditions (precipitation, geology, elevation, topography, soils and vegetation). The hydrologic regime can profoundly affect stream response potential. For example, spring-fed stream systems have low flow variability and are relatively stable and predictable, while stream systems that are driven by rapid run-off from convective storms have highly variable discharges that promote channel change, making them less predictable and more responsive to disturbance. If the hydrologic regime is predicted to shift because of climate change, then the regime with the highest relative risk should be applied.

Y-axis risk factors related to project impact potential

Floodplain disturbance (average floodplain width/disturbed width). This risk element is relevant only to alluvial streams with floodplains, which generally limits its applicability to streams with gradients less than 4% (Castro, 1997; Montgomery and Buffington, 1998). In alluvial streams,

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resilience to disturbance decreases as the proportion of the floodplain that is disturbed increases. For example, if the average floodplain width within the reach of interest is approximately 100 ft (Figure 4, red line), then a perpendicular pipeline crossing would affect 100% of the average width of the floodplain. However, if the crossing was relocated to a narrower area of the floodplain within the same reach (Figure 4, green line), then the degree of floodplain disturbance would be reduced. Alternatively, if the crossing was placed at a wider part of the floodplain (Figure 4, blue line), then the extent of disturbance would be greater. The worst-case scenario, in terms of floodplain disturbance, would be a pipeline paralleling the stream within the floodplain.

Channel disturbance (construction corridor/stream width). This risk element scales the potential for the pipeline crossing to adversely impact stream habitat based on the ratio of the long-stream extent of channel disturbed to the channel width at ordinary high water. For instance, for a construction corridor 75 ft wide crossing a stream with a width of 150 ft, the channel disturbance index would be 0.5; however, the index would be much higher (5) for a smaller stream with a width of only 15 ft. The risk is higher for the smaller stream because more habitat units (i.e. pools and riffles) are likely to be impacted by pipeline installation.

Construction method. The selected crossing construction method greatly influences project impact potential. Horizontal directional drilling (HDD) is generally considered to be low risk because of minimal impacts to the stream, while rock fracturing is considered to be high risk because of the potential for streamflow to be diverted below ground through fissures created by the fracturing process. Trenched crossings have intermediate risk because of direct disturbance to the stream channel and floodplain, the level of habitat disturbance increasing with the depth to which the trench must be excavated.

Figure 4. Effect of different pipeline alignments on degree of floodplain width disturbance. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

Artificial bank/bed stabilization. This factor considers the degree to which the proposed action or project may impede the capability of the stream to accommodate future changes in flow and sediment regimes because of, for example, extreme floods, catchment land use change, or climate change. Risks are higher in streams where channel morphology, sediment transfer, and stream processes are constrained than in non-constrained systems because constrained streams lack the multiple degrees of freedom necessary to absorb disturbance (Hey, 1978).

In this context, the potential risk to resources associated with channel stabilization measures is lower for temporary, deformable bed and bank stabilization structures than for permanent, rigid ones. Deformable structures are designed to provide short-term stability (5 to 10 years) before degrading, which allows vegetation to re-establish. Construction materials for deformable structures typically include large wood, soil lifts, brush mattresses, natural geotextiles, and other forms of live materials. Rigid structures are generally designed to last longer (50+ years) and are typically composed of non-degradable materials such as rock, concrete, and synthetic geotextiles.

Determining the overall level of risk

Once all of the relevant risk factors have been assessed, reviewers and designers can screen crossings based on the overall level of risk. Risks associated with the stream and project attributes may be assessed in at least three different ways depending upon the underlying assumption:

(1) The risk associated with each factor poses a critical, independent threat of harm to the natural resource; thus, the overall risk category is defined by the highest individual risk factor on each of the *x* and *y*-axes.
(2) No factors are individually critical; thus, the overall risk category is defined by the average of the attributes on each of the *x* and *y*-axes.
(3) Some factors are more important than others; thus, the overall risk category is defined by weighting the factors on each of the *x* and *y*-axes.

Rather than using a default approach in deciding upon selection of the overall risk category, consistent, critical thinking and transparent, evidence-based decision-making is required for each project. Responsibility for correctly categorizing relative risk must rest with the individual making the decision. The Risk Matrix can be helpful in making that decision *understandable, explicable,* and *consistent*, but it should not be solely relied upon for *justification*.

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Likewise, a numerical method to rank relative risk can be added, but this should not replace best professional judgment or be a surrogate for field data.

Once the general level of risk has been assessed, the temporal aspects of disturbance can be evaluated in terms of short and long-term effects. The left side of the Risk Matrix, where the stream response potential is low, represents scenarios where the selection of crossing location, floodplain and channel alignment, and construction type dominates the overall impact. Hence, careful pipeline route planning, along with crossing design that minimizes direct impacts during construction, is of paramount importance. Because the stream has a low response potential, the focus is on reducing short-term impacts using standard BMPs. Long-term impacts are less of a risk, and randomized subsample monitoring provides a sufficient basis for post-project appraisal, maintenance and adaptive management.

The right-hand side of the Risk Matrix, which indicates high stream response potential, represents scenarios where risks related to the catchment context and stream type dominate overall impact. Hence, while minimization of construction impacts remains important, the potential for longer term responses in the stream system means that adverse impacts to habitat and species may be the greater risk. The high response potential at such crossings necessitates intensive investigations to understanding stream geomorphology and ecology and, in the case of pipelines with all but the lowest crossing impact potentials, requires individual crossing design elements, customized BMPs, and site specific post-construction monitoring.

Level of review/design/monitoring

Once projects have been screened and allocated to one of nine general categories, the level of additional data collection, analysis, design, review, and monitoring can be determined (Figure 3).

Prescriptive designs are very general and include the design approach but do not include any site-specific drawings. They are intended to be widely applicable and rely heavily upon minimization of construction footprint, impacts (e.g. dewatering/rewatering or staging of equipment) and implementation of BMPs.

Standard designs are more specific to the stream type. For example, a standard crossing design could be developed for laterally confined stream channels with slopes ranging between 4 and 6% that lack floodplains and feature step-pool bed morphologies. BMPs appropriate to this specific catchment context and stream type would also be developed.

Site-specific, detailed designs are developed individually for high-risk crossings and include both the range and depth of analysis required to reduce risks to an acceptable level at that particular site.

APPLICATION: CONTEXT

Pipeline projects are typically undertaken in several phases, regardless of what product the pipe will be carrying. The phases include the following:

(1) route selection,
(2) environmental permitting,
(3) construction,
(4) site restoration, and
(5) monitoring, maintenance and adaptive management.

Route selection and land easements

One of the most challenging, and often contentious, issues in any pipeline project is route selection. Route selection involves consideration not only of physical factors but also of social and economic issues. Once pipelines are permitted, they are granted considerable legal standing to obtain desired rights of way, but permit issuance is generally contingent on the general location of a proposed pipeline. Hence, route selection is often an exercise in avoidance of impacts to natural, archaeological, and human resources. Consideration of costs related to construction and long-term operation of the pipeline also necessitates avoidance to the extent possible of existing and proposed future infrastructure, natural geohazards or other difficult surface or subsurface conditions. This complexity leads to the development of alternative routes during the early stages of project formulation, which are then reduced to a manageable number to carry into more detailed analyses.

If land easements are not secured early in the route selection process, alternative development and risk analyses can be significantly impeded if site access is denied by property owners. In such cases, maps, aerial photos, lidar-based topography, and other remotely sensed data are employed, and a worst-case scenario for site conditions must be assumed for initial risk screening and analysis.

Environmental permitting

Once route selection has been reduced to a few feasible alternatives, the necessary federal, state, and local permits are acquired. Permitting agencies may, depending upon their regulatory authorities, focus on minimizing direct impacts to aquatic and riparian habitat, with an emphasis on maintaining channel and floodplain form and, by inference, habitat forming and maintaining processes. There is also a need to minimize off-site impacts, particularly with respect to water quality. Impact minimization is typically framed as reducing the disturbance footprint, but with dynamic stream crossings, a more sophisticated approach and context-specific design that recognizes stream sensitivity may be required.

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Problematic site conditions, such as incising or laterally mobile streams with highly erodible bed and/or bank materials, need to be identified early in the project development process because unforeseen morphological responses may result in adverse impacts both on site (migration barriers and habitat destruction) and offsite (head cutting and degradation upstream and elevated sediment delivery downstream, leading to system-wide instability), leading to the potential for long-term habitat loss with limited potential for morphological recovery or revegetation. It follows that key aspects of the crossing need to be sufficiently characterized to allow for site evaluation and restoration that supports the level of design necessary to minimize short-term impacts and ensure long-term stability to minimize the need for future maintenance and adaptive management.

By adequately characterizing conditions and preliminary plans for crossing design and restoration, the proponents of a pipeline project can expedite the permitting process because reviewers with relevant services and agencies can identify any remaining issues and alert the proponent so that the initial design can be modified as necessary to meet the outstanding mitigation and monitoring requirements.

Construction

Pipeline construction requires both an appropriate design and application of sound professional judgment and field skills to match the pipeline installation to landscape and local conditions, while also providing adequate site restoration. Consequently, the key to ensuring successful pipeline installation lies in assembling crossing design and construction teams that possess not only a robust understanding of options available for crossing the stream but also the practical experience necessary to deal with unpredictable site-specific problems as they arise.

The primary stream crossing construction methods for pipelines identified in the FERC Procedures (FERC, 2013) and used within the North America are dry ditch and open cut (Lévesque and Dubé, 2007). Dry-ditch crossing methods are categorically approved by FERC for streams up to 30 ft wide and may be constructed according to FERC by one of three different techniques: dam and pump, flume, or HDD (discussed below). Dam and pump and flume methods isolate a section of stream using a temporary coffer dam and divert the entire streamflow over or around the construction area and allow for trenching of the crossing in dry or nearly dry conditions (Figure 5). The open-cut crossing method involves excavation, emplacement, and backfilling of the pipeline trench with no effort to isolate flow from construction activities and is used on minor, intermediate, and major waterbody crossings (CAPP, 2005), however, FERC, (2013) limits the construction window with equipment in flowing water to 24 h for minor waterbodies and 48 h for intermediate

Figure 5. Typical flumed stream crossing. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

waterbodies. FERC requires review and written approval of a detailed, site-specific construction plan and scaled drawings for each major waterbody crossing (FERC, 2013).

For any method requiring a ditch or trench to be excavated in the stream bed, excavation and backfilling are generally accomplished with equipment working in or near the stream (Figure 6). A section of pipe is pulled across the bottom of the trench to the opposite bank, floated across the stream, or carried into place and submerged into the trench. The trench is then backfilled, and the bed and banks of the stream are restored and, if necessary, revegetated or artificially stabilized. During the work, sediment barriers, such as silt fencing, staked straw bales, or trench plugs, are typically installed to prevent backfill and sediment-laden water from entering the stream from adjacent upland areas.

However, not all crossings require direct disturbance of stream bed or banks. While included in FERC guidelines as a 'dry-ditch' method, HDD is an alternative method by which a pipeline is installed beneath obstacles or sensitive areas without causing a surface disturbance. Pipelines are installed in an arc under the stream; therefore, entrance and exit points can be sited well beyond active streambank margins and often beyond FERC-required buffers. Properly designed, this process involves minimal disturbance of the

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Figure 6. Backfilled crossing. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

ground surface at the entry and exit points of the HDD and no disturbance to the ground or the stream between these points. At the crossing midpoint, the pipeline is often several tens of feet below the channel bed. The feasibility and length of crossing that can be constructed by HDD is limited by factors such as access to suitable entry and exit points, subsurface conditions (geology and sediments), and pipe diameter. Use of HDD avoids most of the risks associated with construction of excavated crossings, and site restoration is limited to reinstating and revegetating the ground surface around the crossing entrance and exit points.

Site restoration

Site restoration methods and techniques depend on site conditions, stream type and channel stability prior to crossing construction, the properties of the bed and bank materials, the potential for vegetation regrowth, and how the channel is expected to respond to floods and other potentially destabilizing events during the design life of the crossing. Site restoration does not necessarily imply that a site will be returned to its pre-disturbance condition; this would be inappropriate if, for example, the stream was unstable or environmentally degraded prior to crossing construction. Consequently, site restoration may have dual and potentially conflicting aims of increased channel stability and improved habitat conditions. In such cases, restoration goals must be carefully set to avoid unacceptable environmental impacts while stabilizing the channel sufficiently to protect the pipeline throughout its design life and minimizing future maintenance requirements.

Site characterization provides a benchmark against which site restoration success can be measured. Setting minimum acceptable boundaries for channel stability and target trajectories for the environmental recovery allows designers to evaluate alternative restoration strategies. Experience shows that rigid engineering structures (bed sills and bank revetments) may be essential to protect the pipeline from bed incision or bank line retreat at or around the crossing. In such cases, the potential for local site restoration is severely limited and may not represent a prudent use of resources, making off-site mitigation a more appropriate approach.

Monitoring and maintenance

FERC and pipeline company inspections and monitoring emphasize safety and focus on detecting and avoiding the possibility of pipeline exposure, while permitting agencies are usually more focused on the possibility of adverse impacts on the environment as a result of operation of the pipeline and especially product leakage or spillage as a result of a pipeline rupture. For example, FERC often requires 3 years of vegetation monitoring to ensure soil stability along the pipeline, while pipeline companies aerially inspect their transmission projects at least annually and within a month following flood events of a magnitude sufficient to erode stream beds and banks, which informs maintenance needs (Floyd Robertson, Kinder Morgan, personal communication, August 14, 2013). Regulatory agencies, such as the FWS, may require specific monitoring of the ecological attributes of crossings, such as fish passage and riparian shade. However, a large number of federal, state, and local permits are required for pipeline construction and operation, and in practice, monitoring requirements vary between agencies.

The Framework presented here provides a vehicle with which to consolidate the diverse but overlapping monitoring and maintenance requirements of FERC, the pipeline companies, and the permitting agencies. Once basic data needs and monitoring requirements have been identified, including data resolution and temporal and spatial scales, derivation of an integrated monitoring plan becomes feasible. This has the added advantage that it supports production of a single, consolidated plan, rather than a plethora of customized plans prepared for each entity.

Because the Framework provides a single, well-documented baseline description of habitat conditions at the pipeline crossing, this constitutes an excellent foundation from which to build a comprehensive monitoring plan. The initial baseline condition can be refined and updated following pipeline construction, as field observations reveal further information and engineering adjustments are made. A thorough post-construction survey of the crossing 'as built' then provides the detailed, quantitative data against which all future surveys can be compared.

APPLICATION: CASE STUDY

The Ruby Pipeline Project (Project), completed in 2011 by Ruby Pipeline, LLC (Ruby), was the first project to use both

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the Framework and the Risk Matrix. Ruby worked directly with FWS to help create, refine and improve both the Framework and the Risk Matrix and continues to provide feedback to FWS on their efficacy and limitations.

(a) Basic stream data collection

The Ruby Project comprises approximately 675 miles of 42-inch diameter natural gas pipeline, along with associated compression and measurement facilities, extending between Opal, Wyoming and Malin, Oregon (Figure 7). There are a total of 849 stream crossings on 773 individual streams. Flow at 130 of the crossings is perennial; it is intermittent at 177 and ephemeral at 542. Ruby completed desk-based, remotely-sensed and field surveys for all these crossings during 2008 and 2009. Throughout that period, Ruby consulted with the FWS using the Framework to match basic stream data collection to the needs of FERC and the permitting agencies as well as the pipeline company (Table I).

(b) Initial screening

Once the basic stream data were collected, Ruby worked with the FWS to identify crossings that could be screened out from both further data collection and risk analysis because their potential for generating adverse impacts on habitat and channel stability was negligible.

Crossings screened out in this way included the following:

- perennial and intermittent crossings that required state-mandated fish passage designs
  - these crossings were already subject to a high level of technical and engineering review.
- irrigation canals not located in valley floors
  - these are stable channels that could be scheduled for construction when not in use, are maintained by other entities, and post-construction impacts would not be expected.
- swales and other unchanneled, fluvial features
  - these crossings have no distinct stream channel or bank features and, thus, present no risks related to scour or lateral erosion.
- crossings on very small waterbodies
  - these streams generate insufficient stream power to erode their channel boundary materials because of their low discharges and low channel slopes (as described below).

While crossings of streams with fish passage concerns, irrigation canals, and swales were screened out on the basis of qualitative assessment, those screened out because of the small size of the waterbody were eliminated on the basis of a quantitative analysis based on their bankfull discharge and depth, channel gradient, and bed grain size relative to the grain size predicted for sediment transport at bankfull discharge (MACTEC, 2010). This small waterbody screening procedure was applied to 488 crossings. Based on this quantitative analysis, 439 crossings were screened out from further assessment because they

- had insufficient stream energy to erode the channel boundaries;
- were high (>10%) gradient, non-alluvial cascades, in which channel adjustments are unlikely to propagate upstream or downstream;
- had channel boundaries that were immobile at bankfull flow; or

Figure 7. Ruby Pipeline route. This figure is available in colour online at wileyonlinelibrary.com/journal/rra

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- were sufficiently small that they posed no hazard to the pipeline even if scour and lateral erosion were to occur (specifically bankfull discharge $<2.5\ ft^3$ per second, bank height <0.5 ft).

(c) Use of the Risk Matrix

Further assessments were performed for the 340 crossings remaining after initial screening using the Risk Matrix: 35 in Wyoming, 128 in Utah, 122 in Nevada, and 55 in Oregon. Stream and site response risk variables were assessed based on field data, photographs, and topographic maps. Where construction involved blasting, the crossing was assessed as high risk on the *y*-axis regardless of the risk levels associated with other project risk factors. This is because the degree of modification of the bed and bank can be more extreme and less controllable with blasting that with normal excavation and grading. For factors assessed as lying between two categories (e.g. moderate and high), risk was categorized at the higher level. In cases where the information necessary to assess the level of risk associated with a factor was missing, the factor was categorized as being of high risk.

In terms of stream response potential (the *x*-axis of the Risk Matrix), approximately 30% of crossings were assessed as low risk, 34% as moderate, and 36% as high risk. Streams assessed as high risk tended to lack a riparian corridor and/or had fine-grained bed materials. For example, an ephemeral tributary to Eagle Creek located in Elko County, Nevada, was assessed as having a high stream response potential because of evidence of channel incision, lack of a riparian corridor, and a silt bed. Conversely, Spring Creek, a perennial stream located in Elko County, Nevada, was assessed as having a low stream risk because its stream type was classed as being colluvial. If the channel of a watercourse is classed as bedrock or colluvially controlled, then the remaining risk factors are less applicable because the stream is not fully alluvial and the risk associated with stream response potential is generally assessed as low.

In terms of project impact potential (the *y*-axis of the Risk Matrix), 75% of crossings were assessed as being of low project risk, 16% as moderate, and 9% as high. Blasting was the only factor that resulted in crossings being assessed as being of high project impact potential. For example, Maggie Creek, a perennial stream located in Elko County, Nevada, was assessed as having a high project risk because there was a high probability that blasting would be required as part of construction.

Only one crossing, on Rattlesnake Creek, a perennial stream in Elko County, Nevada, was identified as being of high risk in terms of its potential for both stream response and project impact. The factors responsible for this outcome were that the stream was found to lack a riparian corridor and that constructing the crossing was predicted to be likely to require blasting.

The outcomes of application of the Risk Matrix allowed Ruby and the FWS to focus attention on the streams and crossings with higher risks, while construction of streams and crossings that posed lower risks could be addressed in a more prescriptive manner and their crossing designs expedited.

(d) Baseline and effectiveness monitoring

Baseline (pre-construction) monitoring was completed by Ruby at all crossing sites and included establishment of permanent survey markers for the entire monitoring area, surveying of channel long profiles and cross sections, and photographic documentation from marked photo points. It was followed by implementation monitoring to provide the basis for post-construction effectiveness monitoring and appraisal. Implementation monitoring helps determine if a project was implemented as planned and designed, while effectiveness monitoring evaluates if the project had the desired physical and/or biological effect. To date (2013), one season of effectiveness monitoring has been completed for the project.

The physical and biological effectiveness of crossings will be routinely monitored for 5 years following construction through a programme of annual, visual evaluations. For crossings assessed as low risk, effectiveness monitoring will be based on a randomly selected, 10% sample. Crossings on streams with moderate risk in terms of stream response potential have been grouped according to following characteristics:

(1) limited riparian corridor,
(2) requirement for fish passage,
(3) construction required blasting, and
(4) construction required HDD.

and a random sample of 25% of the crossings within each category will be monitored for effectiveness.

All crossings assessed as being high risk will be monitored for effectiveness. To test the reliability of the ephemeral channel screening procedures discussed in the preceding texts, ten of the excluded crossings screened out in the initial site assessment have been randomly selected for further survey, analysis and effectiveness monitoring. In addition, future monitoring will include visual evaluation and reconnaissance level surveys performed at 2, 5, 10, 15, and 20 years following construction.

To date (2013), just one season of physical and biological effectiveness monitoring has been completed, and the results indicate that no mass wasting occurred at any of the sites during the first year post-construction, while bank erosion extended along less than 20% of the channel within the RoW at 76% of monitored crossings. However, the bank erosion performance target for the project is for at least 80%

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of crossings to meet this criterion within 5 years. At the great majority (85%) of the crossings where more than 20% of the bank lines were found to be eroding, erosion was associated with cattle grazing (i.e. overgrazing, vegetation trampling, and mechanical damage to the bank). It is anticipated that the target for bank erosion will be met because of continued vegetative recovery during subsequent growing seasons, coupled with fencing to exclude livestock and, where necessary, engineering measures to protect the banks at crossings where persistent erosion and/or poaching prevents natural revegetation.

Effectiveness monitoring further established that 1-year post-construction fish passage has been unaffected at monitored crossings along the Ruby Pipeline.

SUMMARY AND CONCLUSIONS

Expanding production of natural gas and oil is driving demand for new or improved pipelines, and past experience at waterbody crossings indicates that the potential for negative impacts to aquatic habitat and channel stability is substantial. To avoid adverse impacts to aquatic species while reducing the likelihood of pipe exposure, a risk-based approach to crossing design and permitting is appropriate. Stratifying crossings according to risk allows the allocation of time and resources to support pipeline design and permitting to be matched to the level of risk. Effort may then be focused on design and review higher risk waterbodies and crossings, with standard methods used to expedite treatment of lower risk streams and crossings.

The Waterbody Crossing Framework (referred to as the Framework) and the Pipeline Risk Screening Matrix (Risk Matrix) reported in this paper were designed by the US FWS in cooperation with Ruby Pipeline, LLC, to provide a robust but flexible and time-efficient approach to crossing design, review and monitoring. While the Framework and Risk Matrix were developed for the conservation of aquatic habitat and species, they are easy to adapt for other uses, including evaluation of geomorphic risks, such as channel incision and bank erosion, associated with pipeline exposure and failure. Similarly, while these tools were developed for natural gas pipelines in the PNW region of the USA, their applicability extends to any existing or proposed pipeline, regardless of geographic location or product being transported.

The Framework and Risk Matrix were both shown to be effective for structuring the evaluation of relative risk because of project implementation and stream response potential, but there is certainly room for improvement. The need for extensive field data to implement the Risk Matrix is a major limitation, especially when sites are inaccessible because of landownership or physical restrictions, as is commonly the case during the route selection process. Without the actual field data, risk factors must be assumed to be high, which may result in unnecessary rerouting of the pipeline. It can be anticipated that increased availability and applicability of LiDAR and improvements in other remote sensing technology will reduce the need for field intensive data collection.

A further limitation is that the Framework and Risk Matrix do not directly address climate change or predicted changes in the landscape because of development or land management, which is a significant limitation given the average life span of a pipeline.

Finally, additional research on how individual risk factors are evaluated and weighted would provide a more quantitative assessment of risk. This could be accomplished through forensic analysis of actual pipeline failures. Additional data analysis would also reduce the risk of overmonitoring factors that are actually low risk and missing high-risk factors.

The approach has been applied to hundreds of stream crossings along the Ruby Pipeline, demonstrating its practical utility, and experienced being gained during post-construction monitoring continues to provide insight into the efficacy and usefulness of these newly developed tools. Whether a pipeline is local or regional in nature, the Framework provides an efficient way to organize data, apply a risk-based approach, and stratify sites for future monitoring in a transparent and logical manner.

ACKNOWLEDGEMENTS

The initial Risk Screening Matrix, on which the Pipeline Risk Screening Matrix is based, was developed as part of the joint RiverRAT effort by NOAA Fisheries and the US FWS. However, the findings and conclusions in this article are those of the authors and do not necessarily represent the views of the US FWS, NOAA Fisheries, or Ruby Pipeline, LLC.

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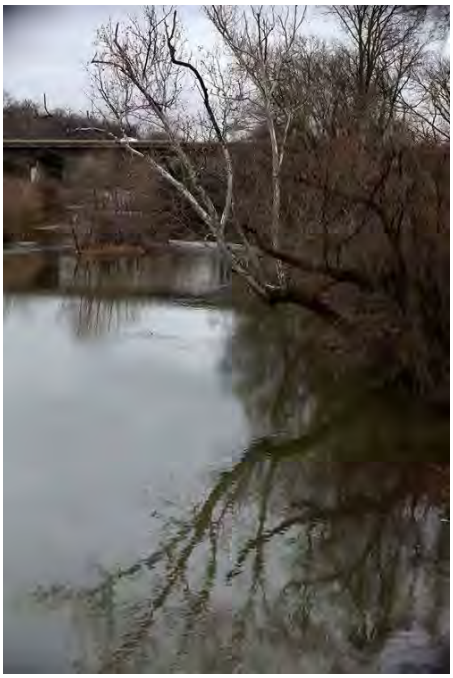
http://www.roanoke.com/business/news/pipeline-s-passage-through-the-region-would-add-sediment-to/article_170bcf60-b493-5e22-98dc-4222ac7e2df9.html

Pipeline's passage through the region would add sediment to Roanoke River watershed

By Duncan Adams duncan.adams@roanoke.com 981-3324 Mar 12, 2017



Sediment is already a worry for the upper Roanoke River.
STEPHANIE KLEIN-DAVIS | The Roanoke Times

The Roanoke River needs love, understanding and attention and not a new source of sediment.

So says Bill Tanger, chairman of Friends of the Roanoke River.

“Sediment is now the biggest problem on the upper Roanoke River,” said Tanger, who is also a member of the Upper Roanoke River Roundtable.

Dwayne D’Ardenne, storm water utility manager for the city of Roanoke, agreed that sediment already is a worry for the upper river. Sediment that settles in streams can smother aquatic life and can transport bacteria and industrial pollutants like PCBs, he said.

Enter the proposed Mountain Valley Pipeline. Although the pipeline’s current route does not pass through the city of Roanoke, city officials recently acknowledged concerns about how erosion and sediment linked to the infrastructure project could affect the Roanoke River as the waterway winds through the jurisdiction.

The 42-inch diameter, 303-mile buried pipeline would pass through the Roanoke River’s watershed in Montgomery and Roanoke counties as it transports natural gas at high pressure from Wetzel County, West Virginia, to another pipeline in Pittsylvania County.

It would cross the river itself about 1.2 miles upstream from the intake for the Spring Hollow Reservoir, a regional source of drinking water whose withdrawals from the river are suspended when sediment levels are high.

The Western Virginia Water Authority operates the 3.2 billion-gallon reservoir, which stores water before it is treated for drinking. The authority has remained neutral about the pipeline, but it has voiced concerns about the project’s potential to precipitate erosion and add sediment.

“Sediment in the river has a direct impact on the number of days we can pump out of the Roanoke River, and we do not want to reduce the number of days that we can pump,” said Sarah Baumgardner, a spokeswoman for the authority.

“While the screens on the intake pumps minimize sediments coming into the reservoir, sediment can transport contaminants and bacteria and ultimately collect in the reservoir,” she said.

No one disputes that the Mountain Valley project, if approved by the Federal Energy Regulatory Commission, will add sediment to the Roanoke River watershed.

That will be especially true during project construction.

First, a 125-foot wide construction right-of-way will be cleared of trees and other vegetation that serves to reduce runoff into the creeks that feed the north and south forks of the Roanoke River at its headwaters.

“The relatively dense tree canopy in the headwater areas intercepts rainfall so that it gently penetrates the ground as groundwater rather than flowing overland as runoff,” wrote Pamela Dodds, a geologist whose report about the pipeline’s potential impacts on watersheds in Roanoke County was submitted by the county to FERC in comments about the commission’s draft environmental impact statement for the project.

As construction proceeds, there will be trenching to a depth of about 10 feet. There will be blasting. Heavy equipment will compact soils. The pipeline’s route will take it up and down steep slopes where soil cover is already susceptible to erosion.

The pipeline itself, or new or altered roads designed to provide access to the pipeline, will cross Roanoke River tributaries, including high-quality streams like Bottom Creek on Bent Mountain.

According to a report by Environmental Solutions & Innovations, or ESI, a consultant hired by the pipeline company, increased sediment loads associated with project construction “are likely to continue downstream [in the Roanoke River] until the sediment is arrested behind the first dam (i.e. Niagara Dam) or is deposited into Smith Mountain Lake.”

Mountain Valley plans to bury the pipeline five feet beneath the bottom of the Roanoke River after diverting water and cutting an open trench across the riverbed.

From the pipeline’s crossing in the upper Roanoke River to the Niagara Dam is a distance of about 20 miles, Tanger said.

The ESI report analyzed potential watershed sedimentation tied to the Mountain Valley Pipeline’s crossing of a total of about 3.4 miles of the Jefferson National Forest.

The Forest Service criticized the report when it was first released in June 2016, suggesting it understated how long erosion from the pipeline project would contribute added sediment loads and overstated how much sediment would be diverted or captured by erosion control barriers or structures.

Mountain Valley recently submitted to FERC a revised report by ESI that acknowledges sediment loads will remain elevated for several years after pipeline construction ends. The report notes that “it is expected that sediment loads and yields will reach a new sediment equilibrium approximately four to five years from the start of the project.”

Tanger is among a host of others who worry that erosion and other sources of sediment tied to the pipeline threaten the ongoing recovery of the Roanoke River from abuses past.

In December, Rupert Cutler and Diana Christopulos — two residents of the region long recognized as knowledgeable environmental watchdogs — advised members of the Roanoke City Council that the pipeline could be a significant source of sediment for the Roanoke River.

Cutler said sediment from the pipeline could be a setback for expensive efforts to control storm water runoff and reduce contamination of the river. He said the sediment also could diminish the Roanoke River’s appeal for canoeists and kayakers as the region continues to promote itself as a mecca for outdoors recreation.

The Roanoke Valley-Alleghany Regional Commission recently received a $5,000 grant from the Virginia Tourism Corp. to help promote the Roanoke River Blueway.

Cutler was a member of the city council when it helped create the regional water authority and was a member of the authority's original board of directors. He served as an assistant secretary of agriculture during the administration of President Jimmy Carter and provided policy direction for the U.S. Soil Conservation Service, now the Natural Resources Conservation Service.

Christopulos, president of both the Roanoke Valley Cool Cities Coalition and Roanoke Appalachian Trail Club, emphasized that the pipeline's ascent and descent of steep slopes could yield an enormous amount of erosion.

And she encouraged members of the city council to learn more about the project. In February, City Manager Chris Morrill provided the council a preliminary report.

Morrill noted that the pipeline's traverse of steep slopes in Roanoke County suggests "there is a significant risk for erosion" and described as legitimate the concern of increased sediment flowing downstream into the city.

He said increased sediment could impact the city's "ability to achieve progress in reducing sediment, bacteria and PCBs" in the river.

James Golden, director for operations for the Virginia Department of Environmental Quality, said the department is well aware that the Mountain Valley Pipeline project has the potential to be a significant source of erosion and sediment along its route in Virginia.

He said the department anticipates that Mountain Valley will soon submit detailed erosion and sediment plans for the project. Natalie Cox, a spokeswoman for the pipeline company, suggested the same.

"MVP has been working with the Virginia DEQ to develop erosion and sediment control plans that meet the requirements of their regulatory program," Cox said.

Golden said Mountain Valley has agreed to pay for additional staff or consultants that DEQ might need to review the erosion and sediment plans and to have inspectors in the field if and when construction launches in Virginia.

He said the erosion and sediment plans will be posted online for public review.

Cutler said government officials must be vigilant watchdogs.

"The protection of the quality of the water in the Roanoke River is a fundamental responsibility of government — protecting health, safety and welfare," he said.

FERC is working on a final environmental impact statement for the pipeline. Mountain Valley hopes to begin construction later this year.

Duncan Adams
Duncan Adams writes about manufacturing, utilities and environmental issues.

ATTACHMENT S

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP Sedimentation Discussion
Date/Time: Tuesday, May 9, 2017 @ 3-4 pm ET
Location: Conference Call

Attendees	Forest Service (FS)	Dawn Kirk, Pauline Adams, Jennifer Adams, Karen Overcash
	GAI Consultants	Joshua Noble, Kevin Bortz
	MVP	Megan Neylon, John Centofanti, John Uhrin, Megan Stahl, Brian Clauto
	Holland and Hart	Sandi Snodgrass
	Tetra Tech	Sean Sparks
	ESI	Taina Pankiewicz
	Galileo Project	Lauren Johnston

Objectives:
✓ Discuss path to addressing FS's 04/25/2017 comments on MVP's Sedimentation Analysis

ACTIONS

- **Taina** sends the following to meeting participants:
  - Sedimentation Analysis reference documents
  - Example United States Geological Survey (USGS) study
  - MVP Erosion and sediment control plan
- **FS specialists** and contractors review sedimentation analysis reference documents
- **FS contractors** review Erosion and Sedimentation Control Plan.

DECISIONS/DISCUSSION POINTS

- Pauline summarized her concerns that the sedimentation analysis utilized annual averages to model sedimentation risks and doesn't take into account seasonal weather changes. FS and GAI were also concerned there was no way to know when construction would take place, if this was considered in the model, and if so, how time of year was taken into account. Kevin suggested without any data to backup how MVP came to its figure for percent containment, FS has no way of knowing if MVP's assumptions are accurate.
- John C and Taina said they are concerned that lowering the containment value from 79% to 48%, as was recommended in FS's comments on the sedimentation analysis, would have ramifications for the entire project analysis and would not accurately reflect the work that MVP has already done. Taina explained the 79% containment figure was based on a field test thesis paper study.
- Dawn stressed FS wants to be sure the sedimentation analysis can provide the most accurate description of impacts on the Jefferson National Forest (JNF) and in areas downstream from the forest. She cited concerns that MVP's analysis shows an increase of greater than 10% sedimentation in several areas. Taina and John C said the 10% increase figure shouldn't be limiting, and can provide USGS and FS documents that show an increase of 10% will not have a measurable effect on species for over 100 years. Pauline said FS wants to be sure the analysis presents close to a real-world scenario and not the best-case scenario for sediment containment and impacts on the JNF.
- Pauline said she would like to see additional supporting documentation for how MVP came up with their model assumptions, in particular containment efficiency. She cited a high level of public interest in waterbody crossings on the JNF and impacts to aquatic species on the JNF. Jennifer and Dawn stressed public interest is piqued due to a recent and catastrophic sedimentation control failure on JNF lands, despite monitoring and industry-standard control

plans. Dawn stressed good plans aren't enough and must be bolstered by consistent monitoring and accurate implementation.

- John C said MVP is happy to provide additional documentation to FS and to the Federal Energy Regulatory Commission docket so that FS has a defensible impacts analysis.
- Jennifer and Karen agreed filing additional sedimentation documents is not as high priority as completing the visual impacts analysis. Karen confirmed any needed changes to the sedimentation controls to mitigate for impacts can be rolled into MVP's plan of development at a later date.

ATTACHMENT T

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

FPISC Call

Date/Time: Thursday, May 18 @ 1 – 2 pm (CT)

Location: Conference Call

Attendees	Forest Service (FS)	Tim Abing, Greg Smith, Reggie Woodruff
	Federal Infrastructure Permitting Improvement Steering Council (FPISC)	Janet Fleeger, Meghan Edwards, Karen Hanley, Amber Levofsky
	Council on Environmental Quality (CEQ)	Michael R Drummond, Edward Boling
	Department of the Interior (DOI)	Erika Vaughan
	Bureau of Land Management (BLM)	Mark Mackiewicz, Stephen Fusilier
	US Army Corps of Engineers (USACE)	Meg Gaffney-Smith, Amy Klein, Chris Carson, Mike Hatten, Suzanne Chubb, Jeff Hopkins, Brian Denson, Phil Tilly, Steve Gibson
	Galileo Project	Lauren Johnston

Objective:

✓ Review MVP's schedule inquiries sent to FPISC

I. National Historic Preservation Act Section 106 (Section 106) compliance

a. BLM/FS Update: Tim indicated there is a site in the proposed Right of Way (ROW) that has undergone Phase II testing and the report is forthcoming. This site may be National Register of Historic Places (NRHP) eligible. A NRHP eligible site with an adverse effect would need a Memorandum of Agreement (MOA) to mitigate that particular site.

The newly identified site is on JNF lands in the Commonwealth of Virginia. Both agencies and the Commonwealth of the Virginia would be signatories. The FS's blanket MOA will not be sufficient. In addition, the State Historic Preservation Office has final say as to whether the Appalachian National Scenic Trail is eligible for listing on the NRHP, which would require additional Section 106 consultation.

The MOA development process should not, but could impede the 90-day decision deadline after the Final Environmental Impact Statement (FEIS) release. BLM's required 60-day congressional notification cannot be streamlined and could impede the schedule. There was a question about whether BLM can issue their ROW grant prior to completion of the Section 106 compliance. FPISC requested the agencies keep them updated on the process and corresponding time table for completing Section 106.

Post meeting note from Mark Mackiewicz: The Ruby Pipeline project offers a precedent for issuing a ROW grant for NRHP properties that would be affected by construction. MOA's for that project were issued after the ROW Grant but before any Notice to Proceed. An MOA for any sites on Federal Lands would need to be completed for the MVP project prior to an issuance of a Notice to Proceed on any Federal Lands.

b. USACE Update: USACE is waiting for the Federal Energy Regulatory Commission (FERC) to complete Section 106 consultation, as FERC is the lead agency. USACE defers to FERC regarding Section 106 completion. FS and USACE agree FERC has decided Section 106 consultation cannot be completed in pieces, but rather will review a Section 106 report when it is fully complete.

Action Item: BLM and FS continue to update FPISC re Section 106 consultation needs and progress.

Action Item: USACE follows up with FERC to determine Section 106 consultation progress.

II. Endangered Species Act Section 7 (Section 7) consultation

a. FS Update: FERC has indicated the biological surveys are complete. FERC plans to initiate formal consultation with the US Fish and Wildlife Service (FWS) when the FEIS is released, scheduled for June 23, 2017.

III. Sedimentation Analysis

a. FS recounted they have previously asked MVP for a more realistic assessment of sediment control measures in MVP's Hydrological Analysis of Sedimentation. It was settled in previous meetings that MVP would provide additional documentation and studies to the FS for review. Greg confirmed MVP and FS Washington Office have settled on a consistent and acceptable methodology for the Hydrological Analysis of Sedimentation.

IV. USACE Permitting

a. USACE said site access for surveys is limited, and the USACE 404 water permit decision cannot be complete until Section 106 and Section 7 consultation are completed by FERC.

b. USACE noted they have previously asked for additional information on how MVP plans to construct through karst and other landscape hazards the MVP project will encounter. MVP has chosen mitigation banking to mitigate the projects impacts, but USACE is unclear as to whether the MVP has purchased the necessary credits, or if the credits are available.

c. USACE said they do not foresee impacts that would delay the schedule unless MVP needs to reroute the pipeline, and as such redo surveys.

d. Meg updated the Huntington District has a 408 permit decision that will need to be included in BLM's Right of Way (ROW) grant, but they cannot complete the authority determination until the final alignment on USACE lands is complete. The Huntington district will provide BLM with any requirements for USACE lands that need to be in the ROW grant.

e. Meg stressed the USACE will, unlike FS and BLM, rely on FERC's Section 7 and Section 106 consultation processes and trust they are complete. USACE does not plan to do any additional consultation.

f. USACE updated they have been providing information directly to FERC and BLM and do not have any lingering information requests they can identify at this time.

Action Item: FIPSC plans future schedule and update calls as needed.

Action Item: BLM Huntington District follows up with FERC and BLM re ROW grant needs as needed.

ATTACHMENT U

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

MVP: Boundary Call
Date/Time: Tue, Dec 6, 2016 @ 9-10am (MT/AZ)/ 11am-noon (ET)
Location: Conference Call & GoTo Meeting

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Alex Faught, Mitchell Kerr, Tom Collins, Mary Helms, Tom Bailey, Angela Parrish
	Mountain Valley Pipeline (MVP)	Megan Neylon, Jacob Sangermano, Melissa Fontanese, Ricky Myers, John Uhrin, James Kerns
	Draper Aden	Billy Newcomb, Mike Futrell
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:

- ✓ Discuss FS expectations for pre- and post-construction treatment of FS boundaries.
- ✓ Review MVP's preliminary site-specific stabilization designs & provide additional guidance.
- ✓ Update on FS topsoil segregation requirements and progress from MVP.

ACTIONS

- **Mitch** and **Megan** follow up this week to discuss FS requirements for marking boundaries.
- **MVP** ties routing to lines and corners.
- **Megan** follows up with consultants on survey methodology and delivery date for routing profile sheets.
- **Megan** updates tracking sheet for missing/outstanding documents to include completed surveys. *Time Sensitive*
- **Megan** updates Jennifer with target delivery date for site-specific stabilization designs.

DECISIONS/DISCUSSION

- FS stressed any corners disturbed, obliterated, or destroyed during the construction process will need to be restored, and the boundary lines re-marked to FS standards post-construction. Mitchell shared two documents outlining FS requirements for boundary marking. The requirements listed in this document should be part of MVP's POD as well as stipulations to the Right of Way grant.
- FS instructed routing and planning profile sheets need to be tied to property corners. Megan stated the surveying contractors have not been tying the routing to property corners, and this may take additional surveying work, which could delay delivery of the final routing planning profile sheets. Megan also stated the surveyors do not search for property corners on private lands unless they are visible or pointed out. Mitchell instructed all property corners in the FS corridor need to be marked to ensure accuracy.
- Megan confirmed the requested routes along Peters Mountain have been completed but the updated Craig Creek Crossing has not been completed.

- Jennifer updated MVP she will be submitting an information request to the Federal Energy Regulatory Commission (FERC) project docket for instructions on additional surveys and visual analysis.
- Melissa presented site-specific stabilization design drawings for a representative steep slope area of the pipeline route in the Jefferson National Forest (JNF), as requested in the Oct 24, 2016 information request from the FS. Tom C. said the drawings are a step in the right direction to meet FS needs to review designs. Tom C. requested more detail with regards to potential for project-induced cut-slope or fill-slope failures. He also instructed FS needs to see accurate and detailed representations of how the trenches may vary based on slope steepness and construction method. Tom C. requested mass balance accounting for cut and fill, and detailed descriptions of where all spoil piles, including trench spoils, topsoil spoils, temporary ROW spoils, and if applicable, ATWS spoils, will be located in order to help assess the need for geotechnical stabilization.
- Melissa and Billy summarized slope stability analysis and potential failure hazards. Billy stressed a key to slope stability will be keeping water out of the construction sites and material. Tom C. emphasized FS wants to see drawings for the restoration including cross-sections of restoration with its cut-and-fills in relation to original ground surface and analysis of the potential for failure and long term stability of any fill left on the slope.
- Miriam requested additional analysis of potential impacts to immediately adjacent slopes. Melissa ensured this analysis would follow if necessary, however most trench-fill will be in rock, not soil. Angela stressed she wants to see further details on construction sequencing and methodology specifically in relation to placement and storage of material removed from trenches, and further post-construction stability measures if needed. Melissa assured these concerns will be addressed in the full report, which will contain construction typicals for dealing with these issues. Melissa noted she expects to file the full site-specific stabilization report in the next few weeks.
- Jennifer inquired if MVP is planning to file a document with FERC stating topsoil segregation will be added to their project proposal. Jennifer stressed if this is not added to MVP's proposal it cannot be analyzed in the FERC's Environmental Impact Statement (EIS), and this may require additional supplemental analysis after the conclusion of the FERC's NEPA process. This is because objectors to the FS decision automatically have standing if they are objecting on the basis of missing data/analysis.
- Tom B. stressed concern there could be limitations to slope contour and topsoil restoration due to steepness of slope and removal of vegetation. Tom C. confirmed the FS wants topsoil segregated and replaced everywhere where slope steepness does not prevent it. Tom would like to see MVP analyze and determine the slope gradient at which topsoil would not be stable.

ATTACHMENT V

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline Project Coordination
Date/Time: Thursday, December 8, 2016 @ 12:00-1:00pm (PT)/ 1:00 – 2:00 pm (MT) 2:00-3:00pm (CT)/3:00-4:00pm (ET)
Location: Conference Call

Attendees	BLM	Vicki Craft, Kimberly Melendez-Rivera, George Matzke
	Forest Service	Jennifer Adams, Alex Faught, Jim Twaroski, Jess Saroka, Mitchell Kerr, Karen Overcash, JoBeth Brown
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** forwards government entities comment tracking table to Karen, Rebecca, Jennifer, and JoBeth. *Complete.*
- **Galileo** adds petition and form letter tracking to comment and objection process tracking.
- **Jennifer** emails Lavinia DiSanto (Cardno) requesting information on petition and form letter tracking in the Federal Energy Regulatory Commission (FERC) process. *Complete.*
- **Galileo** submits comment and objection process tracking strategy to FS next week.
- **Jennifer** submits Visual Resources information request to the FERC project Docket.
- **Galileo** compiles BLM comments on the Draft Environmental Impact Statement (DEIS) and drafts transmittal letter for BLM DEIS comments. *Complete.*
- **Vicki** submits BLM DEIS comments to the Office of Energy policy Compliance (OEPC) by December 12.

DISCUSSION/DECISIONS

- Vicki reiterated the BLM is concerned with the lack of data and analysis in the visual resources section of the DEIS. BLM is also concerned with the lack of contingency plan for crossing the Appalachian National Scenic Trail (ANST) and potential for open-trenching. BLM biologists have expressed concern over incomplete survey data and consultation with the United States Fish and Wildlife Service.
- FS reiterated concerns regarding the still outstanding updated Craig Creek crossing and overall lack of information in the DEIS. The new FS hydrologist is still reviewing the relevant data for accuracy and completion. Alex cited general concern from agencies and the public on the lack of analysis in the DEIS.
- Jennifer stated FS is expecting Mountain Valley Pipeline (MVP) to file a response to their information request for topsoil segregation and herbicide use to get both in the FERC proposal and in the EIS for analysis.
- Jennifer noted the FS met with MVP and contractors to discuss their progress on site-specific stabilization designs. Tom Collins (FS) was pleased with the drawings and requested additional information regarding analysis of potential for project-induced slope, analysis of trench variability based on slope steepness, achievable levels of slope

restoration post-construction, and mass balance accounting for spoil piles. Tom Bailey (FS) requested detailed representation and analysis of topsoil segregation and stressed concerns on limitations to replacing topsoil and slope contour post construction.

- Jennifer noted MVP expects to file updated slope-stability analyses in the coming weeks.
- Karen updated the FS is still discussing the threshold for requesting supplemental analysis due to information missing from the DEIS. The concerns are specific to availability of data and analysis relevant to the FS decision for public comment.
- Mitch provided an update from this week's boundary/survey calls. FS is working with MVP's contractor to assist in identifying property corners and provide the FS with plan drawings that include impacted acres on FS lands if the project is approved and constructed. Mitch cited minor tweaks to the proposed pipeline route but stated the study area and proposed and temporary easements have been adequately marked. He does not recommend monumenting the Right of Way (ROW) at this point.
- Jennifer clarified the pipeline route has minor variations on National Forest System lands however the variations are within the initial study corridor. The main concern at this point for the FS is the lack of acceptable alternative for the Craig Creek crossing.
- Grace summarized Galileo's tasks for helping the FS identify and respond to FS-relevant comments on the MVP project. Galileo is coordinating with Cardno and the FS to come up with a strategy to track comments and to streamline response to objections (if received) during the FS 218 and 219 objection processes. Karen requested Galileo submit a strategy for identifying whether or not objectors have standing once the objection process begins. Grace confirmed Galileo will also search for comments not captured by Cardno which contain FS-relevant information. Jennifer noted she would as Cardno for assistance in identifying commenters on petitions and form letters.

UPCOMING MEETINGS

Internal Law Enforcement Call: Monday, December 12 @ 12:00 ET
External Law Enforcement Call: Tuesday, December 13 @ 10:00 am ET
Visual Resources Call: Tuesday, December 13 @ 3:00 pm ET
Next FS/BLM Coordination Call: Thursday, January 12 @ 3:00 pm ET

ATTACHMENT W

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

MVP Sedimentation Discussion

Date/Time: Thursday, April 6, 2017 @ 7-8 am PT /8-9am MT /9-10am CT /10-11am ET

Location: Conference Call

Attendees	Forest Service (FS)	Dawn Kirk, Pauline Adams
	GAI Consultants	Joshua Noble, Kevin Bortz
	Galileo Project	Lauren Johnston

Objectives:

- ✓ Discuss whether MVP's Sedimentation and Hydrological Analyses are sufficient to accept as part of the Final Environmental Impact Statement, or if more analyses are warranted.
- ✓ Discuss whether MVP's Sedimentation and Hydrological Analyses can be appropriately translated for Biological impacts assessment.

ACTIONS

- **Dawn** and **Pauline** check Environmental Protection Agency 2003 article reference to determine adequacy of 10% sedimentation load impact threshold.
- **Dawn** and **Pauline** confirm aquatic biota sediment standards.
- **Pauline** and **Dawn** complete and send Sedimentation and Hydrological Analysis comments to Jennifer.
- **GAI** starts review and modifications of MVP's sedimentation analysis section in the Administrative Final Environmental Impact Statement (AFEIS) as it becomes available.

DECISIONS/DISCUSSION POINTS

- Kevin Summarized his comments with MVP's analysis as follows:
  - MVP uses broad mapping and a large, watershed-scale with averaged input values across the landscape and lack of localized conditions.
  - MVP's use of analysis model is appropriate to predict erosion due to construction, but he hasn't before seen it applied to a linear project.
  - MVP's analysis may not adequately capture episodic higher intensity events and their effects on the landscape.
  - It is unclear how MVP estimated where 10% increase in sediment load would occur, without more specific analysis of stream characteristics.
- Dawn and Pauline agreed they are concerned MVP's analysis doesn't capture high intensity episodic events or localized conditions. In addition, Dawn expressed concern that cumulative effects are not evaluated far enough off of National Forest System (NFS) lands to address biological concerns and impacts downstream. Dawn emphasized aquatic species the FS is concerned about are mostly found off NFS lands, yet FS need to manage activities on NFS lands to reduce or impacts off Forest.
- Dawn and Pauline expressed concern about MVP's use of sediment threshold increase of 10% to determine where impacts would occur. Kevin said the usual standard in Virginia is to keep sediment load less than 2 tons/acre/year in order to obviate the need for mitigation. Kevin stated this standard is used to prevent impacts to downstream neighbors, and is not specific to Biology. Dawn stressed organisms respond differently to increases in sedimentation, and a 10% impact threshold to determine when impacts would occur is likely

not relevant. Dawn expressed concern that because impacts are at the watershed level, localized impacts will be hard to determine.

- Dawn expressed concern MVP's analysis might not meet her needs to estimate biological impacts, as the cumulative effects area doesn't include Stony Creek and Craig Creek.
- Pauline clarified inspection of erosion control measures and sedimentation mitigation measures needs to be specified in the FS's Special Use Permit and/or Bureau of Land Management's Record of Decision.
- Joshua, Kevin, Pauline, and Dawn agree the following points in MVP's Sedimentation and Hydrological Analyses need to be addressed:
    - Lack of background data to confirm analysis results.
    - How cumulative effects analysis areas were determined and why.
    - Potential over- and underestimate of impacts from construction activities on sedimentation.
    - Clarification on construction starting point and timeline throughout the analysis area; instruction to make sure analysis includes data for 5-7 years post-construction.
    - Clarification on whether MVP included all disturbance within the watershed, even if it was off NFS lands, in impacts analysis as previously instructed by FS.
    - Whether MVP needs to run a limited disturbance scale model to adequately address effects to smaller scale areas in addition to a whole watershed analysis.
    - Accuracy of analysis of efficacy of erosion control measures
- Pauline clarified there has not previously been a sedimentation analysis analyzed in the AFEIS, and that FS has been waiting for a sedimentation analysis for over a year.

ATTACHMENT X

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination – Special Discussion
Date/Time: Friday, Nov. 18, 2016 @ 10:30 – 11:30 am ET
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Nicole Virella John Sullivan, George Matzke, Carol Zurawski, Justin Katusak
	Forest Service (FS)	Jennifer Adams, Alex Faught, Dawn Kirk, Jess Soroka, Dan McKeague, JoBeth Brown, Ted Coffman, Tom Collins, Russ McFarlane, Carol Croy, Mike Madden, Pauline Adams, Fred Huber, Karen Overcash, Tom Bailey, Rebecca Robbins
	Galileo Project	Grace Ellis, Lauren Johnston

Meeting Objectives:

- ✓ Identify any outstanding data and analysis gaps that need to be addressed for FS and BLM to comply with their National Environmental Policy Act (NEPA) process.
- ✓ Discuss a coordinated path forward for complying with NEPA.

Path Forward:

- FS continues to compile a list of outstanding data and submits necessary data requests to the Federal Energy Regulatory Commission (FERC) docket.
- BLM drafts official letter noticing FERC of deficiencies in the Draft Environmental Impact Statement (EIS) and requesting a Supplemental EIS.
- BLM and FS follow up with DOI and OGC, respectively, in addition to FS and BLM management, for continued coordination.
- BLM and FS explore coordination with proponent to request more time for complete analysis and review.

Decisions/Discussion

In an effort to ensure both parties meet specific agency and regulatory requirements for NEPA, BLM and FS agreed to further discuss and pursue a request to FERC for a Supplemental EIS.
Agency Action Item

BLM and the FS have the following criticisms and concerns that warrant this request.

General:

- Upon review of the Draft EIS, Plan of Development (POD), and other NEPA analysis documents the FS and BLM both identified significant deficiencies and inconsistencies in the data, analyses, and conclusions presented in the document. BLM and FS are concerned these problems preclude their agencies' making an informed decision and fully complying with NEPA. To date, the BLM has not yet received the updated SF-299

right of way grant application that includes changes to the proposed route through federal lands.
- An additional point of concern is public access to and ability to comment on additional data, analyses, and plans presented after the closing of the Draft EIS public comment period. While FS acknowledges stakeholders can object to the FS actions before the FS issues their final project decisions, on the whole BLM and FS agree the FERC's EIS is inadequate for BLM and FS NEPA requirements. The volume and severity of data inadequacies would prevent BLM and FS from adopting the FERC Final EIS.

Cultural Resources:

- Cultural resource surveys are constantly under revision and not up to date. Permits to survey have not included a complete record of sites to be surveyed, and mitigation measures have been inadequate or absent in reports.
- Agency staff need to be consulted in process of identifying which sites are potential for listing in the National Register of Historic Places (NRHP).
- BLM is in the process of reaching out to tribes the FERC had potentially missed in their consultation process, including reaching out to the Ponca Tribe. ***Agency Action Item***

Visual Resources:

- The proposed pipeline route has been under revision since the first visual analyses were completed in 2015. FS has requested the proponent re-run the seen area analysis and complete surveys at leaf-off. FS stressed new Key Observation Points (KOPs) still need to be identified for new route variations (***Agency Action Item)***, and the proponent needs to complete initial narrative and photographical visual surveys to determine if additional visual simulations are needed.
- Both BLM and FS note the lack of contingency plan for potential failure of the direct bore method under the Appalachian National Scenic Trail (ANST). BLM and FS cannot support an open cut contingency plan. FS has requested, in writing and verbally, an adequate contingency plan. Jennifer will follow up on this request. ***Agency Action Item***
- FS would also like to point out the ANST is under consideration for listing on the NRHP. This has not been discussed or reflected in the Draft EIS.
- FS and stakeholders are concerned the proposed route maps do not contain the most updated route of the ANST.

Waterbody Crossings:

- FS, contractors, and proponents have discussed the crossing of Craig Creek and its unnamed tributaries on multiple occasions, have met to review proposed crossings, and FS has filed requests in the FERC docket concerning the Craig Creek crossing. FS is still not satisfied that the latest proposed crossing is consistent with the forest plan for the Jefferson National Forest and is waiting for an updated proposed crossing of Craig Creek.
- FS is still missing an updated alignment for the Craig Creek Crossings and Mystery Ridge portions of the proposed route.
- The number and type of waterbody crossings on forest lands is inconsistent throughout the Draft EIS and resource reports. Modifications to waterbody crossings are incomplete as feasibility studies have not been finalized.
- FS is concerned actions taken on FS lands can nearly directly affect water flow and supply to adjacent non-FS lands and wants to be sure these concerns are addressed.

Geology and Soils:

- Schematics for soil and erosion plans are generalized and incomplete. Mitigations are not explained in full detail in the Draft EIS or the POD.
- FS requires plans for topsoil segregation along the entire route of the pipeline. These are not reflected in the proponent's application for a right of way grant or in the Draft EIS.
- Potential rerouting around the Slusser's Chapel Conservation Site could place the proposed pipeline route through karst terrain on FS lands, which would require additional analysis.
- FS has requested multiple times to see analysis of project-induced landslides and specific data on steep slope cuts and fills. This data is still outstanding and vital to FS review of potential debris flow outside of the right of way and other catastrophic hazards related to dangerous steep slope construction.

Biological:

- Biological analyses, including an updated Biological Evaluation and Biological Assessment, are still outstanding. Numerous biological surveys have not been completed, precluding completion of analyses and conclusions.
- Analysis and surveys for threatened and endangered species do not include species likely to be listed as endangered by the United States Fish and Wildlife Service.
- The FS may require herbicide use to control invasive species along the right of way. Herbicide use on FS lands requires additional NEPA action.

ATTACHMENT Y

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Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline
Decision File Guidance

What is a Decision File?
A Decision File (DF) is a comprehensive collection of documents that illustrate the history of the decision making process for the project. The purpose of the DF is to demonstrate that the agency considered alternatives, made reasonable decisions, and complied with legal and regulatory requirements. The DF is maintained until the point at which the Record of Decision (ROD) or other decision document is issued. The DF exists in both a paper version and as electronic files.

How is a Decision File different from an Administrative Record?
These two terms are often used interchangeably but they are actually two different things. If there is a legal challenge filed against the ROD, the DF forms the basis for the Administrative Record (AR) which is assembled by the agency with input and review by agency attorneys.

What goes into the Decision File?
The DF should contain all documents considered by the agency during their decision making process. It is important to note that items should be included in the DF whether they ultimately support or oppose the agency's final decision. This is necessary in order to illustrate that the agency considered alternatives during its decision-making process. See page 3 for examples of items that are included in a DF.

How are Privileged/Confidential items handled?
Privileged/Confidential items will be stored in a secure location which may be separate from the location of other DF items.

If there is litigation, everything in the DF is subject to judicial review. Agency attorneys will determine which documents are privileged or confidential under the law, and those documents will be protected from unauthorized access.

The following items are typically considered privileged or confidential and should be labeled as such before they are submitted to Galileo Project, LLC:

- Reports or maps that reveal the location of archaeological or paleontological resources
- Proposals with cost breakdowns/contractor billing rates
- Proprietary information
- Attorney-Client privileged communications
- Items related to national security (including CEII documents)

Who is responsible for maintaining the Decision File database?
Galileo, under contract to BLM and the USFS, will maintain a joint DF. Members and staff from agency offices involved with the project are responsible for ensuring that documentation relative to their specific jurisdiction is submitted to the DF. This includes relevant information or communication associated with their office and satellite team members. If applicable, USFS and BLM contractors are responsible for submitting all relevant material associated with their contract responsibilities to the DF.

Mountain Valley Pipeline
Decision File Guidance

How do I submit items to the Decision File?
For reports, maps, presentations, oversize items, and large documents, Galileo will require both a digital and paper copy of the item. For original BLM or USFS documents such as cost reimbursement forms, the paper originals alone are fine. Galileo will scan those items to create PDF files for the digital DF.

Submissions should be sent to:

Galileo Project LLC
Attn: MVP Team
4700 S McClintock Dr, Ste 100
Tempe, AZ 85282

Emails and electronic files may also be submitted to the Galileo project staff (grace.ellis@galileoaz.com; lauren.johnston@galileoaz.com). Please make sure that any attachments referenced are included with their parent document when you submit items. Also, please include the project name in the subject line and make sure that the subject line is descriptive of the email.

When should I submit items to the Decision File?
Please submit items to the DF on a weekly or monthly basis. It is advisable to submit items on a regular basis rather than letting them accumulate. Timely submission of DF items allows for greater speed and ease in responding to Freedom of Information Act (FOIA) requests should they occur.

How do I document GIS Data?

- The metadata should include:
  - the person requesting the analysis,
  - the date of request,
  - the person performing the analysis,
  - data limitations, if any
- Final datasets and products should have documentation on:
  - steps used in the analysis,
  - specific tools or models used,
  - define datasets taken from other datasets,
  - queries used to subset the data, buffer sizes, etc.

Project Record – Checklist for *Possible* Contents

Left-hand side analysis
- Proposal Development
- Public Involvement
- EC/DC Analysis and Conclusions
- Screening for plan consistency
- Screening for laws, regulations consistency
- Background documents
  - Land management plan
  - Monitoring reports

Right-side NEPA Project Initiation*[1]
- Proposed Action description
- Purpose and Need analysis
- Project Initiation Letter
- Public Involvement Plan
- Cooperating Agency status
- Team composition
- HFRA criteria[2]
- Work Plan/Time Line

Scoping[3]
- Legal or public notices
- NOI for EIS
- Public meetings[4]/sign in sheets
- Scoping letter, package, etc.
- Mailing lists
- Comments received
- Scoping analysis/report
- Issues list*

ID Team Administration
- Meeting notes[5]
- Official communications
- Line Officer briefings
- Development of Issues*
- Development of alternatives*
- Interdisciplinary review of document

Resources – (data, reports, consultation records, etc.)
- Air Quality
- Botany
- Cultural Resources/SHPO
- Economic
- Engineering/Transportation/RAP
- Entomology
- Fire/Fuels
- Fisheries
- Hydrology
- Minerals
- Range
- Recreation
- Silviculture
- Social
- Soils
- Visual Quality
- Wilderness/Roadless
- Wildlife/BA/BE/BO
- Forest Plan consistency/amendment

EA
- Public involvement activities
- Legal notice for 215 comment period
- Comments/consideration
- HFRA/218 objection notice/process[6]
- Environmental Assessment
- Decision Notice/FONSI/legal notice
- Mailing Lists
- FSH1909.15, @18 change analysis

DEIS
- Federal Register NOA
- Legal notice per 215 or 217
- Draft EIS/Preferred Alt.*
- Mailing List
- Comment Letters/Analysis
- Response to Comments
- Public Involvement activities
- Supplemental Information Report
- Supplement to DEIS (+ all activities)

FEIS
- Federal Register NOA
- Legal notice decision/ 215/217 appeal
- Final EIS
- ROD
- Mailing list
- Public involvement activities
- Supplemental Information Report
- Supplement to FEIS (+ all activities)

Categorical Exclusions[7]

Confidential Material[8]
Include everything that **will or might** need to be protected.

Appeals/Litigation: create separate files with all appeals, letters, decisions, etc.

[1] * indicates Responsible Official approval required by FSH 1909.15, 10.41.
[2] Proof project meets HFRA requirements.
[3] Scoping required for all proposals, commensurate with scope of project.* No methods required.
[4] HFRA requires collaboration, public notice and meeting
[5] Dated, signed, attendees, conclusions

[6] HFRA projects do not follow 36CFR215: no comment on EAs;no appeals on EA/EIS; instead 30-day 218 predecisional objection period for EA/EIS.
[7] CE's may include all items except those legally required for EA/EIS, but should be smaller scale; include FSH1909.15, @30.3 conclusions.
[8] These are not available to public, but would be available to Responsible Official or a Judge.

ATTACHMENT Z

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Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

Date	Meeting Title	Reason not included	Attendees
160829	Mountain Valley BLM Coordination		BLM
160901	BLM USFS Coordination		BLM, FS
160906	NOA Coordination Call		BLM, FS
160908	MVP ACP FS Call		BLM, FS
160913	FS NEPA Call		FS
160928	BLM Decision File Discussion	PRIVILEGED	BLM
161005	BLM Jackson Kickoff	PRIVILEGED	BLM
161014	FS BLM Call	PRIVILEGED	FS, BLM
161020	BLM FS EQT Check-in		FS, BLM, MVP
161021	FS Decision File Discussion		FS
161027	FS BLM Call	PRIVILEGED	FS, BLM
161027	BLM FS EQT Check-in		FS, BLM, MVP
161025	FS EQT Check-in		FS, MVP
161101	BLM FS EQT Check-in		FS, BLM, MVP
161116	BLM FS EQT Check-in		FS, BLM, MVP
161118	FS BLM Call		FS, BLM
161121	Agency Coordination - Unknown		Unknown – No Galileo
161130	BLM FS EQT Check-in		FS, BLM, MVP
161130	FS PM Galileo Future Work		FS, BLM, MVP
161206	Boundary Call		FS, BLM, MVP
161207	BLM FS EQT Check-in		FS, BLM, MVP
161208	FS BLM Call		FS, BLM
161208	Boundary Follow up		FS, BLM, MVP
161212	Internal LE		FS
161213	MVP External LE		FS, MVP
161213	Visual Resources		FS, BLM, MVP
161215	Timber Plan		FS, MVP
170111	BLM FS EQT Check-in		FS, BLM, MVP
170119	FS BLM Call		FS, BLM
170125	BLM FS EQT Check-in		FS, BLM, MVP
170127	FS Galileo Objection Process Call		FS, BLM
170201	Craig Creek Call		FS, BLM, MVP
170202	FS BLM Call		FS, BLM
170208	BLM FS EQT Check-in		FS, BLM, MVP
170214	BLM FS Galileo PM Coordination		FS, BLM
170216	FS BLM Call		FS, BLM
170216	FS BLM Mitigation Team		FS, BLM
170222	BLM FS EQT Check-in		FS, BLM, MVP
170223	FS BLM Mitigation Team		FS, BLM, VDoF
170227	BLM FS MVP Pre Meeting		FS, BLM
170227	BLM FS MVP Coordination Call		FS, BLM, MVP
170302	FS BLM Call		FS, BLM
170302	Mitigation Call – Un-sanitized	FS Request	FS, BLM
170302	Mitigation Call - Sanitized		FS, BLM

Mountain Valley Pipeline			2017
Date	**Meeting Title**	**Reason not included**	**Attendees**
170303	Road Damage Call		FS, MVP
170307	Cultural Survey Call		FS, BLM, MVP
170309	Mitigation Call		FS, BLM, FERC, USACE, FWS,
170309	BLM FS EQT Check-in		FS, BLM, MVP
170314	Geotechnical ANST w/MVP	In Review; MVP edits	FS, MVP
170314	Law Enforcement Call		FS
170316	GAI Internal ANST review call		FS, GAI
170316	FS BLM Call		FS, BLM
170317	Mitigation Call		FS, BLM
170320	BLM Director Call (MVP FS BLM Coordination Call)		FS, BLM, USDA GenCounsel, DOI Solicitor, MVP
170320	FS FWS Call		FS, BLM, FWS
170328	FERC/BLM/FS DEIS Comments		FS, BLM, FERC
170330	FERC/BLM/USFS Geology Call		FS, BLM, FERC
170330	FS BLM Call		FS, BLM
170405	BLM FS EQT Check-in		FS, BLM, MVP
170406	FS Sedimentation Analysis Call		FS, BLM, MVP
170406	FS RMP Discussion		FS
170411	Visual Call	In Review; MVP edits	FS, BLM, MVP
170413	FS BLM Call		FS, BLM
170413	Construction Compliance Call		FS
170419	BLM FS EQT Check-in		FS, BLM, MVP
170420	MVP FS VIA Call		FS, BLM, MVP
170421	MVP Executive Team Call		FS, BLM, MVP
170425	Section 7 Call		FS, BLM, FWS
170424	BLM Atlanta Prep Call	PRIVILEGED	BLM
170426	BLM FS Decision Maker Call	PRIVILEGED	FS, BLM
170427	Maps and Figures Call		FS, BLM, MVP
170428	MVP Wetland Call		FS, BLM, MVP
170502	MVP Internal Visual Update		FS, BLM
170503	BLM FS EQT Check-in		FS, BLM, MVP
170504	FS BLM Call		FS, BLM
170508	BLM FS EQT Check-in		FS, BLM, MVP
170509	VIA Call		FS, MVP
170509	Sedimentation Call		FS, BLM, MVP
170510	VIA Call		FS, BLM, MVP
170515	Public Involvement Call		FS
170518	FPISC Call		FS, BLM, USACE, FPISC
170525	Public Involvement Call		FS, BLM
170605	MVP Executive Team Call		FS, BLM, MVP
170605	MVP Internal Culvert Call		FS
170608	FS BLM Call		FS, BLM

Mountain Valley Pipeline			2017
Date	**Meeting Title**	**Reason not included**	**Attendees**
170609	MVP External Culvert Call		MVP, FS
170614	BLM FS EQT Check-in		FS, BLM, MVP
170615	ANST Managing Partners		FS, BLM, MVP, ANST, ATC, RATC, ODATC
170616	Culvert Field Visit		MVP, FS
170619	Exec Team Call	PRIVILEGED	MVP, FS
170619	Objection /Comment Response		FS, BLM
170626	MVP Executive Team Call	In Review	FS, BLM, MVP
170630	Objection/Comment Response	In Review	FS, BLM

ATTACHMENT AA

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date: Wednesday, January 11, 2016
Time: 11:00am-12:00pm (PT)/ 12:00-1:00pm (MT)/ 1:00-2:00 pm (CT)/ 2:00-3:00 pm (ET)
Location: Conference call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore, Vicki Craft
	United States Forest Service (FS)	Jennifer Adams
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Megan** sends request to Jennifer for Joe Dawley (MVP general counsel) to meet with Joby Timm (FS Supervisor).
- **Megan** follows up with Melissa to review steep slope monitoring data in response to FS's DEIS comment information request on Dec. 22, 2016.
- **Megan** and **Jennifer** follow up re steep slope efficacy information request.
- **Jennifer** forwards MVP meeting request to FS Supervisor.
- **Jennifer** and **Karen Overcash (FS)** review Galileo's objection process strategy. Forwards to Regional Office (RO) for review as needed.
- **Jennifer** and **FS Biologists** finish Right of Way (ROW) rehabilitation suggestions.
- **MVP** completes and submits updated Plan of Development (POD), Biological Evaluation (BE), hydrological analyses, and visual analyses.
- **Jennifer** and FS biologists complete & submit herbicide plan comments to MVP docket.
- **FS RO** reviews MVP-FS Memorandum of Understanding (MOU) and Galileo-FS Nondisclosure Agreement (NDA).
- **Galileo** sends Decision File reminder email to FS teams early next week.
- **Galileo** sends Notice to Proceed graphic to BLM to potentially share with MVP.
- **Lauren** checks for BLM decision file documents & sends update to Vicki.
- **Jennifer** contacts law enforcement officials for meetings.
- **MVP** finalizes BE and sedimentation plans.
- **Megan** sends Craig Creek route map to Jennifer.
- **Jennifer** and **FS Biologists** review and discuss Craig Creek route map.
- **Grace** and **Jennifer** work through POD workshop meeting logistics.
- **Grace** and **Jennifer** schedule upcoming meetings starting next week (see table below).

DISCUSSION/DECISIONS

- Vicki emphasized the Department of the Interior's (DOI) concerns are expressed in the Office of Energy Policy Compliance (OEPC) Draft Environmental Impact Statement (DEIS) Comments. John updated he expects the Federal Energy Regulatory Commission (FERC) to submit an information request that may include the DOI concerns. John stressed if the FERC's request does not include all of those concerns MVP still plans to address them separately.
- Grace clarified Galileo is working with the FERC's contractor Cardno to help FS to review and respond to comments received on the DEIS. Galileo is also tasked with using a keyword search to make sure all FS-relevant comments are identified and addressed.

Grace confirmed this and the objection process effort will both be in a contract modification request from Galileo to MVP.

- Megan said MVP filed supplemental information relevant to the FS on December 22, 2016, including a POD response document and Craig Creek route information. Jennifer noted FS needs to review Craig Creek crossing information for compliance with the FS Land and Resource Management Plan and to ensure it addresses previously-voiced concerns.
- Megan updated MVP plans to file an updated POD, BE, and updated visual and hydrological analysis in the coming few weeks. Megan requested an in-person law enforcement meeting and conservation measures meeting be prioritized to help meet these deadlines with sufficient documents. Jennifer noted FS is working to complete their discussion on the ROW rehabilitation measures necessary to hold these meetings.
- Jennifer reiterated her request for a discussion of the efficacy of steep slope stabilization measures based on available monitoring data from EQT and/or other projects that have steep slopes.
- Miriam clarified pre-construction measures MVP needs to complete before a Notice to Proceed (NTP) can be issued will be given to MVP in advance and are usually included as conditions of the Record of Decision.

Next MVP/FS/BLM Meeting: January 18, 2017 @ 2:00 pm ET

Upcoming Agency/Proponent Meetings			
Meeting	**Attendees**	**Timing**	**Comments/Action Items**
Conservation Measures	FS Biologists, Vicki, Miriam, Megan, MVP contractors, Galileo	January	**Jennifer** works with FS specialists to complete internal conservation measures discussions.
Law Enforcement	FS Law Enforcement Officers, BLM Law Enforcement Officers, MVP contractors Vicki, Miriam, Galileo	January	**Jennifer** forwards sample Law Enforcement information to Megan as needed. **Jennifer** obtains law enforcement officer availability. **Megan** forwards portions of the POD relevant to FS law enforcement to Jennifer.
POD workshop	FS & BLM resource specialists, Vicki, Miriam, Megan, MVP contractors, Galileo	Mid/Late February	**MVP** completes edits to POD and submits to FS. Short successive meetings scheduled by resource. Combination of in-person and GoTo.
ROW Rehab	FS & BLM resource specialists, Vicki, Miriam, Megan, MVP contractors, Galileo	February	**Jennifer** works with FS specialists to complete ROW review.
Timber Plan	FS & BLM resource specialists, Vicki, Miriam, Megan, MVP contractors, Galileo	TBD	**Megan** and **Russ** follow up re Timber comment questions. Meeting can be avoided if Russ can answer Megan's questions, including concerns in the Inventoried Roadless Area.

ATTACHMENT BB

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Friday, March 17, 2017 @ 3:00-4:00pm (Eastern)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Bruce Dawson, Kimberly Melendez-Rivera, Nicole Virella, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Tim Abing
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** emails Paul Friedman (Federal Energy Regulatory Commission, FERC) and Lavinia DiSanto (Cardno) requesting their availability for Draft Environmental Impact Statement (DEIS) comment and Geology discussion calls. *Complete.*
- **Galileo** updates the 03/20 High-level coordination meeting agenda to include "Response to Comments" and "Mitigations". *Complete.*
- **Galileo** drafts an annotated agenda for the 03/20 High-level coordination meeting. *Complete.*
- **Karen** considers next steps for addressing DEIS response to comments with FERC.
- **Tim** drafts mitigation Memorandum of Understanding (MOU) for team review.
- **Jennifer** emails Mary Krueger (National Park Service, NPS) re the planned upcoming Appalachian National Scenic Trail (ANST) crossing meetings with MVP, informing her of FS participation plans. *Complete.*
- **Jennifer** continues to update FS management on attendance at the ANST crossing meetings in early April.

DECISIONS/DISCUSSION POINTS

- Tim updated that the FS is no longer pursuing a formal mitigation rule. Tim expressed his concerns over the MOU development as related to which parties should be involved and have regulatory authority to require mitigation.
- Jennifer stated FERC has not yet updated the schedule and that the initial key milestones in the Notice of Schedule issued by FERC have already passed and are no longer valid. For example, FERC's original schedule showed March 10, 2017 as the issuance date for the FEIS. Jennifer and Tim stressed concerns regarding the DEIS comments and project schedule.
- Grace reviewed that Galileo identified additional potentially-relevant FS comments using the short list of FS-approved keywords in Cardno's master comment list. After removing the comments previously sent to the FS for review, Galileo identified roughly 300 additional potentially relevant comments. Jennifer stated Karen Overcash also identified comments she was expecting to receive from Cardno for the official DEIS comment response but did not. Tim expressed concern over the missing comments and stressed the need to meet with Cardno and FERC to discuss their comment forwarding process.
- Galileo reviewed and BLM/FS provided updates to the high level coordination agenda. Bruce's requested additions are listed in the action items above. Tim and Bruce confirmed BLM and FS want to discuss mitigation with MVP at their next high level meeting on Monday, March 20th.
- Tim noted MVP is performing a Habitat Equivalency Analysis (HEA) for the length of the pipeline route. BLM and FS hope to discuss this with MVP on the upcoming high level coordination call to get more detail about how the HEA was performed and how the

output will be used for mitigation determinations. Tim said he would like to see a breakdown of the HEA by land ownership/regulatory authority. Tim also said it's important for FS to express their preference for a landscape-scale mitigation strategy.

- Jennifer updated that the NPS is requesting FS participate in two day-long meetings to discuss the MVP project and the ANST with managing partners. BLM and FS are concerned the meeting would detract from FS efforts on document reviews and is not necessary for FS and/or BLM personnel to attend. Jennifer suggested it might be appropriate for a Public Affairs Officer to attend, and that she would follow up with FS management accordingly. Bruce said BLM feels the meeting might pose more risk than reward given the FS and BLM are cooperating agencies for the MVP project while the rest of the ANST managing partners are not. ***Post Meeting Note:*** *Jennifer requested and still has not received an agenda from Mary Krueger (NPS) re the meeting's purpose. Jennifer will continue to coordinate with NPS via phone.*
- Jennifer confirmed the FS is responsible for issuing the Special Use Permit to cross the ANST and the NPS will not be involved with that permit.

ATTACHMENT CC

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

MVP & ACP: Pipeline Comment/Future Galileo task discussion
Date/Time: Wednesday, November 30 @ 9:00-10:30 am (MT/AZ)/ 11:00am – 12:30pm (ET)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Alex Faught, Karen Overcash, Karen Stevens, JoBeth Brown
	Galileo Project	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston, Ellen Hopp

Objectives:
- ✓ Review current scope of work (SOW)
- ✓ Identify additional project needs, including:
  - ✓ Tracking Filings
  - ✓ Objection Process Support
  - ✓ Additional Document Review Support
  - ✓ Additional Meeting Support
- ✓ Identify assumptions and deliverables for out of scope tasks
- ✓ Answer Questions About Project Assistance Contracts

Galileo Contract Modifications:
- ✓ Additional meetings each month
- ✓ Additional General Support Hours
- ✓ Comment & Objection Process Tracking
- ✓ Plan of Development (POD) support

ACTIONS

- **Galileo** writes draft contract modification for Mountain Valley Pipeline (MVP) and Atlantic Coast Pipeline (ACP) tasks.
- **Galileo** and **Megan Neylon (MVP)** discuss contract modification and reaching out to 3rd party contractors on weekly MVP/FS Check-in call. *Complete*
- **Galileo** drafts contract modification email for Jennifer to send to Richard Gangle (ACP).
- **Galileo** coordinates with Federal Energy Regulatory Commission FERC contractor, Cardno, to clarify comment tracking process and Forest Service deliverables.
- **Galileo** forwards draft contract mod to Jennifer, Karen S. and Karen O. for review
- **Galileo**, **Karen O.,** and **Karen S**., **Alex**, and **Kent Karriker** (FS) follow up on contract modification and objection process deliverables late next week.
- **Jennifer** forwards contract modification for internal review.
- **Galileo** schedules a call with Jennifer (Jan) to review the construction monitoring plan.
- **Jennifer** sends excel file of scoping comments to Galileo.
- **Jennifer** and **Galileo** follow up to confirm document access and reviews for FS.

DISCUSSION/DECISIONS

- Grace reviewed the meeting objectives and current scope of work, described in slides 3 and 4 of the attached PowerPoint. Maria confirmed additional out of scope support, including litigation assistance, is paid for by the proponent.

- Peter reviewed the reviews and searches FS has asked Galileo to perform, which include searching for government entity comments, tracking down FS-relevant filings from the proponent, and tracking documents which need FS review. These are to help the FS accurately and efficiently identify documents pertinent to their decision.
- Jennifer requested Galileo continue to review internal FS comments for formatting, duplication, and grammar, especially with future reviews of the POD. Jennifer also approved adding more hours for meetings and follow up as well as other general support for project teams to improve efficiency of action item follow up and other tasks.
- Grace reviewed the documents received from Cardno, which include twenty-one comment letters received since the Draft Environmental Impact Statement (DEIS) was released, and a comment-response document identifying comments that need response from the FS and/or the Bureau of Land Management. Jennifer echoed concerns the contractor might not be capturing all of the relevant comments. Jennifer also noted she will send Galileo the scoping comments for objection standing review and comment-response tracking.
- Jennifer approved Galileo to start working with Cardno to identify what the FS needs for comment analysis. FS requested contact information as well as comment compilation, content analysis, and assistance in identifying commenters with objection standing to the FS decisions (See conceptual draft output below). Galileo will also assist FS in tracking responses in the final NEPA document. These review efforts require additions to the Galileo SOW and would consist of the following effort:
    - Work with EIS contractors to find efficiencies in using their database to pull necessary information for inclusion in the objection tracking database.
    - Initiate compilation of scoping comments
    - Initiate preliminary identification/compilation of FS-associated comments, including identification of representative comments.
    - Develop preliminary list of comments that need FS response or action. Target: 2 weeks after contractors provide updated comment tables.
    - Populate objection tracking table once all DEIS comments are processed by contractors.
    - Assist FS with addressing decision points and responding to comments.
    - Work with EIS contractor to identify where comments were addressed in the EIS.
    - Develop standalone report with methodology, representative comments, and responses.

Draft Output Table

Name	Org.	Mail	Email	Date	Letter	Comment	Response	Action	EIS Reference

ATTACHMENT DD

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP FS BLM Executive Team Coordination
Date & Time: Friday, April 21, 2017 @ 11:00am – 12 pm Eastern
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Karen Mouritsen, Mark Mackiewicz, Vicki Craft, Sally Spencer
	Forest Service (FS)	Jennifer Adams, JoBeth Brown, Joby Timm, Karen Overcash, Tim Abing
	USDA Office of General Counsel (OGC)	Sarah Kathmann
	BLM Solicitor's Office	John Henson
	Mountain Valley Pipeline (MVP)	Joe Dawley, John Centofanti, Megan Neylon, Rebecca Watson
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **FS** and **BLM** continue internal mitigation discussions.
- **FS** and **BLM** continue review of MVP documents (POD, SF-299, etc).
- **FS** and **BLM** continue discussion National Historic Preservation Act (NHPA) Section 106 consultation needs.
- **John** and **Megan** forward potential Appalachian National Scenic Trail (ANST) meeting agenda topics to **Galileo.**
- **MVP** submits the Habitat Equivalency Analysis (HEA) and Migratory Bird Conservation Agreement (MBCA) by the first week of May.

DECISIONS/DISCUSSION POINTS

- Karen updated that BLM will continue to work with MVP, as appropriate, to complete Endangered Species Act Section 7 Consultation, NHPA Section 106 Consultation, and edits to MVP's Plan of Development (POD) in an effort to stay on the Federal Energy Regulatory Commission's (FERC) schedule and issue a Record of Decision (ROD), with decisions on concurrence, from the FS and United States Army Corps of Engineers.
- Mark said FERC can issue their Certificate of Convenience and Public Necessity with conditions to complete Section 7 Consultation and Section 106 Consultation afterwards, but it is the BLM's policy to have complete Section 7 and Section 106 consultation before signing a ROD on the application for a Right of Way (ROW) grant.
- Joe questioned why BLM could not go forward with their ROD since FERC is the lead for Section 106 consultation per the Natural Gas Act (NGA) and has conducted consultation for the FS lands affected by the project. Joe also expressed concern that MVP cannot complete Section 106 or Section 7 surveys on the entire route as MVP has been denied access to some private lands in West Virginia, which they can only access if they are given eminent domain per a FERC Certificate.
- Mark said BLM needs to have additional conversations with FS and BLM cultural specialists to determine if FERC's Section 106 consultation is adequate for BLM's and FS's needs. Mark also said he is concerned there doesn't appear to be Memorandums of Agreement between Section 106 consulting parties. He noted these agreements take time. BLM will determine if MOAs need to be completed for BLM to sign a ROD or ROW.
- Rebecca expressed her concern that the fundamental process questions, the likes of which the NGA tries to streamline, are being raised very late in the National Environmental Policy Act (NEPA) process. This could lead to financial penalties for MVP through fault of federal agencies. Karen and John H agreed the process concerns are important and being discussed internally. The BLM's focus is developing an adequate,

defensible document that meets FS and BLM needs as the basis for their respective decisions on the project.

- Rebecca questioned the need for an Interior Board of Land Appeals (IBLA) appeal process, and cited cases against the Ruby Pipeline Project which were taken directly to the relevant circuit courts. Mark confirmed the BLM is discussing the appeals process and procedures internally.
- John Henson clarified the FS objection process is required before the FS can issue their ROD for their plan amendments associated with the project, and subsequently consider concurrence with the BLM's ROD. Tim clarified the FS objection process is a pre-decisional process, meaning their decisions on the Land and Resource Management Plan (LRMP) amendments are not final until after the objection process.
- Joe said MVP hopes to have all federal permits completed, signed, and received by November 1, 2017.
- Joe expressed his concern that FS and BLM have MVP stuck in a "do-loop" with open-ended and dynamic data and analysis requests, citing the FS's recent request for additional photographs in the Visual Impacts Assessment. He stressed the agencies need to be happy at some point with the data and analyses they have, and that MVP feels they have provided adequate data and analysis.
- Jennifer and John C agreed MVP's VIA was well-received by the FS, and that MVP can submit the VIA once completed, adding additional requested photos in the near future. Jennifer noted the analysis needs to meet FS standards in order for them to make a defensible decision. Jennifer clarified FS offered to help identify points for additional requested photos, and MVP and FS have already agreed on a path forward regarding this concern. Job stressed, especially with regard to visual impacts, there is a very high level of public attention on the Jefferson National Forest.
- Jennifer clarified FS and BLM want to see all MVP-agency correspondence, as some of it might tie into the FS's LRMP amendment decision and/or BLM's ROW grant. Jennifer also clarified MVP needs to correct the GIS data layers from the April 2016 soil report recently filed in the FERC docket. She said she wants MVP to make sure the incorrect data layers are corrected in any other documents in which they might have been used.
- Karen updated BLM and FS are working on determining what mitigation measures need to be included in the Plan of Development and as conditions on the ROW grant. Tim clarified FS will need to see the HEA to help assess needed mitigation measures. MVP confirmed the HEA is done, however they are still waiting on comments from the Virginia Department of Conservation and Recreation. Joe said information from the HEA will be included in the MBCA as well. He expects both documents to be filed by early May.
- Karen concluded the discussion saying the BLM is concerned about the volume of information that the public has not had a formal opportunity to comment on. Joe said MVP is aware the project could be litigated and wants to help make sure the NEPA process and document are defensible.

Upcoming Meetings:

ANST Managing Partners Discussion **- Friday, May 12th @ 8:30am – 12:30 pm (ET)**
HEA update **– Friday, May 12th @ 1:30-2:30 pm (ET)**
Executive Coordination Update **– Friday, May 12th @ 2:30 – 3:30 pm (ET)**

ATTACHMENT EE

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Internal FS Law Enforcement Call
Date/Time: Monday, December 12 @ 12:00-1:30 pm (E)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Kent Karriker, Alex Faught, Julie Fosbender, Roni Etheridge, WJ Cober, Gavin Hale, Kim Stadtmueller, Mike Madden, Ted Coffman, James Willet, Rebecca Robbins, Peter Irvine, Katie Ballew
	Bureau of Land Management (BLM)	Miriam Liberatore
	Galileo Project	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston

Objectives:

- ✓ Determine agenda items for law enforcement discussions with pipeline proponents to consider if pipelines are approved through National Forest lands.

ACTION ITEMS

- **James** forwards Law Enforcement questions and needs document to Peter R. for distribution.
- **Maria** updates and forwards agenda to participants for review and edits.
- **Katie** confirms law enforcement cost recovery requirements for the proposed pipeline projects, if approved and constructed.
- **Jennifer** works with Department of Transportation to confirm any restricted activities in the construction Right of Way (ROW) for potential pipeline projects.
- **Participants** review relevant project documents prior to law enforcement discussion with pipeline proponents.

DISCUSSION/DECISIONS

- An updated external law enforcement call agenda reflecting FS concerns is attached to this agenda.
- FS expressed concerns about public exploitation of ROW to access the forest from sites not approved for public access, if pipeline projects are approved and constructed. This could result in damage to existing cultural, heritage, and archaeological sites; poaching; encroachment on wilderness areas; and unauthorized access via off-road vehicles. Mike emphasized concern about potential for archaeological sites to be raided stating significant monitoring would be needed. Mike also expressed concern for unapproved access to important sites during surveying or project implementation.
- Mike stated he is extremely concerned with the forest service Heritage team absorbing monitoring and ARPA related costs for this project long after potential project implementation. Cost recovery for long term heritage monitoring, site stabilization, etc.

need to be addressed looking not only at current issues but also those encountered much later on.

- Peter I. stressed proponent construction/development plans need to be updated to reflect law enforcement responsibilities along the entire proposed ROW, and not just at crossroads and likely access points, to ensure recreation only happens on appropriate roads and trails. Katie noted this will include surveillance camera work and increased FS law enforcement patrols.
- Katie noted that there will be long term effects from the potential pipeline construction long after it is completed. Increased levels of illegal activities will occur on pipeline route right-of-way requiring increased patrolling-monitoring by law enforcement (LEI) and increase the potential for other LEI costs that have occurred in similar environs (I.E. dumping of methamphetamine chemicals and lab equipment requiring clean up, illegal atv use requiring repair, poaching, etc.) These activities will increase costs for LEI not covered by forest budgets.
- The Forest Service noted that any closure orders will require additional NEPA documentation and analysis before they could be approved. The NEPA procedures for closure orders will be outlined in MVP's Plan of Development and the ACP COM Plan.
- Miriam stated the BLM will make sure FS law enforcement stipulations are in the ROW grant written by BLM.
- Katie stressed the FS is not equipped to handle protests and/or emergencies on its own. Allocation of law enforcement responsibilities, including cost recovery, in the short and long terms needs further discussion.
- James expressed a need for the proponent to identify needed safety measures for dangerous areas along the ROW if the pipeline if constructed. This includes road closures, extra enforcement, and proper regulations. James also noted the proponent needs to outline a plan to coordinate with agencies to make sure proponent employees/contractors know relevant regulations and restrictions during and after construction, if approved.

ATTACHMENT FF

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

USFS DROD Relies on Insufficient and Faulty Analyses
of
Nonnative Invasive Plants in MVP and FERC Documents

Summary

The Forest Service Failed to Recognize the Introduction of Nonnative Invasive Plant Species (NIPS) Species as a Significant Issue, Failed to Address the Best Available Science, and Disregarded Expert Comments About these Threats

The USFS Draft Record of Decision (DROD; 23 June 2017) proposes approval of amendments to the Land and Resource Management Plan (LRMP) for the Jefferson National Forest (JNF) in order to facilitate the construction of the Mountain Valley Pipeline Project (MVP), which would otherwise violate current LRMP standards for soil and water conservation. The DROD itself offers no consideration of the critical ecological and economic threats presented to the JNF by nonnative invasive plant species (NIPS), whose proliferation will be enabled and accelerated by construction of the MVP as currently proposed. Such NIPS have recognized negative impacts on native plant communities, soils, and water quality in the JNF, and therefore should have been thoroughly evaluated in the DROD. Instead the DROD relied completely on flawed and incomplete analyses of NIPS presented by the Federal Energy Regulatory Commission (FERC) in its Final Environmental Impact Statement (FEIS) for the MVP.

The FEIS failed to address repeated filings by qualified natural-resource management experts who presented extensively documented scientific evidence that NIPS will become a serious and costly land-management problem for the life of the proposed MVP and beyond. The Forest Supervisor for the JNF was repeatedly informed of these analytical shortcomings in the FERC documents, but also ignored these facts. The DROD failed to consider NIPS as a significant issue, failed to evaluate these direct threats to the JNF, and failed to respond to the filed comments, all in violation of NEPA. Thus the DROD failed to fully and effectively document how the Best Available Science was used to inform the assessment and proposed

decision, in violation of 36 CFR § 219.3. The threat of NIPS is of particular concern because the pipeline would introduce these invasive species into Wilderness, Inventoried Roadless, and Old Growth areas, and there has been no monitoring program added to the Forest Plan to document the spread of NIPS, all in violation of 36 CFR § 219.12.

Furthermore, the DROD failed to specifically address the requirements of Executive Order 13112 (Invasive Species; 3 February 1999) and Executive Order 13751 (Safeguarding the Nation from the Impacts of Invasive Species; 8 December 2016), which have obvious direct applicability in this case.

The current DROD is fatally flawed. It therefore must be withdrawn, appropriately modified, and properly reissued with an appropriate public objection period to follow.

Supporting Arguments

1. Preserve Craig, Inc. filed extensive, scientifically supported comments on the serious and potentially costly threat of non-native invasive plant species (NIPS) to forest ecosystem integrity in June 2015 ***(PF15-3-000, Accession 20150616-5193, Economic and Environmental Impacts of Invasive Plant Species***). This filing was more than 40 pages of detailed and heavily referenced analysis regarding the threat of ecological and economic damage by NIPS on the proposed Mountain Valley Pipeline (MVP). This document included more than 200 specific literature references, the majority of which were peer-reviewed scientific studies and analyses published in credible scientific journals.

   Preserve Craig's analysis detailed the following threats to the Jefferson National Forest:

   a. Removing forest cover will open the ROW to invasion by a variety of economically and ecologically damaging invasive plants species.
   b. Invasive plant species will be spread by wild animals, particularly white-tailed deer and various bird species.
   c. Invasive plant species will penetrate the intact forest on either side of the pipeline, and multiply the effects of pipeline construction and operation on a much broader footprint than just the right-of-way (ROW).
   d. Invasion of adjacent forest and non-forest lands, both public and private, will create expensive control problems for both private landowners and land management agencies.
   e. Establishment of a linear ROW with extensive edge habitat will create an "animal highway" that will be heavily utilized by white-tailed deer. Deer populations in the area of the ROW will likely increase, extensive and rapid deer movement along the ROW will increase vehicular accidents at ROW/road intersections, and increases in both deer populations and deer movement will increase the spread of deer-vectored diseases (e.g., Lyme disease).

2. MVP's response (***PF15-3-000, Accession 20150630-5383***) to these scoping comments was scientifically and logically inadequate.

   a. Their meager response to Preserve Craig's 45-page filing amounted to barely 200 words, as follows:

> *"Revegetation, control of invasive species, and maintenance of permanent easements is addressed in Resource Report 1, Resource Report 3, and the FERC Plan. Understanding the importance of native habitats and the impact of non-native invasive plant species, MVP is committed to using native seed mixes from a reputable seed supplier for restoration efforts. MVP is working closely with the Wildlife Habitat Council in addition to regulatory agencies to utilize native seed mixtures and successfully restore native habitats after construction to the greatest extent practicable. Per FERC's Plan, MVP will utilize truck wash stations and inspection programs to ensure that equipment comes onto construction work areas clean and free of invasive plant material. MVP has also committed to not utilize pesticides or herbicides during construction and right-of-way and facility maintenance (unless requested by a land management agency) allowing long term usage of the right-of-way for pollinators. Restoring the right-of-way using a combination of quick establishing species and a variety of additional native grasses, forbs and wildflowers has the potential to provide a wide array of benefits. Timely reseeding of the disturbed area minimizes the window of opportunity for non-native invasive species to establish. Seeding with native species also minimizes the potential of unintentionally introducing other nonnative species into the habitat."* (p. 14)

b. This response primarily repeated the original unsubstantiated statements from their Draft Resource Report 3 (***PF15-3-000, Accession 20150424-5295***) and offered no specific response to Preserve Craig's detailed analysis that demonstrated severe shortcomings in their restoration plans as related to NIPS. Furthermore, their response did not include a single scientific reference either to counter the Preserve Craig analysis or to support MVP's contentions. Thus, their response can only be taken as a statement of unsupported "opinion" written by someone whose credentials to offer such an opinion are never identified. **Their contention that planting "native seed mixes" of grasses and forbs in forested areas will prevent the establishment of invasive plant species demonstrates either MVP's (and FERC's) lack of scientific understanding of plant ecology and forest ecology, or their disregard for scientific evidence to the contrary.** To wit:

   i. Grasses do not represent "native species" in a forested habitat.

   ii. Such seeding will likely fail, as has been seen in the cases of documented failures of erosion and sediment controls on a recently installed gas pipeline in the Jefferson National Forest in Giles County, VA and other pipelines elsewhere in West Virginia (see ***PF15-3-000, Accession 20150616-5335***, p. 7; and ***PF15-3-000, Accession 20150616-5364***).

iii. Such restoration failure is virtually guaranteed when "seeding" is on shallow and poor mountain soils, and is further exacerbated by the likely erosional failure of such restoration effort on extreme slopes (***PF15-3-000, Accession 20150616-5364*** and ***PF15-3-000, Accession 20150615-5296***).

iv. Neither MVP nor FERC has offered ***ANY* evidence (scientifically credible or even anecdotal) that seeding Appalachian mountain slopes as steep as those proposed has ever been successful to either stabilize soils on steep slopes or to prevent the establishment of invasive plant species.**

c. MVP offhandedly dismissed scientifically supported concerns about negative consequences of deer-human interactions with a single, unsupported sentence: "*The Project is not expected to have a measurable impact on deer populations*" (***PF15-3-000, Accession 20150630-5383;*** p. 13). They offered no evidence, scientifically credible or otherwise, to support their contention or to counter the extensive scientific evidence to the contrary that Preserve Craig presented. In particular, increased deer populations in close proximity to human settlements have been implicated in an increased occurrence of deer-vectored human diseases (Morse 1995: attached here as ***Appendix A***).

3. In September of 2016 the FERC issued the Draft Environmental Impact Statement (DEIS) for the MVP project. **The DEIS claimed (without any supporting evidence) that environmental impacts of the project on plant communities would be reduced to tolerable levels by MVPs adherence to restoration BMPs and by the use of native plants species in that restoration.**

a. In the DEIS, FERC noted that MVP would prevent erosion by following appropriate BMPs, including "*revegetation using seed mixes recommended by the Wildlife Habitat Council*" (p. 4-65). FERC further noted that MVP "*would attempt to minimize impacts on the National Forest by … revegetating temporary and permanent workspaces with native seed mixes as directed by the Wildlife Habitat Council*" (p. 4-169).

b. MVP issued a full-color brochure (MVP 2015a; attached here as ***Appendix B***, and at http://www.mountainvalleypipeline.info/~/media/sites/mvp/files/MVP-Restoration-Plan-by-WHC.pdf) designed for MVP by the Wildlife Habitat Council (WHC), which touted benefits to wildlife and the ecosystem of using native species in a project-tailored planting plan. This brochure implied that MVP would conscientiously adhere to such an expensive but

responsible plan, and listed recommended seed mixes designed by WHC specifically for the MVP project that would enhance wildlife habitat values, particularly for pollinators.

c. MVP also issued an "advertorial" (MVP 2015b; attached here as ***Appendix C***, and at https://www.mountainvalleypipeline.info/~/media/sites/mvp/files/EQT_MVP_Ecological_Resources_Advertorial.pdf) touting their concern for environmental integrity and protection, and their purported "partnership" with WHC.

d. ***Contrary to all these claims,*** the DEIS described restoration plans that included seed mixes very different from those recommended by WHC, and the DEIS-listed plans actually proposed **intentionally planting several notorious NIPS** as part of MVP's "restoration" plan.

   i. Seed mixes listed for use in **West Virginia** (see the FERC DEIS, their Appendix N-11) included only one option for native warm-season grasses and wildflowers, but even this mix was not the "WHC-designed customized mix" advertised earlier by MVP and WHC. In fact, the seed mix listed is one designed by a seed supplier for the Piedmont ecological region, not the Appalachian Mountains. Other seed-mix options did not include even those Piedmont grasses and wildflowers, and were dominated by nonnative species. These mixes include the nonnative grass Tall Fescue which is a well-known invasive species classified as such by the USFS themselves (USFS 2005; attached here as ***Appendix D***). WHC itself classified Tall Fescue as "non-beneficial" to wildlife in the custom "Native Restoration" plan that they designed for MVP (see MVP 2015a, attached here as ***Appendix B***).

   ii. Seed mixes listed for **Virginia** (see the FERC DEIS, their Appendix N-12) were even worse. No mixes included native warm-season grasses and wildflowers (and thus offering little benefit to pollinators, as they claimed). Like West Virginia, planting mixes suggested for Virginia also included the invasive nonnative Tall Fescue, and added another notoriously invasive species, Crown Vetch (classified by USFS as an NIPS that presents "a serious management threat" (USFS 2006: attached here as ***Appendix E***).

   iii. **It appears that MVP never had any intention to follow the recommendations of WHC**, and that FERC is complicit in presenting MVP's "relationship" with WHC for propaganda purposes only.

iv. **Furthermore, MVP's proposal (and FERC's early implicit concurrence) to use known invasive plant species for "restoration" indicates that they either have no credible expertise or advising consultants versed in the subject of ecological restoration, or they simply have no intention to spend additional funds to try reduce the multiple and severe environmental impacts of their project.**

4. MVP's plan for control of invasive plants, as outlined in the DEIS, almost completely ignored the issue that human activities are but one of many vectors for the spread of invasive plant species.

i. They simply described plans to use "native" plant species for restoration efforts, and to wash construction equipment to prevent vehicle-vectored transport of invasive plants.

ii. They completely ignored the scientifically proven facts that deer (Williams and Ward 2006: attached here as ***Appendix F***) and birds (Gosper et al. 2005: attached here ***Appendix G***) can quickly spread invasive plants species along <u>*and outside*</u> a linear ROW. Even NIPS that are not palatable to deer are at a competitive advantage over native species, and can thereby displace native plant communities under browsing pressure from deer (Averill et al. 2016: attached here as ***Appendix H***).

5. In December of 2016 (**CP16-10-000, Accession 20161221-5349**) we specifically alerted BLM, FERC, and the JNF Forest Supervisor himself that serious ecological threats regarding NIPS remained insufficiently addressed in the FERC DEIS. These issues included:

a. All of the previous issues raised above (see Section 1) but still unaddressed by MVP and FERC.

b. The proximity of nonnative invasive plant species to the proposed corridor route, and the threat of these species being spread by pipeline-corridor construction and maintenance.

c. Insufficient consideration of the mechanisms and chronology of likely spread of nonnative invasive plant species as a result of pipeline-related activities.

d. Incongruence of pipeline interactions with nonnative invasive plant species to existing county, state, and federal laws; and county, state, federal, NGO, and private-landowner efforts to control and even reverse the spread of invasive plants.

e. The lack of effective approaches for the early detection, rapid response, and effective control of nonnative invasive plant species in the pipeline corridor, and the ecological and economic risks associated with the presently stipulated approaches.
f. The lack of risk assessment of economic and ecological damage that would be caused by the accelerated spread of nonnative invasive plant species due to pipeline construction and maintenance.
g. No consideration or valuation of the loss or damage to critical ecosystem services caused by pipeline construction and maintenance, and no critical assessment of possible approaches to mitigating those losses.
h. No risk assessment of human-health threats due to pipeline-linked increases in deer populations, increases in deer-hosted tick populations, and herbicide use in the pipeline corridor.
i. No specific critical analyses of the known and likely ecological, economic, and human-health impacts of extensive herbicide use for pipeline corridor maintenance.
j. No consideration or exposition of hidden costs to private landowners and the public (i.e., externalities: costs borne by individuals who made no choice to bear such cost) in terms of opportunity costs, loss of ecosystem services, loss of land productivity, loss of property values, loss of esthetic values related to their land and public lands in the County, threats to human health and well-being, loss of personal freedom and well-being), or assessment of possible mitigation approaches to compensate for these losses.
k. No clear acknowledgement of MVP's corporate responsibility for effective mitigation of all negative effects of pipeline construction and maintenance for the life of the pipeline; no clear identification and explanation of the succession of responsible parties at all stages of construction, operation and maintenance of the pipeline; and no specific identification of parties who will bear responsibility for environmental and economic impacts that will extend well beyond the life of their pipeline project.

No response was ever received or posted regarding these concerns.

6. FERC issued the Final Environmental Impact Statement (FEIS) for the MVP project in June of 2017.
    a. The FEIS remained virtually unchanged from the DEIS, relative to the critical ecological, sociological, and economic issues listed in Items 1 and 5 above.
    b. MVP's plan to control NIPS now called for ***limited post-construction monitoring (2 years only)*** for invasive plant species, with evident concurrence by FERC (p. 4-190).
        i. This plan is completely inadequate for effective control of NIPS that will be stimulated and spread by the extreme ground-disturbing activities proposed for MVP construction. Animal populations will not diminish with the age of the ROW, so the assumption that a simple 2-year monitoring and control program for NIPS will be sufficient for control of NIPS on the MVP ROW is ***scientifically naïve and unsupportable.*** In that vein, it is significant to note that neither MVP nor FERC have offered any scientific evidence that supports their choice of a 2-year monitoring period, or their claim that such will be effective and sufficient. NIPS will be a continual and likely growing problem in the MVP construction corridor, and particularly in the incompletely restored ROW, for the operational life of the pipeline and beyond. MVP's plan to monitor for only two years post-construction presents a severe ecological and economic threat to both federally managed lands and private lands encompassed by or in proximity of the proposed project.
        ii. Recent research (Barlow et al. 2017: attached here as ***Appendix I***) demonstrated that the construction and operation of fracked-gas development projects in Pennsylvania facilitates continual invasions by NIPS. Dispersal of invasive plant species actually increased with time following construction for natural gas development projects rather than decreasing. So, MVP's plan to monitor for only two years post-construction is therefore scientifically naïve, and presents severe ecological and economic threats to both federally managed lands and nearby private lands.
        iii. **In stark contrast, to MVP's plan,** the *Exotic and Invasive Species Control Plan* for the highly controversial Atlantic Coast Pipeline (also located in Virginia) details a commitment to monitor the ROW for invasive plant species ***for the life of that project*** (see Dr. Carl Zipper's letter, ***CP16-10-000, Accession 20170112-5005***). ***Will***

FERC declare such an extended effort to be unnecessary? What evidence would they offer to support such a contention?

c. FERC concluded in the FEIS that MVP impacts to plant communities "would be adequately minimized" (FEIS p. 4-191) when MVP follows WHC's recommendation to use only native plant species for reseeding of disturbed areas, utilizes area –specific mixes and restoration techniques on different stretches of the pipeline project, and monitors NIPS in the project ROW for two years following construction. .
    i. Despite FERC's cautions to MVP about invasive species and assurances to the public about the use of native species, **the FERC FEIS still includes "suggested seed mixes"** (their Appendices N-14 and N-15) **that remain unchanged from those in the DEIS** (as discussed in Section 3 above).
d. The courts have ruled that **FERC has the authority, and the legal obligation, to require effective monitoring and control programs** to prevent the introduction and spread of invasive species in order to protect native fish and wildlife species and their habitats (Janasie 2005; attached here as ***Appendix J***).
    i. **Yet, the FEIS has failed to adequately address the issues** of ecological and economic threats of NPIS from the proposed MVP project, and it fails to require effective monitoring and remediation by MVP for the life of the project.
e. FERC listed a requirement in the FEIS that **"prior to construction, Mountain Valley . . . should file with the Secretary, for review and written approval by the Director of OEP, revised erosion control plans that contain only native species.** (p. 4-190).
    i. There is no indication that FERC will subsequently require NIPS monitoring to be extended beyond 2 years post-construction.
    ii. **It remains to be seen** how MVP will respond to this requirement, or whether there will be any opportunity for public or agency review of their response and subsequent actions or FERC's final decision regarding these issues. Given the uncertain nature of MVP's restoration plans, USFS cannot consider this a closed issue that has been settled satisfactorily.

7. The USFS issued their Draft Record of Decision (DROD, 23 June 2017) (i.e., "draft approval") regarding proposed amendments to the Jefferson National Forest Land and Resource Management Plan (LRMP), which would allow MVP to violate longstanding, publically approved standards meant to protect ecological integrity of the JNF (particularly related to soil conservation and water quality).
    a. The DROD makes no mention of the critical threats that NIPS will pose to ecological integrity of the Jefferson National Forest due to intensive land-disturbing activities by MVP.
        i. Invasive plant species have been shown to deleteriously alter soil properties, and increase soil erosion and subsequent sedimentation to receiving waterways (Pejchar and Mooney 2009; attached here as ***Appendix K***).
        ii. Thus the issue of the effects of NIPS relate directly to the subject of the DROD (i.e., Forest Plan amendments related to standards for soil and water conservation), and should have been addressed in the DROD.
    b. USFS themselves implicated utility corridors and associated ROWs as agents in the spread of invasive plant species, ***specifically in the JNF*** (USFS Undated-a: attached here as ***Appendix L***). JNF staff described NIPS in the JNF as presenting "an immediate threat to natural communities, rare species sites, and other sits of high public interest" (p. 1). Despite these warnings and the obvious awareness by JNF staff, the current USFS DROD fails to comment on or even mention the intense ecological threat posed by such plants, the virtual certainty that they will be spread quickly by the linear MVP corridor and associated activities, and that such invasion will subsequently impact soil and water conservation in the JNF.
    c. By making no mention of these issues in the DROD, the Forest Supervisor by default is agreeing with the inadequate evaluation of these issues by FERC (and USFS as a cooperating agency) in the FEIS. This invalidates the Forest Supervisor's claim that the DROD is based on "Best Available Scientific Information" (as discussed in Section 8 below).
    d. **The failure of the DROD to address issues related to NIPS is a fatal flaw that invalidates the DROD.**

8. The Forest Supervisor contends in the DROD that he met the legal requirement (36 CFR § 219.3) for using best available scientific information (BASI) by the fact that he used information from the FEIS, which he assumed was based on BASI. **This is a patently false or at least misguided claim**,

as both the FERC and USFS were repeatedly informed that early MVP scoping documents and the DEIS itself ignored abundant scientific evidence that MVP's plans were sorely inadequate to assess the threats posed by NIPS, to carefully monitor their possible introduction, and to effectively mitigate possible invasions.

a. BASI is not a well-defined concept in USFS policy. In the absence of specific directives, USFS should at least make certain that basic and accepted scientific practice is employed in a document such as the DROD, which is required to demonstrate the use of BASI to support conclusions about scientific issues. Standard and accepted practices in effective scientific analysis, as are required to be employed for any document accepted for publication in a peer-reviewed scientific journal, offer a basic framework to follow. All scientific journals require that you review the current scientific thought on the issue at hand, analyze it relative to your situation, and then explain how that information has informed your decision. BASI, therefore, must be rooted in scientific evidence, not unsupported opinion. Such exposition requires the listing of recognized scientific literature that you reviewed and analyzed in the process. Neither the DROD nor the FEIS that it relies on incorporate reference to such scientific literature (or analysis of it) to any meaningful extent to support their conclusions, so their conclusions are not based on BASI. A simplistic statement that "BASI was applied" is inadequate justification for a decision if no scientific evidence and analysis is offered to support that decision.
b. The FERC (and, by extension, USFS as a cooperating agency) was alerted to the issues related to NIPS as early as June of 2015 (see Section 1, above). MVP's inadequate and unscientific responses to scoping comments on this issue (see Section 2 above) were called out to FERC by a subsequent filing from Preserve Craig (***PF15-3-000, Accession 20150730-5013***), but these scientifically documented comments were again ignored in the DEIS and then in the FEIS.
c. Issues related to NIPS were not even mentioned, much less thoroughly analyzed, in the DROD. **Therefore, claims of BASI application in the DROD cannot be considered valid.**

9. **USFS, like other federal agencies, is bound by Executive Order (EO) 13112 directing federal agencies to prevent the introduction of invasive species**; provide for their control; and minimize the economic, ecological, and human health impacts that invasive species can cause. The EO further

specifies that federal agencies shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by invasive species, and that all feasible and prudent measures to minimize the risk of harm would be taken in conjunction with the actions (Federal Register 1999; attached here as ***Appendix M***).

a. While the DROD makes reference to and discusses a number of other Executive Orders that relate to the proposed LRMP amendments, **the DROD fails to address or even mention EO 13112.**

b. This failure to address the threat of NIPS to the JNF is particularly egregious, given that a portion of the proposed MVP route crosses a Roadless Area, and JNF staff themselves have identified NIPS as a particular threat to such Roadless Areas (USFS Undated-b; attached here as ***Appendix N***).

c. The FEIS on which the DROD relies falsely describes means by which MVP will effectively meet the requirements of EO 13112:

   i. "Executive Order (EO) 13112 directs federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts that invasive species can cause. . . To avoid and minimize the spread of noxious weeds and invasive plants, Mountain Valley and Equitrans have consulted with federal and state agencies regarding the revegetation of disturbed areas, and would conduct post-construction monitoring (p. 4-174)."

   ii. ***NOTE:*** "Consultation" does not guarantee effective action in this or any case.

   iii. The planned post-construction monitoring is inadequate and thus ineffective (as described in Section 6.b, above), because credible scientific studies have demonstrated that NIPS remain a threat throughout the life of a project, and they even increase in intensity of spread with time after the completion of project construction.

   iv. The Forest Supervisor cannot claim that MVP's "restoration" plan meets the needs of USFS and the requirements of EO 13112, given the fact that MVP's current plan utilizes almost no native plant species and actually proposes to spread the seeds of known nonnative invasive plant species as part of "restoration."

v. Unitl MVP modifies their restoration plan, USFS would be remiss to claim that MVP's plan (and FERC's approval of such) meets the needs and requirements of USFS to satisfy multiple legal requirements and their public duty.

10. Similarly, the DROD fails to mention Executive Order 13751, which extends and amends EO 13112 and further obligates federal agencies to consider the possible role of their actions in increasing vectors of disease (Federal Register 2016: attached here as ***Appendix O***). The requirements of EO 13751 obviously relate to the situation of increased tick-borne human disease that may be caused by construction and operation of the MVP (see Sections 1.e and 2.c above). Any action by USFS to facilitate or approve the MVP project would implicate USFS as a contributing agent to such disease issues, as the MVP ROW will make a direct geographic and ecological connection from the National Forest (where deer ticks thrive) to areas of human habitation. Once again, failure to consider these disease issues in either the DROD or the FEIS invalidates any claim by the Forest Supervisor of conscientious application of BASI.

CONCLUDING COMMENTS

The failures of both the FEIS and the DROD to adequately address critical scientific issues related to the MVP in a complete, responsible, and honest manner violates both the spirit and the letter of the law, and betrays the public trust.

- **What should the public believe: MVP/FERC/USFS's unsupported contentions and opinions, or the results of hundreds of scientific studies that demonstrate the fallacy of their unsupported contentions?**
- **The answer to this question seems obvious, but FERC (and, by extension, USFS) are betraying public trust by accepting MVP's unsupported contentions rather than applying real scientific analysis to these critical issues.**
- **Glaring omissions in the DROD, coupled with the failure of the Forest Supervisor to consider BASI that was repeatedly pointed out to FERC and USFS, means that the current DROD fails to meet appropriate legal requirements or to fulfill USFS's obligations for**

responsible and transparent management of the public resources with which they are entrusted.

Thus, the current DROD should be deemed incomplete and invalid. The DROD should be withdrawn. A properly executed DROD should be issued at a later date, followed by an appropriate public objection period.

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Appendix A

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Factors in the Emergence of Infectious Diseases

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"Emerging" infectious diseases can be defined as infections that have newly appeared in a population or have existed but are rapidly increasing in incidence or geographic range. Among recent examples are HIV/ AIDS, hantavirus pulmonary syndrome, Lyme disease, and hemolytic uremic syndrome (a foodborne infection caused by certain strains of Escherichia coli*). Specific factors precipitating disease emergence can be identified in virtually all cases. These include ecological, environmental, or demographic factors that place people at increased contact with a previously unfamiliar microbe or its natural host or promote dissemination. These factors are increasing in prevalence; this increase, together with the ongoing evolution of viral and microbial variants and selection for drug resistance, suggests that infections will continue to emerge and probably increase and emphasizes the urgent need for effective surveillance and control. Dr. David Satcher's article and this overview inaugurate "Perspectives," a regular section in this journal intended to present and develop unifying concepts and strategies for considering emerging infections and their underlying factors. The editors welcome, as contributions to the Perspectives section, overviews, syntheses, and case studies that shed light on how and why infections emerge, and how they may be anticipated and prevented.*

Infectious diseases emerging throughout history have included some of the most feared plagues of the past. New infections continue to emerge today, while many of the old plagues are with us still. These are global problems (William Foege, former CDC director now at the Carter Center, terms them "global infectious disease threats"). As demonstrated by influenza epidemics, under suitable circumstances, a new infection first appearing anywhere in the world could traverse entire continents within days or weeks.

We can define as "emerging" infections that have newly appeared in the population, or have existed but are rapidly increasing in incidence or geographic range (1,2). Recent examples of emerging diseases in various parts of the world include HIV/AIDS; classic cholera in South America and Africa; cholera due to *Vibrio cholerae* O139; Rift Valley fever; hantavirus pulmonary syndrome; Lyme disease; and hemolytic uremic syndrome, a foodborne infection caused by certain strains of *Escherichia coli* (in the United States, serotype O157:H7).

Although these occurrences may appear inexplicable, rarely if ever do emerging infections appear without reason. Specific factors responsible for disease emergence can be identified in virtually all cases studied (2-4). Table 1 summarizes the known causes for a number of infections that have emerged recently. I have suggested that infectious disease emergence can be viewed operationally as a two-step process: 1) Introduction of the agent into a new host population (whether the pathogen originated in the environment, possibly in another species, or as a variant of an existing human infection), followed by 2) establishment and further dissemination within the new host population ("adoption") (4). Whatever its origin, the infection "emerges" when it reaches a new population. Factors that promote one or both of these steps will, therefore, tend to precipitate disease emergence. Most emerging infections, and even antibiotic-resistant strains of common bacterial pathogens, usually originate in one geographic location and then disseminate to new places (5).

Regarding the introduction step, the numerous examples of infections originating as zoonoses (7,8) suggest that the "zoonotic pool"—introductions of infections from other species—is an important and potentially rich source of emerging diseases; periodic discoveries of "new" zoonoses suggest that the zoonotic pool appears by no means exhausted. Once introduced, an infection might then be disseminated through other factors, although rapid course and high mortality combined with low transmissibility are often limiting. However, even if a zoonotic agent is not able to spread readily from person to person and establish itself, other factors (e.g., nosocomial infection) might transmit the infection. Additionally, if the reservoir host or vector becomes more widely disseminated, the microbe can appear in new places.

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Table 1. Recent examples of emerging infections and probable factors in their emergence

Infection or Agent	Factor(s) contributing to emergence
Viral	
Argentine, Bolivian hemorrhagic fever	Changes in agriculture favoring rodent host
Bovine spongiform encephalopathy (cattle)	Changes in rendering processes
Dengue, dengue hemorrhagic fever	Transportation, travel, and migration; urbanization
Ebola, Marburg	Unknown (in Europe and the United States, importation of monkeys)
Hantaviruses	Ecological or environmental changes increasing contact with rodent hosts
Hepatitis B, C	Transfusions, organ transplants, contaminated hypodermic apparatus, sexual transmission, vertical spread from infected mother to child
HIV	Migration to cities and travel; after introduction, sexual transmission, vertical spread from infected mother to child, contaminated hypodermic apparatus (including during intravenous drug use), transfusions, organ transplants
HTLV	Contaminated hypodermic apparatus, other
Influenza (pandemic)	Possibly pig-duck agriculture, facilitating reassortment of avian and mammalian influenza viruses*
Lassa fever	Urbanization favoring rodent host, increasing exposure (usually in homes)
Rift Valley fever	Dam building, agriculture, irrigation; possibly change in virulence or pathogenicity of virus
Yellow fever (in "new" areas)	Conditions favoring mosquito vector
Bacterial	
Brazilian purpuric fever (*Haemophilus influenzae*, biotype *aegyptius*)	Probably new strain
Cholera	In recent epidemic in South America, probably introduced from Asia by ship, with spread facilitated by reduced water chlorination; a new strain (type O139) from Asia recently disseminated by travel (similarly to past introductions of classic cholera)
Helicobacter pylori	Probably long widespread, now recognized (associated with gastric ulcers, possibly other gastrointestinal disease)
Hemolytic uremic syndrome (*Escherichia coli* O157:H7)	Mass food processing technology allowing contamination of meat
Legionella (Legionnaires' disease)	Cooling and plumbing systems (organism grows in biofilms that form on water storage tanks and in stagnant plumbing)
Lyme borreliosis (*Borrelia burgdorferi*)	Reforestation around homes and other conditions favoring tick vector and deer (a secondary reservoir host)
Streptococcus, group A (invasive; necrotizing)	Uncertain
Toxic shock syndrome (*Staphylococcus aureus*)	Ultra-absorbency tampons
Parasitic	
Cryptosporidium, other waterborne pathogens	Contaminated surface water, faulty water purification
Malaria (in "new" areas)	Travel or migration
Schistosomiasis	Dam building

*Reappearances of influenza are due to two distinct mechanisms: Annual or biennial epidemics involving new variants due to antigenic drift (point mutations, primarily in the gene for the surface protein, hemagglutinin) and pandemic strains, arising from antigenic shift (genetic reassortment, generally between avian and mammalian influenza strains).

Bubonic plague transmitted by rodent fleas and ratborne hantavirus infections are examples.

Most emerging infections appear to be caused by pathogens already present in the environment, brought out of obscurity or given a selective advantage by changing conditions and afforded an opportunity to infect new host populations (on rare occasions, a new variant may also evolve and cause a new disease) (2,4). The process by which infectious agents may transfer from animals to humans or disseminate from isolated groups into new populations can be called "microbial traffic" (3,4). Anumber of activities increase microbial traffic and as a result promote emergence and epidemics. In some cases, including many of the most novel infections, the agents are zoonotic, crossing from their natural hosts into the human population; because of the many similarities, I include here vector-borne diseases. In other cases, pathogens already present in geographically isolated populations are given an opportunity to disseminate further. Surprisingly often, disease emergence is caused by human actions, however inadvertently; natural causes, such as changes in climate, can also at times be responsible (6). Although this discussion is confined largely to human disease, similar considerations apply to emerging pathogens in other species.

Table 2 summarizes the underlying factors responsible for emergence. Any categorization of the factors is, of course, somewhat arbitrary but should be representative of the underlying processes that cause emergence. I have essentially adopted the categories developed in the Institute of Medicine report on emerging infections (12), with additional definitions from the CDC emerging infections plan (13). Responsible factors include ecological changes, such as those due to agricultural or economic development or to anomalies in climate; human demographic changes and behavior; travel and commerce; technology and industry; microbial adaptation and change; and breakdown of public health measures. Each of these will be considered in turn.

Ecological interactions can be complex, with several factors often working together or in sequence. For example, population movement from rural areas to cities can spread a once-localized infection. The strain on infrastructure in the overcrowded and rapidly growing cities may disrupt or slow public health measures, perhaps allowing establishment of the newly introduced infection. Finally, the city may also provide a gateway for further dissemination of the infection. Most successful emerging infections, including HIV, cholera, and dengue, have followed this route.

Consider HIV as an example. Although the precise ancestry of HIV-1 is still uncertain, it appears to have had a zoonotic origin (9,10). Ecological factors that would have allowed human exposure to a natural host carrying the virus that was the precursor to HIV-1 were, therefore, instrumental in the introduction of the virus into humans. This probably occurred in a rural area. A plausible scenario is suggested by the identification of an HIV-2-infected man in a rural area of Liberia whose virus strain resembled viruses isolated from the sooty mangabey monkey (an animal widely hunted for food in rural areas and the putative source of HIV-2) more closely than it did strains circulating in the city (11). Such findings suggest that zoonotic introductions of this sort may occur on occasion in isolated populations but may well go unnoticed so long as the recipients remain isolated. But with increasing movement from rural areas to cities, such isolation is increasingly rare. After its likely first move from a rural area into a city, HIV-1 spread regionally along highways, then by long distance routes, including air travel, to more distant places. This last step was critical for HIV and facilitated today's global pandemic. Social changes that allowed the virus to reach a larger population and to be transmitted despite its relatively low natural transmissibility were instrumental in the success of the virus in its newfound human host. For HIV, the long duration of infectivity allowed this normally poorly transmissible virus many opportunities to be transmitted and to take advantage of such factors as human behavior (sexual transmission, intravenous drug use) and changing technology (early spread through blood transfusions and blood products) (Table 1).

Ecological Changes and Agricultural Development

Ecological changes, including those due to agricultural or economic development, are among the most frequently identified factors in emergence. They are especially frequent as factors in outbreaks of previously unrecognized diseases with high case-fatality rates, which often turn out to be zoonotic introductions. Ecological factors usually precipitate emergence by placing people in contact with a natural reservoir or host for an infection hitherto unfamiliar but usually already present (often a zoonotic or arthropod-borne infection), either by increasing proximity or, often, also by changing conditions so as to favor an increased population of the microbe or its natural host (2,4). The emergence of Lyme disease in the United States and Europe was probably due largely to reforestation (14), which increased the population of deer and the deer tick, the vector of Lyme disease. The movement of people into these areas placed a larger population in close proximity to the vector.

Agricultural development, one of the most common ways in which people alter and interpose themselves into the environment, is often a factor

Table 2. Factors in infectious disease emergence*

Factor	Examples of specific factors	Examples of diseases
Ecological changes (including those due to economic development and land use)	Agriculture; dams, changes in water ecosystems; deforestation/reforestation; flood/drought; famine; climate changes	Schistosomiasis (dams); Rift Valley fever (dams, irrigation); Argentine hemorrhagic fever (agriculture); Hantaan (Korean hemorrhagic fever) (agriculture); hantavirus pulmonary syndrome, southwestern US, 1993 (weather anomalies)
Human demographics, behavior	Societal events: Population growth and migration (movement from rural areas to cities); war or civil conflict; urban decay; sexual behavior; intravenous drug use; use of high-density facilities	Introduction of HIV; spread of dengue; spread of HIV and other sexually transmitted diseases
International travel and commerce	Worldwide movement of goods and people; air travel	"Airport" malaria; dissemination of mosquito vectors; ratborne hantaviruses; introduction of cholera into South America; dissemination of O139 *V. cholerae*
Technology and industry	Globalization of food supplies; changes in food processing and packaging; organ or tissue transplantation; drugs causing immunosuppression; widespread use of antibiotics	Hemolytic uremic syndrome (*E. coli* contamination of hamburger meat), bovine spongiform encephalopathy; transfusion-associated hepatitis (hepatitis B, C), opportunistic infections in immunosuppressed patients, Creutzfeldt-Jakob disease from contaminated batches of human growth hormone (medical technology)
Microbial adaptation and change	Microbial evolution, response to selection in environment	Antibiotic-resistant bacteria, "antigenic drift" in influenza virus
Breakdown in public health measures	Curtailment or reduction in prevention programs; inadequate sanitation and vector control measures	Resurgence of tuberculosis in the United States; cholera in refugee camps in Africa; resurgence of diphtheria in the former Soviet Union

*Categories of factors (column 1) adapted from ref. 12, examples of specific factors (column 2) adapted from ref. 13. Categories are not mutually exclusive; several factors may contribute to emergence of a disease (see Table 1 for additional information).

(Table 2). Hantaan virus, the cause of Korean hemorrhagic fever, causes over 100,000 cases a year in China and has been known in Asia for centuries. The virus is a natural infection of the field mouse *Apodemus agrarius*. The rodent flourishes in rice fields; people usually contract the disease during the rice harvest from contact with infected rodents. Junin virus, the cause of Argentine hemorrhagic fever, is an unrelated virus with a history remarkably similar to that of Hantaan virus. Conversion of grassland to maize cultivation favored a rodent that was the natural host for this virus, and human cases increased in proportion with expansion of maize agriculture (15). Other examples, in addition to those already known (2,15), are likely to appear as new areas are placed under cultivation.

Perhaps most surprisingly, pandemic influenza appears to have an agricultural origin, integrated pig-duck farming in China. Strains causing the frequent annual or biennial epidemics generally result from mutation ("antigenic drift"), but pandemic influenza viruses do not generally arise by this process. Instead, gene segments from two influenza strains reassort to produce a new virus that can infect humans (16). Evidence amassed by Webster, Scholtissek, and others, indicates that waterfowl, such as ducks, are major reservoirs of influenza and that pigs can serve as "mixing vessels" for new mammalian influenza strains (16). Pandemic influenza viruses have generally come from China. Scholtissek and Naylor suggested that integrated pig-duck agriculture, an extremely efficient food

production system traditionally practiced in certain parts of China for several centuries, puts these two species in contact and provides a natural laboratory for making new influenza recombinants (17). Webster has suggested that, with high-intensity agriculture and movement of livestock across borders, suitable conditions may now also be found in Europe (16).

Water is also frequently associated with disease emergence. Infections transmitted by mosquitoes or other arthropods, which include some of the most serious and widespread diseases (18,19), are often stimulated by expansion of standing water, simply because many of the mosquito vectors breed in water. There are many cases of diseases transmitted by water-breeding vectors, most involving dams, water for irrigation, or stored drinking water in cities. (See "Changes in Human Demographics and Behavior" for a discussion of dengue.) The incidence of Japanese encephalitis, another mosquito-borne disease that accounts for almost 30,000 human cases and approximately 7,000 deaths annually in Asia, is closely associated with flooding of fields for rice growing. Outbreaks of Rift Valley fever in some parts of Africa have been associated with dam building as well as with periods of heavy rainfall (19). In the outbreaks of Rift Valley fever in Mauritania in 1987, the human cases occurred in villages near dams on the Senegal River. The same effect has been documented with other infections that have aquatic hosts, such as schistosomiasis.

Because humans are important agents of ecological and environmental change, many of these factors are anthropogenic. Of course, this is not always the case, and natural environmental changes, such as climate or weather anomalies, can have the same effect. The outbreak of hantavirus pulmonary syndrome in the southwestern United States in 1993 is an example. It is likely that the virus has long been present in mouse populations but an unusually mild and wet winter and spring in that area led to an increased rodent population in the spring and summer and thus to greater opportunities for people to come in contact with infected rodents (and, hence, with the virus); it has been suggested that the weather anomaly was due to large-scale climatic effects (20). The same causes may have been responsible for outbreaks of hantaviral disease in Europe at approximately the same time (21,22). With cholera, it has been suggested that certain organisms in marine environments are natural reservoirs for cholera vibrios, and that large scale effects on ocean currents may cause local increases in the reservoir organism with consequent flare-ups of cholera (23).

Changes in Human Demographics and Behavior

Human population movements or upheavals, caused by migration or war, are often important factors in disease emergence. In many parts of the world, economic conditions are encouraging the mass movement of workers from rural areas to cities. The United Nations has estimated that, largely as a result of continuing migration, by the year 2025, 65% of the world population (also expected to be larger in absolute numbers), including 61% of the population in developing regions, will live in cities (24). As discussed above for HIV, rural urbanization allows infections arising in isolated rural areas, which may once have remained obscure and localized, to reach larger populations. Once in a city, the newly introduced infection would have the opportunity to spread locally among the population and could also spread further along highways and inter-urban transport routes and by airplane. HIV has been, and in Asia is becoming, the best known beneficiary of this dynamic, but many other diseases, such as dengue, stand to benefit. The frequency of the most severe form, dengue hemorrhagic fever, which is thought to occur when a person is sequentially infected by two types of dengue virus, is increasing as different dengue viruses have extended their range and now overlap (25). Dengue hemorrhagic fever is now common in some cities in Asia, where the high prevalence of infection is attributed to the proliferation of open containers needed for water storage (which also provide breeding grounds for the mosquito vector) as the population size exceeds the infrastructure (19). In urban environments, rain-filled tires or plastic bottles are often breeding grounds of choice for mosquito vectors. The resulting mosquito population boom is complemented by the high human population density in such situations, increasing the chances of stable transmission cycles between infected and susceptible persons. Even in industrialized countries, e.g., the United States, infections such as tuberculosis can spread through high-population density settings (e.g., day care centers or prisons) (12,26-28).

Human behavior can have important effects on disease dissemination. The best known examples are sexually transmitted diseases, and the ways in which such human behavior as sex or intravenous drug use have contributed to the emergence of HIV are now well known. Other factors responsible for disease emergence are influenced by a variety of human actions, so human behavior in the broader sense is also very important. Motivating appropriate individual behavior and constructive action, both locally and in a larger scale, will be essential for controlling emerging infections. Ironically, as AIDS prevention efforts have demonstrated, human

behavior remains one of the weakest links in our scientific knowledge.

International Travel and Commerce

The dissemination of HIV through travel has already been mentioned. In the past, an infection introduced into people in a geographically isolated area might, on occasion, be brought to a new place through travel, commerce, or war (8). Trade between Asia and Europe, perhaps beginning with the silk route and continuing with the Crusades, brought the rat and one of its infections, the bubonic plague, to Europe. Beginning in the 16th and 17th centuries, ships bringing slaves from West Africa to the New World also brought yellow fever and its mosquito vector, *Aedes aegypti*, to the new territories. Similarly, smallpox escaped its Old World origins to wreak new havoc in the New World. In the 19th century, cholera had similar opportunities to spread from its probable origin in the Ganges plain to the Middle East and, from there, to Europe and much of the remaining world. Each of these infections had once been localized and took advantage of opportunities to be carried to previously unfamiliar parts of the world.

Similar histories are being repeated today, but opportunities in recent years have become far richer and more numerous, reflecting the increasing volume, scope, and speed of traffic in an increasingly mobile world. Rats have carried hantaviruses virtually worldwide (29). *Aedes albopictus* (the Asian tiger mosquito) was introduced into the United States, Brazil, and parts of Africa in shipments of used tires from Asia (30). Since its introduction in 1982, this mosquito has established itself in at least 18 states of the United States and has acquired local viruses including Eastern equine encephalomyelitis (31), a cause of serious disease. Another mosquito-borne disease, malaria, is one of the most frequently imported diseases in non-endemic-disease areas, and cases of "airport malaria" are occasionally identified.

A classic bacterial disease, cholera, recently entered both South America (for the first time this century) and Africa. Molecular typing shows the South American isolates to be of the current pandemic strain (32), supporting the suggestion that the organism was introduced in contaminated bilge water from an Asian freighter (33). Other evidence indicates that cholera was only one of many organisms to travel in ballast water; dozens, perhaps hundreds, of species have been exchanged between distant places through this means of transport alone. New bacterial strains, such as the recently identified *Vibrio cholerae* O139, or an epidemic strain of *Neisseria meningitidis* (34,35) (also examples of microbial adaptation and change) have disseminated rapidly along routes of trade and travel, as have antibiotic-resistant bacteria (5,36).

Technology and Industry

High-volume rapid movement characterizes not only travel, but also other industries in modern society. In operations, including food production, that process or use products of biological origin, modern production methods yield increased efficiency and reduced costs but can increase the chances of accidental contamination and amplify the effects of such contamination. The problem is further compounded by globalization, allowing the opportunity to introduce agents from far away. A pathogen present in some of the raw material may find its way into a large batch of final product, as happened with the contamination of hamburger meat by *E. coli* strains causing hemolytic uremic syndrome (37). In the United States the implicated *E. coli* strains are serotype O157:H7; additional serotypes have been identified in other countries. Bovine spongiform encephalopathy (BSE), which emerged in Britain within the last few years, was likely an interspecies transfer of scrapie from sheep to cattle (38) that occurred when changes in rendering processes led to incomplete inactivation of scrapie agent in sheep byproducts fed to cattle (39).

The concentrating effects that occur with blood and tissue products have inadvertently disseminated infections unrecognized at the time, such as HIV and hepatitis B and C. Medical settings are also at the front line of exposure to new diseases, and a number of infections, including many emerging infections, have spread nosocomially in health care settings (Table 2). Among the numerous examples, in the outbreaks of Ebola fever in Africa many of the secondary cases were hospital acquired, most transmitted to other patients through contaminated hypodermic apparatus, and some to the health care staff by contact. Transmission of Lassa fever to health care workers has also been documented.

On the positive side, advances in diagnostic technology can also lead to new recognition of agents that are already widespread. When such agents are newly recognized, they may at first often be labeled, in some cases incorrectly, as emerging infections. Human herpesvirus 6 (HHV-6) was identified only a few years ago, but the virus appears to be extremely widespread (40) and has recently been implicated as the cause of roseola (exanthem subitum), a very common childhood disease (41). Because roseola has been known since at least 1910, HHV-6 is likely to have been common for decades and probably much longer. Another recent example is the bacterium *Helicobacter pylori*, a probable cause of gastric ulcers (42) and some cancers (43,44). We have lived with these diseases for a long time without knowing

their cause. Recognition of the agent is often advantageous, offering new promise of controlling a previously intractable disease, such as treating gastric ulcers with specific antimicrobial therapy.

Microbial Adaptation and Change

Microbes, like all other living things, are constantly evolving. The emergence of antibiotic-resistant bacteria as a result of the ubiquity of antimicrobials in the environment is an evolutionary lesson on microbial adaptation, as well as a demonstration of the power of natural selection. Selection for antibiotic-resistant bacteria (5,36) and drug-resistant parasites has become frequent, driven by the wide and sometimes inappropriate use of antimicrobial drugs in a variety of applications (27,45,46). Pathogens can also acquire new antibiotic resistance genes from other, often nonpathogenic, species in the environment (36), selected or perhaps even driven by the selection pressure of antibiotics.

Many viruses show a high mutation rate and can rapidly evolve to yield new variants (47). A classic example is influenza (48). Regular annual epidemics are caused by "antigenic drift" in a previously circulating influenza strain. A change in an antigenic site of a surface protein, usually the hemagglutinin (H) protein, allows the new variant to reinfect previously infected persons because the altered antigen is not immediately recognized by the immune system.

On rare occasions, perhaps more often with nonviral pathogens than with viruses (49), the evolution of a new variant may result in a new expression of disease. The epidemic of Brazilian purpuric fever in 1990, associated with a newly emerged clonal variant of *Hemophilus influenzae*, biogroup *aegyptius*, may fall into this category. It is possible, but not yet clear, that some recently described manifestations of disease by group A *Streptococcus*, such as rapidly invasive infection or necrotizing fasciitis, may also fall into this category.

Breakdown of Public Health Measures and Deficiencies in Public Health Infrastructure

Classical public health and sanitation measures have long served to minimize dissemination and human exposure to many pathogens spread by traditional routes such as water or preventable by immunization or vector control. The pathogens themselves often still remain, albeit in reduced numbers, in reservoir hosts or in the environment, or in small pockets of infection and, therefore, are often able to take advantage of the opportunity to reemerge if there are breakdowns in preventive measures.

Reemerging diseases are those, like cholera, that were once decreasing but are now rapidly increasing again. These are often conventionally understood and well recognized public health threats for which (in most cases) previously active public health measures had been allowed to lapse, a situation that unfortunately now applies all too often in both developing countries and the inner cities of the industrialized world. The appearance of reemerging diseases may, therefore, often be a sign of the breakdown of public health measures and should be a warning against complacency in the war against infectious diseases.

Cholera, for example, has recently been raging in South America (for the first time in this century) (50) and Africa. The rapid spread of cholera in South America may have been abetted by recent reductions in chlorine levels used to treat water supplies (34). The success of cholera and other enteric diseases is often due to the lack of a reliable water supply. These problems are more severe in developing countries, but are not confined to these areas. The U.S. outbreak of waterborne *Cryptosporidium* infection in Milwaukee, Wisconsin, in the spring of 1993, with over 400,000 estimated cases, was in part due to a nonfunctioning water filtration plant (51); similar deficiencies in water purification have been found in other cities in the United States (52).

For our Future

In his accompanying article, Dr. David Satcher discusses the history of infectious diseases and the many infections that, from the dawn of history to the present, have traveled with the caravans and followed the invading armies. The history of infectious diseases has been a history of microbes on the march, often in our wake, and of microbes that have taken advantage of the rich opportunities offered them to thrive, prosper, and spread. And yet the historical processes that have given rise to the emergence of "new" infections throughout history continue today with unabated force; in fact, they are accelerating, because the conditions of modern life ensure that the factors responsible for disease emergence are more prevalent than ever before. Speed of travel and global reach are further borne out by studies modeling the spread of influenza epidemics (53) and HIV (54,55).

Humans are not powerless, however, against this relentless march of microbes. Knowledge of the factors underlying disease emergence can help focus resources on the key situations and areas worldwide (3,4) and develop more effective prevention strategies. If we are to protect ourselves against emerging diseases, the essential first step is effective global

disease surveillance to give early warning of emerging infections (3,12,13,56). This must be tied to incentives, such as national development, and eventually be backed by a system for an appropriate rapid response. World surveillance capabilities are critically deficient (12,56,57). Efforts, such as the CDC plan (13), now under way in the United States and internationally to remedy this situation are the essential first steps and deserve strong support. Research, both basic and applied, will also be vital.

This Journal and the "Perspectives" Section

Early warning of emerging and reemerging infections depends on the ability to identify the unusual as early as possible. Information is, therefore, essential. Hence this journal, which is intended as a peer-reviewed forum for the discussion of concepts and examples relevant to emerging infectious diseases and their causes, and to provide a channel for field reports and observations on emerging infections. The "Perspectives" section will provide general overviews dealing with factors in disease emergence, conceptual syntheses of information, approaches for studying or predicting emerging infections, and analyses that shed light on how and why infections emerge, and how they may be anticipated and prevented. Submissions for this section are warmly invited. In coming issues, Perspectives will deal in greater detail with many of the factors discussed in this overview article, and with ways to dissect steps in the emergence process. Discussion of technologies that are broadly applicable to the identification or control of emerging diseases are also appropriate for this section. Case studies are welcome if they are used to develop broader lessons.

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Appendix B

MVP (Mountain Valley Pipeline) 2015a. Native restoration on the Mountain Valley Pipeline Right-of-Way. Prepared by the Wildlife Habitat Council. Available at: http://www.mountainvalleypipeline.info/~/media/sites/mvp/files/MVP-Restoration-Plan-by-WHC.pdf.

NATIVE RESTORATION ON THE MOUNTAIN VALLEY PIPELINE RIGHT-OF-WAY

Right-of-Way Restoration

The revegetation activities under FERC guidelines can be undertaken using any plant species, even those invasive or not native to the United States. Often times, right-of-ways are therefore seeded using low-cost mixes with fast establishing species that offer limited value to wildlife and biodiversity. MVP is committed to utilizing the pipeline installation as an opportunity to increase conservation and biodiversity value in the region. The restoration of the pipeline corridor will be conducted using native grasses and wildflowers, a voluntary pledge from the team surpassing the regulatory requirements. The benefit of creating valuable wildlife habitat has the potential to truly separate Mountain Valley Pipeline LLC from other companies who choose to revegetate right-of-ways using the traditional approach.

Mountain Valley Pipeline, LLC
MVP is proposing a natural gas pipeline project that will span nearly 300 miles starting in northwest West Virginia and ending in southern Virginia. If approved, construction of the pipeline will impact a consecutive stretch of acres to create a right-of-way for the underground pipeline system. The proposed project is regulated by the Federal Energy Regulatory Commission (FERC). Under FERC regulations, the project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities.

Wildlife Habitat Council (WHC)
WHC promotes and certifies habitat conservation and management on corporate lands through partnerships and education. WHC works with corporations and conservation groups to create solutions that balance the demands of economic growth with the requirements of a healthy, diverse, and sustainable environment.

Utilizing Conservation Concepts to Guide Restoration

In a spirit of innovation and dedication to stewardship, MVP sought WHC's expertise to provide guidance on 1) potential activities to enhance the environment compatible with the project, and 2) implementation recommendations.

This document, prepared by WHC, provides explanation of the importance of native restoration and recommended native seed mixes created in collaboration with native seed supplier, Ernst Conservation Seeds, Inc. The customized appendices present various seed mixes as well as additional information in conjunction with the assessment that was conducted.

WHC provided expertise through a series of assessments analyzing ecological and social data, in-situ tours, as well as stakeholder interaction. The scope of the conservation analysis reached beyond the immediate land disturbance of the pipeline right-of-way; it took into account concepts of conservation values and impacts in a 20-mile radius.

The ecological and social parameters resulted in outlining specific areas along the route where habitat enhancement efforts would have a greater stewardship impact (map 1; Appendix A provides larger, clearer version). At the landscape scale, those areas were defined by the assessment as degrees of conservation importance.

Map 1: Results from assessment showing opportunity along route

Green: limited conservation impact beyond the localized changes to the habitat from the presence of the right-of-way.

Orange: potential need for a balanced approach to conservation and natural resources due to moderate occurrence of important ecological features and declaration of conservation priorities.

Red: highest opportunity for an integrated approach to conservation and habitat enhancement in conjunction with education and outreach efforts with potential for partner involvement. The red stretches suggest strong alignment potential with conservation values and priorities.

At a finer scale, the parameters allowed the identification of additional opportunities to consider for stewardship planning. Such sectors include:

- Highly visible areas. Locations along the route known for use by community members, or areas with significant foot or vehicle traffic, representing great conservation and educational potential.
- Stakeholder engagement hotspot. Areas of conservation or recreational value, available to utilize for restoration efforts and outreach initiatives. Those sectors have an ease of access to community members, local environmental groups (native plant societies, watershed groups, trail conservancies) or schools.

The assessments provided a targeted number of projects that could be implemented at a large scale across most of the route, were compatible with pipeline operations, met conservation needs in Virginia and West Virginia, addressed stakeholder's interest and provide sustainable conservation outcomes. Of the options, WHC's primary recommendation is to

focus on native restoration efforts post-construction as the best way to leverage resources and create a long lasting positive environmental impact as part of the project.

Native restoration offers flexibility along the route and can be adapted to operational constraints and topography features. It produces tangible conservation outcomes and related to multiple existing conservation priorities, from local watershed efforts to the Presidential memorandum to create habitat for pollinator species.

A variety of benefits have been linked to the establishment of native grassland habitats. More information can be found in appendix B where copies of the handouts distributed to stakeholders at open houses can be found.

Native Restoration

Native species are animals and plants that originally evolved with one another in this specific area. These plants and animals are accustomed and reliant on one another and on the local climate, therefore creating a well-balanced ecosystem together. Infrastructure installation for the natural gas pipeline will cause a temporary disturbance, but native restoration can create an environment beneficial for wildlife, such as pollinators and other insects, songbirds, and small mammals to flourish. Compared to non-native plants, native plant species provide greater value to wildlife, produce greater water quality benefits, and require less maintenance with irrigation, fertilizers and pesticides.

Systematic implementation of native restoration along the right-of-way can be an excellent starting point with positive impacts associated with watershed health, pollinator, bird, and community benefits. Research on right-of-way management over the past few decades has produced new techniques and ideas on balancing the needs for reliable, safe operations and stewardship of natural resources.

WHC recommends establishment of native vegetation along as much of the route as allowed, based on landowner feedback. It is suggested that at a minimum, the restoration along the disturbed area be completed using a diverse mix of species native to Virginia and West Virginia, turning the easement into an early successional type habitat. Maintained in that state, the right-of-way will not progress toward woody vegetation establishment and will remain as grassland habitat. WHC recommends using native plants, which provide the most value to wildlife, have deeper root systems that absorb and filter more runoff and improve water infiltration into soils, and require relatively little maintenance since they are adapted to the conditions of the region.

Tailored Seed Mixes for MVP Native Restoration

To guide in the team's plan to pursue native restoration, a suite of mixes have been created as options to use along the route. The mixes were developed to provide a rich native habitat while meeting construction specifications, budgetary targets, and stakeholder desires. A summary guide for the mixes, including a base mix and several upgrade options for each habitat, is provided in Appendix D.

The seed mixes options share key features:

- All species native to the eastern United States
- Regionally appropriate for the Virginia and West Virginia counties
- Mixes designed in partnership with Ernst Conservation Seeds, Inc.
- Variety of floral structures to accommodate different pollinators
- Designed for May thru early October blooming

In order to choose the most appropriate options along the route, the MVP team is encouraged to first determine their conservation and education objectives in pursuing native vegetation establishment. In doing so, the team will be able to align features of the different mixes with desired outcomes. Sample objectives to consider are: managing land for the benefit of a specific species or suite of species (e.g. pollinating, threatened and endangered species), pursue native restoration to create wildlife corridors, enhance habitat to meet a need for conservation education in the community, etc. WHC can assist in objective development if needed.

The options can be divided into two main categories:

A) Options of seed mixes for stewardship purposes. All mixes meet the desired characteristics for erosion control and quick establishment while providing additional habitat, wildlife, aesthetic and conservation value.

- Base mix - minimum seed mix the MVP team should consider when vegetating the right-of-way (Appendix C provides an example of a pre-made commercially available native base seed mix); creates native grassland habitat. The base mixes provide native vegetation and therefore basic essential habitat components for a variety of wildlife species. Suitable for green areas in Map 1.
- Level 3 mixes - should be considered if the team wants to incorporate vegetation for a target species in addition to providing a native grassland habitat. Level 3 mixes for each habitat have a minimum goal of providing a benefit for pollinating species. Suitable for green and orange areas.

- Level 2 mixes – mid level seed mix with grasses and increased wildflower variety offers additional and targeted benefits to pollinators while achieving a higher biodiversity of wildlife species visiting established habitat. Recommended for red areas.

- Level 1 mixes – highest diversity of grasses and wildflowers meant for higher value sites along route including wetlands, protected areas, high visibility locations such as recreational trails and national forest where stewardship activities could be conducted. Level 1 mix is going to satisfy and exceed the target of pollinators by providing the most benefit and therefore attracting the highest biodiversity of wildlife as well as being the most appealing to the human eye, inviting public interaction with the landscape. Recommended for small segments of the red areas.

B) Options of seed mixes to address physical and construction characteristics. Enhanced seed mixes for typical feature diversity such as slopes, wet areas, etc.

- Riparian mix – Created to revegetate locations occurring on the banks along water features where erosion concerns and wet soils are present.

- Wet Meadows Mix – Created to revegetate locations that are usually wet, but sometimes dry; species can tolerate saturated or dry soils.

- Wetland Mix - Created to revegetate locations that are inundated or saturated at all times; species can tolerate constantly wet conditions.

Localized recommendations by segment

The base seed mix should be used at a minimum on the entire run of the project although we encourage the MVP team to consider an upgrade if possible within budget and planning. Regardless of the option used, a localized analysis of the route conservation assessment displayed specific needs and additional considerations for higher diversity mixes to be used on specific segments.

Incorporating habitat improvements into corporate land management and planning represents a powerful, integrated approach to ecological health and sustainability.

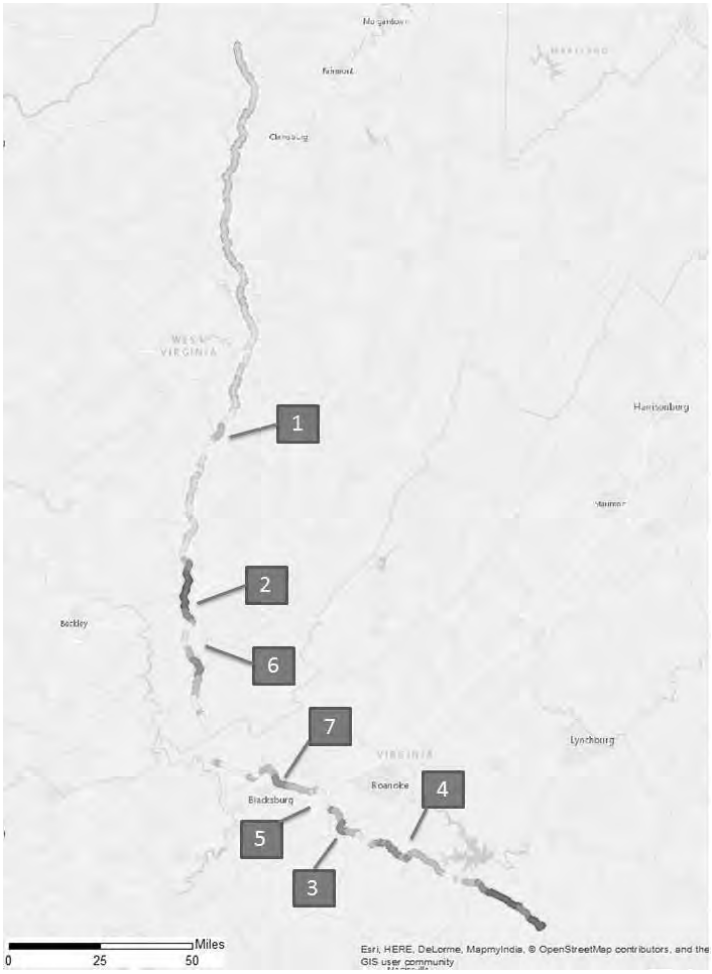
Tables with examples of evaluated information from various route alternatives have been provided for which WHC recommends considering higher value mixes (Level 1-3). Critical segments are provided in one table (Appendix E) and critical crossings (Appendix F) are addressed in another. Complete lists of WHC recommendations will be provided upon completion of field surveys.

Example of noteworthy items includes:

- Water features such as wetlands, reservoirs, rivers, streams, etc.
- Land held in conservation easements or labeled as priority with groups such as The Nature Conservancy, Virginia Outdoors Foundation and Blue Ridge Land Conservancy
- Locations with high visibility potential such as major road and recreational trail crossings
- Proximity to residential areas and schools

Upgraded mixes should be considered for as many segments and points as feasible in order to provide habitat for a wider range of wildlife species. This will create pockets of higher biodiversity while providing an atmosphere of learning for community members.

The identified critical segments do not address the locations driven by physical features (wetlands, topography) as it is always recommended the team use survey data gathered in the field to pinpoint those locations.



Map 2: Numbers notate the general vicinity of critical segments as determined by assessment

Stewardship Activities

For purposes of stewardship activities and future habitat enhancements, the MVP team can revisit the assessment to help determine site visit locations for WHC and/or other stakeholders. The right-of-way created for the natural gas pipeline holds high potential for additional habitat enhancement activities such decreased edge effect where present, installation of songbird nestboxes and other artificial nesting structures as well as community engagement events and sustainable agriculture initiatives.

WHC encourages the MVP team to build momentum in the communities the route traverses by increasing its presence around activities linked to conservation and environment. Initiating a dialogue about the upcoming project in different settings will continue to disseminate the right information into community groups and offer the opportunity to meet community leaders in the areas (WVDNR, USFWS, VDGIS, etc…) who will be valuable partners in next steps.

Outreach Opportunities

During work on the MVP right-of-way, there may be road and trail closures for a period of time. The project area will presumably present signage of any closures and construction areas. WHC recommends supplementing the standard construction signage with large signs informing community members of the restoration efforts in place. Optimal areas for educational signage are in high foot traffic locations such as recreational areas and trail crossings. If the project uses temporary fencing, similar signage can be prepared for banners adapted to fencing. The signage can accompany the construction crews throughout the project life and provide a different narrative around the construction and restoration work.

Schools in close proximity offer great opportunities for partnership and benefit to both parties. Teachers from elementary thru high school can utilize the restored native habitat for science classes, while higher level schools can conduct annual studies and identification surveys on flora, fauna and water quality to create solid monitoring documentation for the MVP team's records. Signage is a good motivator to harness partners to participate in stewardship activities if MVP finds it feasible to focus efforts towards community outreach and engagement.

Maintenance and Monitoring of a Grassland Habitat

A long term maintenance plan is important to draft and understand prior to planting. Maintenance of a grassland habitat should include a mowing regimen (as controlled burns will be more difficult to conduct) in order to maintain the open nature of the early succession growth while suppressing the growth of trees and shrubs. It will also promote the productive growth of native wildflowers and grasses, and may help to increase the diversity of these plants as well. All maintenance operations will be completed within the requirement of FERC.

In the case of the MVP, the team has committed to no herbicide use unless instructed by a federal agency such as the United States Forest Service. They will bypass chemical removal and opt for mechanical and hand removal of woody species. An example of when MVP may be instructed to use an approved herbicide would be in cases of severe invasive species populations where appropriate application of herbicide by a certified expert is necessary to reduce infestations to work towards eradication.

If a mowing schedule is conducted, mow outside the nesting season to prevent harm to birds and their nests. Mow either in the early spring (late March to early April), which will remove the previous year's vegetation and new growth by non-native, cool-season grasses and other invasive plants, or in the early fall (September to early October). Mow in a way

that will flush any wildlife in the grasses out from the center of the field, so they do not become trapped in the field during mowing (e.g., spiraling outwards from the center).

In addition to routine maintenance, the MVP team should be sure to monitor the growth and abundance of the desired native grasses and wildflowers as well as other vegetation in the grassland habitat. Monitoring data will provide information on the diversity of native grasses and wildflowers, persistence of weeds, and overall community structure.

Third Party Recognition

Eligibility for WHC Conservation Certification

Habitats maintained, enhanced or created as part of the Mountain Valley Pipeline could be qualifying projects under WHC's Conservation Certification. Beyond habitat and species projects, stewardship and community outreach activities can also be eligible. Based on the recommendations provided in this document and dependent upon the results of implementation decisions, MVP would most likely be eligible for certification under the project type "grasslands".

In the event that the MVP team pursues additional activities discussed on various occasions, the program could then consider the following project types as well for certification:

- Pollinator Species: if monitoring for pollinator presence and population diversity in some specific areas of the right-of-way occur.
- Awareness & Community Engagement: if educational signage is being used or if active projects involve schools or community groups.

MVP must have at least one qualifying project on the ground prior to submitting a certification application. An eligible project could include a portion of restored native habitat on the right-of-way or the entire restored right-of-way. As part of an integrated program, all acts of conservation should be documented and submitted. To be recognized as a qualifying project, one of the projects suggested above will need to meet the following criteria:

1. Be locally appropriate (e.g., relevant to the habitat conditions found on site, relevant to the needs of the surrounding ecosystem, and/or learning needs for the community, etc.).
2. Exceed regulatory requirements, if any are associated with the upgrade.
3. Associated with at least one conservation and/or education objective, which provides guidance for making management decisions and evaluating outcomes.

4. Provides habitat value that benefits local wildlife and/or provides community value that benefits a learning audience.
5. Supported by documentation of measurable outcomes for project activities, such as lists of species planted, habitat monitoring logs, meeting notes, lesson plans, photographs, etc.

Documentation is a vital component of WHC's Conservation Certification. Information pertaining to planning, implementation, maintenance, and monitoring activities for each project should ideally be captured. Required and suggested data to collect for suggested projects are presented as a reference in the table below.

WHC Project Guidance documents will soon be available on wildlifehc.org for a complete description of the characteristics required and recommended for the projects, as well as suggested conservation and education objectives and the list of application questions to anticipate. A WHC representative can best help guide the certification path and documentation once decisions on restoration and activities are completed.

Table 1: Conservation Certification Theme Alignments

Theme	Minimal Activities & Documentation	Recommended Desirable Characteristics
Grassland Habitat	▪ Seed the grassland with native species of flowering plants and grasses to add native plant diversity appropriate for the region ▪ Monitor plant species diversity, survival, and visitation of the habitat by wildlife ▪ Document activities (e.g., photos of habitat, monitoring and/or maintenance logs, seed mix lists) ▪ Monitor and control for non-native, invasive species in the grassland	▪ Meet the habitat needs for one or more species of concern (may include shrub & tree structural requirements for birds) ▪ Consider expanding into conservation areas if possible ▪ Utilize the grassland as a learning context for education of local community members about grassland ecology and/or the importance of grassland habitats ▪ Share knowledge resulting from the project with an outside entity, via outlets such as publication, presenting at conferences, or submitting data collected by trained volunteers to a citizen science program
Pollinator Species	▪ Plant native plants that benefit local pollinator species ▪ Monitor plant diversity, survival, and visitation by pollinators ▪ Document activities (e.g., photos of habitat and signage, monitoring logs, seed mixes, plant tour agendas and dates, employee communications)	▪ Link efforts to corporate commitment ▪ Post informational signage in the pollinator habitat for visitors to learn about the plants and how they benefit pollinators ▪ Submit pollinator monitoring data to existing citizen science projects, such as annual butterfly counts via North American Butterfly Association
Awareness & Community Engagement	▪ Conduct educational activities that raise awareness about an environmental or conservation topic related to the site's habitat program (e.g., Earth Day event, on-site planting event, visiting schools, employee training) ▪ Document activities (e.g., partner correspondence, examples of curriculum used, event agendas, photographs)	▪ Align the program content with the educational goals of partner organizations (e.g., curriculum standards, scout badges)

For any project to be eligible for application of WHC conservation certification, including native restoration, the MVP team must be able to show documented results of a project. Evidence of ongoing activity must be provided at the time of application. Submit species lists, monitoring and maintenance logs (as recommended above) along with photographic evidence of established flora and fauna utilizing habitat. Include items such as education material used for public outreach efforts (flyers distributed at the open houses – Appendix B) and photos of any signage the team installs in a temporary or permanent manner along right-of-way to educate the community on what is taking place.

In addition, provide documentation and support of any community activities or events that take place with any stakeholder groups. For example, if MVP hosts a planting event near the Appalachian Trail or other recreational area, submit photos and keep detailed logs of activities and sign-up sheets.

WHC will be available for continued presence, guidance and assistance as needed throughout the MVP right-of-way process through certification.

NATIVE RESTORATION ON THE MOUNTAIN VALLEY PIPELINE RIGHT-OF-WAY

Appendix A - Map
Larger version of map 1 showing colored segments

Appendix B – External flyers
One page – front & back – flyers created specifically for external circulation during public meetings in Virginia and West Virginia

Appendix C – Example pre-made seed mix
Commercially available native seed mix example recommended as potential base mix for use along the entire stretch of right-of-way

Appendix D – Seed mix summary guide
Guide for quick reference as to what each seed mix would be recommended for as created in collaboration with reputable seed supplier, Ernst Seeds

Appendix E – Segments of importance
Table created to assist MVP team in choosing locations to implement upgraded seed mixes. Segments highlighted in red indicate higher priority.

Appendix F – Specific crossings of potential interest
Table created to highlight crossings that may be of high interest to MVP team. If team chooses to implement upgrade seeding, choose red as highest or first priority, orange second and green as lowest or last priority.

Appendix A

Green: limited conservation impact beyond the localized changes to the habitat from the presence of the right-of-way.

Orange: potential need for a balanced approach to conservation and natural resources due to moderate occurrence of important ecological features and declaration of conservation priorities.

Red: highest opportunity for an integrated approach to conservation and habitat enhancement in conjunction witheducation and outreach efforts with potential for partner involvement. The red stretches suggest strong conservation values and priorities to align with.

WILDLIFE HABITAT COUNCIL℠

Native Reclamation in **Virginia**

Songbirds benefit from early successional habitat as a food source and for shelter.

What is Native Reclamation?

Native species are animals and plants that originally evolved with one another in a specific area. Reclamation is the process of planting vegetation to re-establish improved conditions in disturbed areas. Native reclamation creates a better environment for wildlife, such as pollinators and other insects, songbirds, and small mammals, to flourish.

Why Does WHC Recommend Native Reclamation?

Compared to non-native plants, native plant species provide greater value to wildlife, produce greater water quality benefits, and require less maintenance with irrigation, fertilizers and pesticides.

What is Early Successional Habitat?

Early successional habitat is an environment in the early stages of becoming a forest, and is typically dominated by forbs, grasses and shrubs. Early successional habitats include meadows and grasslands.

What are the **benefits**?

Benefits to **WATERSHEDS**

A watershed is the area of land where all of the water that is under it or drains off of it goes into the same body of water, like a river or stream. Native plants in an early successional habitat benefit watershed health and water quality in many ways, including:

- The deep, extensive root systems of the native grasses, forbs and shrubs stabilize soil, which prevents erosion and water quality problems associated with it.
- Native plants also reduce flooding and improve water quality in watersheds by absorbing stormwater runoff (and many of its pollutants), and improving soil drainage and filtration for runoff that enters the soil.
- Native plants also help filter out particles (siltation) in runoff as it flows past them.

Benefits to **SOILS**

Native warm-season grasses and forbs in an early successional habitat develop deep, complex root systems that contribute to soil health, as they improve soil drainage and reduce compaction. Here's how:

- The decomposition of these native plant root systems contribute significant amounts of organic matter to the soil over time, further enhancing soil drainage, improving moisture, increasing nutrients, and reducing compaction.
- These deep, complex root systems provide much greater soil stabilization than the poorly developed root systems of non-native cool-season turf grasses like fescue.

More →

Benefits to **POLLINATORS**

Pollinators are the animals – including bees, butterflies, moths, hummingbirds, beetles, flies, and, in some regions, bats – that feed on nectar in flowers. By doing so, they move pollen from flower to flower to accomplish fertilization. Most North American bees are solitary, so they rarely sting because they have no colony to defend (unlike the non-native European honeybee). Pollinators are vital to the health and economy of the world, propagating wild flowering plants as well as many crops. Their many benefits include:

- Early successional habitats that include a diversity of native grasses, forbs and shrubs provide valuable homes to a variety of pollinator species. Native plants have been shown to support more abundant and diverse pollinators than non-native plants.
- Pollinators can forage for nectar and pollen among the flowering plants in this habitat.
- The fruits of many trees, shrubs, and vines provide important food sources for butterflies.
- Pollinators can seek shelter in tall grasses, forbs, and shrubs.
- Many of the plants in early successional habitat also serve as larval host plants for caterpillars, who rely on these plants for leafy forage and cover.

Pollinators using wildflowers in an early successional habitat.

Benefits to the **COMMUNITY**

Early successional habitats can provide many aesthetic, recreational and health benefits to the local community, including:

- Improved water quality in local water bodies and groundwater resources, particularly if wells and reservoirs are the primary sources of drinking water.
- The colorful flowers of native forbs and shrubs growing in the early successional habitat can greatly improve the look of the area.
- The animals attracted to the early successional habitat provide unique wildlife watching opportunities.

Preventing **INVASIVE SPECIES**

When species are introduced into an area where they do not naturally occur, the predators, parasites and competing species that would normally limit them are lacking. As a result, some of these species become invasive, causing harm to that ecosystem by aggressively outcompeting or predating upon other species.

Controlling invasive species is vital to the conservation of native habitats and wildlife. Because they are more likely to establish in disturbed areas, creating an early successional habitat by planting native plant species as soon as possible after the pipeline has been installed will help prevent the establishment of invasive species.

WILDLIFE HABITAT COUNCIL℠

Native Reclamation in **West Virginia**

Songbirds benefit from early successional habitat as a food source and for shelter.

What is Native Reclamation?

Native species are animals and plants that originally evolved with one another in a specific area. Reclamation is the process of planting vegetation to re-establish improved conditions in disturbed areas. Native reclamation creates a better environment for wildlife, such as pollinators and other insects, songbirds, and small mammals, to flourish.

Why Does WHC Recommend Native Reclamation?

Compared to non-native plants, native plant species provide greater value to wildlife, produce greater water quality benefits, and require less maintenance with irrigation, fertilizers and pesticides.

What is Early Successional Habitat?

Early successional habitat is an environment in the early stages of becoming a forest, and is typically dominated by forbs, grasses and shrubs. Early successional habitats include meadows and grasslands.

What are the **benefits**?

Benefits to **WATERSHEDS**

A watershed is the area of land where all of the water that is under it or drains off of it goes into the same body of water, like a river or stream. Native plants in an early successional habitat benefit watershed health and water quality in many ways, including:

- The deep, extensive root systems of the native grasses, forbs and shrubs stabilize soil, which prevents erosion and water quality problems associated with it.
- Native plants also reduce flooding and improve water quality in watersheds by absorbing stormwater runoff (and many of its pollutants), and improving soil drainage and filtration for runoff that enters the soil.
- Native plants also help filter out particles (siltation) in runoff as it flows past them.

Benefits to **GAME SPECIES**

Early successional habitats provides important foraging opportunities for game species like deer, wild turkey, quail, and mourning doves, including:

- Native forbs, grasses, and shrubs provides food such as seeds, nuts, berries, herbaceous forage, and woody browse. Specifically, woody plants and wildflowers – particularly legumes and mast-producing shrubs – provide the most valuable browse sources to deer.
- Native plants support the insects eaten by many game birds, including quail and juvenile wild turkey.
- The native bunch grasses, forbs, and shrubs provide smaller game species, like quail, with valuable shelter from predators and the elements.

More →

Benefits to **POLLINATORS**

Pollinators are the animals – including bees, butterflies, moths, hummingbirds, beetles, flies, and, in some regions, bats – that feed on nectar in flowers. By doing so, they move pollen from flower to flower to accomplish fertilization. Most North American bees are solitary, so they rarely sting because they have no colony to defend (unlike the non-native European honeybee). Pollinators are vital to the health and economy of the world, propagating wild flowering plants as well as many crops. Their many benefits include:

- Early successional habitats that include a diversity of native grasses, forbs and shrubs provide valuable homes to a variety of pollinator species. Native plants have been shown to support more abundant and diverse pollinators than non-native plants.
- Pollinators can forage for nectar and pollen among the flowering plants in this habitat.
- The fruits of many trees, shrubs, and vines provide important food sources for butterflies.
- Pollinators can seek shelter in tall grasses, forbs, and shrubs.
- Many of the plants in early successional habitat also serve as larval host plants for caterpillars, who rely on these plants for leafy forage and cover.

Pollinators using wildflowers in an early successional habitat.

Benefits to the **COMMUNITY**

Early successional habitats can provide many aesthetic, recreational and health benefits to the local community, including:

- Improved water quality in local water bodies and groundwater resources, particularly if wells and reservoirs are the primary sources of drinking water.
- The colorful flowers of native forbs and shrubs growing in the early successional habitat can greatly improve the look of the area.
- The animals attracted to the early successional habitat provide unique wildlife watching opportunities.

Benefits to **GROUND-NESTING BIRDS**

Ground-nesting birds are a suite of bird species that build their nests on the ground, in between the bunching native grasses and forbs, or sometimes underneath shrubby cover. Many of the bird species that use early successional habitat are ground-nesters and will benefit in the following ways:

- Native grasses and shrubs in the early successional habitat provide the cover these birds need for nesting.
- Birds also use the spaces between bunching grasses and forbs for moving about in the early successional habitat.
- Native grasses and forbs provide the birds food in the form of seeds and insects.

Appendix C

Native Upland Wildlife Forage & Cover Meadow Mix

ERNMX #	ERNMX-123
Cost Per Pound	$8.81
Seeding Rate	20 lb per acre
Mix Type	Upland & Meadow Sites
Species List (click for details)	35% Big Bluestem, 'Prairie View'-IN Ecotype (Andropogon gerardii, 'Prairie View'-IN Ecotype) 21% Virginia Wildrye, PA Ecotype (Elymus virginicus, PA Ecotype) 18% Switchgrass, 'Shawnee' (Panicum virgatum, 'Shawnee') 10% Coastal Panicgrass, 'Atlantic'-VA Ecotype (Panicum amarum, 'Atlantic'-VA Ecotype) 5% Partridge Pea, PA Ecotype (Chamaecrista fasciculata (Cassia f.), PA Ecotype) 3% Blackeyed Susan, Coastal Plain NC Ecotype (Rudbeckia hirta, Coastal Plain NC Ecotype) 3% Indiangrass, PA Ecotype (Sorghastrum nutans, PA Ecotype) 2% Oxeye Sunflower, PA Ecotype (Heliopsis helianthoides, PA Ecotype) 1.5% Showy Ticktrefoil, PA Ecotype (Desmodium canadense, PA Ecotype) 1% Plains Coreopsis (Coreopsis tinctoria) 0.4% Panicledleaf Ticktrefoil, PA Ecotype (Desmodium paniculatum, PA Ecotype) 0.1% Common Milkweed, PA Ecotype (Asclepias syriaca, PA Ecotype) Total: 100%

Prices are subject to change without notice. Please call (800) 873-3321 for current pricing.

See more at: http://www.ernstseed.com/seed-mix/?category-id=299#sthash.sgs2t2Wa.dpuf

Appendix D

Native Restoration – Virginia Options Rev 5/20/15

Seed Mix		Description	Purpose
Native Base Mix		Standard mix of native species with **bulk native warm season grasses** and limited wildflower species included	Recommended as a minimum base mix for entire ROW; not ideal for sensitive areas
Meadow Mix	1	**High level diversity**; mix of native warm season grasses and wildflower species that offer valuable early successional habitat to wide variety of native wildlife; low profile, aesthetically pleasing mix	• Highly visible areas • More sensitive/conservation driven segments • Generally short stretches on ROW where community members tend to be present (i.e. trails, parks, other recreational areas) • Can be utilized for educational activities and outreach
	2	**Very good diversity**; native warm season grasses and wildflower species offer quality early successional habitat to native wildlife species; low profile aesthetically pleasing mix	
Pollinator Mix	1	Well-balanced native species with **excellent variety** of native warm season grass and wildflowers to target pollinator species including monarch butterflies	• Mix options for stretches along ROW • Provides range of quality: from increased biodiversity mix for native restoration to high quality native pollinator habitat • Suitable for slopes 3:1 and lower
	2	**Very good diversity** Native species with good variety of native warm season grass and wildflower species to target pollinator species including monarch butterflies	
	3	Native species mix with warm season grasses and wildflower species included to provide **diverse habitat with a pollinator focus**	
Steep Slope Mix	1	**High diversity** of native warm season grasses and wildflowers better suited to vegetate steeper slopes while still providing quality habitat for pollinators and other species	• Use mix on stretches of ROW with slopes greater than 3:1 • Utilize data collected from surveys conducted directly on MVP ROW to identify locations
	2	**Medium diversity** of native warm season grasses and wildflowers better suited to vegetate steeper slopes while still providing suitable habitat for pollinators and other species	
Riparian Mix		Native warm season grasses and wildflowers well suited to vegetate locations occurring on the bank of water features (i.e. river, stream, lake)	• Use mix on stretches of ROW along water features
Wet Meadow Mix		Mix of native species that can tolerate areas of wetness and dryness (saturation or not); grasses, sedges, and wildflowers well suited to vegetate locations that are usually wet, but sometimes dry	• Use mix on stretches of ROW where habitat occurs such as wet meadows
Wetland Mix		Mix of native, water-loving species for areas that are inundated or saturated at all times	• Use mix on stretches of ROW where wetland habitat occurs

Appendix D

Native Restoration – West Virginia Rev 5/20/15

Seed Mix		Description	Purpose
Native Base Mix		Standard mix of native species with **bulk native warm season grasses** and limited wildflower species included	Recommended as a minimum base mix for entire ROW; not ideal for sensitive areas
Meadow Mix	1	**Higher diversity**; mix of native warm season grasses and wildflower species that offer valuable early successional habitat to wide variety of native wildlife; low profile, aesthetically pleasing mix	• Highly visible areas • More sensitive/conservation driven segments • Generally short stretches on ROW where community members tend to be present (i.e. trails, parks, other recreational areas) • Can be utilized for educational activities and outreach
	2	**Good diversity**; native warm season grasses and wildflower species offer quality early successional habitat to native wildlife species; low profile aesthetically pleasing mix	
Pollinator Mix	1	Well-balanced native species with **excellent variety** of native warm season grass and wildflowers to target pollinator species including monarch butterflies	• Base mix for longer stretches along ROW • Provides range of quality: from base mix for native restoration to high quality native pollinator habitat • Suitable for slopes 3:1 and lower
	2	**Medium Diversity** Native species with good variety of native warm season grass and wildflower species to target pollinator species including monarch butterflies	
	3	Native species with **bulk native warm season grasses** and limited wildflower species included	
Steep Slope Mix	1	**High diversity** of native warm season grasses and wildflowers better suited to vegetate steeper slopes while still providing quality habitat for pollinators and other species	• Use mix on stretches of ROW with slopes greater than 3:1 • Utilize data collected from surveys conducted directly on MVP ROW to identify locations
	2	**Medium diversity** of native warm season grasses and wildflowers better suited to vegetate steeper slopes while still providing suitable habitat for pollinators and other species	
Riparian Mix		Native warm season grasses and wildflowers well suited to vegetate locations occurring on the bank of water features (i.e. river, stream, lake)	• Use mix on stretches of ROW along water features
Wet Meadow Mix		Mix of native species that can tolerate areas of wetness and dryness (saturation or not); grasses, sedges, and wildflowers well suited to vegetate locations that are usually wet, but sometimes dry	• Use mix on stretches of ROW where habitat occurs such as wet meadows
Wetland Mix		Mix of native, water-loving species for areas that are inundated or saturated at all times	• Use mix on stretches of ROW where wetland habitat occurs

Appendix E

	General location description	Recommended upgrade	Reason for seed mix upgrade; features of importance	Additional notes
1	Webster and Nicolas County in Craigsville, WV	Meadow Mix	Streams and wetlands; Cherry Run conservation easement **crosses along backyards and town**	
2	South of Greenbrier into Summers counties	Appropriate wet mixes	**Sensitive area** - streams, wetlands, karst, protected areas, Wildlife Management Areas	Vast network of water features in this location
3	Roanoke, Franklin and Floyd county trisect	Meadow Mix	**Route follows stream, trail crossing present, dissects Blue Ridge Land Conservancy conservation easement**	Easement and trail crossing present
4	Franklin county	Meadow Mix	Streams and wetlands, several colleges in close proximity	**Appears to run along a creek and through some residential backyards**
5	Spring Hollow Reservoir in Roanoke County	Meadow Mix	Proposed route runs adjacent to reservoir	A nearby school provides a partnership opportunity here
6	Crossing from Summer into Monroe County	Appropriate wet mixes	River, wetlands, karst	River crossing; flood plain is nearly all agricultural – **Opportunity to discuss BMP's for agriculture**
7	Montgomery County	Appropriate wet mixes	Karst, conservation easement, TNC lands, streams	Crossing two water features, but mostly agricultural lands - **Opportunity to discuss BMP's for agriculture**

Appendix F

General Location Description	Recommended upgrade	Additional notes; reasons for suggested upgrade
Appalachian Trail Crossing	Meadow Mix	High foot traffic area
Runs directly through TNC conservation easement	Pollinator Mix	Consider reaching out to TNC to align with easement efforts
Running directly through wetland	Wetland Mix	Sensitive area
School located near proposed route	Meadow Mix	Red segment; opportunity for community involvement in area of priority
School located near proposed route	Meadow Mix	Consider partnering with James Monroe High School in Lindside, WV, Monroe County; area with upgraded seed mix could be utilized as outdoor classroom
School located near proposed route	Pollinator Mix	Consider partnering with Bent Mountain Elementary, area with upgraded seed mix could be utilized as outdoor classroom
Cluster of schools including higher level located near proposed route	Pollinator Mix	Opportunity for community relationship building activity if needed near northern portion of route
Approximately fifteen miles to Roanoke city center	Pollinator Mix	Red segment; strong opportunity to involve Roanoke County community, large cluster of schools including eight higher level
Cluster of schools located near proposed route	Pollinator Mix	Red segment; opportunity to involve Chatham, VA community in Pittsylvania County
Highway 29 road crossing with trail crossing	Meadow Mix	Higher visibility from road plus foot traffic
Highway 50 road crossing with recreational trail crossing	Meadow Mix	Higher visibility from road plus foot traffic
Highway 122 road crossing with recreational trail crossing #1	Meadow Mix	Higher visibility from road plus foot traffic
Highway 122 road crossing with recreational trail crossing #2	Meadow Mix	Very close to crossing #1, road visibility and foot traffic
Recreational trail crossing	Meadow Mix	Potential for high foot traffic
Recreational trail crossing	Meadow Mix	Potential for high foot traffic
Recreational trail crossing	Meadow Mix	Potential for high foot traffic
Recreational trail crossing	Meadow Mix	Potential for high foot traffic
Pigg River crossing	Riparian Mix	Major river crossing, potential high visibility
Virgil Goode Highway crossing	Pollinator Mix	Potential high visibility from major road crossing
Highway 29 road crossing	Pollinator Mix	Potential high visibility from road
Highway 81 and Highway 11 road crossings	Pollinator Mix	Crossings are as close as one mile from Spring Hollow Reservoir

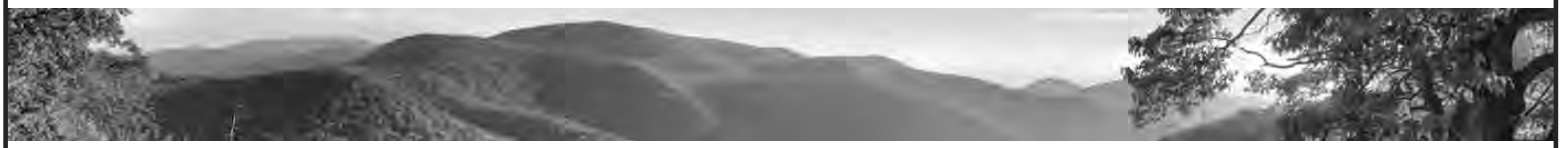
Appendix C

MVP. 2015b. Let's talk about protecting our ecosystems. Pipeline reports: a special series. (***Attached as Appendix C).*** Available at: https://www.mountainvalleypipeline.info/~/media/sites/mvp/files/EQT_MVP_Ecological_Resources_Advertorial.pdf)

Pipeline Reports: A Special Series

Let's talk about protecting our ecosystems.

Water resource protection strategies involve a collaborative effort between professionals, agencies, and wildlife organizations – and the Mountain Valley Pipeline (MVP) project team is committed to working extensively with various regulatory bodies and volunteer groups to ensure ecosystem preservation.



The MVP project includes a proposed underground, interstate natural gas pipeline that when complete would transport natural gas from the Marcellus and Utica shale regions through West Virginia and Virginia to energy consumers along its approximately 300-mile route and then access existing infrastructure to provide natural gas to the nation's Mid-Atlantic and Southeast regions. The project is subject to approval and regulatory oversight from the Federal Energy Regulatory Commission (FERC).

The proposed pipeline route unavoidably crosses, or is near, many water features and resources. However, long before the first shovel of soil is moved — detailed environmental, habitat, and groundwater studies will determine the best possible means to work in these sensitive areas, such as rivers, creeks, streams, and wetlands, in order to avoid potential impacts. Environmental experts will conduct thorough field evaluations to address erosion control, storm water runoff, karst, and other possible concerns to protect surface and groundwater resources. MVP's water and environmental experts are in communication with authorities and regulators to develop comprehensive plans that have oversight by state and federal environmental agencies.

In addition, MVP has partnered with the Wildlife Habitat Council (WHC), a non-profit organization with a long history of restoring and enhancing wildlife habitats. Operating in 45 states and 12 countries, the WHC was the first organization to bring together conservation and business to balance the demands of economic growth with a commitment to responsible environmental stewardship.

"One of the highest priorities for our MVP project team is to ensure the sustainability of the entire ecosystem along the pipeline route – and waterways are certainly a critical element of that plan," said Shawn Posey, Senior Vice President, Mountain Valley Pipeline Engineering and Construction. "From planning, to construction, to restoration, MVP will work with local, state and federal regulators and agencies, as well as with environmental experts from the WHC to make sure that we effectively restore or enhance waterways and wetlands along the route."

Although not typically affected by pipeline construction, MVP plans to identify drinking-water wells located within 150 feet of the pipeline and work with landowners to establish water quality benchmarks prior to construction; and monitoring will continue during construction. Based on scheduling, water sources for domestic use would be sampled three to six months in advance of the construction and immediately prior to construction. The site setting, geology, and topography, along with conditions encountered during trenching would be carefully considered. As a final assurance that no impacts occurred, the supply would be sampled again upon completion of site restoration.

Where wetlands and streams cannot be avoided, MVP engineers will seek to minimize potential impacts by utilizing reasonable crossing procedures. With regulatory approval and oversight, these procedures may include:

- *Dam and pump crossing* that uses temporary dams upstream and downstream to briefly halt water flow
- *Flume crossing,* which directs the flow of water through temporary pipes
- *Horizontal bore crossing/horizontal directional drilling,* which uses boring equipment to safely pass under waterbodies, roads, and railroad tracks
- *Open-cut crossing,* where a trench is excavated across a waterbody and prefabricated pipeline segments are installed with native material, causing no disruption of water flow
- Selective use of highly regulated blasting techniques, only where standard excavation is not possible due to hardness of the rock

Restoration and Reclamation

As each segment of the proposed pipeline is complete, restoration of waterways and wetlands will begin. Topography will be graded to match original contours and to be compatible with surrounding drainage patterns, except at those locations where permanent changes in drainage are required to prevent erosion and possible exposure of the pipeline.

To restore wetlands, there are varying degrees of saturation and water elevation that will require the re-establishment of a variety of plant species. In unsaturated wetlands, most vegetation will be replaced by seeding, while saturated wetlands will typically be allowed to re-vegetate naturally.

"Our goals are to restore the local habitat and waterways along the pipeline route to their condition prior to construction, and where possible enhance that habitat, and that is just one of the ways that we will define success," added Posey.

The safety of our communities, our employees, our contractors, and our pipeline will always remain a top priority – as will the preservation and protection of the environment. This is the standard we live by every day, reinforcing what we mean when we say we're completely committed to building the Mountain Valley Pipeline safely and responsibly. Nothing is more important to us.

Pipeline Reports: A Special Series is sponsored by Mountain Valley Pipeline, LLC. For more information, please visit www.MountainValleyPipeline.info.

Appendix D

USFS (US Forest Service). 2005. Weed of the week: tall fescue. USDA Forest Service, Forest Health Staff, Newtown Square, PA. Available at: https://www.na.fs.fed.us/fhp/invasive_plants/weeds/tall_fescue.pdf.

Tall Fescue

Lolium arundinaceum (Schreb.) S.J. Darbyshire
Sold and widely known as Festuca arundinacea

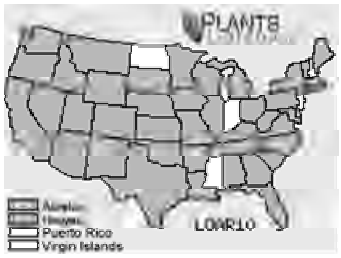
Common Names: Tall fescue, Kentucky 31 fescue is a cultivar name. Not all Tall fescue is KY-31.

Native Origin: Europe, introduced into the United States in the early to mid 1800s for turf, forage, soil stabilization, and wildlife food plots.

Description: Erect, tufted cool-season perennial grass 2 to 4 feet in height, green in winter and spring, during which it is the most common green bunchgrass. Dark-green leaves appearing in late winter, usually flowering in spring (infrequently in late summer). It is semi-dormant during heat of summer, with whitish seed-stalks persisting. Growth resumes in fall and continuing into early winter. Stems are moderately stout, un-branched, hair-less with round cross section and one to three swollen light-green nodes widely spaced near the base. Flat and long lanceolate leaves are 4 to 18 inches long and 0.1 to 0.3 inch wide. In spring, greenish white flowers become purplish and form spindle-shaped clusters. Seeds are husked grain, spindle-shaped, and 0.1 to 0.2 inch (3 to 5 mm) long. It reproduces by seed and spreads vegetatively, forming dense, solid stands.

Distinguishing characteristics include: forming extensive colonies and infestations, growing green in late winter, and having long rounded stems with lower swollen nodes and whitish-flared collars at the base of leaves.

Habitat: Tall fescue, a predominant cool-season bunchgrass, is adapted to a wide range of conditions. It grows best on deep, fertile, silty to clayey loam (medium to heavy texture) soils with open sunlight and a balanced supply of moisture (mesic). It invades a variety of habitats including fields, forest margins, roadsides, ditches, railroad tracks, forest openings, savannas and moist, disturbed places.



Distribution: This long-lived, aggressive perennial invades open areas throughout the United States.

Ecological Impacts: While an invasive species on native grasslands, where it is often considered a pest, it is also a valued turf and forage plant in managed pastures. It can invade grassland, savanna and woodland habitats and the edges of some open marsh and fen systems. It is a persistent perennial that can compete strongly with many native species. It spreads mainly through rhizomes and can form extensive colonies that compete with and displace native vegetation. It is frequently infected with an endophytic fungus that can causes illness such as aborted fetuses in livestock and some wild animals. The endophyte fungus is intentionally developed in many cultivars, in particular KY-31 to give staying power under adverse soil and weather conditions. It is also this fungus that helps make the endophyte containing cultivars aggressive. Endophyte-free varieties are much less invasive.

Control and Management:

- Manual- This species can be controlled by planting competitors, especially legumes. Early spring burning—if repeated—inhibits fescue and encourages native warm-season grasses.
- Chemical- On forest lands, apply a glyphosate herbicide as a 0.5-percent solution in water or imazapyr as a 1-percent solution in spring. On noncroplands apply imazapic 10 to 12 dry ounces per 20 gal. mix (consult the label for additives) per acre in spring. Follow label directions and state requirements.

References: www plants.usda.gov, www.invasive.org/browse/subject.cfm?sub=3037, ELEMENT STEWARDSHIP ABSTRACT- http://tncweeds.ucdavis.edu/esadocs/documnts/festaru.html, Nonnative Invasive Plants of Southern Forests, p. 48-49, www.invasive.org/eastern/srs/TF.html

Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA. WOW 10-24-05
Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants

Appendix E

USFS (US Forest Service). 2006. Weed of the week: crown vetch. USDA Forest Service, Forest Health Staff, Newtown Square, PA. Available at: https://www.na.fs.fed.us/fhp/invasive_plants/weeds/crown-vetch.pdf.

CROWN VETCH

Coronilla varia L.

Common Names: crown vetch, purple vetch

Native Origin: Europe, southwest Asia and northern Africa

Description: Crown vetch is a perennial legume in the pea/legume family (Fabaceae or Leguminosae. It can form large clumps from creeping stems. The stems can be up to 6 feet long. Crown vetch has rhizomes up to 10 feet long which allow the plant to spread rapidly. The vegetative growth habit can rapidly cover and shade out native vegetation. A single plant may fully cover 70 to 100 square feet within a four year period. Compound leaves consist of 15-25 pairs of oblong leaflets. Pinkish flowers are clustered in umbels on long stalks. The flowers develop into narrow, flattened pods. The seeds are reported to be poisonous. Crown vetch blooms from May through August. It spreads both vegetatively through rhizomes and through the dispersal of seeds.

Habitat: Crown vetch has been grown extensively in the northern two-thirds of the United States for temporary ground cover, erosion control, and as a green fertilizer crop. It is also used as a bank stabilizer along roads and waterways. It occurs along roadsides and other rights-of-way, in open fields and on gravel bars along streams. It can survive in a variety of environmental conditions, but has the highest yields in areas with 18 inches or more annual precipitation. It can tolerate up to 65 inches of annual precipitation, as well as withstand long periods of drought, but cannot tolerate flooded or anaerobic soil conditions. It prefers sunny, open areas, as it is intolerant of shade, and mature plants can withstand minimum temperatures of –28° F.

Distribution: This species is reported from states shaded on Plants Database map. It is reported invasive in CT, IN, KY, MD, MI, MO, NC, NJ, OR, TN, VA, and WI.

Ecological Impacts: Crown vetch is a serious management threat to natural areas due to its seeding ability and rapid vegetative spreading by rhizomes. This aggressive exotic is now widespread along roadsides and natural areas. It becomes problematic when it invades into natural areas, such as grassland prairies and dunes, where it works to exclude native vegetation by fully covering and shading native plants. It can climb over small trees and shrubs, and eventually form large single-species stands.

Control and Management:

- Manual- pulling out the entire plant; mowing; prescribed burning may be effective against seedlings or in slowing the spread of crown vetch, but will not control large populations

- Chemical- It can be effectively controlled using any of several readily available general use herbicides such as glyphosate, triclopyr, or clopyralid at recommended label rates on the cut stems and foliage. Follow-up treatment with herbicide is likely required to control any surviving stems or new seedlings. Follow label and state requirements.

References: http://plants.usda.gov, www.conservation.state.mo.us, http://tncweeds.ucdavis.edu/esadocs/documnts/corovar.html, www.forestimages.org, www.nps.gov

Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA. WOW 02-01-06
Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants

Appendix F

Williams, S.C., and J.S. Ward. 2006. Exotic seed dispersal by white-tailed deer in Southern Connecticut. Natural Areas Journal 26:383-390.

RESEARCH ARTICLE

Exotic Seed Dispersal by White-tailed Deer in Southern Connecticut

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Natural Areas Journal 26:383–390

ABSTRACT: We examined the role of suburban white-tailed deer (*Odocoileus virginianus* Zimmerman) in dispersal of exotic plants in forests bordered by medium-density housing in southern Connecticut. Estimated deer density on the research site was 23 deer/km^2 with higher local densities along the suburban/woodland interface. In 2002, 90 pellet groups were gathered periodically from September through December. In 2003, eight pellet groups were collected weekly from early June through late December for a total of 236. All pellet groups were vernalized at 5°C for 60 days. Pellet groups were placed in a growing medium in trays in a temperature controlled greenhouse for six months. Seeds germinated from 47% of pellet groups, which included 656 seedlings of 57 species. Seeds (n = 326) of 32 species not native to Connecticut germinated in 23% of pellet groups. We estimated that the deer herd on site had the potential to disperse 586-1046 viable exotic seeds/day/km^2 during the 2002 sampling period and 390-696 viable exotic seeds/day/km^2 during the 2003 sampling period. Birds, small mammals, and abiotic factors are known dispersal agents for exotic plants, some of which are invasive. Our results indicate that white-tailed deer are another important dispersal agent of exotic species. Thus, white-tailed deer may not only alter vegetation structure through direct browse damage of established plants, but also indirectly by lowering reproductive output of native plants and simultaneously distributing seeds of exotic species.

Index terms: exotic, foliage, fruit, pellet groups, seed dispersal, white-tailed deer

INTRODUCTION

Exotic plant invasions are the cause for significant ecological and economic damage (Blaustein 2001, Costello and McAusland 2003). The United States has approximately 5000 established exotic plant species, some of which are invasive and competing with 17,000 native species (Pimentel et al. 2000). Exotic species are spreading and invading wildlife habitat, displacing numerous native species in the process (Morse et al. 1995).

The invasion of woodlands by exotic plants is particularly noticeable in areas adjacent to suburban neighborhoods. Such areas are becoming more common throughout the United States as demand for development increases habitat fragmentation. This suburban/woodland interface has created ideal habitat for white-tailed deer (*Odocoileus virginianus* Zimmerman) with an abundance of food and protection from hunting and predation (DeNicola et al. 2000). Such areas often experience severe browsing rates of both native and ornamental plant species. Many residents establish gardens with a high proportion of ornamental exotics. These gardens provide a potential seed source for dispersal into adjacent wooded areas.

Until recently in the United States, the potential role of white-tailed deer in the dispersal of native, cultivated, and/or exotic seeds has been largely ignored. Vellend (2002) documented deer as vectors for dispersing honeysuckle (*Lonicera* L.). Vellend et al. (2003) documented deer as dispersing agents for a native species – *Trillium grandiflorum* ((Michx.) Salisb.). Myers et al. (2004) described deer as a long distance dispersal mechanism for numerous species of plants, including exotics. Our study investigated the role of free-ranging white-tailed deer on dispersal of exotic seeds along the suburban/woodland interface in Connecticut.

On our study site, female white-tailed deer (does) had a mean annual home range of approximately 80 ha (Ramakrishnan and Williams, unpubl. data). Deer often browse ornamental and landscape plantings within suburban areas during twilight hours. They retreat to adjacent forested areas during daylight, inevitably defecating and depositing seeds on the forest floor. Does who utilize the suburban/woodland interface within their range can transport seeds anywhere, from several hundred meters to over 3 km (Vickery et al. 1986, Vellend et al. 2003).

Because does have overlapping home ranges, exotic species that germinate and mature in adjacent forests may spread throughout the forest interior. In several growing seasons, does could potentially transport viable seeds many kilometers from suburban areas into wooded ones. Adult male deer (bucks) on the study site comprised approximately 20% of the

population based on vehicular transect data (Ramakrishnan and Williams, unpubl. data), but ranged over larger areas than does. They may transport seeds up to 10 km or further.

Deer probably ingest most seeds unintentionally as they browse. Seeds that would be able to withstand passage through a ruminant digestive tract would most likely be small and have a tough outer coating (Janzen 1984). It is unlikely that seeds of plants with fleshy, succulent fruits would be found in deer feces in any great abundance, as these types of seeds are usually fed upon and transported by birds (Willson 1986). The morphology of plants described by Janzen's (1984) "foliage is the fruit" hypothesis work on nearly the same principle. Plants of this nature have small and inconspicuous seeds proximate to palatable foliage. The hypothesis states that these small-seeded plants use incidental ingestion by large herbivores as a primary mode of dispersal. Seeds of this type were previously thought to be dispersed simply by gravity or surface water runoff (Janzen 1984), but unexplained long-distance dispersals of certain plant species have led researchers to look elsewhere (Myers et al. 2004). We expected the majority of exotic species that germinated from gathered pellet groups to exhibit this type of morphology.

White-tailed deer may play a role in the expansion of exotic species via three mechanisms: (1) increasing available growing space for new seedlings, (2) lowering reproduction output of native species, and (3) dispersal of exotic seeds. Waller and Alverson (1997) stated that in suburban areas, adverse effects of deer browsing are compounded by the invasion of woody and herbaceous exotic plant species. Casual observations suggest that deer dispersing seeds of cultivated and/or exotic species from suburban neighborhoods into adjacent woodlands further compound this problem. To examine this possibility, we gathered and planted deer pellet groups to determine which types of seeds would remain viable after passing through a ruminant digestive tract and could successfully germinate from intact pellets.

METHODS

Study Site and Deer Population

This study was conducted on the South Central Connecticut Regional Water Authority's Lake Gaillard property in southern Connecticut (41°21'N, 72°46'W) in the town of North Branford. The property is privately owned, closed to the public, and covers an area of approximately 2800 ha including a 400 ha reservoir. The property is managed for water quality with some commercial timber harvesting. Our research area was restricted to the 1550 ha bounding the reservoir to the south and extending northward. The property, excluding the reservoir, is approximately 90% forested with some fields and a spruce (*Picea* spp.) plantation at the south end.

The property north of the reservoir extends several kilometers and is considerably further from residential settlements. Legal hunting has been prohibited since the mid-1920s, which has fostered a large deer population. Based on four different censusing techniques (mark/recapture survey, walking line transect method, vehicle line transect method, aerial snow count), deer density was calculated at approximately 23 deer/km^2 throughout the study area in 2003. Portions of the southern population were estimated at 40 deer/km^2 while portions of the northern population were estimated at 14 deer/km^2 (Ramakrishnan and Williams, unpubl. data). Similar densities were reported in 1991 using pellet counts (Ward and Stephens 1995). Southern does had been observed utilizing residents' backyards and gardens as part of their range, while northern does seldom wandered into adjacent suburban areas.

Dominant tree species on site are oak (*Quercus* spp.), sugar maple (*Acer saccharum* Marsh.), tulip poplar (*Liriodendron tulipifera* L.), black birch (*Betula lenta* L.), and American beech (*Fagus grandifolia* Ehrh.). Because of high deer densities, very little woody understory vegetation is present except for sugar maple seedlings less than 10 cm tall, Japanese barberry (*Berberis thunbergii* DC.), winged burning bush (*Euonymus alata* (Thunb.) Sieb.), wine raspberry (*Rubus phoenicolasius* Maxim.), and cat greenbriar (*Smilax glauca* Walt.). Autumn olive (*Elaeagnus umbellate* Thunb.) has become well established in abandoned fields and disturbed areas. Medium-high density residential communities (~ 103 residences/km^2) bound the southern margin of the property.

Field procedures

Ninety pellet groups were collected from 13 September to 16 December 2002 throughout the site. An additional 236 pellet groups were collected from 2 June through 22 December 2003. In 2003, eight pellet groups were collected weekly – four each throughout the northern and southern portions of the site. We hoped to detect the time of year deer had the greatest potential to disperse exotic seeds. Coordinates of sampling locations were determined using standard 7.5-minute topographic quadrangles. Only pellet groups with a sufficient glisten were collected to insure they had been deposited since the previous sampling period. Care was taken to gather only pellets; leaf litter and soil were brushed away to prevent contamination. The entire pellet group was collected, placed in an individual sampling bag, and then vernalized at 5°C for 60 days.

After 60 days, entire pellet groups were removed and placed in pellet form on and lightly covered with the growing medium Promix® (Rivière-du-Loup, Québec, Canada). Pellet groups were individually marked and planted four to a tray. Planted pellet groups were kept in a temperature-controlled greenhouse at 24 ºC. Pellet groups were watered as needed and remained in the greenhouse for approximately six months. Seedlings were allowed to grow until they could be identified, at which time they were removed from the tray and discarded. One control tray was established for every four treatment trays (16 pellet groups) in 2002 and for every eight treatment trays (32 pellet groups) in 2003. These trays were filled with only Promix®. Control trays were placed among, and watered concurrently with, trays containing pellet groups.

We determined United States native versus exotic status and seedling nomenclature using the USDA Natural Resources Conservation Service's Plants Database (USDA, NRCS 2004). Plants native to Connecticut were determined using Dowhan (1979). Species found germinating in white-tailed deer pellets were classified into five categories: (1) F – small fruits that were directly targeted by deer, (2) S – small seeds in close proximity to succulent foliage, (3) G – grasses, (4) P – prostrate plants with seeds close to foliage, and (5) R – prostate plants with raised seeds heads.

Successful establishment of new colonies, essential for maintenance of a local population, is related to both the number of seeds within a pellet group (abundance) and the number of pellet groups with at least some viable seeds. The first factor increases the likelihood of at least one plant becoming established, and the second factor increases the chances of seeds being deposited in a microsite favorable for plant germination and development.

We calculated a dispersal index that incorporated both abundance and frequency. Species were ranked from highest to lowest by both abundance and frequency of occurrence. The dispersal index for each species was then determined by ranking the mean of these two rankings. Note that lowest index value, 1, was assigned to the highest ranked species.

Nine does were fitted with global positioning system (GPS) collars on site (Lotek Wireless Inc., Newmarket, Ontario, Canada) for a separate study during our sampling interval (Ramakrishnan and Williams, unpubl. data). Collars were programmed to record locations at two-hour intervals. Average movement of animals within a 24-hour period was calculated by averaging daily ranges of five random days within each month for each collared animal during the time the collars were deployed. The minimum convex polygon method within the Animal Movement extension (Hooge and Eichenlaub 1997) of the geographic information system program ArcView (Version 3.3, ESRI, Inc. Redlands, CA) was used to determine average daily area utilized (hectares).

RESULTS

Six hundred and fifty-six seeds germinated in 47% of pellet groups. Species not native to Connecticut accounted for 326 (50%) of seedlings. We were able to positively identify 57 taxa to the species level, and five to the genus, which included graminoids, forbs, and woody species. Two species, Canadian horseweed (*Conyza canadensis* (L.) Cronq.) and yellow wood sorrel (*Oxalis stricta* L.), were found in both control and treatment trays. These species were excluded from analysis because it could not be determined if individual seedlings originated in a pellet or were the result of contamination.

Of the 57 species that germinated from pellet groups, 35 (61%) were native to the United States, 10 of which were exotic to the state of Connecticut (Table 1). Thus, only 25 species (44%) were native to Connecticut, while 32 species (56%) were exotic. The most common exotic species was Carolina horsenettle (*Solanum carolinense* L.) comprising 33% of exotic seedlings, followed by little hogweed (*Portulaca oleracea* L.) (24%), lambsquarters (*Chenopodium album* L.) (12%), green carpetweed (*Mollugo verticillata* L.) (4%), redroot amaranth (*Amaranthus retroflexus* L.) (4%), and star chickweed (*Stellaria pubera* Michx.) (3%).

Frequency (percent of seedlings with at least one seedling of a given species) was also examined. Seedlings of exotic species germinated in 23% of pellet groups. Highest frequencies were observed for Carolina horsenettle and little hogweed – coincidentally, the species with the highest number of seedlings. Seedlings of these species appeared in 8.4% and 3.3% of pellet groups, respectively. Although lambsquarters was the third most abundant species, it was only found in 0.9% of pellet groups. The less abundant hairy crabgrass (*Digitaria sanguinalis* (L.) Scop.), in contrast, was found in 2.1% of pellet groups. Sixteen of the species not native to Connecticut were found in only one pellet group, and in most cases, only one individual represented these species.

Using our ranking scheme, the top 10 species included Carolina horsenettle, little hogweed, redroot amaranth, hairy crabgrass, lambsquarters, autumn olive, common gypsyweed (*Veronica officinalis* L.), honeysuckle, black nightshade (*Solanum nigrum* L.), and birdfoot deervetch (*Lotus corniculatus* L.) (Table 1).

Viable exotic seeds germinated in pellet groups gathered throughout the duration of our sampling period. Greater species richness was observed for pellet groups collected in early autumn. Sixteen unique exotic species germinated in pellet groups gathered in September and 14 unique species in October. Total monthly count of germinated stems did not produce any statistically meaningful results because species such as little hogweed and Carolina horsenettle produced disproportionate numbers of seedlings relative to other species, thereby skewing monthly totals.

Forbs accounted for 64% of all germinated exotic seedlings, graminoids 18%, and woody plants accounted for an additional 18%. Species with small fruits that were directly targeted by deer (F) were found in 13% of pellet groups and accounted for 41% of exotic seedlings observed in this study.

Three of the categories fit into Janzen's (1984) "foliage is the fruit" hypothesis that the seeds are incidentally ingested by an herbivore targeting foliage. Species with small seeds in close proximity to succulent foliage (S) were found in 4% of pellet groups and accounted for 17% of seedlings. Grasses (G) were also found in 4% of pellet groups and accounted for 4% of seedlings. Prostrate plants with seeds close to foliage (P) were found in 5% of pellet groups and accounted for 32% of seedlings. The seed heads of prostrate plants with raised seed (R) may have been directly targeted by browsing deer, or consumed accidentally by deer targeting foliage – in which case this group would also fit the "foliage is fruit" hypothesis. Seedlings of this group were found in 5% of trays and accounted for 6% of seedlings.

We found a greater exotic species diversity (n = 24) in pellet groups collected a mean distance of 500 m from medium-high

Table 1. Scientific name, common name, life form (Form), life history (Life), frequency of occurrence (Freq), count of seedlings (Count), and dispersal ranking (Rank) for Connecticut exotic species that germinated directly from intact pellet groups (n = 326).

Corfq	Scientific Name	Common Name	Cloj	Ifcb	Freq	Count	Rank
F	*Solanum carolinense* L.	Carolina horsenettle	F	P	28	106	1
	Elaeagnus umbellata Thunb.	Autumn olive	W	P	5	5	6
	Lonicera L.	Honeysuckle	W	P	4	4	8
	Solanum nigrum L.	Black nightshade	F	AP	2	7	9
	Rubus phoenicolasius Maxim.	Wine raspberry	W	P	2	6	12
	Malus sp.	Apple	W	P	2	2	17
	Rosa multiflora Thunb. ex Murr.	Multiflora rose	W	P	2	2	17
	Silene latifolia Poir. ssp. alba .	Bladder campion	F	BP	1	1	32
S	*Amaranthus retroflexus* L.	Redroot amaranth	F	A	5	13	4
	Chenopodium album L.	Lambsquarters	F	A	3	38	5
	Nepeta cataria L.	Catnip	F	P	2	2	17
	Polygonum persicaria L.	Spotted ladysthumb	F	AP	1	1	32
	Capsella bursa-pastoris (L.)	Shepherd's purse	F	A	1	1	32
P	*Portulaca oleracea* L.	Little hogweed	F	A	11	78	2
	Mollugo verticillata L.	Green carpetweed	F	A	1	14	17
	Stellaria pubera Michx.	Star chickweed	F	P	1	10	18
	Cerastium fontanum Baumg.	Mouse-ear chickweed	F	BP	1	1	32
R	*Veronica officinalis* L.	Common gypsyweed	F	P	4	6	7
	Veronica persica Poir.	Birdeye speedwell	F	A	3	3	11
	Lotus corniculatus L.	Birdfoot deervetch	F	P	3	3	11
	Plantago major L.	Common plantain	F	P	2	2	17
	Vicia sp.	Vetch	F	AP	1	3	19
	Sonchus asper (L.) Hill	Spiny sowthistle	F	A	1	2	20
	Barbarea vulgaris Ait. f.	Garden yellowrocket	F	B	1	1	32
	Plantago lanceolata L.	Narrowleaf plantain	F	AP	1	1	32
	Trifolium repens L.	White clover	F	P	1	1	32
G	*Digitaria sanguinalis* (L.) Scop.	Hairy crabgrass	G	A	7	8	4
	Agrostis capillaris L.	Colonial bentgrass	G	P	1	1	32
	Elymus repens (L.) Gould	Quackgrass	G	P	1	1	32
	Pennisetum glaucum (L.) R. Br.	Pearl millet	G	AP	1	1	32
	Sorghum halepense (L.) Pers.	Johnsongrass	G	P	1	1	32
	Zea mays L.	Corn	G	A	1	1	32

Cloj7 W-Woody, F-Forb, G-Grass

Ifcb7 A-Annual, B-Biennial, P-Perennial

Corfq7 F – small fruits that were directly targeted by deer, S – small seeds in close proximity to succulent foliage, P – prostrate plants with seeds close to foliage, R – prostate plants with raised seeds heads, and G – grasses

density human settlements at the south end of the study site (≈ 103 residences/km^2). Fewer exotic species (n = 17) germinated in pellet groups collected a mean distance of 1600 m from medium density housing (≈ 62 residences/km^2) and interspersed agricultural lands in the northern portion of the site. However, this difference was not significant using Fisher's exact test with Yate's correction for continuity (p = 0.12).

One-way ANOVA analysis of GPS collar data indicated that 24-hour range of does was not equal throughout the sampling period (p = 0.02, df = 209). Mean range size started at a low of 7.0 ha in June and increased to a high of 19.3 ha in December (Figure 1). Concurrently, there was an increase in exotic species diversity through October, followed by a decrease in November and December in 2003 (Figure 1).

Using our estimate of 23 deer/km^2 on site, a defecation rate of 19.6/day (Rollins et al. 1984), our sampling period of 94 days for 2002, and seedling data from our pellet groups, we estimated that deer could potentially deposit 586 viable exotic seeds/day/km^2 from September through December 2002. If a defecation rate of 35/day (Rogers 1987) is used, the number increases to 1046 viable exotic seeds/day/km^2 for the same period. The 2003 estimate was 390 viable exotic seeds/day/km^2 from June through December using Rollins et al. (1984) and 696 viable exotic seeds/day/km^2 throughout the same period using Rogers (1987).

DISCUSSION

It appears that white-tailed deer are responsible for at least some of the dispersal of exotic species in forests bordering residential neighborhoods. Increased development and fragmentation of forests and natural areas make these areas highly susceptible to exotic invasions by providing deer with refugia free of predation and year-round access to food from nearby ornamental gardens.

Because long-distance dispersal of small-seeded species may be rare and difficult to document (Cain et al. 2000, Myers et al. 2004), the transport of seeds by white-tailed deer is a potential mechanism for long-distance dispersal (Vellend 2002, Vellend et al. 2003, Myers et al. 2004). As at least one exotic seedling was found in 24% of pellet groups, the deer at our study site have the potential to establish new colonies of exotic plants some distance from established plants during June through December. In addition, browsing deer can lower reproductive output of native species by reducing plant size or direct browsing of flowers (Fletcher et al. 2001, Webster et al. 2001, Frankland and Nelson 2003). While some populations may recover following release from browse pressure (Anderson et al. 2002, Townsend and Meyer 2002), re-establishment of viable populations following local extirpation may be delayed because many species have short dispersal distances (Carson et al. 2005). The data show that deer are capable of dispersing exotic seeds long distances that can then germinate in an over-browsed native understory. Continual long-distance dispersal by

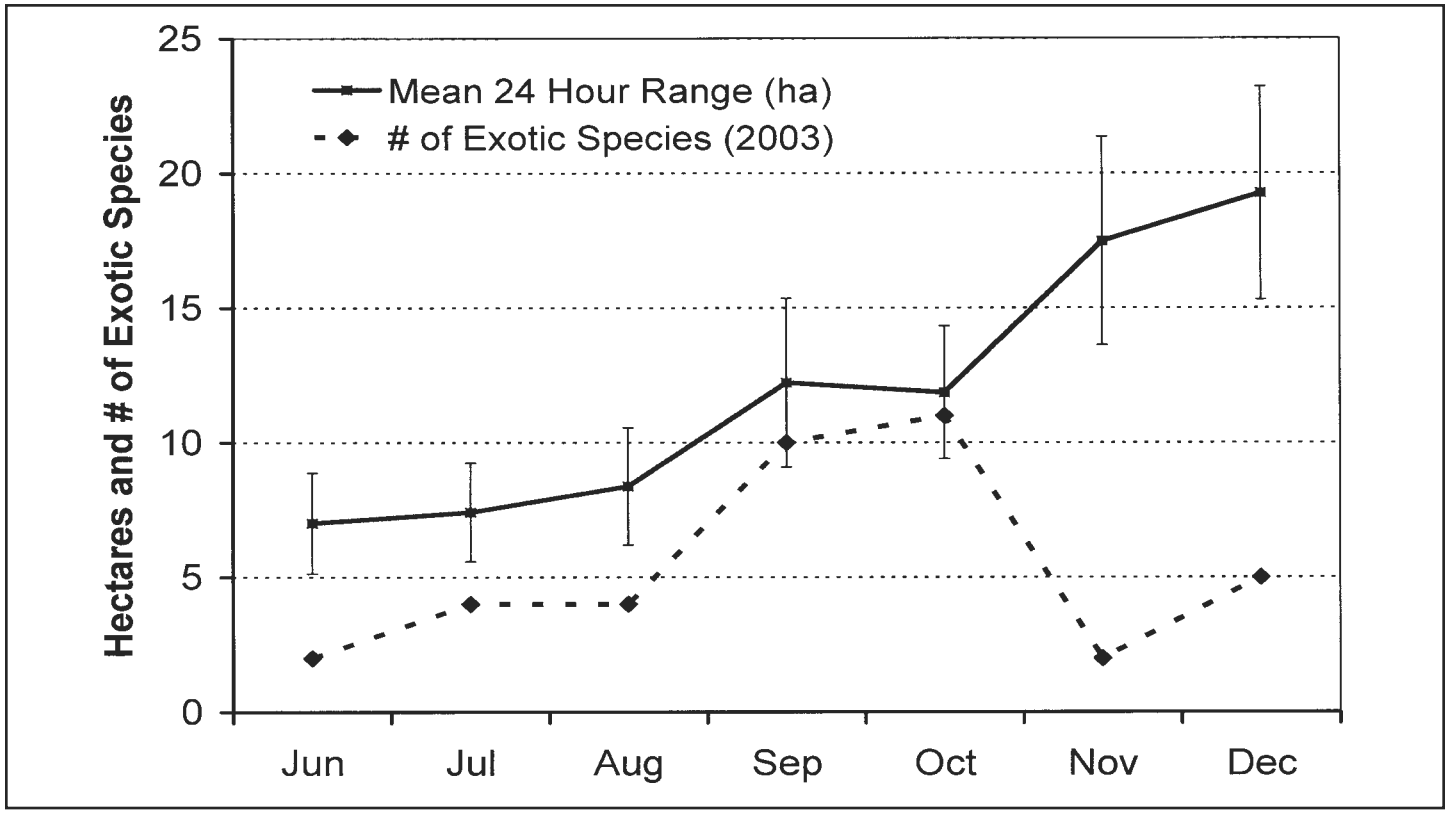

Figure 1. Mean monthly 24-hour area coverage (ha) of 9 does and number of germinated exotic species from pellet piles (n = 236) gathered each month for 2003. Brackets indicate standard error of the mean.

deer will benefit some exotic species over time – precipitating their rapid colonization to the detriment of native forest flora.

The relationship between total abundance and frequency of occurrence is an important one for successful establishment of exotic species in the landscape. Total seedling abundance is only one component of effective seed dispersal. Multiple seedlings of the same species germinating from one pellet group on a favorable microsite would compete with one another resulting in only a few, if any, survivors. However, high seedling abundance in conjunction with dispersal at multiple locations (high frequency) would increase the chances of successful germination and development. Species that had multiple seedlings in multiple pellet groups (e.g., Carolina horsenettle, little hogweed, and redroot amaranth), would most likely disperse long distances over time and successfully establish on the forest floor because of consumption and transport by deer.

Many of the exotic species we observed germinating in pellet groups could employ Janzen's (1984) "foliage is the fruit" for seed ingestion to provide a mechanism for medium to long-distance dispersal. Plants utilizing this mechanism of dispersal produce a high number of small seeds and are often highly nutritious deer forage. For instance, little hogweed, more commonly known as purslane, has its seeds enclosed in a small, round capsule (Niering et al. 1995). Little hogweed is nutritious with high levels, relative to other vegetables, of Omega-3 fatty acids and protein (Ezekwe et al. 1999). The seeds of redroot amaranth contain 18% protein (National Academy of Sciences 1971) and have been reported as a high quality forage for white-tailed deer in North Dakota (Dittberner and Olson 1983). Lambsquarters is a common weed capable of producing thousands of small seeds proximate to edible foliage and is high in beta-carotene and vitamin C (Lu et al. 2001). The foliage as the attractant strategy insures more seeds will germinate away from the parent plant than from dispersal by wind, water, gravity, or biotic factors (Willson 1993, Myers et al. 2004). This could account, in part, for the observed widespread distribution of exotic species across the landscape.

Our results concur with Myers et al. (2004) that the fruit of some herbaceous species may be directly targeted. Carolina horsenettle produces tomato-like fruits and had the highest dispersal ranking. Its relatively high abundance and frequency in our pellet groups strongly suggest these fruits were targeted for consumption by deer. In addition, these fruits are large enough (10-15 mm) that incidental ingestion is not likely. Although numerous seedlings of exotic species with fleshy fruits were observed (Table 1), transport by birds is probably a more important mechanism for their dispersal (Willson 1986, Loiselle 1990, Herrara et al. 1994, Orrock 2005). Transport by deer may provide a mechanism for dispersal within a habitat (e.g., open field, closed canopy forest). Lay (1965) documented the presence of multiple species of fleshy fruits in white-tailed deer feces in the southern United States. Willson (1993) suggests deer are capable of transporting small seeds, such as those found in fleshy fruits, without damaging them by way of digestion. Autumn olive was the only other fruiting species in the top 10, as it had five seedlings in five different pellet groups. Deer have been known to browse autumn olive foliage (I.M. Ortega, foraging ecologist, University of Connecticut, pers. comm.) and may either accidentally ingest or directly target the fruits.

During periods of low browse availability in the 2003 sampling period, deer were witnessed actively seeking out and consuming fruits of Japanese barberry adjacent to sampling areas. Ehrenfeld (1997) suggests that white-tailed deer disperse this species. It is uncertain whether the lack of barberry seedlings in our pellet groups was due to low sampling frequency (relative to total defecation rates), or whether barberry seeds are easily digested, or are incapable of breaking through the pellet encapsulation. Japanese barberry seeds were not documented in deer feces by Myers et al. (2004).

Our dispersal estimates of 586-1046 germinable exotic seeds/day/km^2 for 2002 and 390-696 germinable exotic seeds/day/km^2 for 2003 are approximations for the study area and sampling period based on germination results and varying defecation rates. Undoubtedly, these estimates will vary regionally and annually depending on local deer densities, exotic species densities and seed production, and other factors. However, it is evident that deer play a significant role in dispersal of exotic seeds. The greatest diversity of exotic species germinated in pellet groups gathered in September and October, corresponding to the period of maximum seed production.

Ranges of does during 24-hour intervals increased throughout our sampling period (Figure 1). We suspect smaller ranges existed in summer months while does were tending fawns (Ozoga et al. 1982, Scanlon and Vaughan 1985). Ranges of does tend to increase as fawns are weaned, become more self-sufficient, and less susceptible to predation. As ranges increase, deer are more likely to encounter and consume seeds from a greater variety of plant species, including exotics. Ranges may have increased and number of exotics may have decreased in November due to the breeding season. Both bucks and does were probably preoccupied with breeding or trying to avoid it, and reduced their food (and exotic seed) intake as a result. Exotic species diversity then increases in December, after the breeding season, when animals turn their attention back to feeding in preparation for winter.

It is interesting to note that seed maturity of many exotic species is synchronized with this period of increased home range size. Many plant species exotic to the United States co-exist with cervids in their country of native origin. For instance, China is the country of origin for American exotic such as multiflora rose (*Rosa multiflora* Thunb. ex Murr) and wine raspberry and also to cervids such as tufted deer (*Elaphodus cephalophus* Milne-Edwards), Chinese water deer (*Hydropotes inermis* Heude), and white-lipped deer (*Cervus albirostris* Przewalski). Japan is also home to many American exotics (wine raspberry, Japanese barberry, multiflora rose) and home to the native sika deer (*Cervus nippon* Temminck). Reproduction, gestation, and parturition of these deer are similar to our native white-tailed deer: the rut in October

and November followed by the birth of fawns in May/June (Geist 1998). Thus, the synchronization of seed maturation during the period of home range expansion may be a co-evolved strategy for long-distance seed dispersal that has proven successful in a new locale with a new, but similar, cervid species.

Although Vellend (2002) and Myers et al. (2004) demonstrated that white-tailed deer can transport viable seeds of exotic species, the contribution of white-tailed deer to the encroachment and expansion of exotics species into protected natural areas is probably greater than has been previously documented. Earlier studies that illustrated the role of severe browsing in limiting growth and reproduction of native species, or the destruction of plants by repeating browsing, may not have fully elucidated the influence of large deer herds in modifying community structure. White-tailed deer are one mechanism for transportation of exotic species into, and establishment in, depauperated habitats created by overbrowsing. Limiting the size and growth of white-tailed deer populations near the suburban/woodland interface would help to prevent, or at least reduce, the further spread of undesirable exotic plant species and help to maintain viable native plant populations.

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Appendix G

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BIODIVERSITY RESEARCH

Seed dispersal of fleshy-fruited invasive plants by birds: contributing factors and management options

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ABSTRACT

The ecology of seed dispersal by vertebrates has been investigated extensively over recent decades, yet only limited research has been conducted on how suites of invasive plants and frugivorous birds interact. In this review, we examine how plant fruit traits (morphology, colour and display, nutritional quality, accessibility and phenology), avian traits (fruit handling techniques, gut passage time and effect, bird movements and social behaviour and dietary composition) and landscape structure (fruit neighbourhood, habitat loss and fragmentation and perch tree effects) affect frugivory and seed dispersal in invasive plants. This functional approach could be used to develop generic models of seed dispersal distributions for suites of invasive plant species and improve management efficiencies. Four broad research approaches are described that could direct management of bird-dispersed invasive plants at the landscape scale, by manipulating dispersal. First, research is needed to quantify the effect of biological control agents on dispersal, particularly how changes in fruit production and/or quality affect fruit choice by frugivores, dispersal distributions of seed and post-dispersal processes. Second, we explore how seed dispersal could be directed, such as by manipulating perch structures and/or vegetation density to attract frugivorous birds after they have been foraging on invasive plant fruits. Third, the major sources of seed spread could be identified and removed (i.e. targeting core or satellite infestations, particular habitats and creating barrier zones). Fourth, alternative food resources could be provided for frugivores, to replace fruits of invasive plants, and their use quantified.

Keywords

Biological invasions, exotic species, frugivore, fruit, landscape, mutualism, plant invasions, seed dispersal.

INTRODUCTION

Birds are recognized as the main dispersal agent of many invasive plant species (Glyphis *et al.*, 1981; Buchanan, 1989; Dean & Milton, 2000; Stansbury, 2001; Renne *et al.*, 2002) (the definition of invasive plant is as per Richardson *et al.*, 2000a). Despite this, our understanding of how birds contribute to the success of invasive alien plants is limited, leading to ineffective management of invasive plant spread. Invasive plant dispersal by birds can be via generalized mutualistic or non-mutualistic relationships. Mutualistic spread occurs through intentional fruit consumption and subsequent seed dispersal. In this review, we consider bird-dispersed invasive plants within the framework of mutualistic spread of fleshy-fruited plants (the term 'fleshy-fruited' here after includes arillate seeds and seeds with elaiosomes that are attractive to vertebrate dispersers). Non-mutualistic spread occurs through unintentional ingestion, such as when birds are consuming other foods, or by epizoochory, such as adhesion to feet and feathers (e.g. Vivian-Smith & Stiles, 1994). These methods of dispersal are likely to produce different patterns of seed spread and require quite different management.

Complex dispersal patterns of fleshy-fruited invasive plants should be expected, as studies in systems without invasive plants emphasize a variety of frugivorous species consuming fruits from a single plant species (Snow, 1971; Kitamura *et al.*, 2002). This appears to be the case in several studies to date, where there are many bird-dispersed invasive plants in a particular area, and multiple disperser species with a wide range of estimated dispersal efficiencies (White & Stiles, 1992; Williams & Karl, 1996; Renne *et al.*, 2002; Stansbury & Vivian-Smith, 2003). An understanding of the ecology underlying disperser behaviours and dispersal effectiveness may thus help to determine opportunities and limitations for invasive plant management.

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We review the literature on the ecology of bird-dispersed plants, discussing fruit and frugivore traits, and landscape factors, which influence bird behaviour and shape dispersal patterns. These will, in turn, influence the development of improved management strategies for bird-dispersed invasive plants. In conclusion, we identify research opportunities that will assist in invasive plant management.

Theoretical background

The role of seed dispersal by birds and mammals has been investigated extensively (Snow, 1971; Herrera, 1984; Howe, 1986; Wenny, 2001; Pizo, 2002). A large body of this work focuses on diffuse mutualistic relationships, or 'generalized dispersal systems', between broad groups of plants and dispersers (Howe, 1986; Malmborg & Willson, 1988), and is most relevant to the dispersal ecology of fleshy-fruited invasive plants.

Highly generalized avian seed dispersal systems involve fruits with small seeds that are produced in large quantities and are consumed by a wide range of frugivorous birds (Howe, 1986). Such dispersal systems may rely on chance relationships with common birds where fruit is a component of a varied diet. Consequently, seed shadows (spatial distribution of seeds dispersed from a plant; Nathan & Muller-Landau, 2000) resulting from a generalized system are more difficult to predict than when only one or a few disperser species are involved. Most relationships between frugivorous birds and invasive plants involve a generalized dispersal system (Noble, 1989; Richardson *et al.*, 2000b; Renne *et al.*, 2002), although exceptions exist where plants reliant on one or few biotic dispersal agents become invasive (Setter *et al.*, 2002; Markus & Hall, 2004).

Mutualisms involving bird-mediated seed dispersal facilitate many plant invasions (Richardson *et al.*, 2000b). Birds benefit from this relationship by having a new food source, and the plant may benefit by having its seeds dispersed. Mutualistic seed-dispersal relationships include when native dispersers shift their foraging patterns to use the fruits of an invasive species, mimicking processes occurring in the plant's natural range (numerous examples in Richardson *et al.*, 2000b; Stansbury & Vivian-Smith, 2003). They also occur when a plant species is reunited in the invaded range with species or genera with which it forms partnerships in its native range (Richardson *et al.*, 2000b), for example *Rubus* spp. and blackbirds (*Turdus merula* L.) and foxes (*Vulpes vulpes* L.) in Australia. New mutualisms occur through totally new types of associations between plant and bird species. An example is the accidental spread of seeds of wind-dispersed pines, *Pinus* spp., by seed predating cockatoos, *Calyptorhynchus* spp., in Australia (Richardson *et al.*, 2000b).

Mutualisms may enhance a plant's invasive potential via increased dispersal effectiveness (Mandon-Dalger *et al.*, 2004). Seeds may be deposited away from the parent or to favourable recruitment microsites (Howe & Smallwood, 1982; Wenny, 2001), or receive favourable seed treatment (Panetta & McKee, 1997; Mandon-Dalger *et al.*, 2004). Moreover, dispersal of native fleshy-fruited plant species occupying the same habitat may be negatively affected as a consequence of competition for dispersal services from the invasive plant species. Few studies have compared fruit removal rates in co-occurring native and invasive plant species, and these have produced inconsistent results (Sallabanks, 1993; Vila & D'Antonio, 1998; cf. Greenberg *et al.*, 2001). This, combined with difficulties in identifying the reasons for frugivore preferences due to the multiple traits involved and taxonomic considerations, hinders generalizations as to whether invasive fruit are preferred over native fruit.

Invasive plant management may be improved via a better understanding of mutualisms by enabling us to predict: (1) the likelihood of a fleshy-fruited introduced plant being adopted by a frugivorous bird and its potential to become invasive, and (2) dispersal effectiveness, potential dispersal distributions and rates of spread of invasive plants.

A functional approach

Research-to-date on bird-dispersed invasive plants does not fully reflect the typical situation of interacting multiple invasive plants, native plants and bird species. Rather, it has largely focused on the individual species level and includes: (1) determining the importance of invasive plants in the diets of birds (Buchanan, 1989; Dean & Milton, 2000; Mandon-Dalger *et al.*, 2004); (2) documenting the dispersal vectors and spread of individual fleshy-fruited invasive plant species (Glyphis *et al.*, 1981; Stansbury, 2001; Renne *et al.*, 2002); and (3) quantifying patterns of invasive plant seed rain (Willson & Crome, 1989; Stansbury, 2001) or plant distribution (Dean & Milton, 2000). Exceptions are the work of Debussche and Isenmann (1990), White and Stiles (1992) and Williams and Karl (1996), who examine use of fruits of invasive and native species by a suite of dispersers.

A multispecies approach to studying the problem of bird-dispersed invasive plants may allow the identification of sets of species that are functionally similar in ways that are relevant to invasive plant management, and improve management approaches. These features may include morphological, behavioural or reproductive traits, population dynamics and responses to environmental conditions (Weiher *et al.*, 1999). In the following section, we review traits of fleshy-fruited plants, avian frugivores and landscape structure that contribute to plant invasions.

FRUIT TRAITS

Fruit traits that contribute to plant invasions include those that increase the probability or quality of seed dispersal. These traits can operate by attracting birds to fruit sources and encouraging them to consume fruits (or fruit parts), or by inducing frugivores to leave fruit-bearing plants after only a few fruits have been consumed (Wheelwright & Orians, 1982). The key cues used by birds to select fruit appear largely generalized (Howe & Smallwood, 1982; Wheelwright & Orians, 1982; French, 1991), hence the existing extensive literature from natural systems is of relevance when considering frugivory of invasive species. Despite widespread similarities in fruit traits across many bird-dispersed plant taxa, generalizations about what traits underlie bird choices remain elusive (Levey & Martínez del Rio, 2001). We

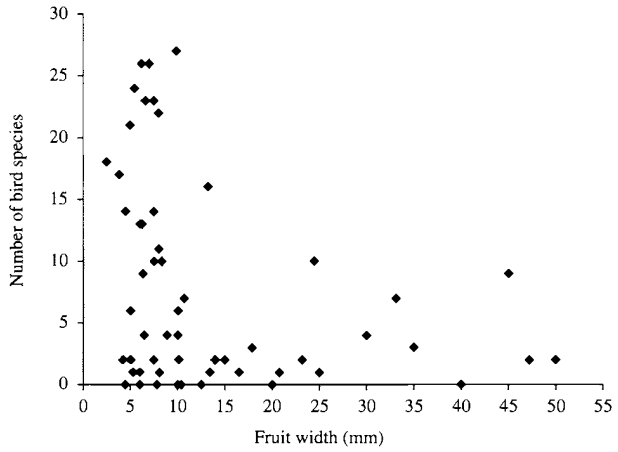

Figure 1 Invasive plant fruit size relative to the number of frugivorous bird species observed using them in subtropical eastern Australia. Observations of frugivory were compiled from published sources ($n = 20$) and personal observations of the authors (sources available from the authors on request). The invasive plants included were derived from combining lists published by Batianoff and Butler (2002) and the New South Wales North Coast Weeds Advisory Committee (2000). Fruit width data taken from measurements (C. Gosper and G. Vivian-Smith, unpublished data) and from local floras (Stanley & Ross, 1983–89; Harden, 1990–93).

present a highly simplified outline of those considered important below, but encourage readers unfamiliar with the frugivory literature to read more comprehensive reviews on this topic (e.g. Herrera, 2001; Levey & Martínez del Rio, 2001).

Aspects of fruit morphology, such as fruit and seed size, seed load (ratio of indigestible seeds to pulp) and seed geometry, affect choices by birds (Herrera, 1984; Howe, 1989; Murray *et al.*, 1993). Smaller fruits (less than about 15 mm in width) predominate among both indigenous (Silva & Tabarelli, 2000) and invasive (Fig. 1) assemblages of vertebrate-dispersed plants and are accessible to a larger variety of fruit-eating birds (Green, 1993; Kitamura *et al.*, 2002). Plants with large fruit (excluding those having many tiny seeds) have few bird dispersers in both native (Green, 1993; Rey *et al.*, 1997) and invasive (Fig. 1) assemblages of bird-dispersed plants.

Birds have excellent colour vision, and visual signals influence fruit choice (Siitari *et al.*, 1999; Schmidt *et al.*, 2004). Advanced visual cues have been noted for invasive plant species in South Africa (Knight, 1986), and in genera of bird-dispersed invasive plants that produce mimetic fruits (e.g. *Abrus* spp. Galetti, 2002); such cues could increase fruit removal rates and seed dispersal of invasive plant species.

The nutritional quality of fruit pulp is relative to the digestive abilities of frugivores, and may play an important role in fruit choice (Martínez del Rio & Restrepo, 1993). Nutritional characteristics can also directly affect seed shadows, as secondary metabolites can affect gut passage time and seed deposition density (Wahaj *et al.*, 1998). A better understanding of the role of fruit nutrient content in fruit choice and the complexity of bird digestive systems (Levey & Martínez del Rio, 2001), along with the accurate measurement of nutrient parameters (e.g. proteins; Izhaki *et al.*, 2002), may improve the identification of potentially invasive species and seed dispersal distributions. The nutritional quality of invasive plant fruits is currently poorly documented, especially in comparison with co-occurring native plants (but see White & Stiles, 1992; Vila & D'Antonio, 1998; Gosper, 2004a).

Fruit crop size, fruit density, fruit accessibility and plant structure are additional traits that affect fruit choices by birds (Denslow, 1986; Sargent, 1990; Stanley & Lill, 2001), and are likely to vary between invasive and native plants. In several studies, invasive plants have produced more fruits than their native congener, and this may have contributed to their greater dispersal (Sallabanks, 1993; Vila & D'Antonio, 1998). In South Africa, invasive plants also tended to have larger and more conspicuous fruit displays than native species (Knight, 1986).

Timing of fruit production and the length of time that fruit are available may influence the fruit choices, abundance and behaviour of dispersers (Snow, 1971; Burns, 2002). Invasive plant fruit production alters local patterns of fruit availability (White & Stiles, 1992; Williams & Karl, 1996; Gosper, 2004a), and fleshy-fruited invasive plants may have distinct phenological patterns that make them attractive to specific groups of frugivores. Those species that fruit when native fruit production is limited may be more readily consumed by frugivores, contributing to their more rapid spread. Changes in fruit availability with increases in invasive and cultivated plants may have resulted in recent changes in the migratory behaviour of blackcaps (*Sylvia atricapilla* L.) (Debussche & Isenmann, 1990). Blackcaps also shifted from native to introduced fruit from early spring to summer, as native fruit became scarcer. However, European robins (*Erithacus rubecula* L.), which are less dependent on fruit, did not (Debussche & Isenmann, 1990). These findings indicate that the effects of phenology on the adoption of fleshy-fruited invasive plants may vary with both habitat (availability and phenology of native fruits) and the characteristics of dispersers.

FRUGIVORE TRAITS

Frugivore traits that contribute to plant invasions are those that determine the capacity of birds to disperse seeds and the seed shadows they generate. These include fruit handling techniques, gut passage rates and effects, movements and dietary composition. Some of these traits also vary when the same bird species feeds on different fruits.

The methods that birds use to handle fruits have substantial implications for seed dispersal and plant invasions. Frugivores can be categorized as seed gulpers, seed discarders (after consuming pulp) or seed predators. The fruit-handling method used by a particular bird species and its efficiency can vary with fruit and seed size (Avery *et al.*, 1993; Rey *et al.*, 1997). Seed gulpers swallow whole fruits, or fruit parts containing seeds, and defecate or regurgitate viable seeds after holding the seeds in their gut for a period. Seed discarders take part or all of the fruits' attractant (pulp, aril or elaiosome) without ingesting the seed(s). Seeds are either separated during mandibulation and dropped beneath the parent plant or elsewhere, or are left attached to the parent plant

(Jordano, 1995). Dropped seeds are subsequently available for secondary dispersal (Norconk *et al.*, 1998). Seed predators lethally damage the seed during foraging, either during mandibulation (e.g. many parrots) or during gut passage (e.g. some pigeons, *Columba* spp., and other genera, which have a strong muscular gizzard). Some seeds handled by these species, however, may escape damage (Norconk *et al.*, 1998) and be dispersed.

Both seed treatment within the gut and the time taken for gut passage affect dispersal distance and effectiveness (Murphy *et al.*, 1993). Gut passage time can be affected by fruit traits (such as secondary compounds, nutrient content and seed size, geometry and load), bird diets and digestive strategies (Wahaj *et al.*, 1998; Levey & Martínez del Rio, 2001). Greater gut passage times increase both the potential for long distance dispersal (Levey & Sargent, 1987) and seed scarification by gut acids (Traveset *et al.*, 2001). Among invasive plants, gut passage increases germination rates in broad-leaved pepper (*Schinus terebinthifolius* Raddi) (Panetta & McKee, 1997) and lantana (*Lantana camara* L.) (Mandon-Dalger *et al.*, 2004) compared to whole fruits, but has little effect in *Ochna serrulata* (Hochst.) Walp. (C. Gosper *et al.*, unpublished data).

Seeds voided by birds may be deposited in clumps of various aggregations (with conspecifics or different species) or singly, depending on bird diets, digestive strategies and fruit traits. This may affect subsequent seedling recruitment. For example, seeds of the invasive pond apple (*Annona glabra* L.) had greater probabilities of germination when deposited singly than in clumps by the southern cassowary (*Casuarius casuarius* L.) (D. Westcott *et al.*, unpublished data).

The movements of birds after feeding on fruits (if they transport seeds and deposit them undamaged) have important implications for invasive plant spread. Plants may facilitate directed dispersal (i.e. dispersal to microsites that favour seedling recruitment) by attracting animal vectors with particular behaviours and habitat preferences, which may lead to a predictable pattern of seed spread (Wheelwright & Orians, 1982, e.g. Wenny, 2000). However, other studies have shown that the distribution of seed by dispersers has not always supported maximal plant recruitment (Rey & Alcántara, 2000; Wenny, 2000). Birds that linger in a plant after feeding could be less effective dispersers than species that spend shorter periods at the fruiting plant (Pratt & Stiles, 1983). In south-east Queensland, the amount of time spent in a fruiting invasive plant varied, with smaller seed dispersers spending less time than larger seed dispersers or seed predators/discarders (Stansbury & Vivian-Smith, 2003).

Dietary composition can be used to identify functionally similar frugivores. This could include the proportion of fruit in their diet and their fruit preferences (e.g. carbohydrate- or lipid-rich fruits; Levey & Martínez del Rio, 2001). Such information could be used to predict groups of potential or likely dispersers and associated dispersal patterns of invasive species.

LANDSCAPE EFFECTS ON SEED DISPERSAL

Landscape processes, through their effects on frugivore community composition and behaviour, are likely to substantially influence seed deposition patterns of invasive plants. Dispersal processes can also operate over variable scales (Kollman, 2000; Burns, 2004). Most models of invasive plant spread, however, assume a homogeneous environment and do not take into consideration how environmental variation may affect dispersal patterns across the landscape (Higgins & Richardson, 1996; With, 2002).

Fruit neighbourhood may affect dispersal of invasive plant species; it can refer to either the distance between fruits within a plant, or the distance between fruiting plants within a local area. Sargent's (1990) work suggests that for invasive plants with abundant dispersers, fruit removal rates are likely to progressively increase with increasing infestation size. Furthermore, habitats heavily invaded by fleshy-fruited plants are also likely to receive more seeds than less infested habitats. Seed dispersal and invasive plant spread are thus likely to increase as the patches become larger or when the diversity of fleshy-fruited invasive plants increases. Gosper (2004b) found greater rates of removal of invasive bitou bush (*Chrysanthemoides monilifera* (L.) Norlindh) fruit from extensive stands than from areas where it had been largely removed, although the cause of this difference (e.g. changes in fruit density, vegetation structure, etc.) was not identified. These two studies suggest that there could be a critical abundance level of invasive plants (if fleshy fruits in the system are limiting), above which there is an increase in frugivorous bird activity, seed dispersal, and ultimately, further invasion. In contrast, Greenberg *et al.* (2001) did not find an increase in fruit removal with greater neighbourhood fruit density in the invasive Oriental bittersweet (*Celastrus orbiculatus* Thunb.).

Habitat loss and fragmentation can alter the abundance and composition of the frugivorous bird community (Restrepo *et al.*, 1999; Moran *et al.*, 2004) and the rate of consumption of fleshy fruits (Galetti *et al.*, 2003). Impacts on seed dispersal through changes in frugivore populations are unlikely to be uniform across fruit traits (Silva & Tabarelli, 2000; Galetti *et al.*, 2003). Dispersal of early successional species can also be promoted in fragmented landscapes (McClanahan, 1986). These interacting effects of landscape processes and fruit traits may be relevant in plant invasions, but they are not well understood.

In some cases, habitat fragmentation may create movement barriers, helping to contain invasive plants. More extensive spread of the fleshy-fruited shrub Amur honeysuckle (*Lonicera maackii* (Rupr.) Herder) in Ohio was associated with higher forest cover and connectivity (Hutchinson & Vankat, 1998). In other cases, habitat fragmentation may have the opposite effect, resulting in an increase in invasion rates. Rapid adoption of invasive plant fruits by some birds and increased invasive plant spread across the landscape has been attributed to habitat loss and an associated reduction in native fleshy fruit availability (Richardson *et al.*, 2000b). Habitat fragments potentially act as stepping-stones for frugivorous birds as they forage across a landscape (Date *et al.*, 1991; With, 2002), and hence may become foci of invasive plant seed dispersal (the nascent foci concept of Moody & Mack, 1988). Disturbed habitats such as forest gaps and edges have more rapid removal of fruits (Galetti *et al.*, 2003), are favoured feeding sites for many frugivorous birds (Malmborg & Willson, 1988; Brothers & Spingarn, 1992) and are therefore

likely to receive proportionately larger amounts of invasive plant seed (With, 2002). Over time, the proliferation of invasive plants in habitat fragments would allow frugivorous birds to forage over a greater range, increasing the potential for infilling between these outlying fruit sources.

The 'perch tree effect' is the enhancement of seed deposition under perch or roost structures, although seeds are not always deposited in environments favourable for recruitment (Holl, 1998). Increased seed deposition by birds occurs beneath habitual roosts and perches (Wenny, 2001), beneath isolated trees and in windbreaks in pastures (Debussche & Isenmann, 1994; Harvey, 2000), and beneath perches within successional landscapes (McDonnell & Stiles, 1983; McClanahan & Wolfe, 1987). The presence of other microhabitat components (e.g. shrub cover within patches; Jordano & Schupp, 2000) can also strongly influence seed deposition patterns.

Seed deposition below perches is important for the spread of invasive species (Ferguson & Drake, 1999). Bridal creeper (*Asparagus asparagoides* (L.) Druce) is often found under the crown of isolated tuarts (*Eucalyptus gomphocephala* DC.) (Stansbury, 2001), with these isolated trees acting as stepping stones for an important disperser, the silvereye (*Zosterops lateralis* Latham). The under-canopy microhabitat aids *A. asparagoides* survival, growth and fruit production (Stansbury, 1999). Similarly, in South Africa, invasive *Opuntia ficus-indica* (L.) Mill. density was substantially greater under telegraph and transmission poles, which acted as perches for corvid and primate dispersers (Dean & Milton, 2000).

SEED DISPERSAL PATTERNS: LINKING FRUIT, FRUGIVORE AND LANDSCAPE CHARACTERISTICS

Regardless of the mode of seed dispersal, seeds of terrestrial plants usually fall in a continuous leptokurtic distribution with the mode under or near the parent plant and with a steady decline with distance (Howe & Smallwood, 1982; Howe, 1989). Rare, long-distance dispersal events may be particularly significant for the spread of invasive plants (Myers *et al.*, 2004; Trakhtenbrot *et al.*, 2005). However, capturing these rare events in studies of dispersal patterns is inherently difficult (Cain *et al.*, 2000; Nathan & Muller-Landau, 2000).

Plants with similar fruits might be used by a similar variety of frugivores, and subsequently might have similar distributions of dispersed seed (Pizo, 2002). The linking of fruit and frugivore traits has the potential to allow the estimation of seed shadows for assemblages of invasive plant species with their assemblages of dispersers (Westcott & Dennis, 2003). When several bird species are involved in dispersal, it is possible for seed shadows to be concentrated close to a source plant, but also with clumps further away deposited by different species (Debussche & Isenmann, 1994; Nathan & Muller-Landau, 2000).

For a given fruit type, it could be expected that the mean dispersal distance generated by small, facultative frugivores that ingest seeds would be closer to the source than for large, facultative frugivores. Differences in the initial flight distances between small and large frugivores after feeding on native (Green, 1993) and invasive (Stansbury & Vivian-Smith, 2003) fruits have been reported. Obligate frugivores are more likely to disperse seeds in a pattern reflecting the distribution of fruit sources (which are often patchy) than for birds that also use other foods. This should result in a more clumped seed shadow of larger spikes (compared to facultative frugivores) at varying distances and with a longer tail. Seed-discarding birds are likely to generate seed shadows with comparatively short tails, as many seeds are dropped directly beneath the parent plant and only occasional fruit are carried away for processing elsewhere. For all these frugivores, small spikes in seed numbers dispersed at varying distances from the source could result from birds spending time at favoured sites, such as other food sources or perch trees.

Few studies have investigated the seed shadows of invasive plants; however, such investigations could provide useful management insights. For example, Setter *et al.* (2002) combined gut passage rates of *Annona glabra* seeds through southern cassowaries with bird movement data. They estimated that these birds might regularly disperse seeds up to 350 m from source plants, and occasionally 1200 m. This has important management implications, as it showed birds could disperse *A. glabra*, which is also dispersed by water, between watersheds. In order to predict the effects of landscape patterns and processes on the spread of bird-dispersed invasive plants, we need to better understand the foraging habits of different groups of frugivorous birds in differently patterned landscapes (With, 2002; Westcott & Dennis, 2003). This would require quantifying the seed shadows generated by various invasive plant–disperser relationships within tracts of native habitat as well as within fragmented landscapes (Westcott & Dennis, 2003).

FUTURE RESEARCH DIRECTIONS AND MANAGEMENT APPLICATIONS

Seed dispersal by vertebrates and plant invasions deserve substantially more research (Richardson *et al.*, 2000b). We believe a functional approach to this issue could be particularly valuable in directing invasive plant management activities. Our understanding of invasive plant and disperser relationships would benefit from detailed analyses of fruits (chemistry, morphology and phenology), frugivore fruit choice and handling (Pizo, 2002), and gut passage combined with bird movements and/or seed deposition. This would provide greater predictive capability in relation to seed dispersal patterns and invasive plant spread that could then be integrated into management programs. Research in these areas is also likely to enable better prediction of the likelihood of adoption of fruit of new plant introductions by bird dispersers, their invasive potential and management priority. An assessment of an introduced plant's opportunity for dispersal by birds is an important component of the invasive plant screening procedure (Pheloung *et al.*, 1999), as plant invasiveness is correlated with the number of dispersal agents (Stansbury & Vivian-Smith, 2003).

To assist management of existing invasions at the landscape scale, adaptive management and research on bird-dispersed

invasive plants should focus on studies that manipulate plant spread. An appropriate aim for these approaches is to maximize their impact on seed dispersal — reducing it to a minimum. Experimental tests of these concepts would examine both their utility in invasive plant management and our conceptual understanding of invasive plant dispersal. They are in addition to current control options available to land managers. We propose studies that focus on four major themes: reducing fruit production or fruit quality, directing seed deposition, identifying and removing the major sources of seed spread and providing alternative resources for frugivores.

Each of these research opportunities is based on the assumption that invasive plant spread is dispersal limited. This assumption is most likely to be met at the extremities of the invaded range and for new incursions, which is where management intervention is often most effective. Seed dispersal determines the potential for invasive spread, although whether invasive spread is realized depends on post-dispersal processes (Nathan & Muller-Landau, 2000). For most species, the relative importance of dispersal and post-dispersal processes on plant demography are unknown, although in a study within the natural range of olives (*Olea europaea* L.), the importance of post-dispersal processes is illustrated by the final spatial pattern of recruitment being different from the frugivore-generated dispersal pattern (Rey & Alcántara, 2000). Additionally, other means of dispersal, even if rare (e.g. human-mediated or secondary dispersal; Nathan & Muller-Landau, 2000; Trakhtenbrot *et al.*, 2005) will need to be considered in delineating incursions and applying the management approaches described below.

Any management actions that reduce fruit production or affect fruit quality in invasive plants potentially affects seed dispersal, provided that frugivore populations are not satiated at the lower production level. Fewer fruits are available, which may affect both the number of seeds dispersed and the dispersal distribution of those seeds through fruit density effects on frugivore behaviour. Biological control agents for bird-dispersed invasive plants have been introduced, with questionable effectiveness, as a means of reducing fruit production (Hoffmann *et al.*, 1998), fruit quality (Day *et al.*, 2003) or for seed predation (Mays & Kok, 1988). Sublethal herbicide application or pruning is an option for culturally significant plants (Scanlon & The Camphor Laurel Taskforce, 2001). Research is needed to determine: (1) how fruit-infesting biological control agents affect fruit choice, as birds may select either for or against infested fruits (Sallabanks & Courtney, 1992; García *et al.*, 1999); (2) whether the establishment of biological control agents changes the dispersal distribution of seeds; and (3) how fruit-infesting biological control agents affect post-dispersal processes.

The proposition of manipulating dispersal has received support from Wenny (2001), who states: 'Where disperser behaviour can be predicted, dispersal can be manipulated ...'. Wenny (2001) also suggests that directed dispersal may become more common in highly disturbed landscapes and would most benefit plants with a generalized dispersal system. Land managers could use this information to structure weed surveys for targeting satellite outbreaks and eradication, or manipulate landscape structure to capture seeds. We speculate that it may be possible to use strategically placed perch structures as invasive plant seed sinks in habitats that are unsuitable for seedling recruitment or where recruitment can be managed. For smaller frugivores, provision of dense vegetation may be more appropriate, as this may encourage them to remain in an area while they void any ingested seeds. More research is needed on the structure of such 'seed sinks', at both the patch and the landscape scale, as factors such as patch shape, size, density, composition and landscape connectivity could affect the accumulation of bird-dispersed seeds (Harvey, 2000). Sites for these features might include the boundary of sources of dispersed seeds, such as existing infestations or urban areas. This strategy might reduce the amount of seed penetrating further into a remnant habitat or to other favourable recruitment sites. Additionally, after killing woody invasive plants, is it more beneficial to leave dead plants *in situ* to provide perches, potentially enhancing recruitment of native plant species? Such an approach would be useful only if there are native fruits available (Robinson & Handel, 2000) and would be constrained by the perches also promoting the deposition of invasive plant seeds (Ferguson & Drake, 1999).

Moody and Mack (1988) demonstrated theoretically the importance of controlling isolated populations of invasive plants for reducing their rate of spread. This approach could also effectively be applied to creating dispersal 'barrier zones' (Sharov & Liebhold, 1998) around important habitats by removing those plants within the maximum dispersal distance of the bird(s). The use or enhancement of natural or anthropogenic barriers to bird movement in the landscape may provide opportunities to limit invasive plant spread (Hutchinson & Vankat, 1998). In a model developed as a decision-making tool, Higgins *et al.* (2000) demonstrate that invasive plant management at sites with low densities of juvenile plants was more cost-effective than other scenarios based on plant density and age. Shea *et al.* (2002), however, suggest that for some bird-dispersed invasive plants, it may be the core populations that contribute most to spread, particularly when they attract greater concentrations of dispersers. More rapid removal of fruits can occur in high than low density stands (Gosper, 2004b). Clearly, further work is required to test whether it is best to remove satellite or core populations of bird-dispersed invasive plants and how this might vary with different invasive plant–disperser relationships (Shea *et al.*, 2002). Additionally, fruits may be removed more rapidly in some habitats than others (C. Gosper *et al.*, unpublished data), reflecting differences in frugivore communities. Removing invasive plants from those habitats with the greatest dispersal effectiveness is another strategy for prioritizing management efforts.

Knowledge of the frugivore–invasive plant relationship can also be used to recommend replacement native plants that provide frugivores with appropriate fruit resources. This has been suggested as a management strategy for the invasive tree, Russian olive (*Elaeagnus angustifolia* L.), in the south-western USA (Brock, 1998). Invasive plant removal can affect frugivore abundance (Gosper, 2004b). From both an ecological and a social perspective, a prudent strategy before broad-scale control programs might be to identify and make efforts to provide suitable alternative food

sources for frugivores, as the importance of invasive plant fruit to fauna can be a significant public issue and galvanize opposition to invasive plant control. The rate that frugivores adopt these new resources could then be measured to assess the success of this management approach.

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Appendix H

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ORIGINAL PAPER

Deer feeding selectivity for invasive plants

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Abstract Native generalist herbivores might limit plant invasion by consuming invading plants or enhance plant invasion by selectively avoiding them. The role of herbivores in plant invasion has been investigated in relation to plant native/introduced status, however, a knowledge gap exists about whether food selection occurs according to native/introduced status or to species. We tested preference of the native herbivore white-tailed deer (*Odocoileus virginianus*) for widespread and frequently occurring invasive introduced and native plants in the northeastern United States. Multiple-choice deer preference trials were conducted for the species and relative preference was determined using biomass consumption and feeding behavior. While more native than introduced plant biomass was consumed overall, deer food selection varied strongly by plant species. Results show consistent deer avoidance of several invasive introduced plants (*Alliaria petiolata*, *Berberis thunbergii*, and *Microstegium vimineum*) and a native plant (*Dennstaedtia punctilobula*). Other invasive introduced plants (*Celastrus orbiculatus*, *Ligustrum vulgare*, and *Lonicera morrowii*) and a native plant (*Acer rubrum*) were highly preferred. These results provide evidence that herbivore impacts on plant invaders depend on plant species palatability. Consequently, herbivore selectivity likely plays an important role in the invasion process. To the extent that herbivory impacts population demographics, these results suggest that native generalist herbivores promote enemy release of some plant invaders by avoiding them and contribute to biotic resistance of others by consuming them.

Keywords Plant invasion · Herbivore–plant interactions · Palatability · Biotic resistance · Enemy release

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Introduction

Biotic constraints such as herbivore food preference influence the internal dynamics of plant community assembly and invasion (Drake 1990; Booth and

Swanton 2002). Previously, native generalist herbivores have been found to reduce plant invasion via preferential consumption of introduced plants instead of native plants (Parker et al. 2006; Morrison and Hay 2011), as suggested by the prominent biotic resistance hypothesis (BRH) (Elton 1958; Levine et al. 2004). A meta-analysis of 63 herbivore exclusion experiments including over 100 introduced plant species and both vertebrate and invertebrate herbivores indicates that native herbivores preferentially consume introduced compared to native plants (Parker et al. 2006). Herbivore-mediated biotic resistance could limit the invasion of relatively palatable introduced plants. The meta-analysis conducted by Parker et al. (2006) as well as more recent work (Morrison and Hay 2011) is consistent with the BRH. Conversely, other introduced plants increase in the face of abundant native herbivores (Knight et al. 2009; Eschtruth and Battles 2009a) and suffer less insect herbivory than native plants (Cappuccino and Carpenter 2005; Agrawal et al. 2005), which lend support to the enemy release hypothesis (ERH) (Mitchell and Power 2003; Carpenter and Cappuccino 2005; Agrawal et al. 2005), sensu Keane and Crawley (2002). Introduced plants that exhibit herbivore resistance or tolerance could become invasive via a "natural enemy escape opportunity" (Johnstone 1986; Shea and Chesson 2002). The fact that empirical support has been found for both the BRH and the ERH suggests that enemy preference varies by species and not by native/introduced status. Generalist herbivores are known to interact with plants on a species-by-species basis (Augustine and McNaughton 1998). Additionally, plants which are considered relatively more invasive have been shown to exhibit less herbivory (Cappuccino and Carpenter 2005). Thus in this work, we test herbivore preference for a set of commonly occurring plants in the eastern US and investigate whether preference varies by native/introduced status or by species.

In the deciduous forests of eastern North America, invasive introduced plants are increasing in number and spatial extent (Vitousek et al. 1997; Pimentel et al. 2005; Rauschert et al. 2009). Concurrently, populations of the native generalist white-tailed deer (*Odocoileus virginianus* Zimm.) have increased up to 15-fold since the early 1900s (McCabe and McCabe 1997; Rooney 2001), leading ecologists to question their role in facilitating plant invasion (Vavra et al. 2007). Literature on the subject is equivocal, with some studies showing that deer increase the abundance of invasive introduced plants (Eschtruth and Battles 2009b; Knight et al. 2009; Kalisz et al. 2014) and others showing the opposite (Rossell et al. 2007), variable (Cadenasso et al. 2002; Knapp et al. 2008; Averill 2014), or no (Bowers 1993) effect of deer. Deer are expected to selectively browse at the individual plant and species levels (Augustine and McNaughton 1998), but deer selectivity across broader groups of native versus invasive introduced plants has not previously been tested. Deer choose among foods based on anti-herbivore defenses and nutritional quality (Augustine and McNaughton 1998; Alm et al. 2002; Côté et al. 2004). Furthermore, growing season is known to affect deer preference due to differences in plant availability and quality as well as varying deer nutritional requirements throughout the year (Crawford 1982; Dumont et al. 2005; Estevez et al. 2010). Selectivity can reduce the abundance of the most palatable plant species and indirectly increase the abundance of less preferred or unpalatable species (Leopold et al. 1947; Horsley et al. 2003; Côté et al. 2004; Wiegmann and Waller 2006). Selective overbrowsing has the potential to increase forest susceptibility to plant invasion (Vavra et al. 2007).

Herbivore preference research often relies on using congeneric or confamilial pairs of plants from native and introduced ranges because plant relatives are expected to have similar defenses and herbivore enemies (Berenbaum 1981; Harborne 1993). Furthermore, Darwin proposed that introduced plants are more likely to invade if they lack taxonomic relatives in the new range in his naturalization hypothesis (Darwin 1859). However, controlling for taxonomic relatedness might not be wholly reliable. Herbivores have been shown either to prefer phylogenetically similar plants, as in groups of tropical (Dawson et al. 2009) and temperate (Hill and Kotanen 2009) plants, or to avoid them, as in successful biological control efforts (Hokkanen and Pimentel 1989) and in data from the Parker et al. (2006) meta-analysis (Ricciardi and Ward 2006). Consequently, a different approach was used here. Regardless of taxonomic relatedness, only widespread and frequently occurring native and invasive introduced plants were chosen for deer preference testing. Additionally, all species used in the trials co-occurred and largely dominated the site where plant material was collected.

Herbivore feeding preference tests were used to determine deer preferences among a suite of native and invasive introduced plants to increase understanding of the role of large mammal herbivory in plant invasion. By testing herbivore preference according to native/introduced status and species, the aim was to (1) elucidate why support has been found for both the BRH and the ERH and (2) explain contradictory findings on the effects of deer on plant invasion based on field experiments. Preference tests have been used previously to demonstrate increased palatability in earlier successional plants (Cates and Orians 1975) and to show that palatability can explain relative plant species abundance at the community level (Landa and Rabinowitz 1983). However, these methods have not been used to explore whether deer preferences vary by species or native and invasive introduced plant groups. In this work, deer preferences were hypothesized to vary by species instead of by native/invasive introduced status.

Methods

Deer preference experiments were conducted at The Pennsylvania State University Deer Research Center in State College, Pennsylvania. The Center has a captive deer population of 75–100 white-tailed deer and provided an ideal venue for testing deer diet preference in a controlled setting, a 0.4 ha pen seeded with a mix of clovers and grasses (Appendix). Preference was assessed with feeding trials in late summer (Aug-2011), early autumn (Sept- and Oct-2011), and in spring (May-2012) to account for variation in deer appetite and palatability of the vegetation during the growing season. Feeding trials consisted of a multiple choice (cafeteria-style) preference test in which deer were offered a suite of 15 plant species (Table 1) simultaneously and which was replicated eight times in spring and summer and seven times in autumn. A trial lasted 20 h, during which plant material was offered to the deer beginning at 3 p.m. and uneaten plant material was collected at 11 a.m. the following day.

The following criteria guided the selection of plant species included in the study. Commonly occurring native and introduced plant species, spanning a range of expected preferences and growth habits, were selected (Table 1). An analysis of the plant species occurring in paired plots where deer were present and absent (fenced exclosures) at more than 20 sites in the Eastern US guided species selection (Averill 2014). Species were also included based on reports in the literature (Table 1), expert opinion, and availability of plant material at the nearby research center. All introduced species are considered moderately or highly invasive in the Eastern US (USDA Forest Service 1998).

Eight mature (>2 years), calm-tempered does without fawns were selected for the experiments. Because preliminary testing revealed deer feeding behavior was altered when individual animals were isolated in a pen, deer were randomly paired for each trial. Each deer was used in two trials per season, pairs were not repeated within each season, and sibling and mother-daughter pairings were avoided. Consequently, while each deer pair was unique within a season, trials were not fully independent. Biomass consumed could not be ascribed to individual deer. Deer were offered their regular diet of commercial deer pellets (Record Rack Breeder, Cargill, Minneapolis, Minnesota 55440) and dry hay prior to and during preference trials. All plant species were presented to deer during a priming phase at least once within the 3 days before experimental trials to allow animals to become familiar with the plants and experimental setup. Deer were moved into the feeding trial pen after feeding stations were in place.

Within 6 hours prior to each trial, representative samples of each species were collected from forest edge and understory habitats at the Russell E. Larson Agricultural Research Center at Rock Springs, Centre County, Pennsylvania. Plant stems were immediately placed in water, where they were kept throughout the feeding trial. Sampling was restricted to the range of deer reach (0–2 m above ground) and samples were collected from at least four individual plants. Flowers, seeds, or fruits were included if present and $\sim$50-cm length stems were sampled from the outer edge of individuals with canopies. The volume of plant material was kept as consistent as possible among species and across trials and seasons. However, due to different plant habits represented in the trials, e.g., grasses and woody species, variation across species occurred in the weights of leafy fresh matter offered [mean $\pm$ standard error (SE) = 87 $\pm$ 3 g; median = 78 g; range = 14–368 g]. Plant material for each of the 15 plant species was bundled and placed in

Table 1 Invasive introduced and native plant species used in cafeteria-style white-tailed deer feeding preference trials

Species[a]	Family	Habit[a]	Known plant defense/s[a]	Palatable to browse animals[a]	Woody plant resprout ability[a]	References	Predicted relative palatability
Invasive introduced							
Alliaria petiolata (M. Bieb) Cavara & Grande	Brassicaceae	Forb	Chemical: glucosinolates, trypsin inhibitor, and peroxidase[b]	Low[b]	NA[c]	Cipollini (2002), Eschtruth and Battles (2009b), Knight et al. (2009)	u
Berberis thunbergii DC	Berberidaceae	Shrub	Chemical: toxicity[b]; physical: spines	Low	Yes	Eschtruth and Battles (2009b), Lind and Parker (2010)	u
Celastrus orbiculatus Thunb.	Celastraceae	Vine	None	Low	No	Rossell et al. (2007)	p
Elaeagnus umbellata Thunb.	Elaeagnaceae	Shrub	None	Medium	Yes	Williams and Ward (2006), Knapp et al. (2008)	p
Ligustrum vulgare L.	Oleaceae	Shrub	None	Low	Yes	Hunter and Mattice (2002), Perdomo et al. (2004)	u
Lonicera morrowii A. Gray	Caprifoliaceae	Shrub	None (*L. maackii*)	Low (*L. maackii*)	Yes (*L. maackii*)	Hunter and Mattice (2002)	p
Microstegium vimineum (Trin.) A. Camus	Poaceae	Grass	None[b]	Low[b]	NA	Rauschert et al. (2009), Averill (2014)	u
Rosa multiflora Thunb.	Rosaceae	Shrub	Physical: prickles[b]	Medium[b]	Yes[b]	Hunter and Mattice (2002), Cadenasso et al. (2002), Averill (2014)	p
Native							
Acer rubrum L.	Aceraceae	Tree	Chemical: slight toxicity	Medium	Yes	Crawford (1982), Abrams (1998), Horsley et al. (2003), Averill (2014)	pu
Dennstaedtia punctilobula (Michx.) T. Moore	Dennstaedtiaceae	Fern	Chemical: coumarin[b]	Low[b]	NA[c]	Bohm and Tryon (1967), de la Cretaz and Kelty (1999)	u
Lindera benzoin (L.) Blume	Lauraceae	Shrub	None	Medium	Yes	(Averill 2014)	p
Parthenocissus quinquefolia (L.) Planch.	Vitaceae	Vine	None	Medium	Yes	Perdomo et al. (2004), Averill (2014	p
Quercus rubra L.	Fagaceae	Tree	Chemical: tannins[b]	Medium	Yes	Campbell and Laseter (2006), Averill (2014)	p

Table 1 continued

Species[a]	Family	Habit[a]	Known plant defense/s[a]	Palatable to browse animals[a]	Woody plant resprout ability[a]	References	Predicted relative palatability
Rhus typhina L.	Anacardiaceae	Shrub	None (*R. glabra*)	Low (*R. glabra*)	Yes (*R. glabra*)	Perdomo et al. (2004)	p
Rubus allegheniensis Porter	Rosaceae	Subshrub	Physical: prickles[b]	High	Yes	Horsley and Marquis (1983), Crimmins et al. (2010)	p

Plant family, habit, characteristics related to herbivory, and predicted palatability (*p* palatable, *u* unpalatable, *pu* palatable/unpalatable) based on references listed

[a] Taxonomy and plant characteristics for most species are according to the USDA Plants Database (USDA, NRCS 2012) unless noted. For *L. morrowii* and *R. typhina*, data were only available for the closely related congener listed. NA indicates information was not available

[b] See listed reference/s

[c] *NA* not applicable for herbaceous plants

a 13-L, 30-cm diameter bucket filled with water. Each bucket was covered with a lid with a 3-cm hole in the center and two layers of mesh wire on the underside to secure stems in an upright position. The 15 buckets were arranged $\sim$50 cm apart from one another over an area spanning $\sim$4 m by $\sim$4 m.

Fresh, wet weights were determined for the plant samples immediately before and following each feeding trial. After trials, woody plant material was separated, weighed, and then excluded from analysis. Species-specific water loss was determined using a set of reference plant samples that were collected, weighed, and treated the same as preference test plant material except in the absence of deer (Manly 1993). Biomass intake by deer (i.e., consumption) was determined for each species by calculating the percentage of leafy (non-woody) biomass consumed during trials after accounting for species-specific water loss. Vanderploeg and Scavia's electivity index (E^*) (Vanderploeg and Scavia 1979) was also used to measure deer preference. The index provides an estimate of a species' perceived value by deer and is a function of the species' change in abundance as well as the change in abundance of the other species offered (Manly et al. 1993) and is calculated as follows:

$$E_i^* = W_i - \frac{1}{n} \Big/ W_i + \frac{1}{n}$$

$$W_i = \frac{r_i}{p_i} \Big/ \sum_i^n \frac{r_i}{p_i}$$

where W_i is the selectivity coefficient, n is the number of species in the trial, r_i is the proportion of species i consumed of all biomass consumed, and p_i is the proportion of species i in the total biomass offered. The E^* varies between "-1" (never used) to "$+1$" (exclusively used), so a negative value indicates avoidance and a positive value indicates preference. A value of zero indicates random feeding, i.e., intake of that species was in the same proportion as the amount of that species offered relative to other species. We used the non-parametric Kruskal–Wallis test (Kruskal and Wallis 1952) to determine the rank order of preference for species within each season (Lechowicz 1982).

Each trial was recorded using a motion-sensor trail camera (Trophy Cam, Bushnell Corporation, Overland Park, Kansas 66214), which records color video during the day and infrared video during the night. The number of deer sniffing and biting events were quantified using JWatcher (Blumstein Animal Behavior Lab, University of California, Los Angeles and The Animal Behaviour Lab, Macquarie University, Sydney) (Blumstein and Daniel 2007). A sniff occurred when a deer smelled a plant, while a bite entailed consumption of the plant. Each sniff or bite was

considered one initiation of the browsing behavior, thus event duration varied. When a deer pulled its head away from the plant, the event ended; if the deer began sniffing or biting the same plant again, it was recorded as a new event. The bite to sniff ratio, i.e., bites per sniff, was calculated by dividing the number of bites by the number of sniffs for each species within a trial.

Linear mixed effect analysis of variance (ANOVA) was used to analyze percentage biomass intake and behavior events. The fixed effects were native/invasive introduced status, species nested within native/invasive introduced status (species [native/invasive introduced]), season, and their interactions and the random effect was deer pair (i.e., trial). An arc-sine square-root transformation of percentage biomass consumed and square-root transformations of behavior events were necessary to satisfy statistical assumptions of normality and homogeneity of residuals. Because *Microstegium vimineum* was too small to include in the spring trials, we performed two sets of analyses, either including data from all seasons but excluding *M. vimineum* or including data from summer and autumn but excluding spring data. Linear regression was used to test for correlations between sniffing and biting events and between behavior events and biomass consumption or electivity index. JMP 10.0 (SAS 2012) was used for statistical analyses. Data means are presented ± standard error (SE).

Results

Biomass consumption by deer

Overall, deer consumed the most biomass in the spring (90 ± 6 g; 73 ± 3 %), less in autumn (54 ± 4 g; 60 ± 3 %), and least in the summer (36 ± 3 g; 50 ± 3 %) (Fig. 1a). Across seasons and plant species, deer consumed more native (67 ± 4 g; 66 ± 2 %) than invasive introduced plant biomass (53 ± 4 g; 56 ± 3 %) (means calculated on a species-basis) (Fig. 1b). However, an interaction between plant species and season was detected ($P < 0.0001$) (Table 2). Deer preference patterns varied strongly by plant species identity. Deer consistently avoided consumption of three invasive introduced plants *Alliaria petiolata*, *Berberis thunbergii*, and *M. vimineum* across seasons. In contrast, deer consumption of three other invasive introduced species, the vine *Celastrus orbiculatus* and shrubs *Ligustrum vulgare* and *Lonicera morrowii*, was consistently high across seasons (Fig. 1b; Table 1). Deer consumption of the native tree *Acer rubrum* was also high across seasons. Consumption of other species varied by season, e.g., consumption of invasive introduced plants *Elaeagnus umbellata* and *Rosa multiflora* and native plants *Lindera benzoin* and *Rhus typhina* was lower in summer and consumption of native plants *Dennstaedtia punctilobula* and *Rubus allegheniensis* was higher in spring (Fig. 1b). Because it was only beginning to germinate, *M. vimineum* was not included in the spring trials, however this species had the lowest mean biomass consumption compared to other species across summer and autumn trials (Fig. 1b). Analyses using summer and autumn data showed very low deer preference for *M. vimineum* (Table 2).

Electivity and preference of deer

Overall, deer showed stronger avoidance of invasive introduced species (−0.17 ± 0.03 electivity index, *E**) than of native species (−0.04 ± 0.03 *E**). Deer especially preferred native species in the spring (Fig. 2a). However, the most pronounced preference differences were seen at the species level. Deer avoided invasive plants with known defenses, including *A. petiolata* and *B. thunbergii* (Tables 1, 3). According to the *E**, deer preferred the invasive vine *C. orbiculatus* and shrubs *L. vulgare* and *L. morrowii* (Fig. 2b; Table 3). Deer showed high preference for *A. rubrum* and for the native vine *Parthenocissus quinquefolia*. Among natives, lowest deer preference was shown for the chemically-defended fern *D. punctilobula* and the physically-defended subshrub *R. allegheniensis* (Fig. 2b; Tables 1, 3). In the spring, deer preferred the native tree *Quercus rubra*, shrub *R. typhina*, and subshrub *R. allegheniensis* significantly more than in summer or autumn. The native shrub *L. benzoin* was least preferred in the summer (Fig. 2b; Table 3).

Deer behavior and biomass consumption

The number of biting events varied by the interaction between species and season. However, sniffing events only varied among species (Table 2). Biting events

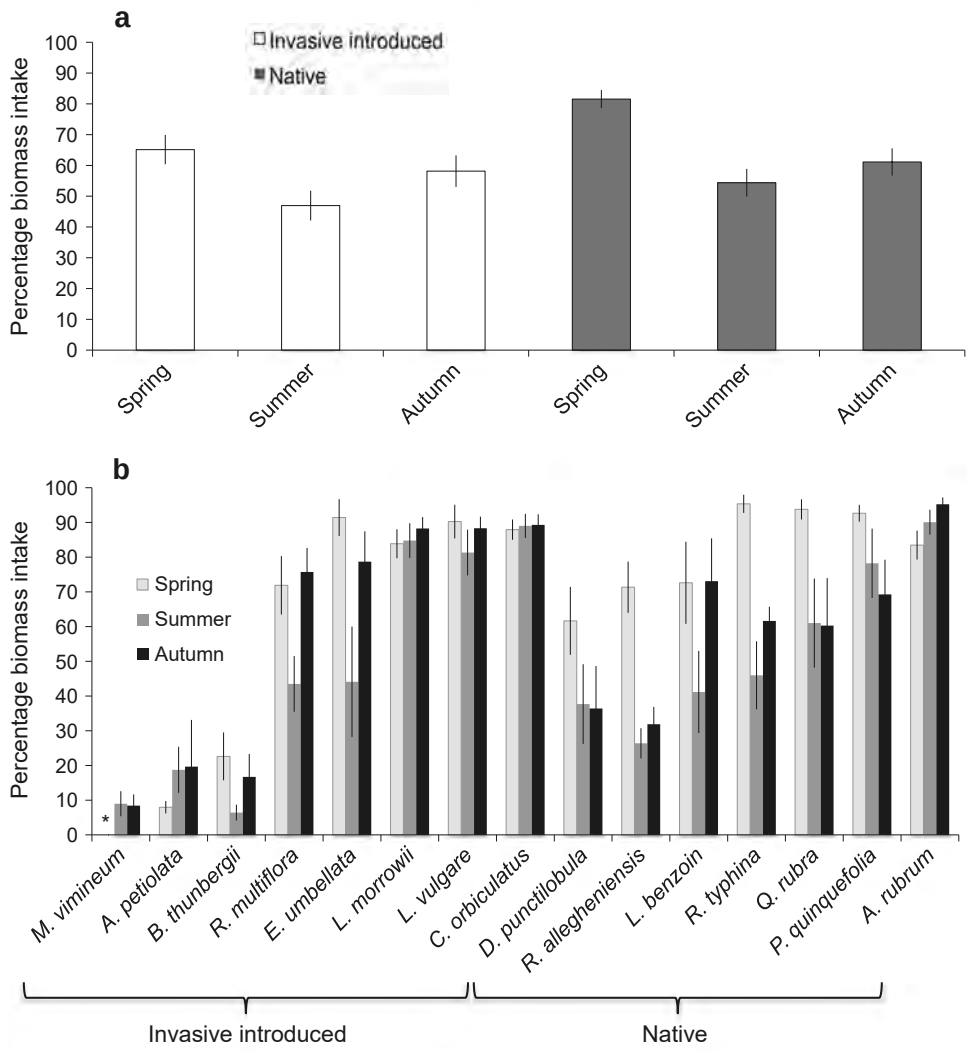

Fig. 1 Leaf biomass consumed (±SE) by adult white-tailed deer (*Odocoileus virginianus* Zimm.) for native and invasive introduced plant species for three seasons in multiple-choice preference trials **a** pooled across species (n = 49–56) and **b** by species (n = 7–8). **M. vimineum* was unavailable in spring

were positively correlated with sniffing events among invasive introduced plants (bites = 2.10 + 0.950*sniffs; $r^2 = 0.40$) and native plants (bites = 2.0 + 0.79*sniffs; $r^2 = 0.44$). Overall, the selective patterns of deer biomass consumption and electivity of introduced plants were positively correlated with deer feeding behavior. For native species however, relationships between biomass consumption or electivity and behavior were mainly positive, but not significant. The number of biting events was a better predictor of biomass consumed and electivity (Appendix) than the number of sniffing events. However, the number of bites per sniff was the best overall behavioral predictor of biomass consumption (Fig. 3a) and electivity (Fig. 3b) and gave a clear picture of which species were preferred and avoided (Fig. 4). Simply put, if the introduced plant material was palatable to the deer, more biomass was consumed per investigative sniff.

Discussion

Overall, deer preferences varied widely by species, supporting the hypothesis tested in this work, which was that deer preferences would vary by species instead of by native/invasive introduced status.

Table 2 Mixed model ANOVA results for effects of plant species, their native/invasive introduced status (N/I status), and season on several measures of deer preference with (w/) and without (w/o) *Microstegium vimineum* (M.v), which was not available in the spring

Fixed effects	% biomass consumption (w/o *M.v.*)	% biomass consumption (w/*M.v.*)	Sniffing (w/o *M.v.*)	Sniffing (w/*M.v.*)	Biting (w/o *M.v.*)	Biting (w/*M.v.*)
N/I status	$F = 5.3_{1,258}$	$F = 4.9_{1,180}$	$F = 1.1_{1,257}$	$F = 2.9_{1,179}$	$F = 0.99_{1,257}$	$F = 0.19_{1,179}$
	$P = \mathbf{0.02}$	$\boldsymbol{P = 0.03}$	$P = 0.3$	$P = 0.09$	$P = 0.3$	$P = 0.7$
Species[N/I status]	$F = 40_{12,258}$	$F = 30_{13,180}$	$F = 7.0_{12,257}$	$F = 5.7_{13,179}$	$F = 39_{12,257}$	$F = 27_{13,179}$
	$\boldsymbol{P < 0.0001}$	$\boldsymbol{P < 0.0001}$	$\boldsymbol{P < 0.0001}$	$\boldsymbol{P < 0.0001}$	$\boldsymbol{P < 0.0001}$	$\boldsymbol{P < 0.0001}$
Season	$F = 4.4_{2,20}$	$F = 1.5_{1,13}$	$F = 2.8_{2,20}$	$F = 2.3_{1,13}$	$F = 4.4_{2,20}$	$F = 3.9_{1,13}$
	$P = \mathbf{0.03}$	$P = 0.2$	$P = 0.08$	$P = 0.1$	$P = \mathbf{0.02}$	$P = 0.07$
N/I status by season	$F = 6.3_{2,258}$	$F = 0.49_{1,180}$	$F = 0.60_{2,257}$	$F = 1.8_{1,179}$	$F = 3.7_{2,257}$	$F = 0.15_{1,179}$
	$P = \mathbf{0.02}$	$P = 0.5$	$P = 0.5$	$P = 0.2$	$P = \mathbf{0.03}$	$P = 0.7$
Species[N/I status] by season	$F = 3.5_{24,258}$	$F = 2.1_{13,180}$	$F = 1.3_{24,257}$	$F = 1.5_{13,179}$	$F = 1.9_{24,257}$	$F = 1.1_{13,179}$
	$\boldsymbol{P < 0.0001}$	$\boldsymbol{P = 0.01}$	$P = 0.2$	$P = 0.13$	$P = \mathbf{0.007}$	$P = 0.3$

Model F and P values are shown[a]. Deer pair (i.e., trial) was the random effect

[a] F values are shown with subscript numerator and denominator degrees of freedom. P values are in bold print if significant at the alpha level $\alpha < 0.05$

Regardless of native/invasive introduced status, deer appeared to limit their intake of plant species with known defenses in favor of those that have fewer defenses (Table 1), pointing to the importance of plant species in plant–herbivore interactions. While native herbivores have been found to generally prefer and reduce the abundance of exotic plants (Parker et al. 2006), based on the results reported here we posit that deer are an example of a native herbivore that prefer natives, but that overall makes food choices at the species level. In the context of herbivory, the distinction among native and invasive introduced species may be of little importance since plant traits that determine palatability are not consistent with plant traits that determine invasiveness. Indeed, chemical extracts from invasive introduced plants have been found to be no different overall in deterring a generalist caterpillar herbivore than biochemistry from native plants; plant deterrence varied widely by species (Lind and Parker 2010, but see Cappuccino and Arnason 2006). That deer strongly avoided several invasive introduced species and consumed more native than invasive introduced plant biomass lends supports to the ERH of plant invasion (Keane and Crawley 2002). However, data presented here also lend some support to the BRH, since several other invasive plants were largely consumed by deer; in natural settings this preferential consumption might limit the establishment or spread of these species (Elton 1958; Parker et al. 2006). Trees and vines were particularly preferred plant habits, perhaps because they can grow out of the reach of deer, i.e., above the browse line (Reimoser et al. 1999). The trees and vines tested do not appear to have defense traits against deer (Table 1).

The strong deer avoidance of *A. petiolata*, *B. thunbergii*, and *M. vimineum* observed in this study is positively correlated with the invasive success of these plants in northeastern forest understories of North America, where deer are often numerous. *A. petiolata* achieves greater abundance in the presence of deer (Knight et al. 2009; Averill 2014; Kalisz et al. 2014) and rarely shows growth- or fitness-reducing effects related to herbivory (Rosenthal and Kotanen 1994; Strauss and Agrawal 1999). Reduced herbivory has been linked to the invasive success of introduced plants (Cappuccino and Carpenter 2005; Carpenter and Cappuccino 2005) and is associated with the occurrence of anti-herbivore traits, such as novel chemistry or morphological adaptations (Campbell and Reece 2002), characteristic of the least-preferred plants (e.g., *A. petiolata* and *B. thunbergii*) in experiments presented here (Table 1). Plant physical protection in the form of spines, thorns, and prickles

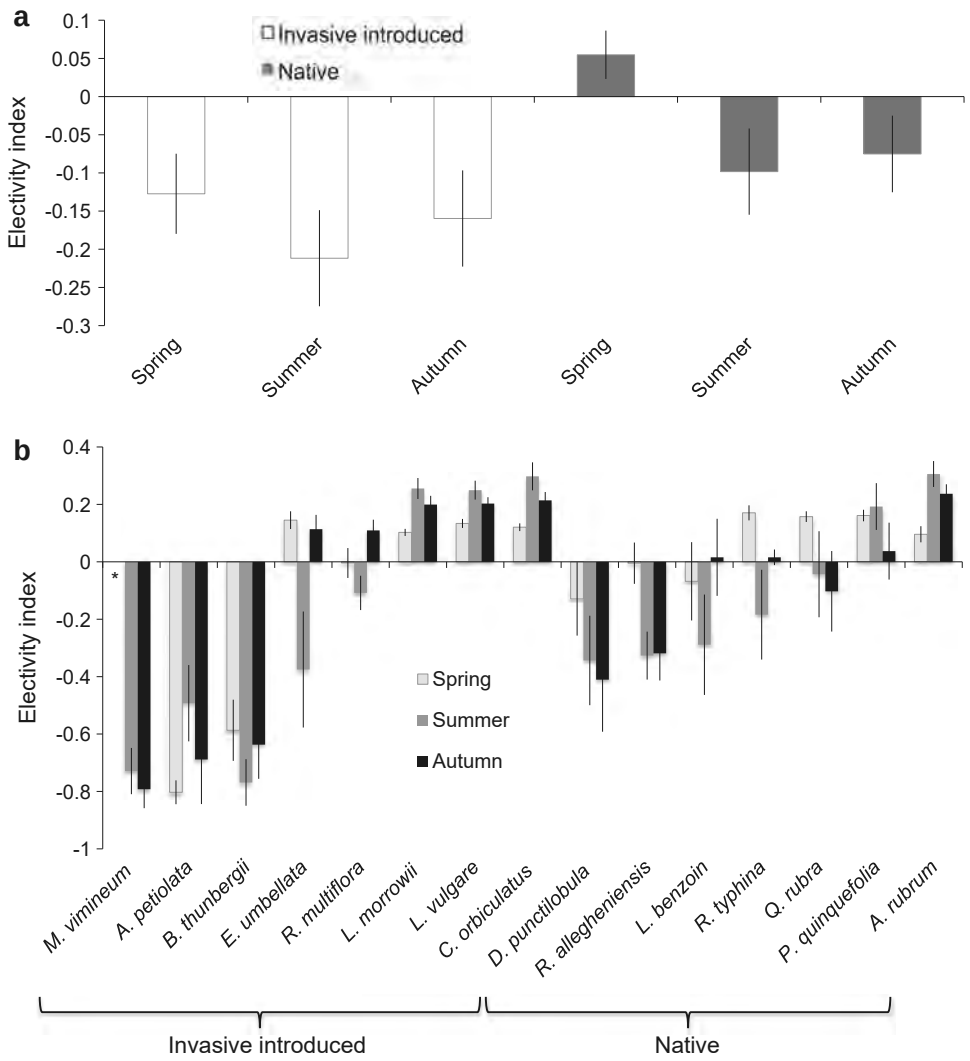

Fig. 2 Relative preferences (±SE) of adult deer for native and invasive introduced plant species for three seasons in multiple-choice preference trials **a** pooled across species (n = 49–56) and **b** by species (n = 7–8). The electivity index ranges from "−1" (strong avoidance) to "+1" (high preference) and a value of zero indicates random feeding. **M. vimineum* was unavailable in spring

(Campbell and Reece 2002), structural compounds (e.g., lignin), and secondary compounds (e.g., tannins) are well known to limit herbivory (Augustine and McNaughton 1998; Alm et al. 2002). In addition to possessing defenses, plant species can avoid being consumed by growing where (Comisky et al. 2005) or when deer pressure is low. In this research, *M. vimineum* had not yet emerged in the spring, the season when deer consumed the most biomass, suggesting a partial temporal avoidance pattern. In the field, *M. vimineum* has been shown to increase where deer are numerous (Baiser et al. 2008; Eschtruth and Battles 2009b). Release from herbivores, regardless of the mechanism, improves an invader's fitness and increases apparent competitive ability (Huang et al. 2012). The fact that deer are so abundant in the region may further facilitate invader success as a result of less competition from more palatable plant neighbors (Augustine and McNaughton 1998).

Just as deer avoided certain invasive introduced species, deer also avoided the native fern *D. punctilobula*, which is considered an invasive native plant in northeastern US forest understories (de la Cretaz and Kelty 1999). Deer are known to

Table 3 Statistically ranked palatability of introduced and native species for captive deer using the electivity index, E^*, based on controlled preference trials conducted in spring, summer, and autumn (1 = most preferred; 15 = least preferred)

Species	Spring	Summer	Autumn	Mean
Introduced				
Alliaria petiolata	14	13	14	14
Berberis thunbergii	13	15	13	14
Celastrus orbiculatus	6	2	2	3
Elaeagnus umbellata	4	10	5	6
Ligustrum vulgare	5	3	3	4
Lonicera morrowii	7	4	4	5
Microstegium vimineum	NA	14	15	15
Rosa multiflora	11	8	6	8
Native				
Acer rubrum	8	1	1	3
Dennstaedtia punctilobula	12	12	12	12
Lindera benzoin	10	9	7	9
Parthenocissus quinquefolia	3	5	8	5
Quercus rubra	1	6	9	5
Rhus typhina	2	7	10	6
Rubus allegheniensis	9	11	11	10

play a key role in the success of the fern, which increases in abundance as deer pressure increases and as deer preferentially consume co-occurring species, while avoiding the fern (Tilghman 1989). Ferns often contain abundant secondary phenolic compounds and *D. punctilobula* contains the herbivore-deterrent compound coumarin (Link 1959; Bohm and Tryon 1967). Overall, plant unpalatability might play a facilitative role in introduced plant invasion and in native plant dominance.

Although anti-herbivory characteristics likely contribute to plant invasiveness, other plant characteristics and habitat conditions are known to promote plant invasion as well, and plants often become invasive for multiple reasons (Cappuccino and Arnason 2006). For instance, the introduced herb, *A. petiolata,* not only has secondary compounds that influence interactions with herbivores, but also releases root exudates known to reduce the germination of other species (Prati and Bossdorf 2004). The introduced shrub, *B. thunbergii*, is associated with altered soil functions, such as increasing nitrification rates, which are thought to increase the density and diversity of introduced species generally (Ehrenfeld et al. 2001). Where intense deer browsing is combined with overstory thinning, the native fern *D. punctilobula* forms closed understory canopies, thus limiting tree seedling establishment (de la Cretaz and Kelty 1999; Pinchot 2011). Additionally, herbivore tolerance via rapid re-growth or compensation for lost biomass following herbivory can enable invasive plant success (Hawkes and Sullivan 2001). Indeed, almost all of the invasive introduced plants tested in this work that were palatable to deer can resprout following aboveground biomass loss (Table 1). Finally, plant species that have a mutualistic relationship with herbivores, such as those possessing fleshy fruits, are more likely to become invasive (Rejmánek 1996). In this work, all of the most palatable invasive introduced plants, and several of the intermediately palatable species as well, can reproduce and disperse via a fleshy fruit. While biomass consumption typically decreases plant fitness, if combined with rapid regrowth and animal-dispersed fruit, palatable species could be invasive in a landscape with abundant frugivores (Richardson et al. 2000; Buckley et al. 2006). The high level of preference for fruit-bearing species has implications for animal-mediated invasive plant spread (Janzen 1984; Myers et al. 2004; Williams et al. 2008).

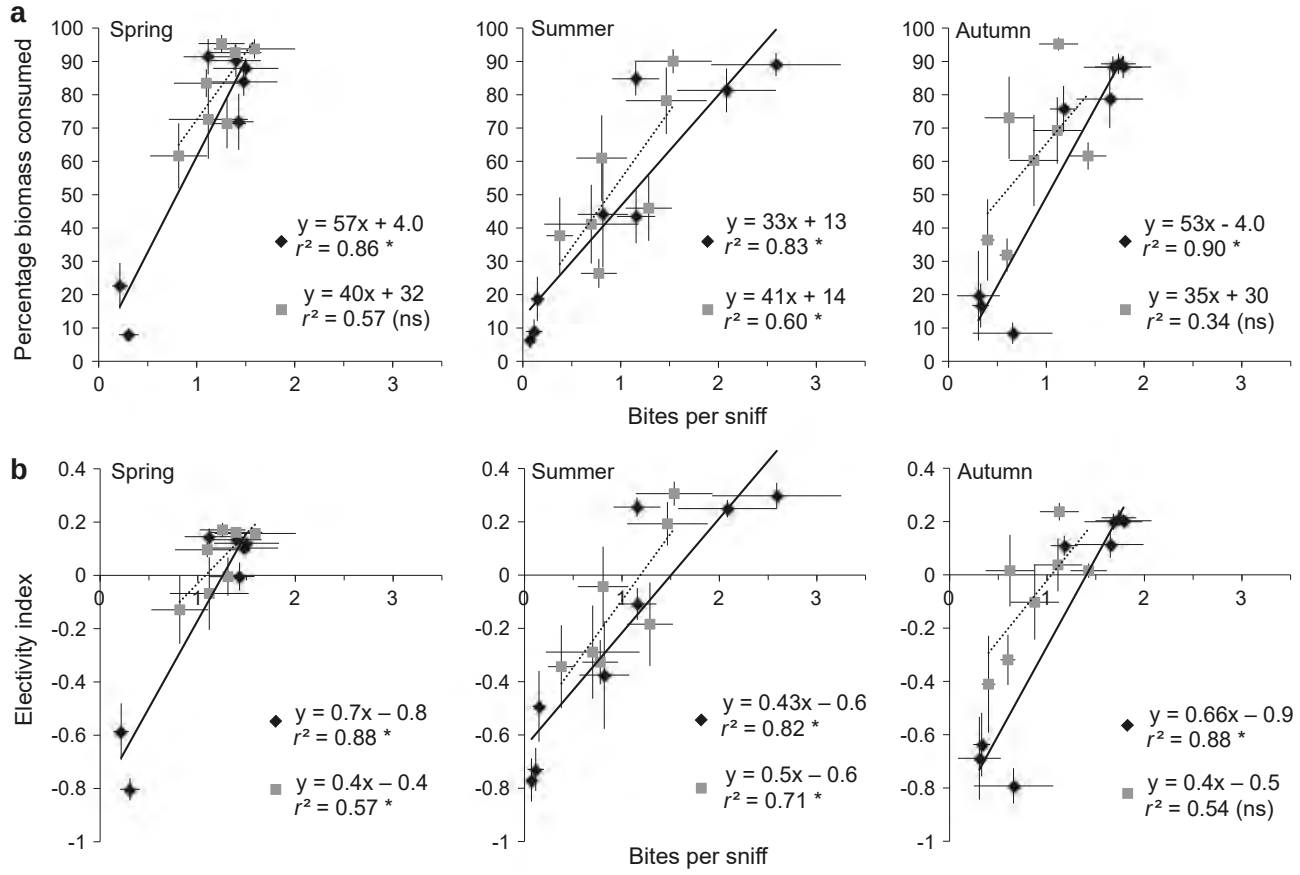

Fig. 3 Relationships between the ratio of deer bites to sniffs and the corresponding **a** leaf biomass consumed by deer and **b** electivity index for three seasons in multiple-choice preference trials. Data points represent eight invasive introduced species (*black diamonds*, *solid lines*) and seven native species (*gray squares*, *dashed lines*). Linear regression relationships are shown for native and introduced species groups and are labeled as significant at the $\alpha < 0.05$ level (*asterisk*) or as not significant (*ns*)

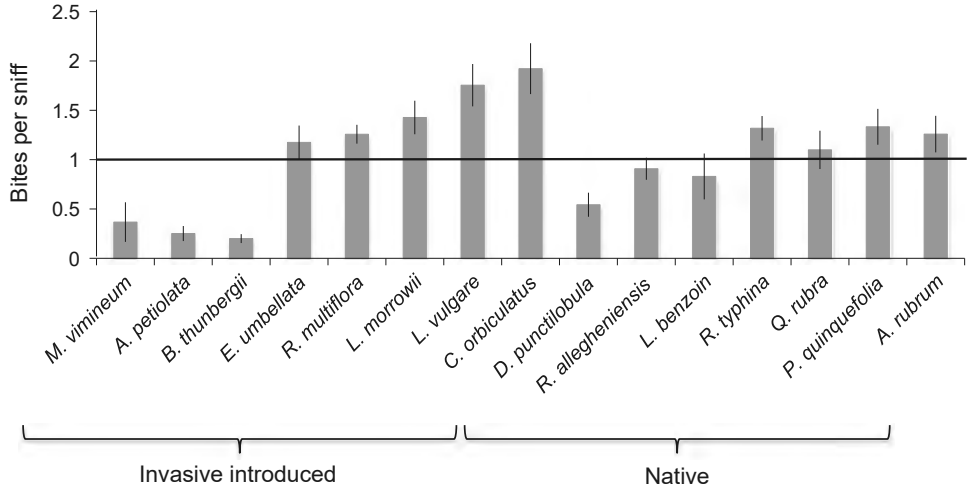

Fig. 4 Ratio of deer bites to sniffs during preference trials for eight invasive introduced and seven native plant species. The 1:1 line provides a reference point for equal numbers of bites and sniffs. Plant species for which the number of bites per sniff was above one were most preferred, while a bite to sniff ratio below one indicated avoidance

Animal- or plant-based changes could explain observed electivity differences across seasons. Physiological needs of deer vary across seasons (Crawford 1982; Dumont et al. 2005; Estevez et al. 2010) and younger plant tissue is typically more palatable (Gill 1992) due to higher digestible energy and nitrogen (Oh et al. 1970; Bryant et al. 1983) and immature defenses (Oh et al. 1970), which might explain elevated biomass consumption in the spring. Specifically, the finding that native woody species including the tree *Q. rubra* and shrub *R. allegheniensis*, which became less palatable as the growing season progressed, could be a result of increasing lignin and/or starch content, compounds known to be less palatable because they have lower nutritional value (Augustine and McNaughton 1998; Alm et al. 2002). Seasonal differences in palatability carry important consequences for plant invasion, especially under forecasted climate change (Wolkovich and Cleland 2011).

Due to the limited number of species in the experiments reported here, results should be interpreted with caution. Many of the plant species currently occurring in the eastern U.S. have likely gone through a deer browse filter and would be expected to be less palatable to deer or more tolerant of deer browsing. Indeed, during a 50-year period in the northcentral U.S., less palatable species increased in abundance, while the more palatable species declined in abundance (Wiegmann and Waller 2006). Including more species in preference trials would certainly help to flesh out the pattern of herbivory at the native/introduced invasive level. However, results presented here showing that some species are highly preferred and others are strongly avoided would undoubtedly persist.

Deer feeding behavior

Results reported here show that sniffing investigation usually leads to biting and therefore consumption. Low numbers of sniffs and bites per sniff for the unpalatable species demonstrate that deer learn to avoid such plants even before sniffing, i.e., by visual cues (Provenza 1995). Feeding behavior is learned through complex interactions among pre- and post-ingestion feedback cues via the senses, i.e., taste, smell, sight, and the viscera (Provenza 1995) and we have assessed a few manifestations of these cues. If quantifying biomass consumption is prohibitive (e.g., in field settings), observations of deer sniffing and biting behavior among plants could provide a strong indication of relative herbivore preference. Food selection is considered an innate behavior in white-tailed deer and is expected to be quite similar among wild and captive individuals (Spalinger et al. 1997). However, differences might occur because the regular diet of captive deer is limited (e.g., the deer in this work typically consume food pellets, dried hay, and species growing in the penned environment). While wild deer use different plants to meet nutritional requirements and to resolve maladies, this is more difficult for captive deer (Spalinger et al. 1997). Thus when captive deer are offered fresh plant biomass, some food consumption might be attributed to satisfying requirements particular to the conditions of their captivity. For example, even though we expected *L. vulgare* to be unpalatable, perhaps the species satisfies a need that the captive deer were lacking, causing deer to consume more of these species in captivity than has been observed in the wild. In particular, the palatability of *A. rubrum* appears to be context-specific, being palatable at certain sites but less palatable at others (Crawford 1982; Abrams 1998 and references therein).

Conclusions

Together, biomass consumption and behavior data indicate that deer selectivity could depend more on species and growing season than on native/invasive introduced plant status. The extreme preference and avoidance among the widespread and frequently occurring invasive introduced plant species observed in preference trials suggest that herbivore selection occurs on species-by-species basis and likely according to species traits. At a minimum, this research indicates that deer might play an important and indirect facilitative role in the invasion processes of unpalatable introduced plants. These species-level herbivore–plant interactions should contribute to deeper understanding of the variable patterns of invasive introduced plants in the face of an abundant

native generalist herbivore across the northeastern US.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

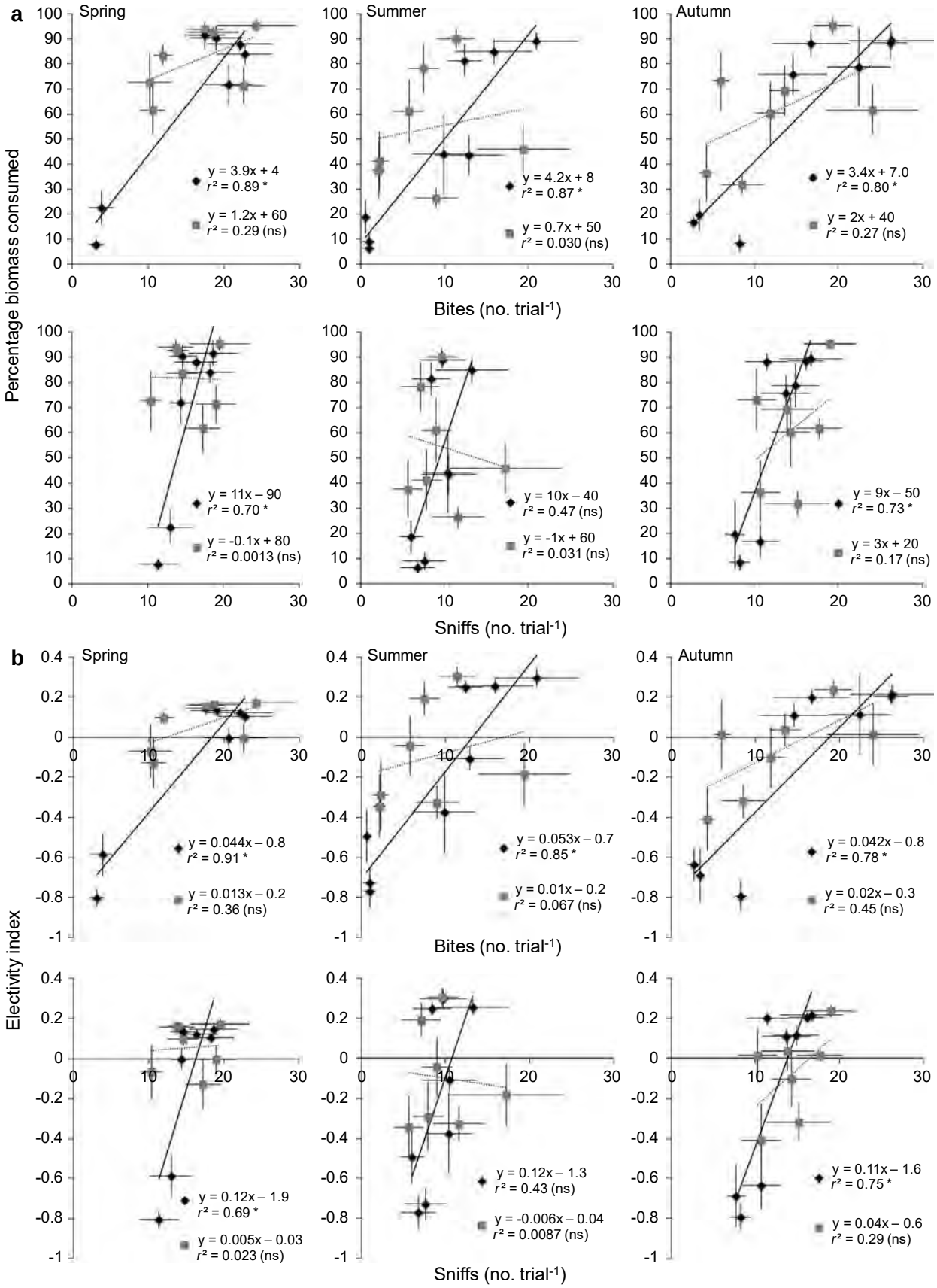
Human and animal rights statement This article does not contain any studies with human participants. All applicable institutional and/or national guidelines for the care and use of animals were followed. The authors declare that experiments complied with the current laws of the country in which the experiments were performed.

Appendix

See Table 4 and Fig. 5.

Table 4 Species sown in May 2011 in the Penn State Deer Research Center paddock used for preference experiments

Common name	Scientific name	Percentage
Alsike clover	*Trifolium hybridum* L.	20.67
"Climax" timothy	*Phleum pratense* L.	17.94
Perennial ryegrass	*Lolium perenne* L.	17.93
Orchardgrass	*Dactylis glomerata* L.	16.49
Annual ryegrass	*Lolium multiflorum* Lam.	12.74
White clover	*Trifolium repens* L.	4.94
Birdsfoot trefoil	*Lotus corniculatus* L.	4.1
Other crop seed		3.0
Inert matter		1.94
Weed seed		0.25


a
Spring
Summer
Autumn
Percentage biomass consumed
y = 3.9x + 4
r² = 0.89 *
y = 1.2x + 60
r² = 0.29 (ns)
y = 4.2x + 8
r² = 0.87 *
y = 0.7x + 50
r² = 0.030 (ns)
y = 3.4x + 7.0
r² = 0.80 *
y = 2x + 40
r² = 0.27 (ns)
Bites (no. trial-1)
y = 11x – 90
r² = 0.70 *
y = -0.1x + 80
r² = 0.0013 (ns)
y = 10x – 40
r² = 0.47 (ns)
y = -1x + 60
r² = 0.031 (ns)
y = 9x – 50
r² = 0.73 *
y = 3x + 20
r² = 0.17 (ns)
Sniffs (no. trial-1)
b
Spring
Summer
Autumn
Electivity index
y = 0.044x – 0.8
r² = 0.91 *
y = 0.013x – 0.2
r² = 0.36 (ns)
y = 0.053x – 0.7
r² = 0.85 *
y = 0.01x – 0.2
r² = 0.067 (ns)
y = 0.042x – 0.8
r² = 0.78 *
y = 0.02x – 0.3
r² = 0.45 (ns)
Bites (no. trial-1)
y = 0.12x – 1.9
r² = 0.69 *
y = 0.005x – 0.03
r² = 0.023 (ns)
y = 0.12x – 1.3
r² = 0.43 (ns)
y = -0.006x – 0.04
r² = 0.0087 (ns)
y = 0.11x – 1.6
r² = 0.75 *
y = 0.04x – 0.6
r² = 0.29 (ns)
Sniffs (no. trial-1)

◀**Fig. 5** Relationships between deer browsing behaviors and **a** leaf biomass consumed and **b** electivity index for three seasons in multiple-choice preference trials. Data points represent eight invasive introduced species (*black diamonds*, *solid lines*) and seven native species (*gray squares*, *dashed lines*). Linear regression relationships are shown for native and introduced species groups and are labeled as significant at the $\alpha < 0.05$ level (*asterisk*) or as not significant (*ns*)

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Appendix I

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Research article

Unconventional gas development facilitates plant invasions

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ABSTRACT

Vegetation removal and soil disturbance from natural resource development, combined with invasive plant propagule pressure, can increase vulnerability to plant invasions. Unconventional oil and gas development produces surface disturbance by way of well pad, road, and pipeline construction, and increased traffic. Little is known about the resulting impacts on plant community assembly, including the spread of invasive plants. Our work was conducted in Pennsylvania forests that overlay the Marcellus and Utica shale formations to determine if invasive plants have spread to edge habitat created by unconventional gas development and to investigate factors associated with their presence. A piecewise structural equation model was used to determine the direct and indirect factors associated with invasive plant establishment on well pads. The model included the following measured or calculated variables: current propagule pressure on local access roads, the spatial extent of the pre-development road network (potential source of invasive propagules), the number of wells per pad (indicator of traffic density), and pad age. Sixty-one percent of the 127 well pads surveyed had at least one invasive plant species present. Invasive plant presence on well pads was positively correlated with local propagule pressure on access roads and indirectly with road density pre-development, the number of wells, and age of the well pad. The vast reserves of unconventional oil and gas are in the early stages of development in the US. Continued development of this underground resource must be paired with careful monitoring and management of surface ecological impacts, including the spread of invasive plants. Prioritizing invasive plant monitoring in unconventional oil and gas development areas with existing roads and multi-well pads could improve early detection and control of invasive plants.

1. Introduction

The rapid development of unconventional oil and gas (UOG) resources from low-permeability rock, including shale and tight sands (limestone and sandstone), has out-paced our understanding of the ecological impacts of its extraction (Kargbo et al., 2010; Souther et al., 2014). UOG production within the continental United States (US) is projected to continue at an annual growth rate of 4% through 2020 and 1% through 2040 largely driven by shale gas production in the East (EIA, 2017). The impact of UOG development on water resources has received much attention spanning wastewater management (Rahm et al., 2013), surface water quality (Olmstead et al., 2013; Warner et al., 2013) and flow (Drohan and Brittingham, 2012), and the potential impact on US regional watersheds (Mauter et al., 2014; Medina and Suedel, 2015). Much less attention has been focused on impacts on vegetation and wildlife (Evans and Kiesecker, 2014; Kiviat, 2013; Souther et al., 2014) including the potential spread of invasive plants.

We chose Pennsylvania (PA) state forests to assess the current state of invasive plant presence and abundance on recently established unconventional gas well pads and access roads, and to assess potential drivers of invasive spread. The second-growth forests of the mid-Atlantic US, including PA, serve as an important timber resource, sink for atmospheric carbon (McGarvey et al., 2015), watershed for major northeastern rivers, key migratory pathway for birds (Brittingham and Goodrich, 2010), and recreation resource. This region has a long history of timber, coal, iron-ore, and conventional oil and gas extraction, and now the development of deep reserves of shale gas from the Marcellus and Utica formations.

Forest fragmentation is a substantial concern where UOG reserves lie beneath core forests (Drohan et al., 2012; Moran et al., 2015; Langlois et al., 2017). In PA, three-quarters of the state, and

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nearly 70% of PA state forests overlay shale gas reserves (Drohan et al., 2012). Unconventional gas extraction from the Marcellus Shale within the PA state forests began in 2008 and by 2012 resulted in the direct loss of 601 ha of forest to 232 well pads, the widening or creation of 259 km of roads, and 167 km of widened or new pipeline corridors (DCNR, 2014). While this direct loss is less than 0.0007% of the total PA state forest system, the development has led to extensive forest fragmentation with an increase in 1762 ha of edge forest and the loss of 3740 ha of core forest (DCNR, 2014). Landscape-scale forest fragmentation and disturbance are known to facilitate the spread of invasive plants (With, 2004; Minor et al., 2009; Vilà and Ibáñez, 2011). Construction of well pads, transmission pipelines, and access roads create new forest edge, can alter soil chemistry and structure (Fink and Drohan, 2015), and plant community composition to non-native, disturbance-adapted species. For example, in the Williston Basin of the Northern Great Plains, US, Preston (2015) found non-native plant recruitment adjacent to unconventional oil well pads in native prairie. In addition to the vegetation and soil disturbance, UOG development results in a dramatic increase in truck and heavy equipment traffic increasing the likelihood that invasive plant seed and vegetative propagules are introduced. Increased disturbance coupled with increased propagule pressure could accelerate invasive plant spread in these previously core forest habitats (Huebner and Tobin, 2006), particularly if source populations from newly constructed roads and pipelines are not managed.

UOG is commonly produced with horizontal drilling and hydraulic fracturing staged on rectangular-shaped pads. These well pads are typically several hectares in size to accommodate drilling equipment, truck traffic and fracturing fluid and proppant storage units. Well pads are often constructed in clusters and connected by a shared access road that branches from existing roads. When development occurs near secondary or rural roads that cannot accommodate large, heavy vehicles (such as within forests), new roads are built or existing roads are widened. The expanded road network for UOG development could increase the likelihood of invasive plant spread and establishment.

Road development within a forest matrix is known to have substantial long-term impacts on ecosystem function (Forman and Alexander, 1998; Kuhman et al., 2010) and can create pathways for invasive plant establishment and spread (Birdsall et al., 2012; Hansen and Clevenger, 2005; Mortensen et al., 2009; Parendes and Jones, 2000; von der Lippe and Kowarik, 2007; Watkins et al., 2003). Roads facilitate spread when plant establishment is enhanced by increased light, and when soil physical and chemical properties are altered to favor establishment and growth of disturbance-adapted alien species over native (Johnston and Johnston, 2004; Nord et al., 2010). Material and equipment used for road construction can play an important dispersal role (Taylor et al., 2012) at these sites. Given the fact that on average 1235 one-way truck trips delivering fracturing fluid and proppant are required to complete an unconventional well (Sibrizzi and LaPuma, 2016), the potential to transport invasive plant propagules is significant. Propagule transport could occur from mud on the tires and undercarriage of vehicles (Taylor et al., 2012), by road construction and maintenance, and by way of vehicle airflow (von der Lippe et al., 2013) and wind (Caplat et al., 2012). For example, Rauschert et al. (2017) attributed much of rapid advance of *Microstegium vimineum* to seed movement by road grading equipment on forested gravel roads. UOG development typically involves drilling one or more wells on a well pad and the addition of new wells can occur over a period of years (Drohan et al., 2012). As high propagule pressure is known to be a significant contributor to successful invasive plant establishment (Simberloff, 2009), we propose that the likelihood of invasive plant propagule introductions increases with accompanying high-density traffic with each additional well.

In this work, we hypothesize invasive plant presence on well pads is correlated with the length of time since pad construction, the number of wells drilled per pad, invasive plant abundance on adjacent well pad access roads, and the density of roads in the area of the pad prior to construction (Menuz and Kettenring, 2013; Watkins et al., 2003). Using field data from 127 well pads, we created an *a priori* piecewise structural equation model (SEM) to evaluate direct and indirect relationships between mechanisms and conditions that could account for invasive plant presence (Fig. 1). We predicted that time since pad construction, wells per pad, and pre-pad road density are indirect drivers of invasive plant presence on pads mediated by the density of invasive plants on access roads. Furthermore, we predicted that wells per pad are directly correlated with time since pad construction. The surrounding plant communities were additionally surveyed on a randomly selected set of 32 well pads in the study. We hypothesized that similar to Preston (2015) non-native plant cover would be greater on the disturbed well pad edges than in the surrounding plant communities.

2. Materials and methods

2.1. Study region

Invasive plant surveys were conducted (see 2.2 for details) between July and September in 2012 and 2013 on 127 Marcellus Shale gas well pads and adjacent access roads. Pads were located in 7 publicly managed PA State Forest Districts (n = 116) and in the Allegheny National Forest (n = 11) in northcentral PA (Fig. 2). The study sites are distributed across the unglaciated Allegheny High Plateau physiographic province (Shultz, 1999), which is dominated by mixed-oak and Northern hardwood forests (Fike, 1999), and the Pittsburgh Plateau and the Ridge and Valley regions of central PA, dominated by mixed-oak forests. Loam or sandy loam soils are the most common surface and subsurface soil textures across the study area (Ciolkosz et al., 1989). The soils of the Pittsburgh Plateau formed from acid clay shales and low fertility sandstones and siltstones while ridges of the Ridge and Valley and Allegheny High Plateau are largely comprised of sandstone and siltstone with some shale (Ciolkosz et al., 1989; Shultz, 1999). Average yearly precipitation in central and northcentral PA ranges between 95 and 115 cm yr^{-1}.

2.2. Invasive plant data collection

At each of the 127 well pad study sites, invasive plant data were collected by walking along a belt transect of the revegetated pad

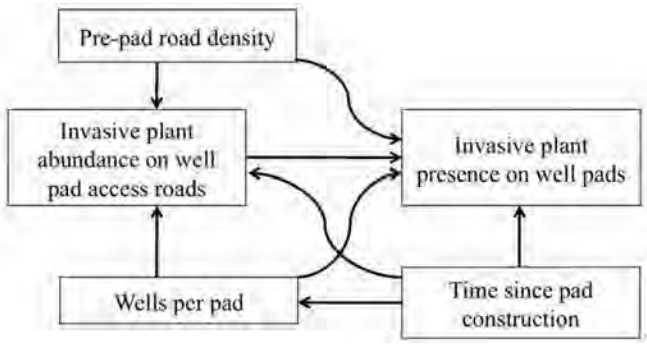

Fig. 1. Hypothesized direct and indirect causal pathways of invasive plant presence on well pads.

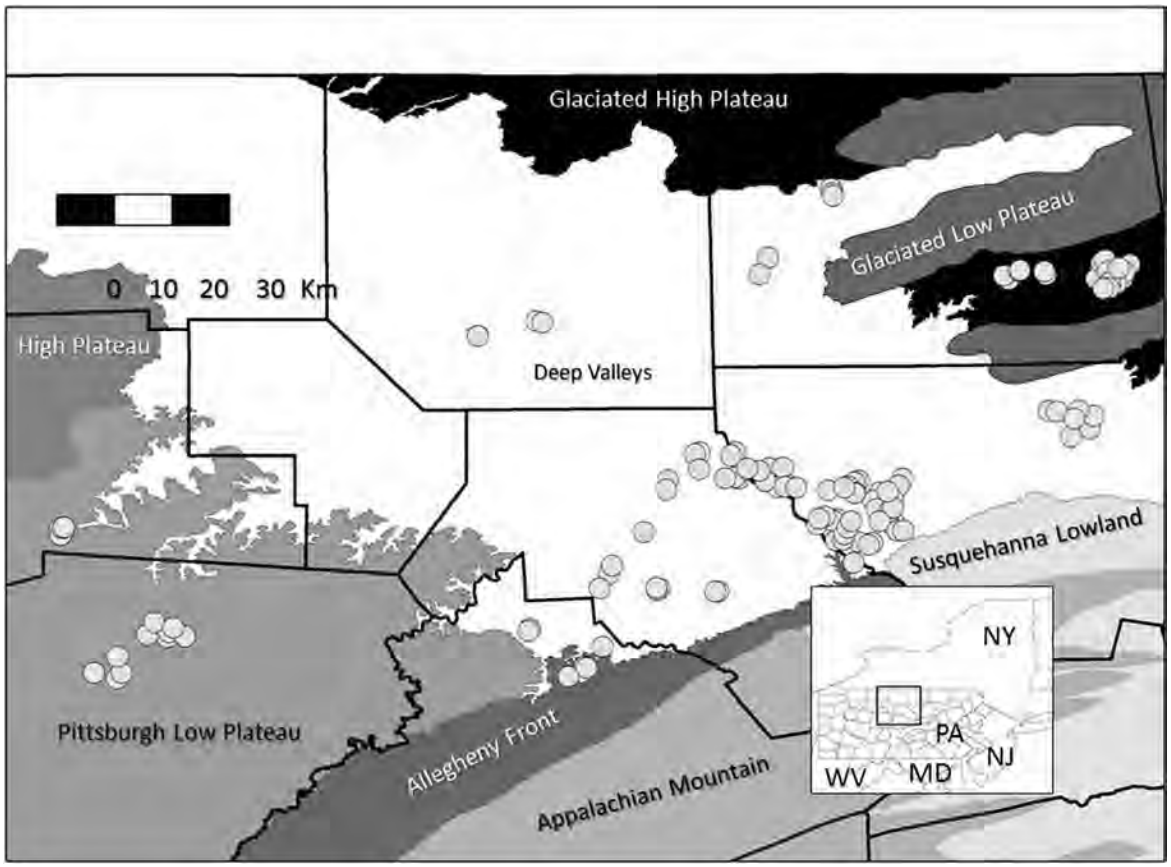

Fig. 2. Map of the survey locations and physiographic sections. Grey spheres mark well pad sites in north central Pennsylvania, with inset map of the northeastern U.S. showing the states of Pennsylvania (PA), New York (NY), New Jersey (NJ), Maryland (MD), and West Virginia (WV).

perimeter and conducting a visual scan of the pad surface. We rarely documented plants growing on the pad surface as pads are typically covered by a thick layer of limestone gravel and are not suitable for plant growth. The width of the revegetated pad perimeter varied but was approximately 10 m wide. As this study focused on well pads in forested landscapes, the disturbance from pad construction was visually distinct from the surrounding forest cover and can be seen from aerial imagery (Fig. 3). Pad access road edges, defined as the disturbed area from gravel road edge to the forest edge, approximately 10 m wide, were also surveyed for invasive plants for a distance of 0.5 km from the pad edge. If the pad was adjacent to a main road those road edges were surveyed 0.25 km in either direction of the well pad. We surveyed for invasive non-native plants of concern in PA forests (Table 1). Stem counts for each species were classed in the following four categories 0, 1–10, 11–100, 101–1000, >1000.

2.3. Data on pad area, age, wells, and road density

The PA DCNR provided data on pad area, pad age (years since construction), and the number of wells drilled per pad. Pad area ranged from 0.35 to 5.60 ha, with a median 1.71 ha, pad age ranged from 0 (within first year of completed construction) to 6, with a median of 2, and the number of wells on a pad ranged from 0 to 11, with a median of 3. Road density in the area of the pad prior to construction was calculated in ArcGIS v10.1 (ESRI, 2012) from 2005 pre-shale gas extraction aerial imagery (1-foot pixel resolution) sourced from the National Agriculture Imagery Program (USDA FSA APFO, 2006). Total road length within a 200 m radius of the pad center included paved and unpaved roads. Road density ranged from 0 to 1395 m, with a median of 290 m.

2.4. Plant community surveys surrounding well pad sites

A subset (32) of well pad sites that spanned the region (6 state forest districts) was randomly selected to survey the surrounding plant communities in comparison to the reclaimed well pad edge. At each well pad 1.5 × 1.5 m quadrats were placed at 0, 25, and 100 m along a linear transect from all four sides of the well pad. Quadrat locations were determined in Google Earth (Google Inc, 2017) prior to conducting the surveys. All plants within the quadrat were identified to species and recorded for percent cover by species.

2.5. Statistical analysis

2.5.1. Invasive plant presence, frequency of occurrence, and density

First, we report on the presence, frequency, and density of invasive non-native plants on well pad edges, and well pad access roads. Stem densities on roads and pads were assessed for normality with the Shapiro-Wilk test and non-parametric test statistics were used when appropriate. Kendall's rank correlation tau, well suited for non-parametric data (Croux and Dehon, 2010), was used to reveal species level insights for *M. vimineum*, which is known to spread along gravel roads typical of the unconventional gas development in the PA state forest system (Mortensen et al., 2009; Rauschert et al., 2017). *M. vimineum* abundance along the well pad edges and adjoining access roads could indicate invasive

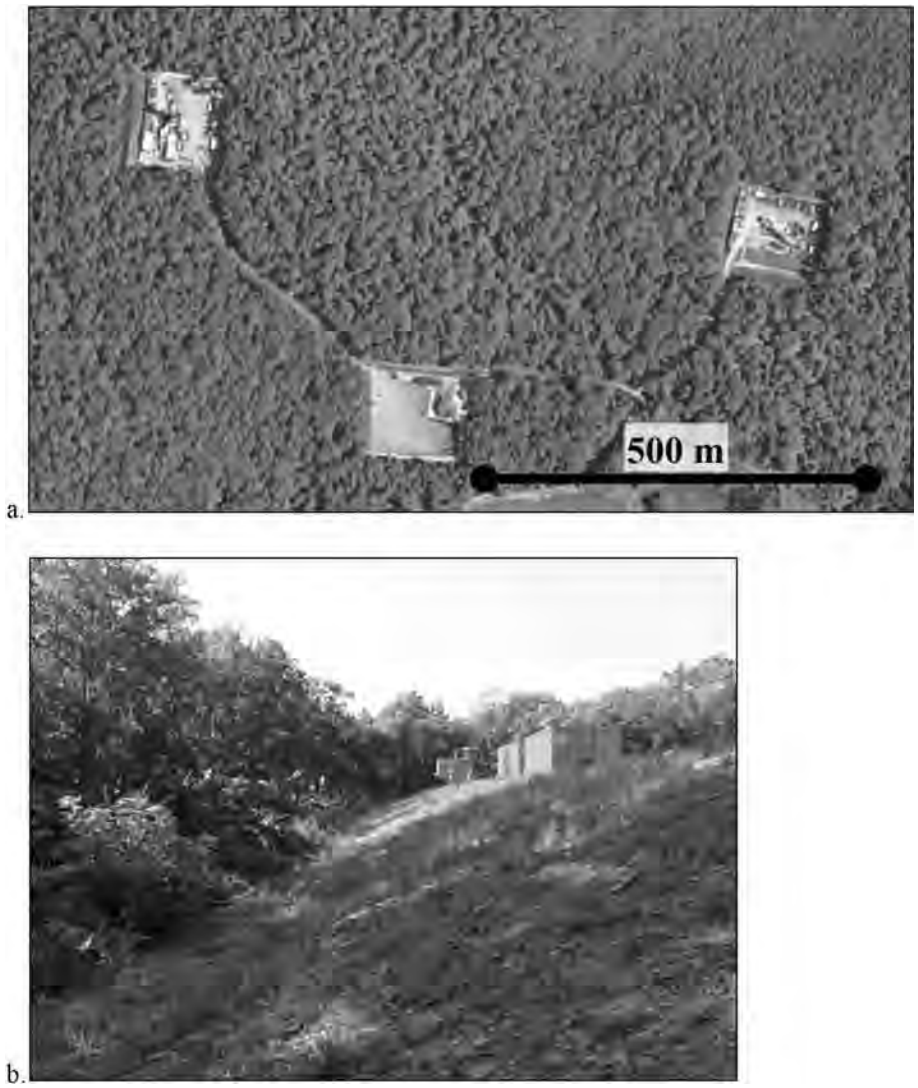

Fig. 3. (a) Aerial photo of three unconventional gas well pads in a northcentral PA forest. A central access road connects the pads to the main road (not seen). Aerial imagery sourced from the National Agriculture Imagery Program (USDA-FSA APFO, 2010). (b) Reclaimed edge of a gas well pad surveyed for invasive non-native plants, pad is out of view to the right. Photo credit: Kathryn M. Barlow.

populations are spreading locally. If a species is absent on the access road but present on the adjacent well pad, this could indicate invasive plant propagules are being spread by development related activities, such as gravel brought to the site and on vehicles traveling to and from the site. For the 4 most common species *M. vimineum*, *Phalaris arundinacea*, *Centaurea stoebe,* and *Cirsium arvense* we report on the frequency of populations found on the well pad and not on the access roads.

2.5.2. Structural equation modeling - invasive plant colonization on pads

Piecewise SEM (Lefcheck, 2016) was used to assess the hypothesized *a priori* direct and indirect drivers of invasive plant colonization (presence) on pads (Fig. 1). SEMs allow for variables to be included as both predictors and outcomes to assess the realistic complexity of their relationships. Variables within and affecting the system are referred to as endogenous, whereas exogenous variables are not driven by the system (Grace et al., 2010). Invasive species presence, not stem density, was used for the endogenous variable on pads, as density is more likely correlated to habitat suitability and abiotic factors on the pad (e.g., soil pH, soil fertility, climate) that were not measured. Because of slower reproductive rates, dispersal, establishment, and spread of woody species only herbaceous species were included in the SEM. For invasive plant abundance on access roads we did not distinguish between species, but used a sum of all invasive herbaceous plant species' abundance. We used the intraclass correlation coefficient (ICC) to assess variability at the forest district level (Nakagawa and Schielzeth, 2010) to determine if we should use multilevel modeling, i.e. observations within a forest district are more similar than between forest districts. Piecewise SEM uses the test statistic Fisher's C, derived from the *p*-values of all linear models in the SEM (basis set), and model fit is indicated by a *p*-value of 0.05 or greater (Lefcheck, 2016).

Mixed effects logistic regression (MELR) models were used for the two binary endogenous variables in the SEM; the presence or absence of invasive plants on pads, and the presence of more than one well per pad. Potential direct drivers of invasion on pads included: road density in the area of the pad pre-construction (200 m radius from pad center), invasive herbaceous plant density on access roads, presence of more than one well per pad, and

Table 1
Herbaceous and woody invasive non-native plants included in the survey on unconventional gas pads in PA forests. Nomenclature according to the United States Department of Agriculture plants database (USDA NRCS, 2017).

Scientific name	Common name	Plant type
Alliaria petiolata (M. Bieb.)	garlic mustard	Herbaceous
Celastrus orbiculatus Thunb.	oriental bittersweet	Herbaceous
Centaurea jacea L.	brownray knapweed	Herbaceous
Centaurea stoebe L.	spotted knapweed	Herbaceous
Cirsium arvense (L.) Scop.	Canada thistle	Herbaceous
Microstegium vimineum (Trin.) A. Camus	Nepalese browntop	Herbaceous
Phalaris arundinacea L.	reed canarygrass	Herbaceous
Phragmites australis (Cav.) Trin. ex Steud. subsp. *australis*	European common reed	Herbaceous
Polygonum cuspidatum Siebold & Zucc.	Japanese knotweed	Herbaceous
Polygonum perfoliatum L.	Asiatic tearthumb	Herbaceous
Securigera varia (L.) Lassen	purple crownvetch	Herbaceous
Acer platanoides L.	Norway maple	Woody
Ailanthus altissima (Mill.) Swingle	tree of heaven	Woody
Berberis thunbergii DC.	Japanese barberry	Woody
Elaeagnus umbellata Thunb.	autumn-olive	Woody
Frangula alnus Mill.	glossy buckthorn	Woody
Ligustrum vulgare L.	European privet	Woody
Lonicera maackii (Rupr.) Herder	Amur honeysuckle	Woody
Lonicera morrowii A. Grey	Morrow's honeysuckle	Woody
Rhamnus cathartica L.	common buckthorn	Woody
Rosa multiflora Thunb.	multiflora rose	Woody

pad age. Results are expressed as unstandardized correlation path coefficients, and as odds ratios by taking the exponential of the coefficients. Odds ratios (OR) describe the change in odds of an outcome for every single-unit increase in the predictor. A generalized linear mixed model (GLMM) was used for a third endogenous variable, the density of invasive plants on well pad access roads, which fit a negative binomial distribution. Results are expressed as unstandardized correlation path coefficients, and as incidence rate ratios (IRR) by taking the exponential of the coefficients. The IRR is the ratio of the rates of two outcomes. Pad area was variable and was used as an offset (Hilbe, 2014) in the GLMM for invasive presence. We report the conditional (fixed and random effects) R^2 values for the MELR model on invasive presence on well pads according to Nakagawa and Schielzeth (2013) and Johnson (2014).

The MELR model of invasive plant colonization on well pads used binary data y_i,

where,

$y_i = 0$ if the i^{th} pad had no invasive plant species present
1 if the i^{th} pad had an invasive plant species present

with the probability p that invasion occurred on the i^{th} pad, and $j = 8$ forest regions (7 PA State Forest districts and the ANF), and colonization is dependent on the following variables, with α intercept, and β and δ path coefficients,

$$\text{logit}(p_{ij}) = \alpha + \beta_1 \times \text{prior road density}_{ij} + \beta_2 \times \text{invasive density on access roads}_{ij} + \beta_3 \times \text{wells}_{ij} + \beta_4 \times \text{pad age}_{ij} + \delta \times \text{district}_j + \text{offset(pad area)}.$$

The MELR model specifications for the presence of more than one well per pad is binary data z_i, where,

$z_i = 0$ if the i^{th} pad had $0-1$ well
1 if the i^{th} pad had 2 or more wells

and dependent on the following variables, with α intercept, and β and δ path coefficients,

$$\text{logit}(p_{ij}) = \alpha + \beta_1 \times \text{pad age}_{ij} + \delta \times \text{district}_j.$$

The model for the density of invasive plants on access roads had a count data response w_i with a negative binomial distribution, and was dependent on the following variables, with α intercept, and β and δ path coefficients,

$$\log(w_{ij}) = \alpha + \beta_1 \times \text{prior road density}_{ij} + \beta_2 \times \text{number of wells}_{ij} + \beta_3 \times \text{pad age} + \delta \times \text{district}_j.$$

Prior road density was used as a surrogate for invasive plant propagule sources for invasion on new roads and pads (Watkins et al., 2003). The number of wells drilled was used as a measure of the amount of traffic to that pad (Sibrizzi and LaPuma, 2016). Pad age was used as a measure of time since the original site disturbance.

2.5.3. Plant community change with gas development

Plant species cover from the 3 m^2 quadrats were categorized by nativity status to assess plant community composition change within a forest after the establishment of a well pad. We calculated the sum of native and non-native cover at the quadrat level, averaged cover by nativity status at each distance at the pad level, and created a ratio of non-native to native cover by distance. We used the Kruskal-Wallis test to assess our hypothesis that non-native plant cover would be greater on well pad edges compared to the surrounding plant communities.

All analyses were performed in R version 3.1.2 (R Core Team, 2014), using piecewiseSEM (Lefcheck, 2016), lmerTest (Kuznetsova et al., 2014), and nlme (Pinheiro et al., 2015) libraries.

3. Results

3.1. Overall findings

Sixty-one percent of pads had at least one invasive non-native plant species, and 19% of those had 3 or more species. The presence of invasive herbaceous plants far outnumbered invasive woody plants; 61% of pads had herbaceous plants while only 17% of the pads had woody invasives. *Phalaris arundinacea*, *Centaurea stoebe*, *Cirsium arvense*, *Microstegium vimineum*, and *Securigera varia* were the most common invasives and were found on 13–25% of pads, whereas other invasive species included in the survey were

each found on less than 4% of the pads. We found evidence of an association between *M. vimineum* stem densities on access roads and adjacent well pads (Kendall's rank correlation tau = 0.31, z = 3.66, p < 0). *Cirsium arvense* was found on the pad and not on access roads at 21 sites, *C. stoebe* at 14, *P. arundinacea* at 13, and *M. vimineum* at 5. For example, at one survey site in the ANF the stem count of *C. stoebe* was in the 1000s of stems on the pad and absent along the 0.5 km access roadside. In such cases, the first point of introduction was likely the pad, which suggests the introduction was related to development activities, such as with gravel or on vehicle tires.

3.2. Invasive plant colonization on unconventional gas pads via access roads

The SEM fit the data (Fisher C 1.77, df = 2, $p = 0.41$). The proportion of variance at the level of forest districts (ICC) was large (0.75) and therefore required it be accounted for in a mixed model analysis. The resulting MELR model with invasive plant presence on pads as the response had a conditional R^2 (fixed and random effects) of 0.42.

Of the factors we hypothesized as drivers of invasive plant spread to well pads, the density of invasive plants on pad access roads was the only directly correlated variable. Fig. 4 provides the unstandardized path coefficients which, when taking the exponential, provides the odds ratio (OR) for the MELR models, and the incident rate ratio (IRR) for the GLMM. Expressed as an OR, for every one-unit increase of invasive plant stems found on access road edges, the odds of an invasive plant colonizing a pad increased by 1.002. The OR is small as the stem number on access roads ranged widely from 0 to 2650 with a median of 110. Pre-pad development road density and sites with greater than one well per pad were significant predictors of access road invasive stem density and therefore were indirectly associated with invasive plant presence on pads. For each meter of road in the vicinity of the pad prior to gas development, the rate of colonization of invasive plant stems on access roads increased by a factor of 1.51, strong evidence that the extent of the road network is associated with invasive plant success. Well pads with more than one well had a rate of invasive plant establishment (stem density) on access roads 1.59 times greater than access roads leading to pads with only one well.

Pad age was not a direct causal factor of invasion on pads, but older pads were more likely to have more than one well and have invasive plants on adjacent access roads, therefore pad age was also indirectly linked to invasion on pads. Nearly 70% of pads surveyed were between 2 and 3 years old. Given time we would expect pad age and continued human activity to be a positive driver of invasive plant spread within regions of UOG development (Vitousek et al., 1997).

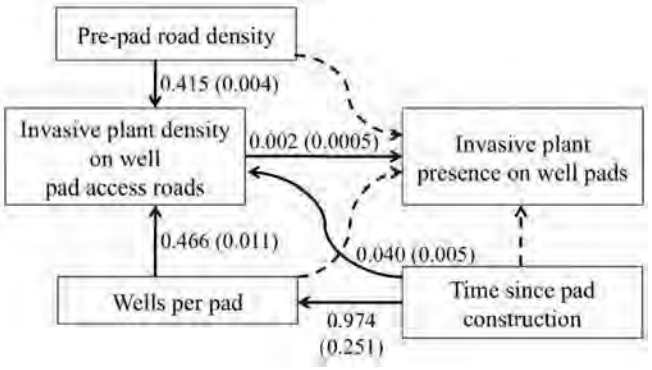

Fig. 4. Unstandardized path coefficients and the standard error (SE) of direct and indirect causal paths to invasive plant presence on well pads. Causal paths with solid lines are significant at the $\alpha = 0.05$ level and non-significant paths are indicated with dashed lines.

3.3. Well pads introduce non-native plants to native forest plant communities

Non-native plants were rarely found in the surrounding forests (quadrats sampled at 25 m and 100 m). In fact, across the 32 well pads we studied, non-natives were present on only 3 well pads at 100 m from the pad edge, each at less than 2% cover, and were never documented at 25 m (Fig. 5). Yet all surveyed well pads had some nonnative plant cover on the disturbed edges with an average of 43% (s.d. 0.19). The Kruskal-Wallis test identified a difference ($\chi^2 = 85.4$, df = 2, p < 0.001) in the ratio of non-native to native cover across survey site distance from the well pad edge (0, 25, 100 m). Non-native presence in the disturbed areas around the pad is due in part to the seed mix composition typically used for reclamation. This is evidenced by the 5 most frequently observed non-native species on the pad edges; *Dactylis glomerata*, *Phleum pratense*, *Trifolium repens*, *Lotus corniculatus*, and *Lolium multiflorum*. But natural recruitment via wind or water, or human management activities, such as contamination in seeding materials and equipment, likely introduced species such as *Agrostis gigantea*, *Plantago lanceolata*, *Holcus lanatus,* and *Veronica officinalis*. The 5 most frequent native plants observed on the pad edges were *Dichanthelium clandestinum*, *Acer rubrum*, *Dennstaedtia punctilobula*, *Rubus* sp., and *Rudbeckia hirta.Dichanthelium clandestinum* and *R. hirta* are often included in reclamation seed mixes. Within the surrounding forests (25 and 100 m) the most frequently observed species were *Acer rubrum*, *Gaultheria procumbens*, *Kalmia latifolia*, *Vaccinium angustifolium*, *Gaylussacia baccata*, *Vaccinium pallidum*, *Dennstaedtia punctilobula*, *Hamamelis virginiana*, and *Amelanchier* sp., plants typical of the dry oak-health and dry oak-mixed understory of most sites in this study.

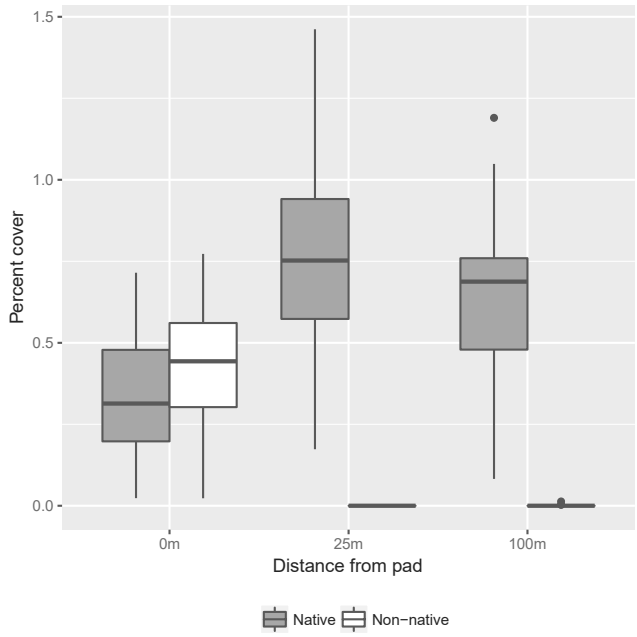

Fig. 5. Percent cover of native and non-native plants on the well pad edge (0 m) compared with the surrounding forest at 25 m and 100 m from the edge.

4. Discussion

4.1. Unconventional gas development spreads invasive plants

Invasive non-native plants are moving further into PA forests with the development of unconventional gas. In fact, non-native plants were virtually non-existent in the forested sites surveyed surrounding well pads, and yet are becoming a dominant part of the plant community around pads. We found that within less than a decade invasive non-native plants have spread to over half of the 127 well pads in our survey, and for the 85% of the pads that were less than 4 years old it occurred in a much shorter period of time. The SEM identified a positive correlation between invasive plants on pad access roads and invasive plant presence on well pads, and demonstrated that invasive plant colonization is more likely as the number of wells per pad increase. Our findings in this forested system are consistent with previous studies. Joly et al. (2011) found that paved regional roads with heavier traffic were a much better predictor of *Ambrosia artemisiifolia* L. distribution than any landscape predictor. In such cases, roads serve as a corridor of suitable habitat and for plant propagule dispersal by way of vehicles driving to pads moving propagules from nearby or distant sources on tires or the vehicle undercarriage (Taylor et al., 2012), by vehicle airflow (von der Lippe et al., 2013), by animals (Cousens et al., 2010), or on human clothes, shoes, and tools. As evidence of the impact of traffic density, we found that the rate of invasive plant establishment on access roads that led to pads with more than one well was 1.5 times that of access roads that led to single well pads. At the time of our study, 28% of well pads within the state forest system had only one well. Throughout PA the number of wells per pad ranged from 1 to 25, with a median of 2, where 37% had only one well and 54% had less than three wells (PA DEP, 2015). As production continues over the next several decades invasive plant spread will likely become a greater challenge. Conversely, some pad sites may remain with one well for years with little human activity. Our research suggests that limited human activity poses a lower risk of invasive plant establishment and therefore would rank single well pads at lower priority for monitoring programs.

We found that pads constructed in areas with higher road density are more likely to become invaded due to proximity to likely sources of invasive plant propagules in edge habitat within the forest matrix (Birdsall et al., 2012). Most of the road networks connecting unconventional gas infrastructure within the PA state forest system were not new (DCNR, 2014), and therefore our survey could have identified pre-existing invasive populations. The process of widening existing roads for heavy truck traffic could also have brought in invasive propagules with trucks and construction material. Widened roads and heavy traffic are common forms of disturbance with unconventional gas development in the region and are likely playing an important role in invasive plant establishment and spread (Hansen and Clevenger, 2005; Moles et al., 2012). Invasive plant populations found along existing roads could have been pre-existing populations or have established during development. From a practical perspective, the fact that invasive plant presence was associated with the pre-existing road network could be used to guide the design, frequency, and citing of invasive plant monitoring protocols. The pre-existing road-invasive plant association also raises questions about suppression strategies. For example, invasive plants in areas with high road density could be targeted for suppression prior to pad and pipeline construction.

We were surprised at the relatively small number of invasive plant species we saw on most pads and adjacent access roads. While not a part of the survey design, microsite conditions obviously varied considerably along the perimeter of the pads and along roadsides. Establishment and spread of these adapted species will be strongly influenced by context specific variation in site conditions (Cadenasso and Pickett, 2001; Minor et al., 2009; With, 2004). For example, while *P. arundinacea* and *P. australis* typically invade roadside verges and nearby wetlands (Houlahan et al., 2006; Jodoin et al., 2008), *C. stoebe* and *C. arvense* invade grasslands (DiTomaso, 2000). Land managers will need to make decisions based on local site characteristics to prioritize species of concern. *Microstegium vimineum* has rapidly become a dominant species on forest roads in central PA forests (Mortensen et al., 2009). Species that are particularly problematic from a management point of view and are particularly well adapted to edges and forest interiors such as *M. vimineum*, *Elaeagnus umbellata*, and *Berberis thunbergii*, and wetland-adapted species such as *Polygonum cuspidatum*, should be a high priority for management at pad sites and along access roads. Although woody species were infrequent in our surveys, we suspect that given time fruit-bearing shrubs favored by birds will be present on forest edges abutting pads, pipeline and access road corridors.

5. Conclusions

Identifying drivers of invasive plant spread within the UOG development footprint will be key to minimizing and managing further colonization. Our work indicates that this development predisposes forested landscapes to plant invasion and raises important questions about how, in the face of continued UOG production, we mitigate the success of invasive plants. Introduction, establishment, and spread of invasive plants at these disturbed sites have the potential to reduce native plant abundance and diversity in surrounding forest communities and alter ecosystem functioning (Vilà et al., 2011), as well as challenge revegetation goals (D'Antonio and Meyerson, 2002). Developing invasion resistant seed mixes for reclamation and long-term site management should be research priorities to assist in stemming establishment and further spread.

Going forward, a greater understanding of the link between expanding road networks in forested landscapes and their role in invasive plant success is needed. Such insights should be incorporated in invasive plant management strategies so that they are designed to be context specific and informed with temporal insight. For example, expanded road networks and gas pipelines create linear corridors passing through a wide range of forested habitats some of which are highly susceptible to invasion. Further investigation into habitat susceptibility is needed to bolster resilience in forests with increasing edge habitat where newly established invasive plant populations could serve as sources of invasion in the broader landscape. Our current analysis suggests effective monitoring and rapid response weed management should be guided by preexisting knowledge of the site. Such “smart” monitoring and control programs will increase management effectiveness, reduce time and labor associated with sampling areas that are less likely to be invaded, and reduce the possibility that plant invasions are overlooked.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Appendix J

Janasie, S. 2005. FERC has the authority to require invasive species monitoring plans. The National Sea Grant Law Center, University, Mississippi. Available at: http://www.nsglc.olemiss.edu/SandBar/SandBar4/4.2ferc.htm.

FERC Has Authority to Require Invasive Species Monitoring Plans

***Rhinelander Paper Co. v. FERC*, 405 F.3d 1 (D.C. Cir. 2005).**

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The D.C. Circuit Court of Appeals recently affirmed the Federal Energy Regulatory Commission's (FERC) decision to delay modification of a hydroelectric project's license boundaries and to require, as a provision of the renewal license, the development of an invasive species monitoring plan. The court found both actions a reasonable exercise of FERC's authority under the Federal Power Act.

Background
The Rhinelander Paper Company (Rhinelander) operates a hydroelectric plant on the Wisconsin River in Oneida County, Wisconsin. On June 26, 1998, the company filed an application to renew its license with FERC for the 2.12 megawatt project. Under the previous license, the project encompassed approximately 2,478.5 acres of land. The modification would have removed privately owned land from the project boundaries and reduced the size of the project to approximately 292.5 acres.

On August 20, 2003, FERC renewed Rhinelander's license under the Federal Power Act, but did not accept the company's modification. In addition, FERC inserted two important provisions in the renewal license. First, FERC required that the project maintain its historical boundaries pending the preparation of a land management plan. Second, FERC required that Rhinelander develop and implement a plan to monitor invasive plant species at the project.

The U.S. Fish & Wildlife Service (FWS) was the primary impetus behind the addition of these two provisions. The FWS recommended maintaining the historical boundaries of the project until Rhinelander provided a clearer identification of the land to be removed from the project. The FWS also requested that the license renewal require Rhinelander to cooperate with state and federal agencies to monitor and control the spread of highly invasive and exotic plant species, despite the fact that there was no evidence of the presence of such species at the project.

Rhinelander requested a rehearing on the Director's decision, which was denied on February 18, 2004. In its denial, FERC admitted that the land slated for removal may not be necessary, but also stated that more information was needed before a decision could be made. Also, FERC stated that the plant monitoring provision was appropriate since section 10(j)(1) of the Federal Power Act requires FERC "to include in each hydroelectric license conditions 'to adequately and equitably protect, mitigate damages to, and enhance, fish and wildlife (including related spawning grounds and habitat),' based on recommendations from federal and state resource agencies."[1] Rhinelander then brought the decision before the D.C. Circuit Court of Appeals for review.

Boundary Modification
In reviewing a FERC licensing decision, the courts are held to the commonly employed "arbitrary and capricious" standard.[2] In other words, a court must determine if the Commission's decision was reasonable and within the bounds of the powers granted to the agency by Congress. In this case, the D.C. Court of Appeals determined that the Commission had made a proper decision with regard to both issues. In regards to the first issue, FERC based its decision on section 10(j)(1) of the Federal Power Act, which states in part that:

the project adopted, including the maps, plans, and specifications, shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes.[3]

The Commission has construed this portion of the Act as imposing a statutory obligation upon both the Commission and the licensee to protect the shoreline and aquatic resources within the project area through the use of a buffer zone. While a modification of the project area in this case may have been acceptable, FERC contended that Rhinelander had not provided sufficient maps and other specific information about the lands for the Commission to make an informed decision concerning boundary modification. The D.C. Court of Appeals found FERC's basis for this decision entirely reasonable.

Invasive Species Monitoring Plan
In regards to the second issue, the D.C. Court of Appeals also held that the Commission's decision was not arbitrary and capricious. As stated earlier, FERC based this decision on section 10(j)(1) of the Federal Power Act, which requires licenses to protect, mitigate and enhance wildlife in the project area. The court used the classic Chevron analysis: determining whether Congress has spoken directly on the point at issue, and if not, whether the agency in question has made a permissible reading of the statute.[4] The D.C. Court of Appeals held that FERC's reading of section 10(j)(1) was permissible. Specifically, the court referred back to Rhinelander's own admissions at oral arguments that a hydroelectric project like the one at issue in this case obviously has an affect upon fish and wildlife within a river system, and that the project has the potential to spread the invasive species at issue through the contribution of the seeds of these plants to the flow of the river. While the court acknowledged that prior cases had held that provisions which required project operators to work with agencies to control the spread of these plant species were premature, the court pointed out that this license

merely required the operator to implement a plan for cooperative monitoring efforts. Thus, FERC's decision was an acceptable interpretation of the statute at issue, and was not in conflict with previous license decisions.

Conclusion

The spread of invasive species like purple loosestrife and Eurasian water-milfoil have become an issue of national import. The court's decision in this case is an important step in fighting the problems caused by these invasive species, as it has read into the Federal Power Act a federal statutory basis for FERC to impose monitoring obligations upon hydroelectric projects. These projects are acknowledged as a significant cause of the spread of these species, and this decision represents one method by which to combat the problem. If similar obligations can be read into the habitat conservation provisions of other agency's statutes, perhaps the spread of invasive species through methods such as ship ballast water can be more adequately addressed in the future.

Endnotes

1. *Rhinelander Paper Co. v. FERC*, 405 F.3d 1,4 (D.C. Cir. 2005).
2. *Alabama Rivers Alliance v. FERC*, 325 F.3d 290, 296 (D.C. Cir. 2003), citing *North Carolina v. FERC*, 112 F.3d 1175, 1189 (D.C. Cir. 1997).
3. 16 U.S.C. § 803(a)(1).
4. *Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837 (1984).

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Appendix K

Pejchar, L., and H.A. Mooney. 2009. Invasive species, ecosystem services and human well-being. Trends in Ecology and Evolution 24:497–504.

Review

Invasive species, ecosystem services and human well-being

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Although the effects of invasive alien species (IAS) on native species are well documented, the many ways in which such species impact ecosystem services are still emerging. Here we assess the costs and benefits of IAS for provisioning, regulating and cultural services, and illustrate the synergies and tradeoffs associated with these impacts using case studies that include South Africa, the Great Lakes and Hawaii. We identify services and interactions that are the least understood and propose a research and policy framework for filling the remaining knowledge gaps. Drawing on ecology and economics to incorporate the impacts of IAS on ecosystem services into decision making is key to restoring and sustaining those life-support services that nature provides and all organisms depend upon.

Invasive species, ecosystem services and valuation

Invasive alien species (IAS), defined as those non-native species that threaten ecosystems, habitats or species [1], are key drivers of human-caused global environmental change [2]. Widely heralded as the second greatest agent of species endangerment and extinction after habitat destruction, particularly on islands [3], IAS are also inflicting serious impacts on the ecosystem processes that are fundamental to human well-being (defined as access to secure livelihoods, health, good social relations, security and freedom) [4]. These changes have global consequences for well-being [5], including the wholesale loss or alteration of goods (e.g. fisheries, agricultural and forest products) and services (e.g. clean and plentiful drinking water, climate stabilization, pollination, culture and recreation) [6].

Because the ecosystem services approach to conservation is becoming central to many areas of environmental policy decision making, valuation information (economic as well as non-economic) is increasingly needed. Much effort has gone into understanding what makes a species invasive and into documenting the ecological effects of invasions [7]. Although invasion-driven changes to the structure and functioning of ecosystems are well known [8], less is known about the mechanisms linking IAS to ecosystem services [9]. Additionally, the economic impact of IAS on these services is often neither quantified nor incorporated into economic impact assessments. As such, the impacts of IAS can result in an 'invisible tax' on ecosystem services that is rarely included in decision making.

There have been several attempts to quantify the economic impact of IAS at a national level [10–12]. In these cases, their impacts are staggering (e.g. US$14.45 billion in China) [12] but largely anecdotal and wide ranging. For example, figures for the total cost of IAS in the USA range from US$131 billion cumulative to US$128 billion annually [10,11], but do not use systematic empirical methods of estimating costs and do not consider benefits [13,14]. In addition, many effects of IAS on ecosystem services that are difficult to convert into monetary terms are regularly overlooked [14,15]. To capture the full impact of IAS on human well-being, dimensions that go beyond monetary costs and benefits must be considered, such as the number of people affected positively or negatively by IAS and the magnitude of this impact on their lives. Policy responses to date have been based on rough estimates of ecological, social and economic damages [15]. Filling this gap would be worthwhile if more data demonstrate that current investments in prevention and eradication could save millions of dollars in diminished losses to human health, agriculture and forestry and in the preservation of natural systems and the services that they provide.

Here we review the literature to understand the significance of making decisions about the prevention and/or control of IAS that ignore impacts on ecosystem services. We address three categories of ecosystem services: provisioning (e.g. food, timber, fiber and water), regulating (e.g. climate mitigation, flood control, disease, pollination and water purification) and cultural (e.g. recreation, tourism, aesthetics and spirituality) [5]. We synthesize recent information on economic valuation of ecosystem services as well as illustrate the large costs that are incurred by the loss of each service owing to the activities of IAS. For the most part, we report damage costs associated with IAS in monetary terms. The costs that we present for various provisioning, regulating and cultural services are roughly comparable because most of the data that we draw on were collected and published during the early 2000 s. Whether damage costs of any magnitude will change the way that IAS are managed will depend on the benefits of the activities that lead to the introductions. We suggest that identifying ecological and economic damages and estimating their magnitude is a positive first step toward properly accounting for the full impact of IAS.

Provisioning services

Food, fiber and fuel

Introduced species are both a blessing and a curse for agriculture and food security. For instance, most food crops

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are deliberately introduced non-native species, yet other IAS can reduce crop yields by billions of dollars annually [10]. The impacts of several plant IAS on agriculture have recently been well documented. For instance, yellow star thistle (*Centaurea solstialis*), an invasive late-season annual in California that is unpalatable to cows, costs the state US$7.65 million annually in lost livestock forage and costs ranchers US$9.45 million in out-of-pocket control expenditures [16]. These numbers amount to 7% of all revenue from active rangeland in California.

Comprehensive economic impact data, however, are still lacking for many IAS in agricultural systems [16]. Environmental and societal costs are often not included in analyses of even the best-documented IAS [17]. For instance, controlling redberry juniper (*Juniperus pinchotii*) in Texas rangelands is economically feasible over a 30 year period because of increased livestock production resulting from its control [18]. The net benefits of controlling this species might be even higher if other services, such as increased water available to recharge aquifers, were included in the analysis.

In addition to impacting terrestrial agriculture, IAS can also have important repercussions for aquatic food production [19]. For example, the introduction of water hyacinth (*Eichhornia crossipes*) into Lake Victoria has reduced the production and quality of fish, obstructed waterways and boat movement, damaged water supply intakes, contributed to the spread of water-borne diseases and increased water loss through evapotranspiration [20].

The nature of the impact of IAS on food, fiber and fuel is usually a matter of scale and perspective. An invasive tree in Florida (*Melaleuca quinquenervia*) has a positive impact on honey production (US$15 million annually [21]), but removing this species would result in a US$168.6 million yr^{-1} gain in ecotourism dollars that would otherwise be lost if *Melaleuca* were to infest the Everglades and other south Florida natural areas [22]. The introduction of brush-tailed possums (*Trichosurus vulpecula*) to New Zealand has resulted in massive defoliation, but is also highly profitable for the 'eco-friendly' fur industry (at least US$20 million yr^{-1} in exports [23]). Both of these cases illustrate that the costs and benefits of IAS can be distributed differently: those who benefit do not pay the costs and those who lose are not compensated [24,25].

IAS can have complex and sometimes beneficial impacts on rural low-income communities in particular [26] (Box 1). For example, in South Africa, invasive *Acacia* and *Pinus* species have resulted in reduced stream flow and increased fire intensity [27]. However, these species are also important 'ecosystem goods' that are now used for thatching, timber, medicine, charcoal and firewood by local communities [25,28]; the economic value of the firewood alone is US$2.8 million [29]. Because introduced species are often incorporated into local livelihoods, it is not possible to assume that harmful impacts on biodiversity or other ecosystem goods and services automatically translate into universally negative effects on human well-being [30] (Box 1).

Fresh water

In contrast to the effects on crop and pastureland, fewer studies have documented the impacts of IAS on hydrological services [31]. It is known that plant IAS can fundamentally change the flow of water for drinking and irrigation if they have at least one of the following characteristics in comparison to native species: (i) deeper roots; (ii) higher evapotranspiration rates; or (iii) greater biomass [4]. For example, salt cedar (*Tamarix ramosissima*), a widespread invasive alien tree along streams in the southwestern USA, consumes more water than do native riparian species, using an additional 1.4–3.0 billion cubic meters of water each year [32]. Thus, US$26.3–67.8 million of water is lost annually that would otherwise be available for irrigation, municipal drinking water or hydropower [32]. Similarly, the yellow star thistle depletes soil moisture, costing between US$16 million and US$75 million a year in lost water to the Sacramento watershed [33].

M. quinquenervia, which is invasive in Florida and Australia, and several *Eucalyptus* species, introduced in California, all have deep tap roots and use large amounts of water relative to their host native plant communities [34]. By contrast, in the midwestern USA, invasive alien grasses have shallow roots, and therefore might use less water than do the native perennial grasses that they displace [35].

In one of the clearest examples of IAS impacts on ecosystem services, many woody plant IAS in South Africa, which have high evapotranspiration rates, decrease the amount of surface water and the magnitude of stream flow [36]. These results are the basis for the innovative program 'Working for Water,' which has been largely successful in combining the cutting of woody IAS to restore hydrological services with poverty alleviation through job creation (Box 1) [37,38].

Regulating services

Impacts of IAS on regulating services are relatively unknown but, because they interfere with basic ecosystem functions such as the provision of clean water and a stable climate, they might well dwarf the impacts on the better-understood provisioning services discussed previously. IAS could thus have underappreciated but widespread impacts on pollination, water purification, pest control, natural hazards and climate mitigation, services that are both the cornerstone of fisheries, agriculture and forestry and fundamental to human well-being [39].

Pollination

Non-native honeybees (*Apis mellifera*) are widely used to pollinate crops in North America, providing indispensable services for farmers, particularly in areas where native pollinators are scarce. These pollination services are worth an estimated US$14.8 billion annually in the USA [40]. In some cases, however, honeybees act as IAS. The European honeybee has hybridized with the far more aggressive Africanized honeybee in Latin America and is moving northward. This hybrid is a danger to human health, chasing people perceived to be a threat great distances from the hive and inflicting large numbers of potentially deadly stings. Bee IAS can also disrupt mutualisms [41] by displacing native bees that are superior pollinators [42]. Non-native bees could also enable range expansion in pollinator-limited plant IAS [43] and distract both native and non-native pollinators away from native species [44].

Box 1. Woody plant IAS and ecosystem services in South Africa

Table I illustrates the complex interactions between woody plant IAS, ecosystem services and society in South Africa. Introduced trees and shrubs have benefited the forest products industry, and provide fuel wood and building supplies for local communities [25]. However, owing to high rates of evapotranspiration, these species have also led to a loss of hydrological services, with 30% less water now available to downstream users [27,29,36,73,74]. These woody plants have invaded the native and unique fynbos ecosystem, impacting pollination services, ecotourism and displacing native fynbos plants that are used as tea and in medicine [73,75]. Higher fuel loads have led to increased fire frequency and a subsequent rise in surface-water runoff and erosion of topsoil [78].

Many of these impacts were incorporated into cost–benefit analyses, and the findings (net negative impacts on fresh water) led to policy action [37]. 'Working for Water' is an innovative government-funded program that combines removing woody plant IAS (Figure I) to restore hydrological and other services with much-needed income for South Africa's poorest citizens [27,37]. The environmental benefits of Working for Water (e.g. water saved and biodiversity protected) are well demonstrated [27,36], whereas the social dimension of the program has had mixed success [38].

Figure I. Contract workers and participants in the Working for Water program removing a dense thicket of woody plant IAS in South Africa. Reproduced, with permission, from Working for Water (http://www.dwaf.gov.za/wfw).

Table I. Diverse impacts of woody plant IAS on ecosystem services in the South African fynbos ecosystem[a]

Service impacted	Description of impacts	Positive or negative	Value (US$)	Refs
Fiber	Used for building material and paper products; fewer flowers and thatching reed	+/–	\$300 million yr^{-1} from forestry; \$22 million yr^{-1} in building materials for local communities; \$1.6 billion yr^{-1} in other value-added wood products; \$18 million yr^{-1} in lost flower and grass earnings	[25,28,29,73,74]
Fuel	More firewood and charcoal	+	Up to \$143 million	[25,28–30]
Fodder	Increase in fodder and shade for livestock grazing; impenetrable thickets impede grazing	+/–	Insufficient data	[27]
Fresh water	Use more water than native species	–	\$1.4 billion in water lost to transpiration; up to 30% of water supply; \$119 ha^{-1}	[27,29,36,73,74]
Medicine	Displace fynbos plants used for drugs and tea; loss of option value (undiscovered medicinal plants)	–	Rooibos tea exports worth \$2.1 million (1993)	[73,75]
Pollination	*Eucalyptus* increases honey production; fewer flowers lead to loss of native nectar	+/–	\$52 ha^{-1} in lost pollination services	[73,76]
Climate regulation	Sequester more carbon than do native plants; darker trees might absorb more heat than do light-colored fynbos plants	+/–	\$24 million in potentially tradable stored carbon	[25]
Erosion control	More intense fires result in soil loss with rainwater runoff	–	Insufficient data	[77,78]
Natural hazards regulation	Increased biomass/fuel load; increased runoff following erosion causes flooding	–	Insufficient data	[78,79]
Aesthetic value	More ornamentals and shade trees; loss of fynbos wildflowers	+/–	Existence value of fynbos ecosystem = \$16 million yr^{-1}	[73]
Recreation and tourism	Invasion of dunes has led to loss of beaches; damage to fynbos ecotourism; restricts access to riparian fishing areas and less fresh water in estuaries	–	Ecotourism in fynbos valued at \$14 million yr^{-1}	[27,73,75,80]
Cultural heritage	More wood used for ceremonies; less native flora for flower harvesting; disturb sacred pools	+/–	Insufficient data	[27,30]

[a]Woody species include: black wattle (*Acacia mearnsii*), silver wattle (*Acacia dealbata*), *Eucalyptus, Hakea, Pinus* and *Prosopis* spp.

Understanding the ecological dimensions and economic impacts of IAS on pollination is crucial for food security and the maintenance of agricultural and natural plant communities worldwide.

Climate regulation

When IAS replace native plant species, differences in carbon storage capacity could affect the amount of carbon dioxide released into the atmosphere. For example, non-native annual grasses have largely replaced the native sagebrush ecosystem in the US Great Basin region. This net loss of carbon sequestration (-0.5 μmol m^{-2} s^{-1}) over a large land area (12.7 million ha) could contribute to climate warming [45]. Carbon storage capacity has also been lost from the Brazilian Amazon as fire-prone non-native pasture grasses have steadily replaced rainforest; carbon pools in post-fire pasture are only 3% of adjacent primary forest [46]. By contrast, more carbon can be sequestered when woody species replace native grassland, a phenomenon occurring with the encroachment of *Prosopis glandulosa* into the southern Great Plains (USA) [47].

Box 2. Ecosystem services impacted by zebra mussels

Zebra mussels *Dreissena polymorpha* have been deliberately introduced to some aquatic environments because they are extremely efficient filter feeders that increase water clarity [50,83]. However, most introductions have been accidental, with many unanticipated impacts on a host of ecosystem services (Table I) [85]. Zebra mussels clog water intake pipes (Figure I), costing millions of dollars in damage to industry and interfering with the flow of fresh water in and out of lakes [19,51]. They serve as food for some native species (e.g. waterfowl) and compete with others (e.g. native mussels) in addition to changing the light and nutrient environment substantially through filter feeding [39,81,83]. They bioaccumulate toxins that end up in fishes and birds that we eat [82,86] and they coat beaches, boats and docks, cutting the feet of bathers. They make shipwrecks easier to find by coating them in mussels but often foul them before they are found [88]. Because of clear economic impacts on local industry and communities, the impacts of zebra mussels on ecosystem services are particularly well quantified [19]. This species is both a blueprint and a warning for evaluating potential ecological and economic impacts of other aquatic invaders.

Figure I. Effects of zebra mussels. The mussels clog water intake pipes, with negative impacts on the provision of fresh water from the Great Lakes and costs for local industries of millions of dollars in maintenance. Photograph by Don

Table I. Impacts of zebra mussels on ecosystem services in the Great Lakes (USA)

Services impacted	Description of impacts	Positive or negative	Value ($US)	Refs
Food	Source of food for some fishes, crayfish and diving waterfowl (adult mussels); change light environment and compete with fishes for zooplankton prey	+/–	$32.3 million yr^{-1} in net costs to aquaculture	[39,81]
Fresh water	Clog intake pipes: increase in mussels on water intake screens and in water treatment plants impairs flow	–	339 water-dependent facilities reported total zebra mussel-related expenses of $69 070 780 from 1989 to 1995; control costs of average large water user: $400 000–460 000 yr^{-1}	[19,51]
Disease regulation	Accumulate mercury and lead (in fish eaten); contributes to avian botulism	–	Insufficient data	[82]
Water purification	Efficient filter feeders; impart odor in drinking water owing to release of geosmin; changes nutrient fluxes, resulting in phytoplankton and cyanobacterial blooms	+/–	Local government (Windsor, Ontario) spent $323 000 yr^{-1} to eliminate taste and odor problems	[83–85]
Aesthetic value	Covers beaches and boats	–	Insufficient data	[85]
Recreation and tourism	Cover beaches, boats, docks and piers; cause cyanobacterial blooms; lead to increase in organochlorine and heavy metals in some recreational fishes and the ducks that prey on them	–	Threatens $4 billion sports fishery; costs boat owners $660 yr^{-1} in upkeep	[19,86,87]
Cultural heritage	Fouled shipwrecks are spotted more easily; concentrate heavy metals that are dangerous to divers; can cut bathers' feet	+/–	Insufficient data	[88]

Water purification

IAS in aquatic ecosystems have had mixed consequences for water purification. For example, by heavily grazing aquatic plants, the golden apple snail (*Pomacea canaliculata*) has transformed wetlands across Southeast Asia from a clear water purification system to a turbid, algae-dominated state [48]. In addition to these dramatic impacts on water quality, this snail feeds voraciously on young rice seedlings, with serious economic repercussions for rice production; Philippine rice farmers lost US$425–1200 million in 1990 alone [49]. By contrast, on occasion, a non-native species can increase water filtration and purification, but often not without impacts on other important services. For example, the zebra mussel (*Dreissena polymorpha*) is the 'poster child' for an effective biological filtration machine [50] that has also caused serious damage to the ecological and economic value of the Great Lakes region, coating boats and beaches and clogging water intakes of municipal water supplies and hydroelectric companies [51] (Box 2).

Soil stabilization

Water quality can also be affected by erosion, a natural process that shapes landscapes. If the rate of erosion is exacerbated by IAS, erosion can result in turbid water, limit agricultural production and compromise the stability of land under homes and other infrastructure. IAS can influence erosion through multiple mechanisms: (i) plant IAS can alter soil properties; (ii) root structure of plant IAS can change the soil-stabilization capacity; and (iii) vertebrate IAS can eat plant biomass, including roots, increasing erosion (Box 3). In several cases, IAS have been introduced deliberately for their ability to limit erosion, but these introductions frequently have unintended consequences for other ecosystem services. For instance,

Box 3. Impacts of feral pigs on ecosystem services in Hawaii

During the past 200 years, the Polynesian race of the feral pig (*Sus scrofa*; Figure I) has hybridized with the European boar, moved into the forests of Hawaii and has become an integral part of Hawaiian hunting culture. Hunted for subsistence, ceremony and recreation, the feral pig is now ubiquitous in native forests, with the exception of a few fenced reserves. Pigs provide positive goods and services to the community in the form of meat and cultural and religious value (Table I) [89]. However, they also ransack food crops adjacent to forests and probably negatively impact a range of regulatory services by uprooting ferns and other native understory plants (Table I) [91,92,94]. By knocking down and carving out tree ferns for their fleshy interior (Figure I), pigs create breeding habitat for introduced mosquitoes, which host infectious diseases such as avian malaria and dengue fever that impact wildlife and human communities [93,94]. Although impacts on biodiversity (negative) and cultural services (mixed) are substantial and relatively well documented [89,91,94], there are few quantitative data on the impacts of the feral pig on other ecosystem services that sustain life, such as water purification and disease regulation. The feral pig in Hawaii epitomizes conflict over IAS, reminding us that not all ecosystem services are valued equally by all people.

Figure I. Effects of feral pigs. The feral pig knocks down tree ferns in Hawaii and eats the fleshy interior. Their actions cause erosion and often result in hollows that collect water, creating additional habitat for disease-carrying mosquitoes. Reproduced, with permission, from Jack Jeffrey (http://www. jackjeffreyphoto.com).

Table I. The impacts of feral pigs on regulating, provisioning and cultural services in Hawaii

Services impacted	Description of impact	Positive or negative	Value (US$)	Refs
Food	Damage crops; provide subsistence food	+/–	50% of some nut crops lost	[89]
Water purification	Deposit fecal matter and increase sedimentation in waterways	–	Insufficient data	[90]
Erosion control	Eat roots, create wallows and trample soils	–	Insufficient data	[90–92]
Disease regulation	Create breeding habitat for disease-carrying mosquitoes; transmit brucellosis and toxoplasmosis; spread plant pathogens	–	Insufficient data	[93,94]
Natural hazards regulation	Probably increase risk of flooding through erosion	–	Insufficient data	[90]
Cultural heritage	Used for cultural events; have spiritual and religious value; damage cultural plants	+/–	Insufficient data	[89]
Recreation and tourism	Important for hunting over last 150 yrs; damage trails and forests	+/–	\$450 000 yr^{-1} in damage to national parks	[89,91,94]

kudzu (*Pueraria lobata*) was introduced to the southeastern USA for erosion control in 1876 but now covers an estimated 3 million ha of the eastern USA and is spreading by 50 000 ha per year. Kudzu is a major economic liability, smothering trees, homes and telephone poles as well as impacting air quality [52].

Disease regulation

Invasive alien plants can serve as novel habitat for disease vectors, and animal IAS can themselves be vectors. For example, the invasion of dense stands of lantana (*Lantana camara*) in East Africa has provided new habitat for the tsetse fly (*Glossina* spp.), which carries sleeping sickness [53]. The brushtail possum transmits bovine tuberculosis to cattle and deer in New Zealand, posing a large economic threat that has led to millions of dollars in control costs [54]. Invasive mosquitoes have exacerbated the spread of yellow fever, dengue fever and other infectious diseases throughout the Americas and Asia [55].

Flood mitigation

By increasing the intensity or frequency of fires or floods, IAS can exclude native species and increase risk to nearby human communities. The alteration of fire regimes by IAS has been well studied [56]; IAS can change fuel properties and the frequency, intensity, extent, type and seasonality of fire. Examples include the large-scale invasion of the North American shrub-steppe community by an annual grass, *Bromus tectorum*, which is fire adapted and has permanently altered the native plant community, which is unable to regenerate in the face of heightened fire frequency [57]. A similar transformation has occurred in Hawaii following the invasion of exotic grasses [58]. Altered fire regimes can result in substantial social and economic costs. In Florida alone, *M. quinquenervia* is projected to cause US\$250 million in fire damages by 2010 by increasing fuel loads [21].

IAS can increase flood risk by narrowing stream channels and decreasing holding capacity [32]. The floods that occurred as a result of the introduction of *Tamarisk* cost an estimated US\$52 million annually in damages. The introduction of beavers into novel riparian areas can also increase flood risk to some communities, as well as decrease water quality [59]. Removing aquatic plant IAS from lakes and waterways in Florida results in US\$10 million annually in avoided flood damages to residential structures [60] and US\$6345 per acre in avoided flood damage to citrus crops [61]. The 'fire and flood prevention' services that some native ecosystems supply are generally underappreciated. These services should be accounted for in controlling IAS and protecting native ecosystems.

Cultural services

Impacts of IAS on cultural services, defined as those attributes of an ecosystem that are non-consumptive (i.e. hold value for recreation, tourism, history, education, science, heritage, inspiration, spirituality and aesthetics) [5], are

difficult to assess because they are based on personal and local value systems. IAS usually alter cultural services, either negatively or positively, and sometimes in opposition to impacts on other services.

Recreation and tourism

Of all cultural services, impacts of IAS on recreation and tourism are most likely to be quantified. Recent data show that land- and water-based recreation are both strongly affected by IAS. For example, water-based recreation alone in Lake Tahoe is worth US$30–45 million a year. Even a 1% loss in recreation revenue from the potential introduction of Eurasian water milfoil (*Myriophyllum spicatum*) into Lake Tahoe would cost up to US$500 000 a year [62].

Plant and animal invaders are just as costly in terrestrial systems. By lacerating hikers, yellow star thistle has decreased the recreation value of large areas of the western USA [63], as well as costing millions per year in lost livestock forage value [16]. Similarly, the red imported fire ant (*Solenopsis invicta*) has cost billions of dollars in medical treatment for stings, damage to electrical equipment and crop losses across many southern US states. If accidentally introduced to Hawaii, this species is projected to result in US$134 million in forgone outdoor opportunities to both locals and tourists, in addition to impacts on health, industry and agriculture [64].

Aesthetic beauty

IAS have transformed landscapes for better or worse, depending on one's perspective. Prohibiting sales of ornamental plant IAS could have social costs in the form of lost consumer benefits and profits for nurseries. However, surveys show that consumers who are aware of the problems associated with IAS strongly prefer that nurseries stop selling such plants. Therefore, there is little reason to expect negative impacts on the nursery industry if IAS are replaced with non-invasive plants [65]. Whether it is socially optimal to prevent the sale and use of particular species could depend on the level of invasion risk and the nature and magnitude of impacts [66].

IAS can have severe impacts on the audioscape as well as the landscape. The coqui frog (*Eleutherodactylus coqui*), native to Puerto Rico, was introduced to Hawaii during the late 1980 s with nursery plants. This tiny frog emits very loud (80–90 dBA at 0.5 m) mating calls and, in Hawaii, reaches densities of 55 000–133 000 frogs ha^{-1}, more than twice as high as in its native Puerto Rico [67]. Owing to the noise, property values of homes within 500 m of coqui populations have declined significantly relative to other homes in the area [68].

Other cultural services

In addition to recreation and aesthetics, IAS can be valued or reviled for their role in inspiration, spirituality, religion, ceremony and tradition (e.g. Box 3). The impacts of IAS on these culturally important elements of ecosystems remain poorly studied, complex and difficult to quantify.

Future directions

Assessing the impacts of IAS on ecosystem services has only recently become an explicit focus of studies of invasion ecology [27], and certainly some ecosystem services are better understood than others. For example, the impacts of IAS on provisioning services (food, fiber and fuel) are frequently well quantified. Impacts on other life-supporting services, such as fresh water and most regulating services (pollination, disease and pest regulation and flood and fire control), are rarely calculated, but are likely to be substantial. Finally, of all the services, the interaction between IAS and culture is perhaps the most complex and underaddressed. Yet these types of service tend to resonate strongly with diverse stakeholders, such as private landowners, local communities and cultural practitioners [15].

Much invasion research thus far has focused on predicting invasibility, comparing invader and native traits and assessing environmental impacts, particularly on biodiversity. Do species with the greatest ecological impacts also have the greatest impacts on ecosystem services? Given that it is usually easier to prevent an introduction than to control an invasion, it is important to make good predictions regarding which species or groups of species will impact ecosystem services by understanding the underlying mechanisms. For example, are differences in impact of invasive plant species due to functional traits (e.g. nitrogen fixation) or to biomass [69]? This is not an easy task. Models and short-term experiments are poor predictors of invasions [70]. The best approach might be intensive study and long-term monitoring of impacts of previous invasions of the same or similar species.

Global trade and travel is likely to exacerbate the problem of invasions and continue to compromise vital ecosystem services. More effective inspection systems at international borders are crucial to identify and cut off pathways of introduction [71]. Because losses from IAS are not always transparent and are spread across many stakeholders, few industries or communities view IAS as their primary concern. Thus, few groups have emerged to pressure governments to implement or enforce effective regulations. Using economic incentives and disincentives, such as taxes, fines and grants, could result in greater compliance for those introducing IAS and is already working well to control established IAS in many places, such as South Africa (Box 1). Investing in education on IAS and their diverse impacts in tandem with economic incentives could also lead to better bottom-up enforcement [72] and more public support for prescreening and trade regulations.

Finally, much of invasion biology focuses on ecological effects, predicting spread and developing control methods rather than documenting economic and social damage to society from impacts on ecosystem services. Because ecosystems provide life-support services to all of human society, using the ecosystem-service framework for prevention and control of IAS has potential for reaching a diverse audience and giving them a stake in the outcome of IAS introductions. The next generation of IAS science and policy should reflect the fact that invasive alien species, similar to habitat loss and climate change, are emerging as a major driver of global environmental change, with grave consequences for biodiversity and human well-being.

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Appendix L

USFS. Undated-a. Proposed actions: (1) Forest-wide nonnative invasive plant (NNIP) control and (2) invasive woody plant control in maintained roadsides, utility corridors, and wildlife openings. George Washington and Jefferson National Forests, USDA Forest Service, Roanoke, Virginia. Available at: https://www.fs.usda.gove/Internet/FSE_DOCUMENTS/fsbdev3_000149.pdf.

PROPOSED ACTIONS: (1) FORESTWIDE NONNATIVE INVASIVE PLANT (NNIP) CONTROL AND (2) INVASIVE WOODY PLANT CONTROL IN MAINTAINED ROADSIDES, UTILITY CORRIDORS AND WILDLIFE OPENINGS

George Washington and Jefferson National Forests

PURPOSE AND NEED FOR THE PROPOSED ACTIONS

Nonnative invasive plants (NNIP) are introduced species that can thrive in areas beyond their natural range. These plants are characteristically adaptable, aggressive, and have a high reproductive capacity. Their vigor combined with a lack of natural enemies often leads to outbreak populations. The Chief of the U.S. Forest Service (USFS) has identified nonnative invasive species as one of the four critical threats to USFS ecosystems (USDA Forest Service Strategic Plan: FY 2007–2012). While not all nonnative species are known to disrupt native ecosystems, of particular concern are those that are successful at invading and rapidly spreading through natural habitats. Based on plot data collected through the Forest Inventory and Analysis (FIA) program, it has been estimated that 10% of the forested acres throughout Virginia are infested with NNIP (USFS Southern Research Station 2009). This amounts to almost 1.7 million acres experiencing the presence of NNIP to some degree across the state. Numerous NNIP have been documented across the George Washington and Jefferson National Forests and many infested sites present an immediate threat to natural communities, rare species sites, and other sites of high public interest. Given the current known distribution of NNIP on the George Washington and Jefferson National Forests, there is a need to implement an integrated program of NNIP control to protect forest resources. Management of NNIP infestations would also help prevent the George Washington and Jefferson National Forests from becoming a source of infestations for surrounding lands, both public and private, and would help slow the spread of NNIP in the central and southern Appalachian region.

Executive Order 13112 requires federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts. Numerous federal laws have been passed over the years that pertain to noxious weeds and invasive plants. The purpose and need for this project is consistent with the USFS National Strategy and Implementation Plan for Invasive Species Management (USDA Forest Service 2004) and the Southern Regional Strategy for the Prevention, Control, and Eradication of NNIS (USDA Forest Service 2005). The George Washington and the Jefferson National Forest Revised Land and Resource Management Plans have forest wide direction to minimize the negative effects of NNIP on the landscape. At a local level, the Virginia General Assembly passed legislation during its 2009 session that establishes the state's commitment to addressing the invasive species that threaten the Commonwealth through cooperation and coordination of government agencies, the business community, conservation organizations, and public citizens. The legislation directs Virginia’s Secretaries of Natural Resources and Agriculture and Forestry to "coordinate the development of strategic actions to be taken by the Commonwealth, individual state and federal agencies, private business, and landowners related to invasive species

prevention, early detection and rapid response, control and management, research and risk assessment, and education and outreach."

Specific needs that have been identified include:

- Reduce the risk of NNIP introduction into currently un-infested areas;
- Control NNIP that threaten rare communities and high-interest ecosystems such as botanical areas, research natural areas, TES species habitat, and wilderness;
- Eliminate emerging infestations of NNIP that have the potential to develop into large-scale ecosystem-damaging infestations;
- Control NNIP and woody plants that are impeding tree regeneration or damaging wildlife habitat improvements;
- Prevent the spread of invasive plants on adjacent private and public lands; and
- Be able to respond quickly to new invasive infestations before establishment and rapid spread.

The purpose of the first proposed action is to limit, or where feasible, eliminate, the adverse effects of nonnative invasive plants on native biodiversity and other resources through an integrated use of manual, mechanical and chemical methods.

The purpose of the second proposed action is to meet the management needs of maintaining open conditions in existing wildlife openings, roadsides of open roads and the open portions of utility lines through the use of manual, mechanical and chemical methods to control woody vegetation in addition to nonnative invasive plants. Because of their open conditions, these areas are often exploited by nonnative invasive plants and are therefore priority areas for treatment. Combining treatment of NNIP with treatments for maintaining open conditions will improve efficiency, reduce the number of treatments, enhance the management of these areas and help control NNIP.

PROPOSED ACTION (1): NONNATIVE INVASIVE PLANT CONTROL

The proposed action is to treat known and new nonnative invasive plant infestations across the George Washington and Jefferson National Forests using a combination of mechanical, cultural, and/or chemical control treatment methods. To meet the intent of Executive Order 13112, this proposed action is intended to be adaptive in nature, treating both currently known sites, and allowing for the future treatment of undocumented invasive plant infestations that are rapidly evolving and spreading on the forest.

The treatments are expected to begin in the spring of 2010 and will continue for ten years, with a comprehensive review at the five year interval. Certain areas may need to be treated more than once. Treatments will be subject to available funding and resources each year but our current program of work treats between 1,000-2,000 acres per year. Species to be treated include any nonnative invasive plant species listed on Virginia, West Virginia, or Forest Service invasive plant lists. Lists of websites for these species are in Appendix A.

The definition of nonnative invasive plant species is based on Executive Order 13122 (EO 1999). A species is considered a nonnative invasive species if:

- It is not native to the ecosystem under consideration, and
- Its introduction causes or is likely to cause economic or environmental harm or harm to human health.

Priority NNIP Species for Treatment

Nonnative invasive species vary greatly in their degree of establishment and rate of spread. Populations of some species have been known for years, and have spread considerably since they were first identified. Others are still being found in small infestations. The species that are currently the greatest threat on the Forest have been prioritized for their rate of invasiveness (http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf) and for their control priorities. While the proposed action has the potential to treat any nonnative invasive plant species found on the Forest, 27 of these species are anticipated to make up the largest percentage (by acreage) of actual treatments implemented. Of these 27 species, 15 are listed as Highly Invasive by the Virginia Department of Conservation and Recreation, 9 are listed as Moderately Invasive, one is listed as Occasionally Invasive, and two are not listed but, are locally invasive on the Forest. Table 1 is subject to change as new species and locations are found.

Table 1. Priority Species for NNIP Control

SCIENTIFIC NAME	COMMON NAME	INVASIVENESS*	PRIORITY**
Ailanthus altissima	tree of heaven	1	1
Akebia quinata	chocolate vine	2	1
Berberis thunbergii	Japanese barberry	2	1
Celastrus orbiculatus	oriental bittersweet	1	1
Ligustrum spp.	privet	1	1
Lolium arundinaceum	tall fescue	2	1
Lonicera maackii	Amur honeysuckle	2	1
Lonicera morrowii	Morrow's honeysuckle	1	1
Lonicera tatarica	Tartarian honeysuckle	2	1
Lythrum salicaria	purple loosestrife	1	1
Perilla frutescens	beefsteak plant	3	1
Persicaria perfoliatum	mile-a minute	1	1
Polygonum cuspidatum	Japanese knotweed	1	1
Buddleja davidii	butterfly bush	L	2
Carduus nutans	musk thistle	2	2
Cirsium vulgare	bull thistle	2	2
Elaeagnus umbellata	autumn olive	1	2
Lespedeza cuneata	sericea lespedeza	1	2
Paulownia tomentosa	princess tree	2	2
Pueraria montana var. lobata	kudzu	1	2
Rosa multiflora	multiflora rose	1	2
Spiraea japonica	Japanese spiraea	2	2

Alliaria petiolata	garlic mustard	1	3
Centaurea biebersteinii	spotted knapweed	1	3
Lonicera japonica	Japanese honeysuckle	1	3
Microstegium vimineum	Japanese stiltgrass	1	3
Tussilago farfara	coltsfoot	L	3

*** Invasiveness is based on Virginia Department of Conservation and Recreation: 1=Highly Invasive;2=Moderately invasive;3=Occasionally invasive; L=Locally invasive**

**** Priority: 1=high, eradicate wherever found**
2=medium, control source populations and eradicate outliers
3=low, prevent invasion of last areas not invaded; eradicate high priority areas

Priority Areas for Treatment

Control of nonnative invasive plant species is only one of a myriad of issues facing forest managers in any given year. Limitations in budget and personnel demand hard choices, thus a process is needed to ensure that any money and time spent in treating invasive plant infestations is efficient and effective. In addition to priorities for the species, infestations would also be prioritized based on the locations of the infestations.

Rare Species or Communities

The areas with highest priority are areas that contain threatened, endangered, and sensitive species (TES) and/or rare natural community types. Actions taken in these places would be to eliminate NNIP existing infestations and prevent new infestations. Control methods would favor manual treatment, mechanical treatment and fire. If herbicides are used near TES species, precautions would be taken to prevent impacts to these species.

Examples: Special Biological Areas -Whitetop Mountain, native bald plants
Guest River Gorge - Virginia spiraea
TESLR locations – Harrington Roadside, Smooth coneflower
Research Natural Areas – Ramseys Draft, Little Laurel Run

Wilderness

Another high priority area is Wilderness, where limitations on control methods could make treatment difficult. Actions taken in Wilderness would be to eliminate NNIP existing populations before they become extensive and to prevent new infestations. Control methods would entail manual treatments that are not motorized. The use of motorized manual equipment, mechanical equipment or herbicides in Wilderness would require approval by the Regional Forester and the use of these treatments are not part of this proposed action.

Example: Wilderness - James River Face, high disturbance from repeated wildfire areas

Travel Corridors and High Use Areas

Travel corridors and high use areas (recreation and administrative sites) are another class of priority areas. Humans act as vectors for plant propagules in a variety of ways through clothing, boots, pets, vehicles, firewood, and dumping of vegetation. Travel corridors include roads for vehicles, trails, and streams. Streams may facilitate NNIP movement through human action or by

carrying propagules downstream. Actions taken along travel corridors and high use areas would be to prevent the spread of NNIP. Control methods would include manual treatment, mechanical treatment and herbicide. Any herbicide used in proximity to streams or open bodies of water would be approved for aquatic use.

Examples: Roads – Rt. 60 Oronoco, Rt. 781 Cave Mt. Lake and Parkers Gap – kudzu,
Rt. 59, Great North Mountain - Japanese knotweed
Streams – Jennings Creek, Middle Creek, North Creek – butterfly bush

Disturbed and Open Condition Areas

Disturbed areas or areas maintained in an open condition are another priority and include a variety of places where the vegetation has been altered or the soil exposed. These sites can arise through natural processes, such as landslides, ice storms, wind-caused blow-down, insects and diseases, wildfires, or through human activities, such as trails, roads, wildlife openings, pastures, hayfields, utility corridors, timber harvest and prescribed burning. Actions taken in these areas would be to eliminate existing NNIP infestations and prevent new infestations. For the past several years, we have included the need to treat any existing NNIP infestations wherever we have proposed ground-disturbing activities, such as timber sales, and have included monitoring for NNIPs following project implementation. However, some of our older timber harvest areas and prescribed burn areas contain NNIP infestations that need attention. Control methods would favor prevention of NNIP establishment or spread through treating areas with NNIP before management activities take place, prompt revegetation of disturbed areas (unless this conflicts with desired natural processes), and elimination of NNIP infestations using manual or mechanical treatment, herbicide, or fire.

Other areas have been prioritized in the following table but the consideration of the NNIP species and other resources are also a factor in determining priorities.

Table 2. Priority Areas for NNIP Control

Priority	Area
A	Threatened, Endangered or Sensitive Plant Species
A	Rare Communities/Special Biological Areas
A	Research Natural Areas
A	Wilderness and Wilderness Study Areas (manual treatments only)
A	Roadsides
A	Trails and Trailheads
A	Stream Corridors
A	Any area in which ground or vegetation disturbing management has occurred and there is an existing population of a Priority 1 species (refer to Table 1)
B	Any area in which ground or vegetation disturbing management is

	planned and there is an existing population of Priority 1, 2 or 3 species (refer to Table 1)
B	Any area in which ground or vegetation disturbing management has occurred and there is an existing population of a Priority 2 species (refer to Table 1)
B	Any area with a new infestation of a Priority 2 species (refer to Table 1)
C	Any area in which ground or vegetation disturbing management has occurred and there is an existing population of a Priority 3 species (refer to Table 1)

Table 3 shows these priority areas along with their approximate acres on the George Washington and Jefferson National Forests and an estimate of the acres that may potentially need treatment over the ten year period.

Table 3. Potential Extent of Treatment Areas

Treatment Area		Acres Analyzed*		Potential Treatment
		Acres	% infested	Acres*
Wilderness Areas		100,434	2	2,009
National Scenic Areas		7,695	5	385
Rare Species or Communities	Research Natural Areas	3,900	2	78
	Special Biological Areas	62,300	2	1246
Travel Corridors or High Use Areas	Forest Roads – 100’ corridor each side	114,570	10	11,457
	Trails – 50’ corridor each side	53,285	5	2664
	Recreation sites and administrative sites	89,500	15	13,425
	Riparian areas –100’ corridor each side	56,727	5	2836
Open or Disturbed Areas	Wildlife openings	2,400	25	600
	Pastures, hay fields	7,492	25	1873
	Utility corridors – 100’ corridor each side of right-of-way	16,742	15	2,511
	Wildfire areas	13,047	5	652
	Prescribed burn areas	110,796	5	5540
	Past timber harvest areas (0-40 age class)	167,000	5	8,350
TOTAL		805,888		53,626

*Actual treatment acres are difficult to determine even at the known sites since the density of infestation varies at each site. The % estimate is a gross estimate.

Methods of Treatment

Proposed Manual Methods (pulling, grubbing, cutting, and digging): Manual methods would be the principle method for controlling or eradicating small spot infestations, typically less than 0.10 acres) when the method is effective and efficient. Manual methods may be used in conjunction with herbicide application in some locations. Examples of manual methods include, but are not limited to: shovels, saws, axes, loppers, hoes, weed-wrenches, string trimmers, chain saws, brush saws, aquatic harvesters, and push mowers.

Proposed Mechanical Methods (mowing, tree/brush shearing, uprooting, seeding, disking, and plowing): Mechanical methods would employ the use of tractors or other heavy equipment such as dozers and backhoes. Other equipment could include mowers, bush hogs, and forestry brush cutters/mulchers. Normally, this method would be applied to larger, relatively open areas suitable for equipment access. These areas are usually grown up fields, pastures, roadsides, and other open lands. Mowing or shearing may be used in conjunction with herbicide application. Plowing or disking would be used to restore heavily infested areas or to help establish desirable vegetation before infestation begins.

Proposed Cultural Methods (controlled fire, mulch): Cultural methods may include the use of fire, mulch, or other inhibiting techniques such as weed cloths and plastic sheeting. Fire would be used in accordance with approved burn plans.

Proposed Chemical Methods (herbicide): The objectives of herbicide use would be to control NNIP infestations where manual, mechanical or cultural means would be cost-prohibitive or result in excessive soil disturbance or other resource damage. All herbicides would be used according to manufacturer's label direction for rates, concentrations, exposure times, and application methods. Applications will be done under the supervision of a certified applicator. Herbicides would be directly applied to the target plants. Techniques that could be used include direct foliar applications using hand-held systems, backpack sprayers, hand-held brushes, basal bark and stem treatments using spraying or painting (wiping) methods, cut surface treatments (spraying or wiping), and woody stem injections. No herbicides would be applied aerially. Only formulations approved for aquatic-use would be applied in or within 30 feet of lakes, wetlands, perennial or intermittent springs, and streams, in accordance with label directions and Forest Plan standards.

Proposed Herbicides

Specific herbicides that could be used in the project area are listed below. Detailed descriptions of these chemicals, including comprehensive risk assessments for each, can be found at:

http://www.fs.fed.us/foresthealth/pesticide/risk.shtml
http://www.regulations.gov/search/Regs/home.html#home

Clopyralid is a selective herbicide that controls broadleaf herbs, primarily composites, legumes, and smartweeds (a perennial plant that forms dense colonies in shallow water). This chemical acts as a growth regulator and is typically applied as a direct foliar application. With selectivity to legumes, this chemical is particularly useful in the control of kudzu, mimosa, and lespedeza. Commercial brand-names include, but are not limited to Transline™.

Dicamba is a somewhat selective herbicide that controls most annual and perennial broadleaf herbs and some woody species. Care must be taken as it can damage or kill hardwood and pine seedlings, but has little to no effect on grasses. This chemical acts as a growth regulator and is typically applied as a direct foliar application. It is known to be effective on autumn olive. Commercial brand-names include, but are not limited to Vanquish™ and Overdrive™.

Glyphosate is a non-selective, broad spectrum herbicide that can be used to control many grasses, forbs, vines, shrubs, and tree species. Specific formulations of Glyphosate have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. This chemical is a growth inhibitor that can be applied through direct foliar application, stem injection, and cut-surface application. It has been proven effective on a wide variety of nonnative invasive plant species. Commercial brand-names include, but are not limited to Accord™, Roundup™, and Rodeo™.

Hexazinone is a photosynthetic inhibitor selective to most hardwood tree species, shrubs and some grasses. Most southern yellow pines are resistant. It has been proven effective on lespedeza and privet. Commercial brand-names include, but are not limited to Velpar™ and Pronone™.

Imazapic is a selective herbicide that is used primarily in and around populations of native, warm season grasses. Warm season grasses, many wildflower species, and legumes are resistant, while many cool season grasses (including nonnative species of fescue) and broadleaf weeds are susceptible. Commercial brand-names include, but are not limited to Plateau™.

Imazapyr is a selective herbicide that is used primarily in the control of hardwood trees and some species of grasses. This chemical is a plant protein production inhibitor that can be absorbed either through roots or foliage, or injected directly into the stem, and works systemically throughout the target plant. It has been proven effective in the control of tree of heaven, princess tree, mimosa, autumn olive, privet, and multiflora rose. Use in combination with Triclopyr or Glyphosate can increase target specificity. Commercial brand-names include, but are not limited to Arsenal™ and Chopper™.

Metsulfuron methyl is a systemic herbicide that is selective to woody species, broadleaf weed species, and many annual grasses. It has been proven to be effective in the control of lespedeza, Japanese honeysuckle, kudzu, and multiflora rose. Commercial brand-names include, but are not limited to Escort™.

Triclopyr is a selective herbicide that controls many species of herbaceous and woody broadleaf weeds, but has little to no effect on grasses. This chemical acts as a growth regulator and can be applied as a direct foliar application, stem injection, or cut-surface treatments. Specific formulations of Triclopyr have been labeled for aquatic application. Formulations labeled for aquatic sites can be effective on both emergent aquatics and shoreline vegetation. It has been proven effective on a wide variety on nonnative invasive plant species. Commercial brand-names include, but are not limited to Garlon 3A™, Garlon 4™, and Pathfinder II™.

2,4-D is a selective herbicide that controls invasive broadleaf herbaceous plants and woody seedlings, but does not harm certain monocots (including grasses). Commercial brand-names include, but are not limited to Frontline ™.

Fluazifop-P-Butyl is a monocot specific post-emergent herbicide primarily affecting grasses, sedges, and lilies. Commercial brand-names include, but are not limited to Fusilade ™.

Fenoxaprop-ethyl is a selective herbicide primarily used to control grasses. Commercial brand-names include, but are not limited to Acclaim ™.

Fosamine ammonium is a brush control agent that is diluted with water and applied as a foliar spray. It controls many woody species by inhibiting bud growth and treated plants will not leaf out or grow the season after treatment. Commercial brand-names include, but are not limited to Krenite)™.

Proposed Treatments for Priority Nonnative Invasive Plant Species

Detailed information on 27 NNIP species and associated treatment methods are provided in Appendix B. A summary of the proposed methods for each species is shown in the Table 4.

Table 4: Proposed Treatment Methods for Priority Nonnative Invasive Plant Species on the George Washington and Jefferson National Forests (not including manual treatments)

Scientific Name (common name)	Clopyralid	Dicamba	Glyphosate	Hexazinone	Imazapic	Imazapyr	Metsulfuron methyl	Triclopyr	2,4-D	Fluazifop-P-butyl	Fenoxaprop-ammonium	Fosamine	Mechanical	Cultural
Ailanthus altissima (tree of heaven)			X			X	X	X	X			X	X	
Akebia quinata (chocolate vine)			X					X	X				X	
Alliaria petiolata (garlic mustard)			X					X	X			X		X
Berberis thunbergii (Japanese barberry)									X			X	X	
Buddleja davidii (butterfly bush)			X					X	X				X	
Carduus nutans (musk thistle)			X					X	X				X	
Celastrus orbiculatus (Oriental bittersweet)			X					X	X				X	X
Centaurea biebersteinii (spotted knapweed)	X								X				X	
Cirsium vulgare (bull thistle)		X	X					X	X				X	
Eleagnus umbellata (autumn olive)		X	X			X		X	X			X	X	
Lespedeza cuneata (sericea lespedeza)	X		X	X			X	X	X				X	X
Ligustrum sp. (privet)			X			X	X	X	X			X		X
Lolium arundinaceum (tall fescue)			X		X	X				X				X
Lonicera japonica (Japanese honeysuckle)			X				X	X	X			X	X	X
Lonicera maackii (Amur honeysuckle)						X		X	X			X	X	X
Lonicera morrowii (Morrow's honeysuckle)						X		X	X			X	X	X
Lonicera tatarica (Tartarian honeysuckle)						X		X	X			X	X	X
Lythrum salicaria (purple loosestrife)			X					X	X				X	X
Microstegium vimineum (Japanese stiltgrass)			X							X				X
Paulownia tomentosa (princess tree)			X			X		X	X			X	X	
Perilla frutescens (beefsteak plant)			X						X				X	
Persicaria perfoliatum (mile-a-minute)			X						X				X	
Polygonum cuspidatum (Japanese knotweed)			X					X	X				X	X
Pueraria montana var. lobata (kudzu)	X		X				X	X	X				X	X
Rosa multiflora (multiflora rose)			X			X	X	X	X			X	X	X
Spiraea japonica (Japanese spiraea)			X					X	X			X	X	X
Tussilago farfara (coltsfoot)			X						X				X	

Design Criteria (from the George Washington and Jefferson Forest Plans):

Any action taken will be consistent with both Forest Plans, the decision document, and will comply with applicable laws and regulations such as the Endangered Species Act and the Archaeological Resources Protection Act, and herbicide labeling. Additional measures to be implemented for herbicide use include:

- The method and timing of herbicide are chosen to achieve project objectives while minimizing effects on non-targeted vegetation and other environmental elements. Selective treatment is preferred over broadcast treatment.
- No class B, C, or D chemicals may be used without approval of the Regional Forester. (Table 2-6 Jefferson Forest Plan, none are proposed here)
- Vegetable oil is used as the herbicide carrier when available and compatible with the proposed application.
- No herbicide will be ground applied within 60 feet of any known threatened, endangered, proposed or sensitive plant (PETS) except where a nonnative invasive species is affecting federally listed or sensitive species.
- No herbicide will be ground-applied within 30 horizontal feet of lakes, wetlands, and perennial or intermittent springs and streams. No herbicide will be applied within 100 horizontal feet of any public or domestic water source. Selective treatments (which require added site-specific analysis and use of aquatic–labeled pesticides) may occur within these buffers only to prevent significant environmental damage such as nonnative invasive plant infestations.
- With the exception of utility corridor and road rights-of-way, no herbicide is broadcast within 100 feet of a private land and 300 feet of a private residence, unless there is private owner permission.
- No soil-active herbicide is applied within 30 feet of the drip line of reserved vegetation or within 30 feet of the drip line of vegetation adjacent to the treated area.
- Aquifers and public water sources are identified and protected.
- Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers.
- Herbicide mixing, loading, or cleaning areas in the field are not located within 200 feet of private land, riparian corridors, open water or wells, or other sensitive areas.
- No herbicide will be broadcast on rock outcrops or sinkholes. No soil-active herbicide with a half-life longer than 3 months will be broadcast on slopes over 45 percent, erodible soils, or aquifer recharge zones. Such areas will be clearly marked before treatment so applicators can easily see and avoid them.

- Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health. Application rate and work time must not exceed typical levels (Table 3-11, George Washington Forest Plan).
- Weather is monitored and the project is suspended if temperature, humidity, or wind becomes unfavorable as shown in Table 2-7 of the Jefferson Forest Plan.

Treatment of Future Infestations

The project proposal is also intended to be adaptive in nature and allow the use of integrated methods for the future treatment of invasive plant infestations. Nonnative invasive species infestations are uncertain and dynamic; even the most complete inventory will never cover the actual infested area and will quickly be out of date. During the life of this project, invasive plants are likely to be introduced to new locations by vehicles, heavy equipment, livestock, wildlife, recreationists, and all the usual vectors of spread, and will be detected through monitoring. It is also likely that additional species of invasive plants not identified may be discovered on the Forest over the term of the project. Treatment options may vary according to the particular invasive species, the size and configuration of the infestation, site location, and site conditions. Prior to any treatments of future infestations, the proposed treatment would be reviewed by forest resource specialists in the areas of wildlife biology, botany, aquatics, soils, recreation, and heritage resources. A site-specific implementation checklist of required reviews (see Appendix C), documentation of any additional site-specific mitigation measures, and consideration of potential cumulative effects would be used to ensure that potential environmental impacts are within the scope of the impacts disclosed from the environmental analysis completed for this project proposal. Any new treatment method or new herbicide would require a separate environmental analysis and decision.

Monitoring

Weed infestations are rarely eradicated, or even controlled, with a single treatment. Follow-up monitoring to evaluate the success of the treatments will be necessary to successfully implement the control program. It is anticipated that many infested sites will require multiple treatments over several years to gain the desired level of control. Monitoring will be a necessary component in determining the frequency and type of successive treatments, as well as the effects on non-target species and other resources.

Other Management Actions

Prevention of NNIP infestations remains the foremost priority for addressing this issue. The GWJ currently pursues several prevention strategies for NNIPs. For example, the Forest uses various media outlets to encourage visitors to take preventative measures such as cleaning bicycles, vehicles, horses, trailers, etc. prior to recreational visits to the Forest; not bringing livestock forage onto the Forest; using only locally-procured firewood; and other measures as deemed appropriate. Weed-free forage and mulch (hay) currently is not available in the local area. Therefore, the Forest generally requires that straw be substituted for hay wherever mulch is used. Straw is less likely than hay to contain NNIPs because of the more intensive cultivation under which it is produced. Permits for organized equestrian use on the Forest encourage users

not to bring hay on to the National Forest whenever practical. Cleaning of logging equipment prior to use on National Forest land is national and regional policy. When necessary, special use permits require prevention measures such as seed testing, prohibiting use of hay for mulch, and cleaning of construction and maintenance equipment. For the past several years, we have included the need to treat any existing NNIP infestations wherever we have proposed ground-disturbing activities, such as timber sales, and have included monitoring for NNIPs following project implementation. The environmental analyses and decisions made for future ground-disturbing activities will include prevention, treatment and monitoring of nonnative invasive plant species.

PROPOSED ACTION (2): INVASIVE WOODY PLANT CONTROL IN MAINTAINED ROADSIDES, UTILITY CORRIDOR AND WILDLIFE OPENINGS

Roadsides, utility corridors and wildlife openings are typically maintained in grass, forb or shrub vegetation and can provide large, contiguous pathways for NNIP spread or encroachment of unwanted woody plant species. The proposed action for maintaining these areas includes the previously described action to control nonnative invasive plants, but also includes control of some woody vegetation that could include native species, such as black locust.

In addition to problems with NNIP, it is also important to manage vegetation immediately adjacent to open roads for driver safety. Tall woody vegetation growing in the road right-of-way (ROW) creates visibility and safety problems for motorists utilizing these roads. A road closed-in with woody vegetation does not allow for sunshine to help keep the road ROW free from ice and water. This in turn increases road service maintenance needs. So we are also proposing chemical treatment of unwanted woody vegetation in the right-of-way of open roads on the Forests. Mowing and brushing (historical maintenance techniques) keep the vegetation down but these methods do not kill the roots of many species. Over time the root system gets larger while maintaining the above ground vegetation. With each mowing or brushing, the woody vegetation is cut down but sprouting actually increases because of the larger root system that remains after cutting. Chemical control is needed to control this woody vegetation. Treatment would occur annually on about 872 miles of road, for a total treatment area of about 2,600 acres (about 12 feet on either side of the road).

Wildlife openings provide important habitat for the many species that need open, grassy or shrubby habitat at some point in their life history. Mowing, brushing and chemical control are important to maintain the open conditions. Mowing and brushing are standard practices to maintain these areas and along with fire, would continue to be the primary method of maintenance. Woody vegetation, particularly autumn olive (*Elaeagnus umbellata*) and tree-of-heaven (*Ailanthus altissima*), are encroaching into areas maintained in grasses and forbs for wildlife forage. In addition to these NNIP, black locust and other native shrubs can become established in the openings and reduce the ability to mow. Since chemical control of the unwanted vegetation may be necessary for NNIP control, we are also proposing chemical control of native unwanted vegetation within wildlife openings. Treatment would occur sporadically as needed in an individual area. Any of the 2,400 acres of maintained openings could be treated with chemicals in a given year.

Utility corridors need to be managed to provide for safety and reliability of the utility. This generally means maintaining a grass/forb or shrub community without trees. The use of herbicides can enhance the growth of desirable species that maintain the needs of the utility, reduce long-term maintenance needs and produce open canopy habitat for wildlife species. Treatment with herbicides is proposed as needed across the 3,414 acres of utility rights-of-way across both Forests.

Areas to Be Treated and Methods of Treatment

The areas to be treated, methods of treatment, and standard management practices are as described in the previous section for the first proposed action. Herbicides used to control woody vegetation in road and utility rights-of-way and wildlife openings would include fosamine ammonium, glyphosate, and triclopyr. One additional method of treatment for these areas is the use of broadcast spraying with a boom sprayer attached to a vehicle.

DECISIONS TO BE MADE

The Forest Supervisor of the George Washington and Jefferson National Forests is the Responsible Official for the decision to be made for both proposed actions. The decision-maker will answer the following questions based on the environmental analysis:

- Whether the proposed action would result in significant environmental effects that would require the preparation of an Environmental Impact Statement, or if there is a finding of no significant impact.
- If significant impacts are not anticipated, the Forest Supervisor will determine whether the proposed action will proceed as described above, as modified by an alternative, or not at all.
- Mitigation measures and monitoring requirements to be implemented by the Forest Service.
- Whether there needs to be a separate decision for each of the proposed actions or they can be combined in one decision.

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USDA Forest Service, Southern Research Station 2009. Southern Research Station Forest Inventory and Analysis Data Center – Nonnative Invasive Plant data tool. Available at http://srsfia2.fs.fed.us/nonnative_invasive/Southern_Nonnative_Invasives.htm

APPENDIX A. NNIP List Websites

Virginia:

http://www.dcr.virginia.gov/natural_heritage/documents/invlist.pdf

http://plants.usda.gov/java/noxious?rptType=State&statefips=51

West Virginia:

http://www.wvdnr.gov/Wildlife/DirtyDozen.shtm

http://plants.usda.gov/java/noxious?rptType=State&statefips=54

Forest Service:

http://www.na.fs.fed.us/fhp/invasive_plants/weeds/index.shtm

http://www.fs.fed.us/invasivespecies/speciesprofiles/index.shtml#plants

http://www.fs.fed.us/r8/resources/ecosystems/nnis/list.php?p=1.1.3.4

APPENDIX B. Ecology and Treatment Methodology for the Species of Greatest Threat
Information drawn extensively from Evans et al. 2006, SE-EPPC 2004, and Miller 2003. (See references section).

***Ailanthus altissima* (tree of heaven)**
Ecology: This deciduous tree is originally from China and was introduced to the United States in the late 1700's as an ornamental species. Tree of heaven can grow up to 80 feet in height and spreads rapidly by root sprouts forming dense colonies. This species is a prolific seeder capable of producing upwards of 300,000 winged seeds per plant that are readily transported long distances both by wind and water. Tree of heaven is extremely tolerant of poor soil and drought conditions and readily invades roadsides, forest openings, and other disturbed areas. This species re-sprouts vigorously after being cut or burned and is also alleopathic, enhancing its ability to displace other species and rapidly invade disturbed areas.
Proposed treatment methods: Cutting, girdling, and hand-pulling will provide some control of this species, however, it re-sprouts aggressively and will require continuous follow-up treatments. Mechanical methods are best used in conjunction with chemical treatments. Tree of heaven readily re-sprouts after fire, thus prescribed fire is not considered to be a viable control option for this species. For large trees apply stem injections of triclopyr, glyphosate, or imazapyr, or fell the trees and treat cut stumps immediately with the same herbicides. Treatment for saplings and seedlings could include mechanical removal with a weed wrench or hand-pulling, and/or application of triclopyr to young bark. Direct foliar applications to seedlings and re-sprouts imazapyr, glyphosate, or triclopyr, or metasulfuron-methyl could also be used.

***Alliaria petiolata* (garlic mustard)**
Ecology: This cool season biennial forb was first introduced from Europe in the 1800s.
The basal rosettes of leaves persist over the winter and the erect stems are among the first plants to flower in the spring. A single plant can produce hundreds of seeds which are dispersed up to a few yards around the parent plant. Due to its prolific growth, garlic mustard displaces many native spring wildflowers such as spring beauty (*Claytonia virginica*), wild ginger (*Asarum canadense*), bloodroot (*Sanguinaria canadensis*), Dutchman's breeches (*Dicentra canadensis*), toothworts (*Dentaria* species) and trilliums (*Trillium* species) that occur in the same habitat.
Proposed treatment methods: Because the seeds of garlic can remain viable in the soil for five years or more, effective management requires a long term commitment. The goal is to prevent seed production until the stored seed is exhausted. Hand removal of plants is possible for light infestations and when desirable native species co-occur. Care must be taken to remove the plant with its entire root system because new plants can sprout from root fragments. This is best achieved when the soil is moist, by grasping low and firmly on the plant and tugging gently until the main root loosens from the soil and the entire plant pulls out. Pulled plants should be removed from site if at all possible, especially if flowers are present. For larger infestations of garlic mustard, or when hand-pulling is not practical, flowering stems can be cut at ground level or within several inches of the ground, to prevent seed production. If stems are cut too high, the plant may produce additional flowers at leaf axils. Once seedpods are present, but before the seeds have matured or scattered, the stalks can be clipped, bagged and removed from the site to help prevent continued buildup of seed stores. This can be done through much of the summer. For very heavy infestations, where the risk to desirable plant species is minimal, application of the systemic herbicide glyphosate is also effective. Herbicide may be applied at any time of year,

including winter (to kill overwintering rosettes), as long as the temperature is above 50 degrees F. and rain is not expected for about 8 hours. Fire has been used to control garlic mustard in some large natural settings but, because burning opens the understory, it can encourage germination of stored seeds and promote growth of emerging garlic mustard seedlings. For this reason, burns must be conducted for three to five consecutive years. Regardless of the control method employed, annual monitoring is necessary for a period of at least five years to ensure that seed stores of garlic mustard have been exhausted.

***Akebia quinata* (chocolate vine)**

Ecology: Fiveleaf akebia is a vigorous vine that grows as a groundcover and climbs shrubs and trees by twining. Once established, its dense growth crowds out native plants. Fiveleaf akebia is found in 16 states in the eastern U.S. and has been reported to be invasive in Kentucky, Maryland, New Jersey, Pennsylvania, Virginia and the District of Columbia. Akebia is shade and drought tolerant and can invade many types of habitats, preferring lighter, well drained soils and sunny to partially shaded environs. Fiveleaf akebia was brought to the United States in 1845 as an ornamental which eventually escaped from cultivation and has since become naturalized in warmer climates. Akebia spreads primarily by vegetative means and is capable of growing twenty to forty feet in a single growing season. In the mid-Atlantic region, fruits are not always produced. Seeds of akebia may be dispersed by birds. Long distance spread of akebia is largely through human activities.

Proposed treatment options: Control options must be determined on a site-by-site basis. Manual, mechanical and chemical control methods are all effective for control of *Akebia*. Employing a combination of methods often yields the best results and may reduce potential impacts to native plants, animals and people. The method you select depends on the extent and type of infestation, the amount of native vegetation on the site, and the time, labor and other resources available to you. For small or scattered infestations manual and mechanical methods may suffice. Systemic herbicides such as triclopyr and glyphosate or a combination of manual, mechanical and chemical are probably more effective and practical for large infestations. Whenever possible and especially for vines climbing up trees or buildings, a combination of cutting followed by application of concentrated systemic herbicide to rooted, living cut surfaces is likely to be the most effective approach. For large infestations of ivy spanning extensive areas of ground, a foliar herbicide may be the best choice to minimize soil disturbance that could lead to reinfestation.

***Berberis thunbergii* (Japanese barberry)**

Ecology: Japanese barberry forms dense stands in natural habitats including canopy forests, open woodlands, wetlands, pastures, and meadows and alters soil pH, nitrogen levels, and biological activity in the soil. Once established, barberry displaces native plants and reduces wildlife habitat and forage. White-tailed deer apparently avoid browsing barberry, preferring to feed on native plants, giving barberry a competitive advantage. In New Jersey, Japanese barberry has been found to raise soil pH (i.e., make it more basic) and reduce the depth of the litter layer in forests. Japanese barberry has been reported to be invasive in twenty states and the District of Columbia. Due to its ornamental interest, barberry is still widely propagated and sold by nurseries for landscaping purposes in many parts of the U.S. Barberry is shade tolerant, drought resistant, and adaptable to a variety of open and wooded habitats, wetlands and disturbed areas. It prefers to grow in full sun to part shade but will flower and fruit even in heavy shade. Japanese barberry was introduced to the U.S. and New England as an ornamental plant in 1875 in the form

of seeds sent from Russia to the Arnold Arboretum in Boston, Massachusetts. In 1896, barberry shrubs grown from these seeds were planted at the New York Botanic Garden. Japanese barberry was later promoted as a substitute for common barberry (Berberis vulgaris) which was planted by settlers for hedgerows, dye and jam, and later found to be a host for the black stem grain rust. Because Japanese barberry has been cultivated for ornamental purposes for many years, a number of cultivars exist. Japanese barberry spreads by seed and by vegetative expansion. Barberry produces large numbers of seeds which have a high germination rate, estimated as high as 90%. Barberry seed is transported to new locations with the help of birds (e.g., turkey and ruffed grouse) and small mammals which eat it. Birds frequently disperse seed while perched on powerlines or on trees at forest edges. Vegetative spread is through branches touching the ground that can root to form new plants and root fragments remaining in the soil that can sprout to form new plants. Japanese barberry may be confused with American barberry (Berberis canadensis), the only native species of barberry in North America, and common or European barberry (Berberis vulgaris) an introduced, sometimes invasive plant.
Proposed treatment options: Do not plant Japanese barberry. Because it is a prolific seed-producer with a high germination rate, prevention of seed production should be a management priority. Barberry can resprout from root fragments remaining in soil so thorough removal of root portions is important. Because Japanese barberry leafs out early, it is easy to identify and begin removal efforts in early spring. Small plants can be pulled by hand, using thick gloves to avoid injury from the spines. The root system is shallow making it easy to pull plants from the ground, and it is important to get the entire root system. The key is to pull when the soil is damp and loose. Young plants can be dug up individually using a hoe or shovel. Hand pulling and using a shovel to remove plants up to about 3 ft high is effective if the root system is loosened up around the primary tap root first before digging out the whole plant. Mechanical removal using a hoe or Weed Wrench ® can be very effective and may pose the least threat to non-target species and the general environment at the site. Tools like the Weed Wrench ® are helpful for uprooting larger or older shrubs. Shrubs can also be mowed or cut repeatedly. If time does not allow for complete removal of barberry plants at a site, mowing or cutting in late summer prior to seed production is advisable. Manual control works well but may need to be combined with chemical control in large or persistent infestions. No biological control organisms are available for this plant. Treatments using the systemic herbicides glyphosate and triclopyr have been effective in managing Japanese barberry infestations that are too large for hand pulling. Application early in the season before native vegetation has matured may minimize non-target impacts. However, application in late summer during fruiting may be most effective. Triclopyr or glyphosphate may be used on cut stumps or as basal bark applications

***Buddleja davidii* (butterfly bush)**
Ecology: has been planted in landscapes to attract butterflies, bees, moths and birds. It can escape from plantings and become invasive in a variety of habitats such as surface mined lands, coastal forest edges, roadsides, abandoned railroads, rural dumps, stream and river banks to displace native plants.
Proposed treatment options: Manual, hand pick seedlings or dig out where possible. Big plants may be difficult to dig out. Chemical: cut plants and treat stumps with any of several readily available general use herbicides such as triclopyr or glyphosate.

***Carduus nutans* (musk thistle)**

Ecology: An aggressive, biennial herb from western Europe. Musk thistle grows from sea level to about 8,000 ft elevation, in neutral to acidic soils. It invades open natural areas, meadows, prairies, grassy bald, disturbed areas, old pastures, roadsides, waste places, ditch banks, old fields, and hay fields. It spreads rapidly in areas subjected to frequent natural disturbance events such as landslides and flooding but does not grow well in excessively wet, dry or shady conditions. The invasive nature of this aggressive plant can lead to severe degradation of native grasslands and meadows because grazing animals focus on native vegetation giving the thistles a competitive advantage.
Proposed treatment options: Manual, hand pulling is most effective on small populations and can be done throughout the year, but is most effective prior to the development of seeds. Flowers and seed-heads should be bagged and disposed of in a landfill to prevent or minimize seed dispersal. Minimizing disturbance to the soil during removal activities will help reduce the chance of germination of seeds stored in the soil. Chemical control can be achieved using any of several readily available general use herbicides such as glyphosate or triclopyr. Treatments should be applied during the rosette stage or prior to flowering. Glyphosate is a non-selective systemic (i.e., moves through the plant) herbicide that can kill non-target plants that are only partially contacted by spray. Triclopyr is selective to broadleaf species and is a better choice if native grasses are present.

***Celastrus orbiculatus* (oriental bittersweet)**
Ecology: This woody vine was introduced from Asia in the 1800's as an ornamental species. Oriental bittersweet can climb upwards of 60 feet forming thickets in tree canopies and sometimes girdling or completely covering smaller trees. It produces clusters of attractive fruits that are eaten by birds and other wildlife species and are collected by people for decorative wreaths, resulting in widespread seed dispersal. Oriental bittersweet poses a serious threat to native plant communities due to its high reproductive rate, long range dispersal, ability to root sucker, and rapid growth rate. Climbing oriental bittersweet vines severely damage native vegetation by constricting and girdling stems. Vines can shade, suppress, and ultimately kill native vegetation.
Proposed treatment methods: Cut climbing or trailing vines as close to the root collar as possible to control small populations. Cutting will prevent seed production and strangulation of surrounding woody vegetation, however Oriental bittersweet will aggressively re-sprout unless cut so frequently that its root stores are exhausted. Digging or pulling can also be effective for small populations. Fire is not considered to be a control option for this species due to its ability to rapidly re-sprout from underground roots. Chemical control can be achieved using direct foliar application of glyphosate or tryclopyr. For stems too tall for foliar application, basal bark treatments of tryclopyr are effective. Large stems can also be cut at the base and treated with a solution of glyphosate or tryclopyr to prevent re-sprouting.

***Centaurea biebersteinii* (spotted knapweed)**
Ecology: From Eurasia; introduced in 1890's as a contaminant in alfalfa or hay seed. Spotted knapweed is found at elevations up to and over 10,000 feet and in precipitation zones receiving 8 to 80 inches of rain annually. It is most common in sunny habitats with well-drained or gravelly soils. It grows on heavily disturbed sites, roadsides, agricultural field margins, undisturbed dry prairies, oak and pine barrens, rangeland, lake dunes, and sandy ridges. It releases a toxin into the soil that hinders or prevents the growth of neighboring species. This promotes its domination,

reduces plant diversity and limits forage and crop production. As spotted knapweed populations rise and other plant species are excluded, surface runoff and sedimentation often increases. Water holding capacity of soil decreases as taproots replace the network of native plant root systems.
Proposed treatment methods: Mechanical: hand-pull small infestations prior to seed set. Use gloves to prevent skin irritation. Remove entire crown and taproot to prevent re-growth. Chemical: spotted knapweed can be effectively controlled using any of several readily available general use herbicides such as clopyralid or picloram. Picloram will control spotted knapweed for three to five years. Clopyralid should be applied during bolt or bud growth stage. Biological control - two species of seed head flies, Urophora affinis and U. quadrifasciata, are well established on spotted knapweed. The larvae of these species reduce seed production by as much as 50% by feeding on spotted knapweed seed heads and causing the plant to form galls. Three moth species (Agapeta zoegana, Pelochrista medullana, and Pterolonche inspersa) and a weevil (Cyphocleonus achates) that feed on spotted knapweed roots have also been released. Biological control agents may be more effective when combined with other control methods such as herbicides, grazing, and revegetation with desirable, competitive plants. Other methods: Long-term grazing by sheep and goats has been found to control spotted knapweed. Burning, cultivation, and fertilization typically are not effective on spotted knapweed unless combined with other methods of control.

***Cirsium vulgare* (bull thistle)**
Ecology: Introduced from Europe, western Asia, and North Africa. Bull thistle is a widespread weed that can grow in a wide range of environments but is most troublesome in recently or repeatedly disturbed areas such as pastures, overgrazed rangelands, recently burned forests, forest clear-cuts, and along roads, ditches, and fences. It is found on dry and wet soils, but is most common on soils with intermediate moisture. Although bull thistle is a problem predominantly in disturbed areas, it also can be found in natural areas. The basal rosette may grow to over 3 feet in diameter before bolting. Once established, bull thistle out-competes native plant species for space, water, and nutrients.
Proposed treatment methods: Manual: mow to prevent seeding. Chemical: can be effectively controlled using any of several readily available general use herbicides such as glyphosate, triclopyr, or dicamba. Biocontrol: the seed-feeding fly, Urophora stylata Fabricius, has been selected and released for biological control of bull thistle.

***Eleagnus umbellata* (autumn olive)**
Ecology: This deciduous shrub was introduced from China and Japan in the 1800's and was widely and actively promoted by many state and federal agencies for erosion control, mine reclamation, and wildlife habitat, and was also widely marketed as an ornamental prior to being recognized as a threat to native ecosystems. Autumn olive is a prolific producer of fruit and can produce over 30,000 seeds per plant per year that are readily consumed by birds and small mammals. This species is also a nitrogen fixer and thus is able to colonize nutrient poor sites giving it an advantage in areas with infertile soils. Autumn olive re-sprouts vigorously after being cut or burned and can form dense thickets that can rapidly displace native vegetation if left unchecked.
Proposed treatment methods: Cutting, girdling, and hand-pulling will provide some control of this species, however, it re-sprouts aggressively and will require continuous follow-up

treatments. Mechanical methods are best used in conjunction with chemical treatments. Autumn olive readily re-sprouts after fire, thus prescribed fire is not considered to be a viable control option for this species. Large stems can be pulled with a weed wrench or cut and treated with imazapyr or glyphosate directly on the cut-surface. Other chemical control options include applying direct foliar application of dicamba, imazapyr, or triclopyr, or for stems too tall for foliar application, basal bark treatments of tryclopyr.

***Lespedeza cuneata* (sericea lespedeza)**

Ecology: Sericea lespedeza was introduced from Japan in 1896 to be tested as an agricultural crop. Since that time it has been used as livestock forage, erosion control, in wildlife plots, and to improve eroded soil. This species thrives in a wide range of soil moisture conditions, tolerating some flooding and also showing resistance to drought. Because if its ability to fix nitrogen, it can rapidly invade nutrient poor sites forming dense thickets. Sericea lespedeza sprouts rapidly from the root crown and is promoted by fire making it an aggressive invader of open areas. Seeds can remain viable in the seedbank for decades making eradication extremely difficult.

Proposed treatment methods: Hand pulling may be used for small plants or in loose soil, however, pulling of mature plants is impractical due to lespedeza's extensive perennial root system. Mowing plants before blooming for two or three consecutive years may reduce the vigor of lespedeza stands and control further spread. Plants should be cut as low to the ground as possible. Prescribed fire is not a control option for this species and will only promote its spread. Chemical control can be achieved through a variety of options. Direct foliar applications of clopyralid, glyphosate, hexazinone, or triclopyr or metsulfuron-methyl have all been shown to be effective in controlling this plant.

***Ligustrum sp.* (privet)**

Ecology: Several species of privet native to Asia, Europe, and North Africa have been introduced to the United States, primarily as a hedge in landscaping. They are difficult to distinguish and include common privet (*L. vulgare*), Chinese privet (*L. sinense*), and Japanese privet (*L. japonicum*). All easily escape cultivation to invade adjacent areas and since the fruits are eaten by birds, seeds can be spread to great distances. Privet is an aggressive invasive often forming dense thickets particularly in bottomlands, riparian areas, and along fencerows. Privet is an aggressive sprouter after damage and spreads both through seed dispersal and abundant root sprouts.

Proposed treatment methods: Mowing or cutting can be effective for small populations or environmentally sensitive areas where herbicides cannot be used. Repeated mowing or cutting will provide some control to the spread of privet, but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible.

Privet is effectively controlled by manual removal of young seedlings. Plants should be pulled as soon as they are large enough to grasp but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. Larger stems can be removed using a weed wrench or similar uprooting tools. The entire root must be removed since broken fragments may re-sprout. Privet responds by sprouting after fire damage, but repeated fire has been shown to afford some control for this species. Mechanical methods are most effective when used in conjunction with the following chemical treatments. Apply direct foliar treatments of glyphosate, imazapyr, or metsulfuron-methyl during the dormant season . For stems too tall for foliar application apply

basal bark treatments of tryclopyr. Cut-surface or stem injection treatments of glyphosate or triclopyr are also effective on larger stems.

***Lolium arundinaceum* (tall fescue)**
Ecology: This grass species was introduced from Europe in the mid 1800's for use as a turf and forage grass. It has been widely established across the United States (and world) where various cultivars are still used extensively for turf, forage, and erosion control. Tall fescue is a cool season grass that is tolerant of a wide range of ecological conditions and is capable of forming dense stands along roadsides or in fields or any other open and disturbed areas.
Proposed treatment methods: Frequent mowing as close to the ground as possible will slow the spread of tall fescue, but will not eliminate it from the site. Prescribed burning in the early spring of successive years will inhibit fescue growth and usually promotes desirable native warm season grasses and legumes. To eradicate fescue from a site, a combination of burning and chemical treatments is needed. Apply imazapic or glyphosate as a foliar spray, or a foliar application of imazapyr in the early growing season for the best control.

***Lonicera japonica* (Japanese honeysuckle)**
Ecology: This woody vine was introduced from Japan in the early 1800's as an ornamental and has since been widely planted for erosion control and wildlife (deer) forage. Japanese honeysuckle can climb to heights of over 80 feet, but also forms sprawling mats over shrubs, rocks, and on the ground. It is probably the most commonly encountered invasive plant species in the southeastern states and is adapted to wide range of ecological conditions, occurring in floodplains and dry ridges, and within the full shade of mature forests, to open areas in full sunlight. Japanese honeysuckle spreads rapidly through root-sprouts and fast growing vines that root at the nodes. Seeds are readily dispersed by animals that feed on the numerous fruits. The slender twining vines can girdle shrubs and small trees, and the dense mats rapidly shade out native vegetation resulting in a dramatic reduction in native biodiversity in heavily infested areas.
Proposed treatment methods: For small patches, repeated pulling or digging of entire vines and root systems may be effective. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. Mowing large patches of honeysuckle may be useful if repeated regularly (twice a year) but is most effective when combined with herbicide applications to reduce re-sprouting. Prescribed burning removes the above ground vegetation and can sever vines but does not kill the underground rhizomes, which will continue to sprout. Foliar applications of glyphosate, metsulfuron-methyl, or triclopyr will provide control for this species, or for larger vines, cut and treat the cut-surface immediately with glyphosate or triclopyr.

***Lonicera* spp.** (Bush honeysuckles, includes L. *maackii, L. morrowii, and L. tartarica*)
Ecology: In torduced from Asia in the 1700s and 1800s and planted as ornamentals and for wildlife. Often forms dense thickets in open forests, forest edges, abandoned fields, pastures, roadsides, and other open upland habitats. Relatively shade tolerant. Bush honeysuckles colonize by root sprouts and spread by abundant bird- and other animal-dispersed seeds. Seeds are long-lived in the soil.
Proposed treatment methods: Glyphosate applied as a foliar spray from August to October is effective. Or, apply triclopyr as to young bark as a basal spray. For stems too tall for foliar

sprays, cut large stems and immediately treat the stumps with one of the following herbicides: imazapyr or glyphosate.

***Lythrum salicaria* (purple loosestrife)**

Ecology: Native to Eurasia- Great Britain, central and southern Europe, central Russia, Japan, Manchuria China, Southeast Asia, and northern India. Purple loosestrife is capable of invading wetlands such as freshwater wet meadows, tidal and non-tidal marshes, river and stream banks, pond edges, reservoirs, and ditches. It spreads through the vast number of seeds dispersed by wind and water, and vegetatively through underground stems at a rate of about one foot per year. Seed banks can remain viable for twenty years. Purple loosestrife adapts to natural and disturbed wetlands. As it establishes and expands, it can out compete and replace native grasses, sedges, and other flowering plants that provide a higher quality source of nutrition for wildlife. The highly invasive nature of purple loosestrife allows it to form dense, homogeneous stands that restrict native wetland plant species, including some federally endangered orchids, and reduce habitat for waterfowl.

Proposed treatment methods: Manual - small infestations of young purple loosestrife plants may be pulled by hand, preferably before seed set. Older plants can be removed with a shovel. Landfill or burn removed plants. Chemical: purple loosestrife can be effectively controlled using any of several readily available general use herbicides such as glyphosate or triclopyr. These herbicides may be most effective when applied late in the season when plants are preparing for dormancy. However, it may be best to do a mid-summer and a late season treatment to reduce the amount of seed produced. Biological control: for long term control of large infestations biological control is recommended. As of 1997, three insect species from Europe have been approved by the USDA for use as biological control agents. These plant-eating insects include a root-mining weevil (Hylobius transversovittatus), and two leaf feeding beetles (Galerucella calmariensis and Galerucella pusilla). Two flower-feeding beetles (Nanophyes) that feed on various parts of purple loosestrife plants are still under investigation. Galerucella and Hylobius have been released experimentally in natural areas in 16 northern states, from Oregon to New York. Although these beetles have been observed occasionally feeding on native plant species, their potential impact to non-target species is considered to be low.

***Microstegium vimineum* (Japanese stiltgrass)**

Ecology: Nepal grass is native to temperate and tropical Asia and was first identified in the United States at Knoxville, Tennessee in 1919. It apparently spread rapidly from there, and by 1972, it had been identified in 14 eastern states. Microstegium vimineum is an annual, shade tolerant grass that is colonial in nature, rooting from the nodes, and may form dense monotypic stands. Each plant may produce from 100-1,000 seeds that remain viable in the soil for five or more years. Seed dispersal is primarily by animals, flooding, and deposition with fill dirt. This plant spreads rapidly into disturbed areas but can also invade undisturbed areas when seeds "hitch-hike" into pristine area on the fur of animals, car or bicycle tires, hiker's boots, or flooding. On fertile, mesic sites Japanese grass can replace competing ground vegetation within 3-5 years.

Proposed treatment methods: Mowing plants as close to the ground as possible using a weed-eater or similar grass cutting tool can be effective in reducing seed production. Treatments should be made when plants are in flower and before seeds are produced. Treatments made earlier may result in plants producing new seed heads in the axils of lower leaves. Hand-pulling

could be effective for small patches, but is usually not a feasible control option given the extent of infestations. Prescribed fire is also effective in eliminating seasonal growth, but is difficult to implement in the mesic sites where this species often occurs and it quickly re-establishes on disturbed ground from seed. For chemical control apply a foliar treatment of glyphosate in late summer.

***Paulownia tomentosa* (princess tree)**

Ecology: This deciduous tree is native to China and was introduced to the United States as an ornamental in the early 1800's. The showy purple flowers have made it popular as a landscaping tree and the wood of mature trees is also valuable in many overseas markets. Princess tree is an extremely fast grower and can reproduce from seed or from root sprouts. Sprouts can grow to over 15 feet in a single season. Each tree produces numerous clusters of seed pods each with four compartments that contain as many as 2,000 tiny winged seeds. It has been estimated that one tree is capable of producing twenty million seeds that are easily transported in water or wind. Paulownia tolerates drought and low soil fertility, allowing it to invade almost any habitat from rich riparian areas to vacant city lots. It is most often found on roadsides, stream banks, and disturbed areas, and its ability to sprout prolifically allows it to survive fire, cutting, and even bulldozing in construction areas.

Proposed treatment methods: Cutting, girdling, and hand-pulling will provide some control of this species, however, it re-sprouts aggressively and will require continuous follow-up treatments. Mechanical methods are best used in conjunction with chemical treatments. Princess tree readily re-sprouts after fire, thus prescribed fire is not considered to be a viable control option for this species. For large trees stem injections of glyphosate or imazapyr, or fell the trees and treat cut stumps immediately with the same herbicides. Treatment for saplings and seedlings could include mechanical removal with a weed wrench or hand-pulling, and/or application of triclopyr to young bark with a penetrant. Direct foliar applications to seedlings and re-sprouts using imazapyr, glyphosate or triclopyr could also be used.

***Perilla frutescens* (beefsteak plant)**

Ecology: From Asia where it is a traditional crop of China, India, Japan, Korea, Thailand, and other Asian countries. Beefsteak plants are prominent along roadsides, railroad rights-of-way, streams, spring branches, pastures, fields, woodlands and gravel bars. It can grow in rich soils, alluvial soils or dry soils. Often planted as showy ornamentals, beefsteak plants may readily escape cultivation, spreading to disturbed areas where they disrupt native ecosystems. The species has toxic characteristics and very few predators. It is ordinarily avoided by cattle and has been implicated in cattle poisoning. Plants are most toxic if cut and dried for hay late in the summer, during seed production. One reason for beefsteak plants' survival in pastures is that cattle avoid it. Sold as a salad plant for its dark purple foliage, this member of the mint family is extremely invasive by wind-borne seeds.

Proposed treatment methods: Manual - Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. To prevent spread of seeds, cut off spent flowers ("deadhead") or cut off seeds or fruits before they ripen, then bag, burn, or send to the landfill. Chemical: beefsteak plant can be effectively controlled using any of several readily available general use herbicides such as glyphosate.

***Polygonum cuspidatum* (Japanese knotweed)**

Ecology: This semi-woody shrub is native to Japan and was introduced to the United States in the 1800's as a landscape plant and for erosion control. It forms dense thickets that can reach heights of 3 to 10 feet and is easily recognizable by its "bamboo-like" stems and large, ovate leaves. Japanese knotweed spreads rapidly from stout rhizomes forming dense clonal stands. Seeds and rhizome fragments are distributed by water in floodplains and transported with fill dirt. Once established, populations are quite persistent and can rapidly out-compete existing vegetation.
Proposed treatment methods: Digging, plowing, or hand-pulling can be effective if care is taken to remove the entire plant including all roots and runners. Any portions of the root system not removed will potentially re-sprout. All plant parts, including mature fruit, should be bagged and disposed to prevent re-establishment. The effects of prescribed fire on this plant are unknown, though the dry, hollow stems of the previous seasons' growth should burn rapidly. Cutting or mowing may prevent seasonal reproduction, but will not provide effective control unless used in combination with chemical treatments. For chemical control apply a foliar treatment of either glyphosate or triclopyr, or cut stems and apply the same herbicides directly to the cut surface.

***Persicaria perfoliatum* (mile-a-minute)**
Ecology: Mile-a-minute, also called Devil's tear-thumb, was experimentally introduced into Portland, Oregon in 1890, and later to Beltsville, Maryland in 1937 but did not become established at either site. An additional unintentional introduction in the 1930s to a nursery site in York County, Pennsylvania was successful and is the likely source of this invasive plant in the mid-Atlantic and northeastern United States. Seeds of the plant may have been spread with rhododendron stock. Mile-a-minute weed is found in the northeast from Virginia to New York to Ohio and Oregon. It invades open and disturbed areas, such as fields, forest edges, stream banks, wetlands, roadsides and wetlands. Mile-a-minute grows rapidly, scrambling over existing plants, limiting their photosynthess, which can lead to their death.
Proposed treatment methods: Hand pulling and glyphosate. Manual and chemical methods are effective for controlling mile-a-minute. Seedlings and vines are easy to pull by hand as long as gloves and sturdy clothing are worn. However, pulling vines with mature fruits should be avoided as it may help spread seeds. Contact and systemic herbicides are effective in controlling it. Because the foliage has a waxy covering, the herbicide must be mixed with surfactant to help it adhere to the plant. Mile-a-minute is an annual and reproduces by seed—roots do not persist through the winter. Continued presence of mile-a-minute in a location is due to seeds from the previous year, not from plants regrowing from roots. Care should be taken to dispose of pulled or cut materials properly, using the following guidelines, to minimize the potential for further spread by seed. Hand pulling of seedlings is best done before the recurved barbs on the stem and leaves harden. Removal of vines by hand may be conducted throughout the summer. Repeated mowing or trimming of mile-a-minute plants will prevent the plants from flowering and thus reduce or eliminate fruit and seed production. Mile-a-minute spreads by seed. Even small, green seeds can still germinate. Seeds should not be composted, as composting may not kill seeds. Seeds have been known to germinate after long periods in the soil (up to 7 years), so it is important to check and re-check the area frequently to be sure that all the plants have been removed and follow up in later years, or the problem could begin all over again. Minimize movement of the plants. Vegetative material (with no fruits) can be pulled and can be left on-site if possible. Vegetative material can be composted. Cultural methods: maintain vegetative community stability and avoid creating gaps or openings in existing vegetation. Maintaining

broad vegetative buffers along streams and forest edges will help to shade out, reduce the dispersal of fruits by water and prevent establishment. Chemical: glyphosate will control mile-a-minute weed.

***Pueraria montana* var. lobata (kudzu)**

Ecology: This woody vine is native to Japan and China and was introduced into the United States in the late 1800's as an inexpensive livestock forage. The Soil Conservation Service distributed approximately 85 million seedlings starting in 1933 in an effort to control agricultural erosion. Kudzu was listed by USDA as a common weed of the south in 1970 and it is now estimated that kudzu covers over seven million acres in the southeast. This aggressive vine can grow up to a foot per day forming a continuous cover of foliage that chokes out competing native vegetation. Kudzu grows well under a wide range of environmental conditions and can grow in nearly any type of soil, resulting in large-scale alteration of biotic communities. Kudzu has large, tuberous roots that reach depths of up to 5 meters making it extremely difficult to eradicate with any method other than a systemic herbicide.

Proposed treatment methods: Plowing, digging, mowing, and pulling (young plants) all can have some effect on controlling spread of smaller patches, but it is extremely difficult to eradicate without resorting to the use of chemicals. Like the previous mechanical treatments, prescribed fire can reduce above ground biomass, but the plant rapidly re-sprouts from the deep-seated roots and re-establishes rapidly. To treat chemically apply a foliar spray of clopyralid, a foliar spray of glyphosate or triclopyr, or a foliar treatment of metsulfuron-methyl. Treat the bark of larger vines with triclopyr ,or cut stems and immediately treat the cut surface with a glyphosate or triclopyr for additional control.

***Rosa multiflora* (multiflora rose)**

Ecology: Multiflora rose was introduced from Asia in the late 1800's as an ornamental species and was subsequently used for wildlife plantings and windbreaks. In some states, it was even planted as a crash barrier along highways. Plants produce long, arching, vine-like stems that form sprawling clumps and often climb high into the branches of nearby trees. Multiflora rose reproduces by seed and also spreads rapidly from root sprouts and by rooting from the tips of arching branches. Its fruits are eaten by birds and other small animals that then disperse the seeds great distances. Seeds may remain viable in the soil for 10-20 years. Multiflora rose will tolerate a wide range of environmental conditions and once established, grows rapidly forming dense, impenetrable thickets.

Proposed treatment methods: Mowing and cutting can be effective at controlling the spread of small populations or environmentally sensitive areas where herbicides cannot be used, but will not eradicate it. Stems should be cut at least once per growing season and as close to ground level as possible. Hand cutting of established clumps is extremely difficult due to the long arching stems and prolific thorns. Prescribed burning will reduce above ground biomass and seems to have some benefit as a control measure, though more information is needed on long-term effectiveness of this treatment option. The best control is achieved though the use of chemical treatments. For large stems, cut and immediately treat the cut surface with glyphosate or imazapyr. Stems can also be treated with a basal application of triclopyr. Direct foliar applications can also be made using imazapyr, glyphosate, or metsulfuron-methyl.

***Spiraea japonica* (Japanese spiraea)**

Ecology: Japanese spiraea is a perennial shrub native to Japan that was introduced to the United States in the late 1800's as an ornamental species. Spiraea will tolerate a wide range of ecological conditions but is most commonly encountered along streams or roads in moist soils. It grows well in full sun but may endure partial shade. It will grow in almost any disturbed habitat including riparian areas, successional fields, roadsides, power line rights of way, and forest edges. Once established, spiraea grows rapidly forming dense stands that may invade canopy gaps of adjacent woodlands. Each plant produces hundreds of small seeds that can be dispersed by water and deposited along stream banks, or easily transported in fill dirt or by vehicle tires along roadways.
Proposed treatment methods: Mowing, cutting, and hand-pulling are appropriate for small populations or environmentally sensitive areas where herbicides cannot be used. Repeated mowing or cutting may control the spread of Japanese spiraea, but will not eradicate it. Stems should be cut at least once per growing season prior to seed production and as close to ground level as possible. The use of weed wrenches or hand-pulling of seedlings will effectively control small populations. The effects of prescribed fire are not well documented for Japanese spiraea. Related species are top-killed, but re-sprout after fire. Because this species often occurs in riparian areas or other mesic habitats, prescribed fire is probably not an option as a control method. For chemical control apply a foliar solution of glyphosate or triclopyr, or cut stems and immediately treat the cut surface with a solution of the same herbicides.

***Tussilago farfara* (coltsfoot)**
Ecology: A native of Europe, this plant is believed to be brought to this country by early settlers for its medicinal properties. Coltsfoot thrives in low-lying mesic areas including stream banks, moist field or pastures, roadsides, and disturbed areas. It can also be found in drier sites and in poor soils. It is intolerant of shade and is not commonly found in wooded areas, though it has been documented invading forests following fire.
Proposed treatment methods: Small infestations may be controlled by hand pulling to remove the entire plant. Chemical: coltsfoot can be effectively controlled using any of several readily available general use herbicides such as glyphosate. Treat in summer when the leaves of coltsfoot are fully developed.

Appendix C: Implementation Checklist for the Treatment of NNIP Species

NRIS Site ID: _____ Primary Species name: _____
Lat/Long in decimal degrees: N_____ W _____
GIS Acres: _____ (*calculated from GIS*) % of Site Infested: _____

List other NNIP species present at site:

Treatment method (List methods, chemicals to be used, date to be treated, by whom, etc)

Botanist Review: (Describe any special circumstances including the presence of TES species and rare or unique communities. List all recommended mitigations below.)

Wildlife Biologist Review: (Describe any special circumstances including potential impacts to forage and wildlife investments. List all recommended mitigations below.)

Aquatic Biologist Review (only required when treating sites within riparian area): (Describe any special circumstances including the presence of aquatic TES species. List all recommended mitigations below.)

Hydrologist/Soils Review: (Describe any special circumstances regarding potential impacts to water quality. List all recommended mitigations below.)

Archaeologist Review (only required if treatment involves ground disturbance): (Describe any special circumstances regarding historical or cultural significance. List all recommended mitigations below.)

Signatures:

_____	_____	_____
Botanist/Ecologist	Wildlife Biologist	Aquatic Biologist
_____	_____	
Archaeologist	Hydrologist/Soil Scientist	

Appendix M

Federal Register. 1999. Presidential Documents. Executive Order 13112 of February 3, 1999. Invasive species. Volume 64, No. 25, pp. 6183-6186.

Presidential Documents

Executive Order 13112 of February 3, 1999

Invasive Species

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 *et seq.*), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa *et seq.*), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 *et seq.*), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. *Definitions.*

(a) ''Alien species'' means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) ''Control'' means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) ''Ecosystem'' means the complex of a community of organisms and its environment.

(d) ''Federal agency'' means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) ''Introduction'' means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) ''Invasive species'' means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) ''Native species'' means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) ''Species'' means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) ''Stakeholders'' means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, non-governmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) ''United States'' means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Sec. 2. *Federal Agency Duties.* (a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Sec. 3. *Invasive Species Council.* (a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Sec. 4. *Duties of the Invasive Species Council.* The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

Sec. 5. *Invasive Species Management Plan.* (a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no

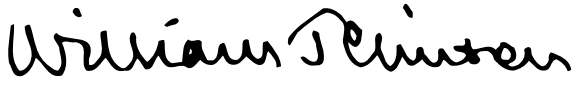
less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Sec. 6. *Judicial Review and Administration*. (a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.



THE WHITE HOUSE,
February 3, 1999.

[FR Doc. 99–3184
Filed 2–5–99; 8:45 am]
Billing code 3195–01–P

Appendix N

USFS. Undated-b. Ecological, social, and economic considerations. Travel analysis process. George Washington and Jefferson National Forests, USDA Forest Service, Roanoke, Virginia. Available at: https://www.fs.usda.gove/Internet/FSE_DOCUMENTS/fseprd537422pdf.

APPENDIX B
ECOLOGICAL, SOCIAL, AND ECONOMIC CONSIDERATIONS
George Washington and Jefferson National Forests
Travel Analysis Process

Ecosystem Functions and Processes (EF)

EF 1: What ecological attributes, particularly those unique to the region, would be affected by roading of currently unroaded areas?

Road construction in currently unroaded areas could facilitate the movement of non-native invasive species, particularly non-native invasive plants, into areas where they do not currently occur (See EF2). Road construction could potentially increase the sediment load to streams. Road construction can fragment habitat for some species, but this effect is considered minor for most species on the Forests, particularly for the low maintenance level roads primarily constructed for management activities. Road construction could allow additional restoration activities, such as creation of grasslands, shrublands, open woodlands and regenerating forests which are not currently at the levels desired in many ecological systems on the Forests.

EF 2: To what degree do the presence, type, and location of roads increase the introduction and spread of exotic plant and animal species, insects, diseases, and parasites? What are the potential effects of such introductions to plant and animal species and ecosystem function in the area?

The road system can be a main contributor to the establishment and spread of non-native invasive plants. Some species are brought in with fill material, planted for erosion control, or brought in with forest visitors using the roads. Other species are spread with the movement of forest visitors from one location to another and by road maintenance operations such as grading and mowing. Once established, some species are persistent and spread rapidly out into the surrounding landscape and replace native plants and associated insects. These invasives may displace the habitat of existing native species. Ecosystem function can be dramatically altered by the introduction and spread of invasives and our road systems may provide a major opportunity for introduction of new species from other states, areas, or nearby infestations.

Potential effects can be reduced through management activities. The use of Category 1 Species is prohibited. The establishment or encouragement of Category 2 Species is prohibited in areas where ecological conditions would favor invasiveness and is discouraged elsewhere. Projects that use Category 2 Species should document why no other (non-invasive) species will serve the purpose and need. A contractor's sources of fill, soil, shale, and related materials will be pre-approved. Contractors will submit a description of the source. The project inspector or a qualified designee will inspect the supply source. Use of the source will be prohibited if contaminated by transferable agents of invasive species. Forest sources of fill, borrow or road surfacing material will be examined for NNIP and treated as necessary to prevent transfer of invasive plants to other parts of the Forest. Mechanical equipment, such as that used for logging, mowing, fire fighting and earth moving (including road graders), should be free of soil, seeds, and other attached material prior to coming on the Forest or being moved from areas on the Forest with NNIP infestations to areas free from noticeable infestations. Such equipment should be examined by qualified Forest Service personnel before allowed on the Forest.

EF 3: To what degree do the presence, type, and location of roads contribute to the control of insects, diseases, and parasites?

The main situation where roads can contribute to the control of insects and diseases is with southern pine

beetles. Treatment of outbreaks of southern pine beetles needs to be done quickly, so often the only areas where treatment can be done is in areas that already have road access.

EF 4: How does the road system affect ecological disturbance regimes in the area?

Roads allow access for timber management that can mimic disturbance regimes that create openings and regenerating forests. Roads also provide access for prescribed burning and wildfire control. They provide fuel breaks to manage fires.

Road access increases risk for human-caused fires on the Forest by dispersing people. Roads also allow rapid response opportunities for fire suppression. Even though it is acknowledged that road access in the Forest increases risk for human caused fire, this risk can be minimized through administrative means such as smoking and campfire restrictions and complete closures during high and extreme fire danger periods. Forest Service gates may be used to restrict public access while allowing for suppression-resource access.

EF 5: What are the adverse effects of noise caused by developing, using, and maintaining roads?

Given the interspersed nature of private lands and National Forest System lands and current extent of Forest Service and state roads, it is very difficult to escape the noise of roads on this Forest. This is not considered to be an important issue for transportation analysis.

Aquatic, Riparian Zone and Water Quality (AQ)

AQ 1: How and where does the road system modify the surface and subsurface hydrology of the area?

The roads have three primary effects on hydrologic processes. They intercept rainfall directly on the road surface and cut banks, and intercept subsurface water moving down the hillslope; they concentrate flow, either on the surface or in an adjacent ditch or channel; and they modify water flow from paths that it would otherwise take if the road were not present. Roads can affect peak streamflows depending upon the size of the watershed involved. As a general rule, however, roads extend the drainage network of a watershed and result in quicker flood peaks. In the GWNF, roads constitute a small proportion of the land surface and have relatively insignificant effects on peak flow. Roads do not appear to alter annual water yields within the watershed.

It is likely that all roads on the Forest modify surface hydrology to some degree due to the nature of the road prism on the landscape. The loss of vegetation, compaction of the soil, and modification of the slope all contribute to changes in surface hydrology. These affects are mitigated to various degrees by the design of the road and condition of the road surface. For example, an insloped road would divert surface runoff to the inside of the road where it is concentrated for a given distance until it is diverted off the road prism, where an outsloped road would shed water off the road surface along its length. Condition of the road surface is notable as well since a well-vegetated road surface will typically shed water at a slower rate than a road without a vegetative cover due to increased roughness associated with vegetation.

The type of crossing structure where a road crosses a stream can affect the hydrology. Undersized culverts can restrict high flows resulting in the loss of the culvert and fill material or in the movement of the stream channel to a new location.

AQ 2: How and where does the road system generate surface erosion?

By their nature, all native or aggregate surfaced roads will generate some surface erosion. The amount

depends on factors such as soil type, road surface type, road gradient, road prism, the spacing and effectiveness of drainage structures, traffic use, and maintenance activity. The extent of surface erosion occurring on road cutbanks depends on the steepness, slope length, soil type, and vegetative cover. Road ditches concentrate water flow which generates surface erosion and also increase sediment delivery to streams from road surfaces and road cutbanks. Ditches and culverts that are blocked create surface erosion issues by diverting water flow onto road surfaces.

Native surfaced roads often referred to as unsurfaced roads, generally have the most roadbed erosion because there is no surface to protect the soil particles from rain impact. Commercial gravel surfacing provides a good level of protection to the road surface from rain impact and moderate vehicle traffic. Generally, the addition of gravel, increases the porosity and increases the hydraulic conductivity of the road, which decreases the runoff and associated erosion (Flerchinger and Watts 1987). Gravel also reduces the formation of ruts and reduces water flow path within the roadbed (Foltz and Truebe 1995). Overall properly sized and applied gravel has been shown to result in reductions in erosion of 79 to 97% over unprotected, unsurfaced roadbeds (Swift 1984; Burroughs et al., 1985; Kochenderfer and Helvey 1987). Paved roads rarely experience any erosion of the roadbed, but often direct high amounts of water off the road so that there is more erosion adjacent to the road.

The more erodable a soil is the more the roadbed will benefit from gravel for reducing erosion. The level of erosion reduction from gravel also depends on the size applied, the amount applied, and the erodability of the soil or other material the road is built on. Larger average size of gravel applied to the road will generally result in lower erosion rates, as will greater depths of gravel applied (Swift 1984). It is important to note that while helping to further reduce erosion, larger gravel is more expensive and can cause safety hazards for drivers.

Roadbed erosion primarily occurs through rainsplash movement and sheet erosion just as on exposed soils. Roadbeds erode more readily than typical exposed soils because they have lost soil structure due to extreme compaction (Froelich 1975). Rilling and gullying are also common erosion processes on roadbeds (Novotny and Olem 1994). Traffic volume on a given road, especially those with native and gravel surfacing, can increase the erosion from the roadbed (Reid and Dunne 1984; Sullivan and Duncan1981). Often heavy traffic volume is an indication to increase the durability of the road surface to limestone or pavement. Another solution to the issue of high traffic volume is to restrict traffic by closing or restricting travel on the road. The times for restriction are typically in the spring to avoid periods when roads and trails are on saturated soils that are susceptible to damage.

The steeper the grade of the road the greater the erosion potential from the roadbed (Elliot and Tysdal 1999). The steeper the slope perpendicular to the road the greater the fill slope erosion potential and potential erosion of adjacent areas from excess water draining off the road (Burroughs and King 1989; Soil Survey Staff 1999). Erosion of the fill slope can create unstable conditions in the roadbed or even gullies that extend into the roadbed. Back slope erosion is also greater on steeper slopes perpendicular to the road as runoff from land above the road or from subsurface flow intercepted by the road cut increases velocity on the often-exposed back slope soil. Runoff in the drainage ditch can also cause accelerated erosion if it is allowed to concentrate for great lengths (Burroughs and King 1989). Typically this erosion will occur in the drainage ditch itself, but it may extend into the roadbed or onto the fill slope and land down slope where the drainage ditch runoff is deposited (King 1979; Burroughs and King 1989).

Road maintenance involving ditching and crowning of the road can cause short-term increases in roadbed and drainage ditch erosion as the armored, and sometimes vegetated, surface is displaced. A vegetated drainage ditch has been observed to produce only about 10-20% as much sediment as a freshly graded drainage ditch (Luce and Black 1999). Road construction produces the same high increase in short-term erosion as road maintenance, but also adds new long-term chronic increased levels of erosion (Megahan

and Kidd 1972). The wider a newly constructed or maintained road is the more effect it will have on runoff and in turn potential soil erosion.

Even though road maintenance can cause short-term increases in erosion and sedimentation it will typically reduce erosion in the long-term. Road maintenance can range from simple grading to ditching and crowning to adding gravel surface to improving road drainage to stabilizing back and fill slopes. Grading, while bringing up highly erodable fine soil material, can remove ruts, which if left alone would create long flow paths for carrying water that could erode and transport sediment for long distances (Elliot 2000). Ditching and crowning is a form of grading that also pulls sediment out of the drainage ditch along with any vegetation or armoring and incorporates it back into the roadbed. Adding gravel will also reduce rutting and reduce rainsplash erosion of the roadbed (Foltz and Truebe 1995). Gravel also allows a road to hold up better under heavy traffic volumes with less maintenance. Improved drainage will help to avoid concentrated water creating gullies on steep slopes (Weaver et al., 1995; Wemple et al., 1996) and place water in proper locations to avoid increasing the hazard of mass wasting (see AQ3). Drainage of the road can also help to deposit sediment-laden runoff onto low gradient, well vegetated areas where the sediment can settle out before reaching the stream. Back and fill slopes stabilized with rip-rap, slash windrows, geotextiles, erosion mats, straw, etc. are more resistant to erosion and mass wasting (Burroughs and King 1989).
The beneficial effects of road maintenance discussed above are based on the assumption that the road is receiving some level of use. If a road is completely closed off to use it will usually stabilize on its own over time, but it can continue to be a chronic source of increased sediment (Elliot et al., 1996). Often stabilization of sediment inputs can take several decades so decommissioning, which will cause a short-term increase in erosion, is preferred. Decommissioning also has other benefits such as improved hydrological function, restored landform, improved slope stability, and reduced compaction. The decision to allow a closed road to stabilize over time or to decommission it must be site specific as a closed road can be a chronic source of sediment if left alone but sometimes decommissioning a road can create more erosion and sedimentation than it will save (Elliot et al., 1996; Elliot 2000).

AQ 3: How and where does the road system affect mass wasting?

While mass wasting can be a problem on the GWNF it is most often a natural landslide process related to excessive rainfall and can occur across the landscape. However, in some situations roads can trigger mass wasting.

Excavation for road construction on a steep slope can undercut and remove some support from the hillside. In some geologic settings (adverse bedrock structures or weak surficial materials), this undercut and removal of support may lead to failure of the road cut-slope. Or, construction of a road fill or log landing fill on a steep slope may lead to a failure of the fill-slope. Slope failures of road cut-slope or fill-slope occur occasionally, generally during intense rainstorms when natural landslides also occur. A geologic hazard related to management activities of special concern are debris flows caused by failure of fill slopes. Destructive debris flows that can sweep hundreds or thousands of feet down slope can be caused not only by failure of natural slopes but also by failure of fill slopes (roads, log landings). On the National Forests of North Carolina in September 2004 Hurricanes Frances and Ivan triggered many road fill failures on Forest Service roads as well as on the Blue Ridge Parkway that resulted in debris flows gouging destructive paths long distances, endangering people and damaging infrastructure (Collins, T.K., 2008). Road fills (or log landings fills) on steep slopes may be marginally stable, but vulnerable to failure during intense rainstorms. As demonstrated in September 2004, road fills on a steep slope high on a mountain are a special concern because of the snowball effect as the fill failure transforms to a debris flow and bulldozes the soil, weathered rock, and trees into a larger destructive mass as it gouges down the mountainside. Such debris flows caused by fill failures can travel a mile or two down slope just like

debris flows caused by natural slope failures, endangering people and infrastructure down slope and in the valleys.

AQ: 4 How and where do road-stream crossings influence local stream channels and water quality?

All road-stream crossings have the potential to influence stream channels and water quality. These crossings represent direct interaction of roads and streams and serve as a primary conduit for road-related erosion and storm drainage to reach streams. Road-stream crossings can physically change the alignment of stream channels for short distances. Long-term contributions of sediment into streams can result in geomorphic changes to channel alignment and substrate condition. Increases in storm runoff associated with roads can also result in channel alignment and substrate changes such as downcutting.

In most cases culverts have more of an influence on stream channels and water quality than do bridges or bottomless culverts. A culvert can modify flow energy as streamflow moves from the channel to the pipe and into the channel again. Streamflow at a culvert that is too small to effectively pass flow produced by a runoff event or that becomes plugged by debris or sediment can exceed the culverts inlet capacity and result in overtopping of the inlet and thus a rise in water level on the fillslope. When doing so, the risk of fillslope failure and flow diversion out of the channel increases, as does the potential for erosion and sedimentation. When road crossings overtop and the crossing does not allow water to pass over the road fill and back into the channel below the crossing, flow can be diverted away from the crossing and down the road ditch or running surface. Thus, erosion can occur on the road prism and/or downslope of the road as it leaves the road. If this diverted flow were to travel down to a neighboring stream crossing then additional adverse impacts could occur at the crossing and in the receiving stream channel.

Stream crossings without a bridge or culvert such as ford crossings can allow greater sediment delivery to streams because of the direct connection from a road to a stream as compared to culvert crossings or bridges. However, fords with solid substrate in wide channels can also reduce the amount of fill brought in to cover a culvert, or provide support to bridge abutments.

AQ 5: How and where does the road system create potential for pollutants, such as chemical spills, oils, deicing salts, or herbicides, to enter surface waters?

Forest Service roads generally have a low potential for pollutants to enter surface waters. However, many state roads traverse the GWNF and the use of deicing salts and the use of these roads by vehicles hauling materials that could cause pollution have a greater potential for problems.

AQ 6: How and where is the road system "hydrologically connected" to the stream system? How do the connections affect water quality and quantity?

The road system is connected to streams at stream crossings, roadside ditches that empty directly into streams, drainage turnouts, and at some locations, by road surfaces that lie adjacent to streams and direct runoff and sediment from roadbed/fill surfaces to streams. Stream crossings and insloped roads with drainage ditches are the principle means of hydrologic connectivity within the analysis area. The primary consideration (on national forest lands) of hydrologic connectivity on water quality is the input and transport of sediment (See AQ (1) and AQ (4)

Some roads on the Forest existed before the lands became part of the National Forest System. Often these roads are located in the valley bottoms and have frequent crossings of the streams. These roads are the most hydrologically connected on the Forest.

AQ 7 What downstream beneficial uses of water exist in the area? What changes in uses and demand

are expected over time? How are they affected or put at risk by road-derived pollutants?

Downstream beneficial uses of water on the GWNF include: drinking water for over 30 communities, habitat for the endangered James spinymussel, habitat for native brook trout, habitat for other sensitive aquatic species, fishing, and swimming.

AQ 8: How and where does the road system affect wetlands?

There are no known locations where the road system is affecting wetland conditions or function.

AQ 9: How does the road system alter physical channel dynamics, including isolation of floodplains, constraints on channel migration, and the movement of large wood, fine organic matter, and sediment?

The road system can alter physical channel dynamics by increasing runoff and sediment delivery to affected streams. Sediment entering streams can reduce pool depths and contribute to changes in channel substrate (i.e. embeddedness). Stream crossings can retard or prohibit the movement of large woody debris, fine organic matter and sediment. Areas located within the riparian corridor tend to isolate the floodplain associated with streams and impede or prevent natural channel migration.

"Stream channels are dynamic. They migrate within historic floodplains, eroding the bed and banks in one place while aggrading the bed and building new banks in other places. Streams also transport and deposit large pieces of woody debris and fine organic matter, and provide physical structure and diverse aquatic habitat to the stream channel. When roads encroach directly on stream channels, these processes can be modified. Wood and sediment can be trapped behind stream crossings, reducing downstream transport and increasing the risk of crossing failure. Road alignment and road fills can isolate floodplains, constrict the channel, constrict channel migration, and simplify riparian and aquatic habitat. In some places, road encroachment can divert streamflow to the opposite bank, thereby destabilizing the hillslope and resulting in increased landsliding." (USDA-FS 1999)

Road-stream crossings are locations where the movement of large wood, fine organic matter, and sediment are often modified. Fills within the floodplain typically characterize road-stream crossings and culverts that can constrict flood flows. During flood events when flows inundate the floodplain, a road crossing typically creates a "bottle neck" condition and a temporary impoundment as the water funnels through the culvert or bridge opening. During these situations, streamflow is slowed upstream of the crossing and the potential for deposition of entrained material increases, thereby reducing the likelihood of downstream transport. As a result, channel-forming processes can be altered.

AQ 10: How and where does the road system restrict the migration and movement of aquatic organisms? What aquatic species are affected and to what extent?

Fish, mussels, reptiles, and amphibians are susceptible to blockage at road crossings. Low water fords, bridge aprons, and culvert pipes may include artificial cascades or waterfalls that are beyond the jumping and swimming capabilities of many aquatic species. These drops may block movements primarily during low flows. The shallow laminate flows of aprons or the concentrated flow of culverts can impede aquatic organism movements at either low or high flows.

Road crossings and other artificial barriers may restrict fish access to prime habitat. Smaller stream fishes may not migrate across large distances, however, many species rely on seasonal upstream movements to access more suitable spawning habitat and to replenish populations that have declined due to natural or human caused disturbance. Since mussels rely on fish hosts during their early life history, mussels may

also be limited in their distribution due to artificial barriers. Young mussels attach themselves on to fish. In this way, mussel populations can re-populate upstream areas that could otherwise become devoid of mussels over years of downstream drift or periodic floods and drought. Amphibians and reptiles may also be affected by road crossings. Semi-aquatic species such as turtles and frogs may be forced to travel overland and across roadways where they are susceptible to predation and road kill. Even slow moving snails and salamanders can be affected since they may be attracted to the cobble cover and hardened substrates present at some low water fords. Their concentration at crossings can result in elevated road mortality and deplete local populations.

A comprehensive fish passage assessment has been completed for parts of the GWNF.

AQ 11: How does the road system affect shading, litterfall, and riparian plant communities?

Most of our roads are located outside of riparian areas and do not significantly alter shading of the riparian areas. Short stretches of riparian communities may have altered species composition due to increased sunlight from road crossings.

AQ 12: How and where does the road system contribute to fishing, poaching, or direct habitat loss for at-risk aquatic species?

The road system allows the public to access our streams and lakes for recreational opportunities. Habitat loss for aquatic species is most likely to come from passage barriers created by culverts and low water crossings and/or additional sedimentation caused by poor road maintenance or road location.

AQ 13: How and where does the road system facilitate the introduction of nonnative aquatic species?

Roads give the public access to our waters and they allow the possible introduction of aquatic NNIS into streams and lakes. However, the main NNIS of current concern is Didymo and its introduction is more closely related to the fishery (coldwater releases from impoundments) than to road access.

AQ 14: To what extent does the road system overlap with areas of exceptionally high aquatic diversity or productivity or areas containing rare or unique aquatic species or species of interest?

Many watersheds in the GWNF support high aquatic diversity. The road system is no more, nor no less in extent in the higher diversity watersheds.

Terrestrial Wildlife (TW)

TW 1: What are the direct effects of the road system on terrestrial species habitat?

The Forest road system and human use of those roads alters terrestrial species habitat. Direct effects include disruption of normal animal behavior and habitat use, isolation of small, low-mobility species populations, fragmentation of habitats, and increased parasitism, mortality and predation. Some potentially beneficial effects of roads include provision of exposed soil and gravel to birds to aide in digestion and dusting areas to aide birds in feather maintenance and parasite control, and improved brood rearing habitats along road edges through increased arthropod production. Such necessary habitat features are often limiting in forested habitats. Roadsides provide potential habitat for plant species that require early successional herbaceous habitats.

Roads may act as barriers to wildlife movement. The effectiveness of the road as a barrier is a function of the road width, traffic density, and mobility of the species. A forest road may be wide enough to increase

predation on individuals or to inhibit dispersal of individuals depending on width of cut-and-fill slopes and maintained right-of-ways. Fragmentation of a population leading to isolation of individuals and eventual loss of population viability could result from road construction through sensitive habitat.

Levels of human access within bear habitat determine the degree of negative effects on bears (Beringer 1986; Brody and Pelton 1989). Generally, high bear population densities are associated with areas of low open road density (SAMAB 1995:87). Low-traffic roads and trails are used by bears as travel ways and provide the benefit of additional edge and associated soft mast, whereas high traffic volumes have a negative impact (B. Fletcher, pers. comm.). Effects vary based the duration and time of year the road or trail is open for use and the number and type of recreation users present.

TW 2: How does the road system facilitate human activities that affect habitat?

Many species including whitetail deer, turkey, and others utilize early successional forest habitats frequently interspersed with mature forest. In these habitats the canopy is opened, the forest structure is frequently disturbed (often by fire), and herbaceous or shrub vegetation often proliferates. Public demand for hunting opportunity is high. Game species, many songbirds, and many showy and desired plants are benefited by management actions producing early successional conditions. Hunting, wildlife viewing, and other wildlife-based recreation are facilitated by access provided by roads, and many desirable wildlife species populations are increased by forest management practices that utilize road systems.

Roads, including the rights-of-way associated with them, are narrow corridors of early successional habitat through the Forest providing areas where populations of game species are enhanced. The road system provides access for forest management. Roads allow access to permanent openings managed as early successional herbaceous habitats. Additionally, roads may serve as firebreaks during prescribed burns. During wildfires, where one of the goals is to protect wildlife habitat, roads provide access for firefighters and firebreaks that limit the extent of damage.

Roads facilitate collection (both legal and illegal) of Forest products including timber, firewood, plants, and animals. Timber sale and firewood areas are designated by the Ranger Districts and are designed to have minimal adverse impacts on most wildlife species while providing improved habitat for many species.

TW 3: How does the road system affect legal and illegal human activities? What are the effects on wildlife species?

Forest road systems facilitate legal hunting, which is an important wildlife management tool. In addition, road access supports activities such as wildlife viewing and nature photography. Poaching (illegal take of wildlife) is closely associated with roads. Wildlife is often drawn to roadsides to feed on herbaceous plants, which may be limited to roadsides in areas of mature forest. This puts them at risk from poachers illegally shooting from roads. Increases in open road miles diminish the effectiveness of a fixed number of law enforcement officers, and increase poaching opportunities.

Roads allow people access to the Forest for illegal dumping, which can be dangerous to indigenous animals that might ingest it, and it may also attract nuisance wildlife (crows, rats, feral cats and dogs, nuisance bears, etc.).

Roads can serve as access points for illegal use of off-road vehicles, arson, and marijuana plots.

TW 4 How does the road system directly affect unique communities or special features in the area?

Because rare communities and special features are usually discreet, small areas, poor road location or construction could directly destroy or reduce unique communities and special features. Well-located roads may provide necessary access for monitoring and habitat improvements.

Economics (EC)

EC 1: How does the road system affect the agency's direct costs and revenues? What, if any, changes in the road system will increase net revenue to the agency by reducing cost, increasing revenue, or both?

Refer to Report Section, tab 1 in TAP spreadsheet.

EC 2: How does the road system affect the priced and non-priced consequences included in economic efficiency analysis used to assess net benefits to society?

The management of the road system involves decisions to build new roads, reconstruct roads, perform maintenance on some roads and not others, decommission roads, or temporarily close them if they are no longer needed or are causing resource damage.

Construction of new roads, although improving access to an area (a benefit to some), may diminish the desired natural and remote character associated with the area and would reduce its passive use value to some visitors.

Passive use values include features society values simply because they exist without actually using them or they expect them to be preserved for others to use and enjoy (a scenic landscape, wilderness, or an endangered plant or animal). They are also features valued for preservation (cultural resources and historic sites).

Decommissioning and/or closing roads may be necessary to meet budget and funding constraints or to prevent resource damage, but may diminish access to areas that are important to certain users of forest resources. People with a strong attachment to a place, activity, or road may consider it a loss in value unless they are willing and able to find, and adapt, to substitute experiences.

The road users that contribute the most significant economic benefits are those who visit the area for recreation-related activities such as:

- Driving for pleasure
- Camping
- Hunting - All open and seasonally opened roads provide access for hunting.
- Hiking/ Mountain Biking/Equestrian Use
- Special Events, such as long-distance trail rides
- Fishing
- Wildlife viewing - The open roads are used by visitors for this activity

Based on the activities that the road system accommodates, the following consequences are realized:

Priced:

- Sale of commodities such as timber, minerals, firewood
- Payments to states (counties)
- Less cost due to convenient access for research, inventory, and monitoring

- Road development and maintenance
- Liability, compliance with safety standards
- Maintenance of trails and recreation-related sites
- Fire suppression
- Resource management
- Control of invasive species
- Mitigation of resource damage from roads
- Law enforcement
- Special use permits, such as for utility corridors and communications sites

Non-priced:

- Resource protection on NFS lands as well as adjacent private lands from fire and non-native species infestations,
- Wildlife and watershed management to preserve the "passive" value that the public assigns to natural resources
- Access to public land and its resources
- Noise and air pollution
- Scenery
- Water quality
- Fish habitat, access for stocking
- Effect of road density on wildlife
- Litter

Typically, the road system increases the value of both priced and non-priced commodities, because without access these items have less value or cost more to obtain. The most notable exception to this is commodities that have an intrinsic value because they are difficult to access, such as a wilderness or remote area.

The type of experience society desires in the study area and its associated value depends in large part on whether or not there are roads, their density, their condition, and whether or not they are open to motor vehicle use. The consequence may be a net benefit or a cost depending on what value the public assigns to the type of experience they desire.

Road management activities that benefit some members of society by enhancing their quality of life, may negatively impact resources that other members value for their quality of life. These may include impacts to resources such as soil, water, habitat, scenic beauty, or a reduction in value that people assign to an area such as limited accessibility or solitude. Public input is needed to provide information to evaluate the tradeoffs being considered and will help assign "value" to non-priced consequences.

EC 3: How does the road system affect the distribution of benefits and costs among affected people?

The accessibility to resources in the study area is important to the local economy and commerce associated with forest visitors and has an economic influence on many counties. Since counties do not collect property taxes on federal land, activities that generate other tax revenue such as sales tax are beneficial to the community.

Forest roads are the primary means of access to forest resources. Changes to the road system and/or in road management can affect long-established access and use patterns, lifestyles, recreation activities, forest resource-related businesses, the collection of forest products, fire suppression, and the distribution of recreational opportunities available to users. These effects can change the distribution benefits and

costs for all users.

Construction, maintenance, or decommissioning of roads in the area is not likely to have a significant long-term impact on the economic benefits derived from recreation activities unless there is a significant reduction in the total mileage of roads that provide access for this use.

The road system distributes the following economic benefits to businesses of various sizes as well as individuals:

- Income from the sale of gas, food, lodging, supplies, and souvenirs.
- Employment under Government contracts for:
    - road maintenance
    - control of invasive species
    - vegetation management
    - trail maintenance
    - watershed management
    - fire suppression
    - maintenance of recreation sites

The road system creates different benefits and costs to people who use vehicles for travel within the area than to visitors who travel on foot or by other non-motorized methods. For those who choose non-motorized forms of transportation, the economics of the road system may cost more in terms of aesthetic values, air and noise pollution, and conflicts with motorized vehicle use.

Reduced road mileage and/or maintenance can lead to unbalanced recreation opportunities among users and directly affect the distribution of economic benefits and costs to the region. Closing roads would limit or eliminate access to those who are unable or unwilling to walk long distances, which can have greater impacts as the population ages. Census projections indicate that nearly 1 in 5 Virginians will be 65 or older by 2030. Reduced access could increase the cost of resource removal, which usually requires mechanized equipment. This could have economic impacts for the local communities, which may depend on convenient access for employment opportunities.

In contrast, improved road access can increase the efficiency and effectiveness of fire-suppression activities, but can also contribute to an increase in the number of human-caused fires in the area. Closing or restricting roads to minimize traffic could be a benefit by reducing fires and keeping the road in a condition that facilitates use by firefighting equipment.

State roads between communities affect how the benefits and costs associated with use of the area are distributed beyond the immediate communities. The GWNF is often located on long ridges and higher elevations, with private lands adjacent in the valleys and lower elevations. A number of Forest roads serve as local connector routes for commuters, school bus routes and emergency services. Closure of some roads could greatly increase local travel needs.

Commodity Production - Timber management (TM)

TM 1: How does the road spacing and location affect logging system feasibility? How does the road system affect managing the suitable timber base and other lands?

Much of the transportation network has been built for and through timber sales so the system serves the timber resource well. Planning has considered future needs as well as immediate sale needs. A few large blocks of land suitable for timber production is not currently roaded, but collector road access is generally adequate. Timber sales may require the opening of closed system roads, construction of temporary roads

and construction of very limited mileage of permanent roads to extend access to some areas suitable for timber production.

TM 2: How does the road system affect managing the suitable timber base and other lands?

See TM1

TM 3: How does the road system affect access to timber stands needing silvicultural treatment?

See TM 2.

Commodity Production - Minerals Management (MM)

MM 1: How does the road system affect access to locatable, leasable, and salable minerals?

Only about 12,000 acres of the GWNF are currently under lease for gas and oil. If gas deposits are found to be commercially feasible for development, additional roads will likely be needed for exploration and development. The road system is the only means of access for public use of salable minerals (mineral materials). The Forest has acquired lands status, and so, locatable mineral laws do not apply on the Forest.

Commodity Production - Range Management (RM)

RM 1: How does the road system affect access to range allotments?

The existing road system adequately provides access to the current range allotments.

Commodity Production - Water Production (WP)

WP 1-3: How does the road system affect access, constructing, maintaining, monitoring, and operating water diversions, impoundments, and distribution canals or pipes, municipal watersheds, or hydroelectric projects?

Several Forest roads are used to access the Bath County pumped storage project on the Warm Springs Ranger District. These roads are managed under a long term special use permit.

Commodity Production - Special Forest Products (SP)

SP 1: How does the road system affect access for collecting special forest products*?*

Firewood is the main special forest product collected on the GWNF. The road system adequately meets the needs of firewood collection.

Special Use Permits (SU)

SU 1: How does the road system affect managing special-use permit sites (concessionaires, communications sites, utility corridors, and so on)?

About 50 miles of the current road system are necessary for managing special use sites and meeting the special use needs are the primary purpose of these roads.

General Public Transportation (GT)

GT 1: How does the road system connect to public roads and provide primary access to communities?

Primary accesses into and out of the GWNF is provided by State or Federal Highways. These roads are open year-round and designed for both passenger cars and trucks. These roads connect to arterial, collector, and some local Forest Service roads, where traffic is dispersed in the Forest for a variety of uses. Some county roads and state highways traverse into or through the National Forest. There is much interspersed private and federal land ownership, so many National Forest roads provide access to and from private lands.

GT 2: How does the road system connect large blocks of land in other ownership to public roads?

There is much interspersed private and federal land ownership, so many National Forest roads provide access to and from private lands. About 100 miles of the current road system provide this type of access and are being considered for designation as Forest Highways.

GT 3: How does the road system affect managing roads with shared ownership or with limited jurisdiction? (RS2477, cost share, prescriptive rights, FLPMA easements, FRTA easements, DOT easements)

Rights of access by law, reciprocal rights, or easements are recorded in Forest files and county courthouse documents. The Forest recognizes these rights and works with the owners to preserve access while protecting the natural resources and facilities on adjacent National Forest Lands.

GT 4: How does the road system address the safety of road users?

Road System: In 1975, the Forest Service developed a Memorandum of Understanding with the Federal Highway Administration that required the Forest Service to apply the requirements of the National Highway safety program, established by the Highway Safety Act, to all roads open to public travel. In 1982, this agreement was modified to define "open to public travel" as "those roads passable by four-wheeled standard passenger cars and open to general public use without restrictive gates, prohibitive signs…" Most roads maintained at level 3, and 4 meet this definition. Design, maintenance, and traffic control on these roads emphasize user safety.

The largest proportions of road maintenance and improvement funds allocated to the Forest are spent on reporting and general health for these higher standard roads. Safety work such as surface maintenance, roadside clearing and installation and maintenance of warning and regulatory signs are performed on an annual basis. Traffic control signing follows standards set forth in the Manual on Uniform Traffic Control Devices (MUTCD).

Administrative Uses (AU)

AU 1: How does the road system affect access needed for research, inventory, and monitoring?

People interested in conducting research, inventory, and monitoring on the GWNF have not identified access as an issue. Research has been performed on the forest in the past and we have received no negative comments related to our road system due to it. The Forest Service system provides adequate access for research, inventory, and monitoring.

AU 2: How does the road system affect investigative or enforcement activities?

Unlawful activities are often centered on roads. Illegal use of closed roads, unlawful collection of forest

products, mud bogging, drug use/manufacturing and the dumping of trash along roads are just a few of these activities. The same open and closed roads that provide access for these illegal activities are the roads that provide access for law enforcement to investigate these activities.

The road system provides access to the George Washington and Jefferson National Forests for a variety of purposes. As long as there is access to the forest, illegal activities can occur.

Protection (PT)

PT 1: How does the road system affect fuels managements?

Roads are a key element in planning and implementing a fuels management program. Roads provide critical access for fuels management activities (prescribed burning). Existing roads are used as control features on many of the prescribed burns that are implemented on the Forest. Roads are preferred control features because they allow lines to be easily patrolled, rapid response to spot fires, and minimal ground disturbance is required. The current forest road system has been adequate to meet the needs of the fuels management program. It has not been necessary to consider construction of a road strictly for fuels management.

In general, decommissioning roads will restrict access during prescribed burns. Limited access will lead to increased response times. In the absence of an existing road, dozer lines are used. However, using these types of lines will require the need for additional ground disturbing activities to create an adequate control line. Most roads serve as an additional control feature that allows managers more flexibility for contingency planning for burn units. Decommissioning roads could also increase the size of escapes due to limited patrolling opportunities and the limited ability to respond to spot fires with fire suppression equipment.

PT 2: How does the road system affect the capacity of the Forest Service and cooperators to suppress wildfires?

The current road system has not presented any problems in the Forests' ability to suppress wildfires. There have not been any critical areas identified that need roads specifically for wildfire suppression purposes. The forest continues to utilize all roads to the fullest extent possible during wildfire suppression efforts.

In general, decommissioning roads will restrict access of wildfire personnel and equipment. These restrictions may lead to increased fire size and a heightened probability that severe resource damage may occur. Most roads serve as excellent control features as well as escape routes for firefighting personnel. Conversely, road construction may increase accessibility of wildfire personnel and equipment, limit fire size, and provide additional safety during wildfire suppression.

Roads are often used as firebreaks and control lines for wildfire control. Using roads as firebreaks can be a particularly effective, efficient and low cost method of addressing the issues of wildfire hazards, and in the management of fuels. Most roads are adequate for firefighting equipment to travel on. Closed and gated classified roads may need minimal dozer work to be utilized for equipment movement.

PT 3: How does the road system affect risk to firefighters and to public safety?

Roads serve two main functions during wildfire suppression efforts. First, they serve as access routes to the fire. Second, they serve as excellent escape routes for firefighters as well as the public. In the wildland/urban interface (WUI), roads should be designed, or upgraded, to allow for the access and egress

of larger protection equipment. Most forest roads are able to accommodate tandem axle dozer transports as well as smaller, brush-type engines used by the Districts. Roads can greatly increase the safety of firefighters. Roads can also be used by arsonists to set fires. Higher standard roads may also increase the risk of firefighter/public conflict due to increased volumes of traffic.

Recreation – Unroaded Recreation (UR) and Roaded Recreation (RR)

UR 1: Is there now or will there be in the future excess supply or excess demand for roaded or unroaded recreation opportunities?

Recreation supply and demand is discussed in Chapter 3 of the Draft Environmental Impact Statement (DEIS) for the Draft Revised Land and Resource Plan of the GWNF.

Public land ownership is interspersed in large tracts of privately-owned and inhabited land. There are a number of miles of country roads throughout the area. Visitors using forest roads are often hunters, hikers, bikers, and people driving the backcountry for pleasure. Visitors are generally a local audience traveling near their "back yards," a few miles from their property. The remote nature of the public lands in the area, with few or a moderate number of forest roads provides a sense of remoteness and solitude for people in vehicles. Users enjoy roaded access to their National Forest and any road closures are met with opposition from those that use the road. The GWNF is currently well roaded and provides many opportunities to those who enjoy roaded access.

The current level of wilderness, remote backcountry (remote highlands), the National Scenic Areas and other unroaded areas appear to provide an adequate amount of unroaded recreation opportunities.

The increase in development on adjacent private lands will increase the demand for all types of recreation on the GWNF, including roaded and unroaded recreation.

UR 2: Is developing new roads into unroaded areas, decommissioning of existing roads, or changing the maintenance of existing roads causing substantial changes in the quantity, quality, or type of recreation opportunities?

Depending on the extent that new roads penetrate into the interior of unroaded areas, new road construction could cause changes in the quantity or quality of unroaded recreation. However, new road construction around the perimeter of unroaded areas would not cause any substantial change in the quality, quantity or type of unroaded recreation opportunities. o Additional decommissioning could enhance some of these unroaded recreation opportunities. Changing maintenance levels will not substantially cause a change in quantity, quality or type of recreation opportunities, however it could result in a change in the number of visitors engaging in recreation opportunities on the national forest. Increased maintenance levels may result in increased visitation; decreased maintenance levels may result in decreased visitiation, particularly to front-country destinations such as developed recreation sites where easy access is anticipated and expected.

UR 3: What are the adverse effects of noise and other disturbances caused by developing, using, and maintaining roads on the quantity, quality, and type of unroaded recreation opportunities?

Road development and the sounds of passing vehicles diminish the sense of solitude and remoteness of an area, but provides for more access into more areas of the Forest.

UR 4: Who participates in unroaded and roaded recreation in the areas affected by constructing, maintaining, and decommissioning roads?

All of the Forest users participate and nearly all enjoy some level of both roaded and unroaded recreation. New road construction is very limited on the GWNF and does not generally affect the major unroaded areas on the Forest.

UR 5: What are these participants' attachments to the area, how strong are their feelings, and are alternative opportunities and locations available?

Attachment to the main unroaded areas of the GWNF is high among a number of user groups. Alternative unroaded opportunities are available on the Jefferson National Forest, Monongahela National Forest, and Shenandoah National Park. However, of the three, the GWNF is the largest provider of unroaded recreation opportunities. Attachment to roaded areas is also high. There are many alternative locations for roaded recreation opportunities including nearby national forests, national parks, Virginia and West Virginia state parks, and parks and greenways provided by cities and counties.

Passive Value (PV)

PV 1: Do areas planned for road constructing, closure, or decommissioning have unique physical or biological characteristics, such as unique features and threatened or endangered species?

Any project proposing road construction, closure or decommissioning is subject to environmental analysis for effects to unique, physical or biological characteristics, such as unique features and threatened, endangered and sensitive species. This analysis will be conducted at the project level.

PV 2: Do areas planned for road construction, closure, or decommissioning have unique cultural, traditional, symbolic, sacred, spiritual, or religious significance?

The issues of cultural, traditional, symbolic, sacred, spiritual or religious significance have not been common on road construction projects, except in a general context. Any project proposing road construction, closure or decommissioning is subject to analysis for effects to cultural resources. This analysis will be conducted at the project level.

PV 3: What, if any, groups of people (ethnic groups, subcultures, and so on) hold cultural, symbolic, spiritual, sacred, traditional, or religious values for area planned for road entry or road closure?

See PV2

Social Issues (SI)

SI 1: What are people's perceived needs and values for roads? How does road management affect people's dependence on, need for, and desire for roads?

Many people view roads as beneficial to their experience and to forest management.Roads are used to transport goods and people and access recreation and commercial opportunities. Well-maintained roads facilitate recreation and other experiences; poorly maintained roads make these experiences unpleasant, difficult, or impossible. During the Fiscal Year 2006 National Visitor Use Monitoring project, over 90% of recreation visitors to the George Washington and Jefferson National Forests who completed a satisfaction survey indicated that national forest roads were either very important or important to them.

However, roads are not always viewed as beneficial. Many people feel that the National Forests have too many roads and that no new road construction is necessary.

SI 2: What are people's perceived needs and values for access? How does road management affect people's dependence on, need for, and desire for access?

People's needs and values for access are diverse. It ranges from people who want to be able to access all areas of the National Forest on motorized vehicles to people who want limited access due to a desire for solitude or concerns about environmental impacts as well as those who are dependent on forest access for their livelihoods. Access to developed sites, residences, and commercial sites is important to many who use the forest transportation system.

Recreation access has been a controversial issue. While nearly all people use a motor vehicle to access the National Forest, the extent of the access can be an emotional issue. For people who want a non-motorized experience while immersed in the environment for hiking, mountain biking, horseback riding, or birding, motor vehicles can be an intrusion. For people who choose to experience the forest through motorized recreation, increased access improves their experience by providing a range of opportunities and challenges.

SI 3: How does the road system affect access to paleontological, archaeological, and historical sites?

Roads give greater access to these sites and as a result, can provide opportunities for studying, learning about, and enjoying our natural history and cultural heritage. However, this greater access and the probable increased visitation can make sites more susceptible to unintentional physical damage and intentional looting and vandalism.

SI 4: How does the road system affect cultural and traditional uses (such as plant gathering, and access to traditional and cultural sites) and American Indian treaty rights?

This has not been a significant issue on the GWNF.

SI 5: How are roads that constitute historic sites affected by road management?

This has not been a significant issue on the GWNF.

SI 6: How is community social and economic health affected by road management (for example, lifestyles, businesses, tourism industry, infrastructure maintenance)?

The road system provides access to forest lands for recreation and tourism. It provides access for infrastructure maintenance and contract implementation. Community social and economic health is directly affected by road management decisions on the national forest in varying degrees. Many local citizens use national forest roads for commuting as well as to enjoy the recreation opportunities provided by the national forest. Local communities recognize the importance of the GWNF in their comprehensive plans, which recognize the recreation and tourism benefits of the Forest. These benefits include both the roaded and unroaded opportunities. The Highlands Scenic Tour is a component of the Forest Service National Scenic Byways system. It was established to enhance tourism and interpret the scenic, historic and natural resources of the area.

SI 7: What is the perceived social and economic dependency of a community on an unroaded area versus the value of that unroaded area for its intrinsic existence and symbolic values?

No local communities have identified a dependency on any particular unroaded or roaded areas.

SI 8: How does road management affect wilderness attributes, including natural integrity, natural appearance, opportunities for solitude, and opportunities for primitive recreation?

Road management does not affect wilderness attributes since there are no roads in wilderness areas. If any road construction is proposed in Potential Wilderness Areas, the effects on wilderness character would be evaluated.

SI 9: What are traditional uses of animal and plant species in the area of analysis?

The primary use of animal and plant species is for viewing and hunting.

SI 10: How does road management affect people's sense of place?

"Sense of place" is linked to many different factors that invoke a special feeling or attachment to a certain area. An area's vegetation, views, solitude and recreation or commercial opportunities, among other things, may all contribute to this "sense of place".

In some cases, the road itself facilitates a person's enjoyment of the area by providing a pleasurable driving experience and encouraging a certain type and amount of use. Altering road systems or a decline in road maintenance can disrupt or change long-established patterns of access and use and may result in not meeting visitor expectations. Conversely, some people's "sense of place" is dependent on there being no or limited access to some areas. Building roads in such areas will change the setting, and probably, destroy the "sense of place" of some individuals or user groups.

Civil Rights and Environmental Justice (CR)

CR 1: How does the road system, or its management, affect certain groups of people (minority, ethnic, cultural, racial, disabled, and low-income groups)?

The road system is used by all groups of people. Changes in road management, including closing or decommissioning of any of the roads, would generally have the same effect on minorities, ethnic, cultural, racial groups of people. The disabled could have less access to the National Forest due to road closing and decommissioning. There may be some low-income groups that use the National Forest road system to access gathering, fishing, hunting areas that would be adversely affected by road closure, or decommissioning. These needs need to be further evaluated in project scale analysis.

Appendix O

Federal Register. 2016. Presidential Documents. Executive Order 13751 of December 5, 2016. Safeguarding the nation from the impacts of invasive species. Volume 81, No. 365, pp. 88609-88614.

Federal Register
Vol. 81, No. 236
Thursday, December 8, 2016

Presidential Documents

Title 3—

The President

Executive Order 13751 of December 5, 2016

Safeguarding the Nation From the Impacts of Invasive Species

By the authority vested in me as President by the Constitution and to ensure the faithful execution of the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, (16 U.S.C. 4701 *et seq.*), the Plant Protection Act (7 U.S.C. 7701 *et seq.*), the Lacey Act, as amended (18 U.S.C. 42, 16 U.S.C. 3371–3378 *et seq.*), the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), the Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. 7781 *et seq.*), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control, and to minimize the economic, plant, animal, ecological, and human health impacts that invasive species cause, it is hereby ordered as follows:

Section 1. *Policy.* It is the policy of the United States to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established. Invasive species pose threats to prosperity, security, and quality of life. They have negative impacts on the environment and natural resources, agriculture and food production systems, water resources, human, animal, and plant health, infrastructure, the economy, energy, cultural resources, and military readiness. Every year, invasive species cost the United States billions of dollars in economic losses and other damages.

Of substantial growing concern are invasive species that are or may be vectors, reservoirs, and causative agents of disease, which threaten human, animal, and plant health. The introduction, establishment, and spread of invasive species create the potential for serious public health impacts, especially when considered in the context of changing climate conditions. Climate change influences the establishment, spread, and impacts of invasive species.

Executive Order 13112 of February 3, 1999 (Invasive Species), called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. Executive Order 13112 also created a coordinating body—the Invasive Species Council, also referred to as the National Invasive Species Council—to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the Federal response to invasive species. Past efforts at preventing, eradicating, and controlling invasive species demonstrated that collaboration across Federal, State, local, tribal, and territorial government; stakeholders; and the private sector is critical to minimizing the spread of invasive species and that coordinated action is necessary to protect the assets and security of the United States.

This order amends Executive Order 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations

of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action.

Sec. 2. *Definitions.* Section 1 of Executive Order 13112 is amended to read as follows:

''**Section 1.** *Definitions.* (a) 'Control' means containing, suppressing, or reducing populations of invasive species.

(b) 'Eradication' means the removal or destruction of an entire population of invasive species.

(c) 'Federal agency' means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(d) 'Introduction' means, as a result of human activity, the intentional or unintentional escape, release, dissemination, or placement of an organism into an ecosystem to which it is not native.

(e) 'Invasive species' means, with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.

(f) 'Non-native species' or 'alien species' means, with respect to a particular ecosystem, an organism, including its seeds, eggs, spores, or other biological material capable of propagating that species, that occurs outside of its natural range.

(g) 'Pathway' means the mechanisms and processes by which non-native species are moved, intentionally or unintentionally, into a new ecosystem.

(h) 'Prevention' means the action of stopping invasive species from being introduced or spreading into a new ecosystem.

(i) 'United States' means the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the U.S. Virgin Islands, the Commonwealth of the Northern Mariana Islands, all possessions, and the territorial sea of the United States as defined by Presidential Proclamation 5928 of December 27, 1988.''

Sec. 3. *Federal Agency Duties.* Section 2 of Executive Order 13112 is amended to read as follows:

''**Sec. 2.** *Federal Agency Duties.* (a) Each Federal agency for which that agency's actions may affect the introduction, establishment, or spread of invasive species shall, to the extent practicable and permitted by law,

(1) identify such agency actions;

(2) subject to the availability of appropriations, and within administrative, budgetary, and jurisdictional limits, use relevant agency programs and authorities to:

(i) prevent the introduction, establishment, and spread of invasive species;

(ii) detect and respond rapidly to eradicate or control populations of invasive species in a manner that is cost-effective and minimizes human, animal, plant, and environmental health risks;

(iii) monitor invasive species populations accurately and reliably;

(iv) provide for the restoration of native species, ecosystems, and other assets that have been impacted by invasive species;

(v) conduct research on invasive species and develop and apply technologies to prevent their introduction, and provide for environmentally sound methods of eradication and control of invasive species;

(vi) promote public education and action on invasive species, their pathways, and ways to address them, with an emphasis on prevention, and early detection and rapid response;

(vii) assess and strengthen, as appropriate, policy and regulatory frameworks pertaining to the prevention, eradication, and control of invasive species and address regulatory gaps, inconsistencies, and conflicts;

(viii) coordinate with and complement similar efforts of States, territories, federally recognized American Indian tribes, Alaska Native Corporations, Native Hawaiians, local governments, nongovernmental organizations, and the private sector; and

(ix) in consultation with the Department of State and with other agencies as appropriate, coordinate with foreign governments to prevent the movement and minimize the impacts of invasive species; and

(3) refrain from authorizing, funding, or implementing actions that are likely to cause or promote the introduction, establishment, or spread of invasive species in the United States unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(c) Federal agencies shall pursue the duties set forth in this section in coordination, to the extent practicable, with other member agencies of the Council and staff, consistent with the National Invasive Species Council Management Plan, and in cooperation with State, local, tribal, and territorial governments, and stakeholders, as appropriate, and in consultation with the Department of State when Federal agencies are working with international organizations and foreign nations.

(d) Federal agencies that are members of the Council, and Federal interagency bodies working on issues relevant to the prevention, eradication, and control of invasive species, shall provide the Council with annual information on actions taken that implement these duties and identify barriers to advancing priority actions.

(e) To the extent practicable, Federal agencies shall also expand the use of new and existing technologies and practices; develop, share, and utilize similar metrics and standards, methodologies, and databases and, where relevant, platforms for monitoring invasive species; and, facilitate the interoperability of information systems, open data, data analytics, predictive modeling, and data reporting necessary to inform timely, science-based decision making.

Sec. 4. *Emerging Priorities.* Federal agencies that are members of the Council and Federal interagency bodies working on issues relevant to the prevention, eradication, and control of invasive species shall take emerging priorities into consideration, including:

(a) Federal agencies shall consider the potential public health and safety impacts of invasive species, especially those species that are vectors, reservoirs, and causative agents of disease. The Department of Health and Human Services, in coordination and consultation with relevant agencies as appropriate, shall within 1 year of this order, and as requested by the Council thereafter, provide the Office of Science and Technology Policy and the Council a report on public health impacts associated with invasive species. That report shall describe the disease, injury, immunologic, and safety impacts associated with invasive species, including any direct and indirect impacts on low-income, minority, and tribal communities.

(b) Federal agencies shall consider the impacts of climate change when working on issues relevant to the prevention, eradication, and control of invasive species, including in research and monitoring efforts, and integrate invasive species into Federal climate change coordinating frameworks and initiatives.

(c) Federal agencies shall consider opportunities to apply innovative science and technology when addressing the duties identified in section 2 of Executive Order 13112, as amended, including, but not limited to, promoting open data and data analytics; harnessing technological advances in remote sensing technologies, molecular tools, cloud computing, and predictive analytics; and using tools such as challenge prizes, citizen science, and crowdsourcing.

Sec. 5. *National Invasive Species Council.* Section 3 of Executive Order 13112 is amended to read as follows:

''**Sec. 3.** *National Invasive Species Council.* (a) A National Invasive Species Council (Council) is hereby established. The mission of the Council is to provide the vision and leadership to coordinate, sustain, and expand Federal efforts to safeguard the interests of the United States through the prevention, eradication, and control of invasive species, and through the restoration of ecosystems and other assets impacted by invasive species.

(b) The Council's membership shall be composed of the following officials, who may designate a senior-level representative to perform the functions of the member:

(i) Secretary of State;

(ii) Secretary of the Treasury;

(iii) Secretary of Defense;

(iv) Secretary of the Interior;

(v) Secretary of Agriculture;

(vi) Secretary of Commerce;

(vii) Secretary of Health and Human Services;

(viii) Secretary of Transportation;

(ix) Secretary of Homeland Security;

(x) Administrator of the National Aeronautics and Space Administration;

(xi) Administrator of the Environmental Protection Agency;

(xii) Administrator of the United States Agency for International Development;

(xiii) United States Trade Representative;

(xiv) Director or Chair of the following components of the Executive Office of the President: the Office of Science and Technology Policy, the Council on Environmental Quality, and the Office of Management and Budget; and

(xv) Officials from such other departments, agencies, offices, or entities as the agencies set forth above, by consensus, deem appropriate.

(c) The Council shall be co-chaired by the Secretary of the Interior (Secretary), the Secretary of Agriculture, and the Secretary of Commerce, who shall meet quarterly or more frequently if needed, and who may designate a senior-level representative to perform the functions of the Co-Chair. The Council shall meet no less than once each year. The Secretary of the Interior shall, after consultation with the Co-Chairs, appoint an Executive Director of the Council to oversee a staff that supports the duties of the Council. Within 1 year of the date of this order, the Co-Chairs of the Council shall, with consensus of its members, complete a charter, which shall include any administrative policies and processes necessary to ensure the Council can satisfy the functions and responsibilities described in this order.

(d) The Secretary of the Interior shall maintain the current Invasive Species Advisory Committee established under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council. The Secretary shall, after consultation with other members of the Council, appoint members of the advisory committee who represent diverse stakeholders and who have expertise to advise the Council.

(e) Administration of the Council. The Department of the Interior shall provide funding and administrative support for the Council and the advisory committee consistent with existing authorities. To the extent permitted by law, including the Economy Act, and within existing appropriations, participating agencies may detail staff to the Department of the Interior to support the Council's efforts.''

Sec. 6. *Duties of the National Invasive Species Council.* Section 4 of Executive Order 13112 is amended to read as follows:

''**Sec. 4.** *Duties of the National Invasive Species Council.* The Council shall provide national leadership regarding invasive species and shall:

(a) with regard to the implementation of this order, work to ensure that the Federal agency and interagency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective;

(b) undertake a National Invasive Species Assessment in coordination with the U.S. Global Change Research Program's periodic national assessment, that evaluates the impact of invasive species on major U.S. assets, including food security, water resources, infrastructure, the environment, human, animal, and plant health, natural resources, cultural identity and resources, and military readiness, from ecological, social, and economic perspectives;

(c) advance national incident response, data collection, and rapid reporting capacities that build on existing frameworks and programs and strengthen early detection of and rapid response to invasive species, including those that are vectors, reservoirs, or causative agents of disease;

(d) publish an assessment by 2020 that identifies the most pressing scientific, technical, and programmatic coordination challenges to the Federal Government's capacity to prevent the introduction of invasive species, and that incorporate recommendations and priority actions to overcome these challenges into the National Invasive Species Council Management Plan, as appropriate;

(e) support and encourage the development of new technologies and practices, and promote the use of existing technologies and practices, to prevent, eradicate, and control invasive species, including those that are vectors, reservoirs, and causative agents of disease;

(f) convene annually to discuss and coordinate interagency priorities and report annually on activities and budget requirements for programs that contribute directly to the implementation of this order; and

(g) publish a National Invasive Species Council Management Plan as set forth in section 5 of this order.''

Sec. 7. *National Invasive Species Council Management Plan.* Section 5 of Executive Order 13112 is amended to read as follows:

''**Sec. 5.** *National Invasive Species Council Management Plan.* (a) By December 31, 2019, the Council shall publish a National Invasive Species Council Management Plan (Management Plan), which shall, among other priorities identified by the Council, include actions to further the implementation of the duties of the National Invasive Species Council.

(b) The Management Plan shall recommend strategies to:

(1) provide institutional leadership and priority setting;

(2) achieve effective interagency coordination and cost-efficiency;

(3) raise awareness and motivate action, including through the promotion of appropriate transparency, community-level consultation, and stakeholder outreach concerning the benefits and risks to human, animal, or plant health when controlling or eradicating an invasive species;

(4) remove institutional and policy barriers;

(5) assess and strengthen capacities; and

(6) foster scientific, technical, and programmatic innovation.

(c) The Council shall evaluate the effectiveness of the Management Plan implementation and update the Plan every 3 years. The Council shall provide an annual report of its achievements to the public.

(d) Council members may complement the Management Plan with invasive species policies and plans specific to their respective agency's roles, responsibilities, and authorities.''

Sec. 8. *Actions of the Department of State and Department of Defense.* Section 6(d) of Executive Order 13112 is amended to read as follows:

''(d) The duties of section 3(a)(2) and section 3(a)(3) of this order shall not apply to any action of the Department of State if the Secretary of State finds that exemption from such requirements is necessary for foreign policy, readiness, or national security reasons. The duties of section 3(a)(2) and section 3(a)(3) of this order shall not apply to any action of the Department of Defense if the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy, readiness, or national security reasons.''

Sec. 9. *Obligations of the Department of Health and Human Services.* A new section 6(e) of Executive Order 13112 is added to read as follows:

''(e) The requirements of this order do not affect the obligations of the Department of Health and Human Services under the Public Health Service Act or the Federal Food, Drug, and Cosmetic Act.''

Sec. 10. *General Provisions.* (a) Nothing in this order shall be construed to impair or otherwise affect:

(1) the authority granted by law to an executive department or agency, or the head thereof; or

(2) the functions of the Director of the Office of Management and Budget relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

THE WHITE HOUSE,
December 5, 2016.

[FR Doc. 2016–29519
Filed 12–7–16; 8:45 am]
Billing code 3295–F7–P

ATTACHMENT GG

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Draft Outline for

Proposed Forest Plan Amendments

Associated with the

Mountain Valley Pipeline

Prepared by:

Mountain Valley PIPELINE LLC

Submitted To:

USDA Forest Service

December 2015

1 INTRODUCTION

1.1 BACKGROUND

Describe the purpose of the proposed project and why plan amendments to the 2004 Revised Land and Resource Management Plan (Forest Plan) are being considered.

1.2 DESCRIPTION

Describe the overall project.

Discuss where the project would cross National Forest System (NFS) land and the management areas and resources it would affect.

State that the Jefferson National Forest Plan was reviewed to identify any project inconsistencies with the Forest Plan. Refer to the Consistency Table for the Jefferson National Forest Plan in Attachment A.

1.3 REASON FOR AMENDING THE PLAN

The proposed pipeline project would not be in a NFS designated utility corridor and would not be consistent with some management prescriptions and standards. Describe briefly what standards and management prescriptions would be affected. Discuss the process for analyzing the project on the Forest and any Forest Plan amendments.

> *Any decisions on projects to implement the Revised Plan are based on site-specific analysis in compliance with the National Environmental Policy Act (NEPA). This environmental analysis is appropriately documented based on direction in the Council on Environmental Quality Regulations For Implementing The Procedural Provisions Of The National Environmental Policy Act (40 CFR Parts 1500-1508) and the Environmental Policy and Procedures Handbook (FSH 1909.15). Projects are evaluated to determine if they are consistent with the management direction in the Revised Plan. This evaluation is documented in the project-level environmental document with a finding of consistency incorporated into the decision document. (JNFP 2-1)*

1.4 DECISIONS TO BE MADE

Describe key decisions and identify the deciding official(s).

FERC: the Commission will decide wether to issus a Certificate of Public Convenience and Necessity

Forest Service: The Forest Supervisor will decide whether to issue a Special Use Authorization (SUA). The Forest Supervisor will decide whether to approve or not approve any proposed amendments to the Forest Plan.

1.5 FOREST PLANNING REGULATIONS

Describe planning regulations affecting this project and amendment process, including the 2013 planning rule Objection process.

2 SCOPING PROCESS AND PUBLIC COMMENTS

Summarize the scoping process,

List dates and locations of the scoping meetings

List key issues related to the Forest identified through the scoping process

3 ALTERNATIVES AFFECTING THE JEFFERSON NATIONAL FOREST

3.1 ALTERNATIVES CONSIDERED IN THE EIS, INCLUDING PROPOSED AND NO ACTION ALTERANTIVES

Describe the Proposed Action where it crosses the National Forest (expand on the description in the FERC EIS as needed)

Describe the No Action Alternative and its implications (adapted from the FERC EIS)

Discuss other alternatives considered in Chapter 3 of the FERC EIS that would either affect or avoid the Forest

3.2 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

Briefly discuss alternatives that were considered but eliminated from detailed study (based on the discussion in Chapter 3 of the FERC DEIS and internalal scoping by the Forest Service).

4 FOREST PLAN DIRECTION

4.1 OVERVIEW OF THE JEFFERSON NATIONAL FOREST REVISED LAND AND RESOURCE MANAGEMENT PLAN

This would be based on the information in Chapter 1 and the introduction on page 2-1 of the Forest Plan.

4.2 FOREST-WIDE DIRECTION

4.2.1 Forest Management Goals and Objectives

This subsection will briefly discuss how the Forest Plan provides management direction for the Forest. It will discuss the relationship between the goals, objectives, standards, and management prescriptions.

Define the terms Goal and Objective as used in the Forest Plan

4.2.2 Forest Management Standards

Standards – Standards are specific technical resource management directions and often preclude or impose limitations on management activities or resource uses, generally for environmental protection, public safety, or resolution of an issue (JNFP 2-1).

4.3 MANAGEMENT AREA PRESCRIPTIONS AFFECTED BY THE PROJECT

Discuss how management prescriptions provide direction for specific areas. Forest-wide standards apply to all resource/areas unless within the specific management direction in the prescription takes precedence.

Describe the management areas crossed by the Mountain Valley Pipeline Project and the emphasis and standards for each area: currently the proposed route would cross through NFS land managed under six management prescriptions where it would not be consistent with the management prescription:

- 4A – Appalachian National Scenic Trail corridor
- 4J – Urban/Suburban Interface
- 6A – Old-Growth Forest Communities not Associated with Disturbance
- 6B – Old-Growth Forest Communities Dependent on Fire

- 6C – Old-Growth Forest Communities Associated with Disturbance
- 8A1 – Mix of Successional Habitat in Forested Landscapes

In addition, explain that the proposed route is not within a designated utility corridor. The Forest Plan states that if approved, the pipeline route should be designated as Management Prescription C5 – Utility Corridors, as directed by FW-248.

Describe the emphasis and standards for this Management Prescription

5 PLAN INCONSISTENCIES

5.1.1 Standards to be Amended

Discuss the Forest Plan Standards that would need to be amended for the project to cross the Forest. Currently these include the following Standards:

5.1.1.1 Water and Soil Quality

Standard FW-9: Heavy equipment is operated so that soil indentations, ruts, or furrows are aligned on the contour and the slope of such indentations is 5 percent or less.

Discuss the Need for an Amendment: Discuss the Plan inconsistency and the need for an Amendment.

> For example: in the case of FW-9 the project would not meet the standard due to the linear nature of the project and requirements for pipeline installation, heavy equipment operating within the construction ROW. Discuss how erosion and sediment control measures would be used during construction to control and confine overland surface water and sediment flow. Following construction, ground contours and surface flow would be restored to pre-construction conditions.

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

5.1.1.2 Channeled and Ephemeral Zones

Standard FW-13: Management activities expose no more than 10% mineral soil in the channeled ephemeral zone.

Standard FW-14: Up to 50% of the basal area may be removed down to a minimum basal area of 50 square feet per acre. Removal of additional basal area is allowed on a case-by-case basis when needed to benefit riparian-dependent resources.

Discuss the Need for the Amendments: Discuss the Plan inconsistency and the need for an amendment for each.

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

5.1.1.3 Wildlife Management

Standard FW-33: Potential black bear den trees will be retained during all vegetation management treatments. Potential den trees are those that are greater than 20” diameter breast height. Potential den trees also include those that are hollow with broken tops or those with limbs greater than 12 inches diameter broken near the bole of the tree.

Need for an Amendment: Discuss the Plan inconsistency and the need for an amendment.

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

Standard FW 45: Each Indiana bat hibernaculum has a primary and secondary cave protection area managed according to management prescription 8E4. If additional hibernacula are found, the desired condition and standards of management prescription 8E4 apply until an environmental analysis to consider amendment to the Forest Plan is completed.

Need for an Amendment: Discuss the Plan inconsistency and the need for an amendment (this amendment may not be needed if surveys indicate that there is no inconsistency).

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

Standard FW-48: When active roost trees are identified on the Forest, they will be protected with a ¼ mile buffer surrounding them. This protective buffer remains until such time the trees and associated area no longer serve as a roost (e.g., loss of exfoliating bark or cavities, blown down, or decay).

Need for an Amendment: Discuss the Plan inconsistency and the need for an amendment (this amendment may not be needed if surveys indicate that there is no inconsistency).

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

Standard FW-49: No disturbance that will result in the potential taking of an Indiana bat will occur within this active roost tree buffer.

- Commercial timber harvesting, road construction, and use of the insecticide diflubenzuron are prohibited.
- Prescribed burning, timber cutting, road maintenance, and integrated pest management using biological or species-specific controls during non-roosting season are allowed, following Project level analysis to determine the direct, indirect, and cumulative effects on Indiana bats and the hibernacula.

Other activities within this buffer are allowed following determination that they will not result in a potential taking of an Indiana bat.

Need for an Amendment: Discuss the Plan inconsistency and the need for an amendment (this amendment may not be needed if surveys indicate that there is no inconsistency).

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

Standard FW-55: If active maternity roost sites are identified on the Forest, they will be protected with a 2-mile buffer defined by the maternity roost, alternate roost sites, and adjacent foraging areas.

Need for an Amendment: Discuss the Plan inconsistency and the need for an amendment (this amendment may not be needed if surveys indicate that there is no inconsistency).

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

Standard FW-63: A minimum of 200 foot buffers are maintained around cave entrances, sinkholes, and cave collapse areas known to open into a cave's drainage system. There are no soil-disturbing activities or harvest of trees within this buffer. Wider buffers are identified through site-specific analysis when necessary to protect caves from potential subterranean and surface impacts. Perennial, intermittent, channeled ephemeral stream standards will apply beyond the first 200 feet.

Need for an Amendment: Discuss the Plan inconsistency and the need for an amendment (this amendment may not be needed if surveys indicate that there is no inconsistency).

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

5.1.1.4 Old Growth

Standard FW-78: Following Project analysis, make appropriate adjustments to Management Prescription 6A, 6B, or 6C, depending on community type, through the Forest Plan amendment process.

Need for Amendment: Discuss the Plan inconsistency and the need for an Amendment.

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

5.1.1.5 Recreation Opportunity Spectrum

Standard FW-161: New structures and facilities are constructed and maintained to meet the adopted ROS class for the area.

Need for Amendment: Discuss the inconsistency and the need for an amendment.

Mitigation: Identify the applicable mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

5.1.1.6 Amendments Associated with Management Area Prescriptions

5C – Designated Utility Corridors

Discuss Standard FW-248: it requires that, following evaluation of the criteria listed under Lands and Special Uses, “decisions for new authorizations outside of existing corridors and designated communication sites will include an amendment to the Forest Plan designating them as Prescription Area 5B or 5C.”

Need for Amendment: The Project right-of-way would not be in an area of this management prescription where major impacts already exist; however, if an amendment designating a new utility corridor (Prescription Area 5C) is approved the project would be consistent with that management prescription.

4A – Appalachian National Scenic Trail Corridor:

Need for Amendment: The project would not cross the Trail in an area with other disturbances and would, therefore, not be consistent with the 4A. However, the project would be limited to a single crossing of the Appalachian National Scenic Trail, and would bore under the trail, leaving a 100-foot forested buffer on each side of the trail.

Mitigation: Consultation with the Forest Service, National Park Service, and Appalachian Trail Conservancy is ongoing with regards to potential impacts and mitigation strategies for the

proposed crossing. Current mitigation includes crossing underneath the trail by conventional bore, potential additional mitigation measures include timing of construction during non-peak use, flagging of work zones, and signage for trail users.

Identify any additional mitigation measures described and analyzed in the EIS (reference location). Identify any additional mitigation required by the Forest.

4J – Urban/Suburban Interface: Describe the need for an amendment and the proposed mitigation.

6A – Old-Growth Forest Communities Not Associated with Disturbance: Describe the need for an amendment and the proposed mitigation.

6B – Old-Growth Forest Communities Dependent on Fire: Describe the need for an amendment and the proposed mitigation.

6B – Old-Growth Forest Communities Dependent on Disturbance: Describe the need for an amendment and the proposed mitigation.

8A1 – Mix of Successional Habitats in Forested Landscapes: Describe the need for an amendment and the proposed mitigation.

6 PROPOSED AMENDMENT(S)

6.1.1 Reason for Amendments

Describe how the amendments would allow for the construction, operation, and maintenance of gas pipeline across portions of the Jefferson National Forest.

6.1.2 Proposed Amendments

An amendment to the Jefferson National Forest Plan would be needed to bring the proposed project into compliance with Forest Plan management direction for NFS crossed by the proposed project. The final text of the amendment(s) would depend on the final route selected. The amendment, if approved, would only apply to those NFS lands identified in the Record of Decision for the Project.

The Forest could develop a separate amendment for each inconsistency or a single amendment that included all the inconsistencies.

Option 1: develop a single amendment that designates the right-of-way as 5C and specially states that the following Standards would not apply within the right-of-way easement:

> Standard FW-9: Heavy equipment is operated so that soil indentations, ruts, or furrows are aligned on the contour and the slope of such indentations is 5 percent or less.
>
> Standard FW-13: Management activities expose no more than 10% mineral soil in the channeled ephemeral zone.
>
> Standard FW-14: Up to 50% of the basal area may be removed down to a minimum basal area of 50 square feet per acre. Removal of additional basal area is allowed on a case-by-case basis when needed to benefit riparian-dependent resources.
>
> Standard FW-33: Potential black bear den trees will be retained during all vegetation management treatments. Potential den trees are those that are greater than 20” diameter breast height. Potential den trees also include those that are hollow with broken tops or those with limbs greater than 12 inches diameter broken near the bole of the tree.
>
> Standard FW-161: New structures and facilities are constructed and maintained to meet the adopted ROS class for the area.

Standard FW-78: FW-78: Following Project analysis, make appropriate adjustments to Management Prescription 6A, 6B, or 6C, depending on community type, through the Forest Plan amendment process.

Similarly, project inconsistencies with management area prescriptions would be resolved once the right-of-way is designated as 5C.

Option 2: develop a separate amendment for each inconsistency.

Effects on Goals and Objectives: Discuss how the proposed amendment(s) would affect meeting Forest Plan Goals and Objectives for each resource affected.

6.1.3 Amendment Applicability

Describe where amendment would apply and what management it would or would not change. Discuss the Utility Corridor Standards and management under the 5C Management Prescription designation

6.1.4 NEPA Analysis

Discuss the NEPA evaluation process and CFR documents and determination of significant or non-significant amendment.

6.1.5 Effects

Discuss how the amendment would affect management on the Forest, such as effects on resource productivity and on achieving the Forest Plan's management goals and objectives.

Discuss where the direct, indirect, and cumulative effects of the project on the Forest Plan are discussed in the EIS.

Discuss where effects on individual resources are discussed in the EIS.

ATTACHMENT HH

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP FS National Environmental Policy Act (NEPA):
Land and Resource Management Plan (LRMP) Amendment Discussion
Date/Time: Thursday, April 6, 2017 @ 11:00-1:00pm (AZ)/2:00-3:00pm (E)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Karen Overcash, Pauline Adams, Dawn Kirk, Tom Bailey, Ginny Williams
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:
- ✓ Determine which Forest-Wide and Management Standards are still violated by the MVP project.
- ✓ Determine which plan amendments are still necessary to the MVP Project.

ACTIONS

- **Karen** confirms whether or not MVP crosses any wetlands with the wetland report.
- **Karen** confirms whether or not the pipeline would be an approved facility, if permitted.
- **Ginny** meets with MVP to discuss MVP's Visual Impacts Analysis (VIA).
- **Ginny** follows up with FS landscape architects to discuss any additional visual amendments needed.
- **Ginny** follows up with FS GIS specialists to fix glitches in Scenic Class data layers.
- **MVP** updates VIA per FS instruction.
- **FS Specialists** analyze MVP's updated visual analysis to determine if Scenic Integrity Objectives Will be met and determine if additional amendments are needed.
- **FS Specialists** send any additional standards and/or amendments to carry forward to Karen by April 21st.
- **Karen** reviews the Inventoried Roadless Area briefing paper for visual impacts.
- **Karen** finalizes which FS standards and project amendments will be carried forward for the Final Environmental Impact Statement (FEIS).
- **Karen** facilitates publication of a Federal Register notice discussing the Plan Amendments as they relate to the 2012 Planning Rule.

DECISIONS/DISCUSSION POINTS

- Karen reiterated that the Proposed Amendments for the Proposed MVP projects were based on scant information in the Draft Environmental Impact Statements (EIS). She updated the Proposed Amendments need to follow the updated 2012 planning rule. Decisions on standards that will be violated by the projects and which amendments will be carried forward to the Final EIS are tracked in the accompanying plan amendment summary document.
- Karen said the FS deadline for final plan amendments to include in the Final EIS are due April 21st. Karen clarified the Plan-Level Utility Corridor amendment did not need to be discussed today and that changes were already in progress.
- See Attached MVP DEIS Plan Amendment Description Document for decision and discussion points. Edits to the initial document noted in green text.

ATTACHMENT II

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land and Resource Management Plan Amendment for the Jefferson National Forest
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination
Date/Time: August 29, 2016 2:00 pm CT
Location: Conference call

Attendees	BLM	Vicki Craft, Miriam Liberatore
	Galileo Project	Grace Ellis, Lauren Johnston, Peggy Fry

ACTIONS

- **Vicki** mails project documents to **Galileo** for inclusion in the decision file.
- **Vicki** confirms Galileo kickoff meeting date with **district manager** and **staff**.
- **Vicki** drafts biweekly briefing recipient list and forwards to **Galileo**.
- **Vicki** follows up with **Allison McCartney** (BLM Southeastern States District Office Wildlife Biologist & NEPA lead) on need for Federal Register notice and possibly separate BLM scoping. Consult **Bruce Dawson** (BLM Southeastern States DO).
- **Galileo** schedules coordination call between United States Forest Service (USFS) and BLM to kick off project this week.
- **Vicki** and **Galileo** collaborate on agenda for BLM/USFS kickoff coordination meeting, including line item for scheduling recurring agency check-ins.
- **Galileo** drafts communication/coordination plan and distributes drafts to **Jennifer Adams** (USFS) and **Vicki** for approval.
- **Galileo** drafts decision file database organization to service both BLM and USFS needs.
- **Miriam** forwards sample federal register notice to **Galileo**.
- **Galileo** drafts Federal Register Notices as directed.
- **Galileo** compiles BLM Interdisciplinary Team (IDT) contact information.

DECISIONS/DISCUSSION

- BLM has two decisions to make for the the Mountain Valley Pipeline (MVP, the Pipeline):
  i. Adopt Federal Energy Regulatory Commission (FERC) EIS
     - A Record of Decision (ROD) may not be required for this
  ii. Decision whether to issue a Right of Way grant (ROW)
     - A ROD is required for this
     - Miriam notes the ROW grant ROD is appealable but not protestable.
- BLM is lead agency for ROW but does not have land affected by the Pipeline. BLM is involved to issue a ROW because two federal agencies, Army Corps of Engineers and United States Forest Service (USFS), both have land affected by the Pipeline.
- Galileo noted a second pipeline, the Equitrans expansion project, is listed jointly in all FERC federal register notices for MVP. Miriam clarified BLM is not involved in, and will have no ROD for, the Equitrans expansion project.
- FERC is expected to publish a draft EIS (DEIS) on September 24th, 2016. A 90-day public comment period follows DEIS.
- ***Urgent BLM decisions***:
  i. Does BLM need to issue its own Notice of Intent (NOI) and initiate its own scoping process, as BLM's decisions are not formally listed in any federal register notices to date (August 29, 2016)

- Miriam noted BLM Washington Office (WO) approval of Federal Register notices takes 9-12 weeks, and the 90-day NOI scoping period for the two BLM RODs would end before the NOI would even be published. It isn't clear whether the issue of not including BLM on FERC's NOI could be solved with FERC including this information in their NOA or in a separate NOI.

ii. Does BLM need to publish its own NOA for the DEIS, and, if so, should this be joint with the USFS?

- FS needs to prepare a Forest Management Plan amendment to accommodate the Pipeline. Galileo will coordinate public communication, document editing, and document review efforts between BLM and FS.

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination
Date/Time: September 1, 2016 10:30 pm CT
Location: Conference call

Attendees	BLM	Vicki Craft, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Karen Overcash
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** sends project schedule and any objection period info to Grace.
- **Galileo** updates project schedule and flow chart using Forest Service (FS) decision and objection requirements. Forwards to FS for review, then to BLM when complete.
- **Galileo** drafts joint communication/coordination plan.
- **Galileo** develops a draft decision file strategy based on BLM guidance and forwards to FS to incorporate their specifications.
- **Galileo** schedules conference call and GoTo meeting to review the FS Notice of Availability (NOA) language with BLM and FS on ***September 6th, 2016***. (*complete)*
- **Vicki** confirms NOA strategy with BLM Solicitor.
- **Karen** forwards draft NOA to Vicki and Miriam for review. (*Complete*)
- **Jennifer** forwards FS comment filings on Mountain Valley Biological Evaluation (BE) to Vicki with cc to Grace. (*Complete*)
- **Galileo** coordinates with FS on handout for upcoming Draft Environmental Impact Statement (DEIS) public meetings.

DECISIONS/DISCUSSION

- The Federal Energy Regulatory Commission (FERC) is the lead agency preparing an Environmental Impact Statement (EIS) to issue a certificate of public convenience and necessity for the project.
- BLM's decision is whether to issue a Right of Way grant (ROW) for the Pipeline with concurrence from the FS and the United States Army Corps of Engineers (USACE or ACE). FS must concur with the BLM Record of Decision (ROD) before it is issued. The Secretary of the Department of the Interior can issue a ROD without FS concurrence.
- FS will decide on whether to issue plan amendments, so the 218 and 219 objection processes are in effect. The Notice of Availability (NOA) for the Draft Environmental Impact Statement (EIS) accommodates a 90-day comment period for the forest service plan amendments.
- Jennifer noted the FERC project schedule does not necessarily include time for correct sequence of the objection process, concurrence, and decisions.
- Jennifer noted the DEIS is being pushed through quickly without adequate time to gather and review data. FS has asked for more time for review, which was previously granted by Paul Friedman (FERC project manager) but has since been taken out of the schedule per objection from proponents. FS noted that completing the DEIS without adequate data could slow down progress from the DEIS to the Final EIS (if FS receives numerous comments from the public).

- FS has asked Dominion to request more time on the DEIS to avoid needing a supplemental EIS, but FERC denied the request to amend the schedule.
- FS and BLM will be reviewing FERC's NOA to make sure it adequately represents the decisions to be made by the agencies. FS plans to issue their own NOA (and will allow BLM to review text pertaining to the decision). BLM is not inclined to issue an NOA. While a BLM NOA would be more easily accessed by their constituents, the review process is prohibitive and the NOA(s) that add clarifying language on the BLM decision should be adequate. Vicki will confirm.
- Bi-Weekly Cooperator meetings do not require documentation from Galileo.
- Paul Friedman will send the FERC NOA for publication on September 16th. FS will send their NOA for publication as close to September 16th as possible; however, FS doesn't want to be published before FERC.
- All public comments on the Pipeline are submitted to the FERC.
- All communications with FS will go through Jennifer and not directly to the IDTeam.
- Sequence of BLM and FS concurrence and Decisions:
    - FERC NOA for DEIS and FS amendment
    - 90-day DEIS and FS amendment comment period
    - Update EIS and respond to comments
    - FERC Final EIS and FS draft Record of Decision (ROD)
    - FS objection period.
    - FS concurrence with BLM ROD
    - BLM issues ROD, FS issues final ROD on plan amendments.
    - 30-day ROD waiting period. FS ROD does not have 30-day waiting period but plan amendments are not in effect until BLM issues the ROW
    - BLM issues ROW (if project is approved)
    - BLM issues Notice(s) to Proceed (if project is approved).

Upcoming Meetings			
Participants	**Objective**	**Date**	**Time (P/C/E)**
BLM/FS/GP	Review comments on NOA	9/6/16	12:00/2:00/3:00
BLM/GP	Decision File Review	9/28/16	12:00/2:00/3:00
BLM/GP	PM Coordination (in MS)	8/5/16	8:30/**10:30**/11:30
BLM/GP	BLM IDT Kick-Off (in MS)	8/5/16	11:00/**1:00**/2:00
FS/GP	PM Coordination/Kick-Off	*TBD*	
BLM/FS/FERC	Bi-Weekly Cooperator Calls	Ongoing	

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination
Date/Time: Tuesday, September 6, 2016 @ 12 pm Central
Location: Conference Call

Attendees	BLM	Vicki Craft, Miriam Liberatore
	Forest Service	Jennifer Adams, Karen Overcash, Elizabeth Hoyt
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Karen** forwards updated draft joint FS/BLM Notice of Availability (NOA) to team (*complete*)
- **Vicki** follows up with BLM NEPA planning coordinator to clarify whether BLM will want a joint NOA (which would need a signature).
    - *If signature is needed,* **Vicki** forwards draft NOA to Bruce Dawson, BLM Southeastern States District Office District Manager, for review, and to Karen Mouritsen, BLM Eastern States Offices State Director, for review and signature.
- **Jennifer** follows up with the Federal Energy Regulatory Commission (FERC) to include FS amendment language in FERC's NOA.

DECISIONS/DISCUSSION

- Forest Service has drafted a joint Notice of Availability (NOA) for FERC's Draft Environmental Impact Statement (DEIS). As written, the NOA includes the BLM as a signatory. BLM will clarify whether or not a joint FS/BLM NOA is needed, or if FS writes its own NOA and mentions the BLM decision, without BLM's signature. A key factor in this decision is that no BLM lands are impacted by the Mountain Valley Pipeline.
- BLM notes FS agency information should be listed first in the NOA if it is to be a joint NOA.
- BLM has no comments on the FERC NOA.
- The BLM decision-maker and Federal Register notice signatory is Karen Mouritsen, BLM Eastern States Offices State Director.

Mountain Valley Pipeline	2016

NEPA COORDINATION MEETING
Date/Time: Tuesday, September 13, 2016 @ 10:00-11:00 (AZ)/11:00-12:00 (MT)/12:00-1:00 (Central)/1:00-2:00 (East)
Location: Conference Call

Attendees	Forest Service	Jennifer Adams, Kent Karriker, Elizabeth Hoyt, Karen Stevens, Karen Overcash
	Galileo Project	Grace Ellis, Maria Martin, Peter Rocco, Peggy Fry, Lauren Johnston, Alexa Esquivel

ACTIONS

- **Jennifer** clarifies objection timing with Karen O. and Elizabeth.
- **Jennifer** forwards draft objection timing info from Karen Overcash to Galileo. *(Complete)*
- **Galileo** updates project graphics with 219 objection period.
- **Galileo** forwards project graphics, one-page contact information and communication/coordination plan to the Forest Service (FS) team.
- **Jennifer** forwards internal project schedule to Galileo and NEPA specialists. *(Complete)* Galileo provides assistance updating schedule and providing related action items as needed.
- **Jennifer** meets with the Federal Energy Regulatory Commission (FERC) to solidify period for identifying commenters with standing for the FS objection periods. Follows up with Galileo project with guidance. Low priority for now.
- **Galileo** drafts public outreach handout using objection period graphics and existing FS flyers and sends to team members on this call.
- **Galileo** forwards decision file guidance documents and proposal to Jennifer, Kent, and Alex Faught (George Washington and Jefferson NF) for review.
- **Jennifer** forwards MVP meeting notes to Galileo for cross-check.
- **Galileo** coordinates with BLM on their decision/appeals process and incorporates it into the graphic.

DISCUSSION/DECISION

- The MVP Draft Environmental Impact Statement will be available on the FERC website on September 16th and open for comment until December 22nd. Jennifer notes the FERC has indicated to cooperators that the Final FEIS will likely not be available until April 2017.
- As proposed the pipeline would require two types of amendments, one a plan-level amendment and the other several project-level amendments. The plan-level amendment would amend the utility corridor right of way management prescription to accommodate the pipeline, and requires a 60-day objection period outlined in 36 CFR 219. Three project-level amendments do not affect any future projects. These project-level amendments require a 45-day objection period under 36 CFR 218.
- The FS needs to identify which public commenters will have standing for the FS amendment objection periods. FS will need to rely on the FERC's contractor to identify and provide FS with a list of commenters that have standing. FS is responsible for public outreach to commenters with standing for amendment objection periods.
- FS has requested a brochure for use at the FERC's public meetings for the pipeline, to include explanation of objection periods and plan- and project-level amendments. See action items above.

Mountain Valley Pipeline	2016

Team Contacts – Mountain Valley Pipeline			
Forest Service	***BLM***	***Proponent***	***Galileo***
Jennifer Adams	Vicki Craft	Megan Neylon	Grace Ellis
Alex Faught	Miriam Liberatore		Lauren Johnston
Karen Overcash			Peggy Fry
			Maria Martin (SME)

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In ACTION
Date/Time: Thursday, October 20, 2016 @ 8:00-9:00 am (Pacific/AZ)/ 9:00-10:00 am (MT)/ 10:00-11:00 am (CT)/ 11:00 am – 12:00 pm (ET)
Location: Conference Call

Attendees	BLM	Vicki Craft, Miriam Liberatore*
	Forest Service	Jennifer Adams
	MVP/EQT	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

*Partial attendance

ACTION ITEMS

- **Megan** forwards Mountain Valley's (MVP) Appalachian National Scenic Trail (ANST) resources to Vicki and Miriam.
- **Vicki** forwards ANST resources to John Henson (DOI Solicitor's Office); forwards to Galileo as appropriate.
- **Megan** separates United States Forest Service (FS) comments and responses from master comment matrix for Draft Environmental Impact Statement (DEIS) updated filing.
- **Jennifer** compiles and submits comments on Virginia Department of Conservation and Recreation (DCR) Slusser's Chapel alternate route with the Federal Energy Regulatory Commission (FERC) docket.
- **MVP** reevaluates Slusser's Chapel alternate route per public and FS comments.
- **Jennifer** compiles and submits FS comments on MVP Plan of Development (POD)
- **Megan** updates POD per FS comments and new route variations; filing in FERC docket expected by Thanksgiving 2016.
- **Jennifer** schedules POD page-turn with FS, MVP, and BLM representatives; target date in early December. **Galileo** provides support as requested.
- **Megan** forwards Wednesday, Oct. 19th meeting with FS presentation along with other needed documents to Grace, cc. to Lauren.
- **Jennifer** reviews notes from Oct. 19th MVP/FS meeting and forwards to Grace, cc to Lauren.
- **Jennifer** includes Vicki and Galileo on invites to FS Interdisciplinary Team (IDTeam) meetings and MVP/FS meetings, as appropriate.
- **MVP** /**BLM**/**FS** meetings scheduled initially for every other Thursday at 2:00 pm ET, starting with Thursday, Oct. 27th.
- **Jennifer** includes Galileo on internal FS planning/deliberative calls for note-taking as needed.
- **Galileo** includes agency attendance tracking sheet for DEIS public meetings. *Complete.*
- **Galileo** invites Vicki to FS Decision File proposal meeting. *Complete.*
- **Galileo** forwards FS Region 8 Decision File input to Vicki. *Complete.*
- **Vicki** reviews FS Region 8 Decision File input.
- **Galileo** forwards final BLM DEIS public meeting handout to Jennifer. *Complete.*
- **Jennifer** follows up with NEPA and public affairs IDTeam members to finalize decision process graphic and review BLM handout.
- **Galileo** forwards BLM decision process graphic to Jennifer. *Complete.*

- **Galileo** researches FERC communication with the National Park Service (NPS) re the MVP project and similar projects, forwards to Vicki and Jennifer.

DECISIONS/DISCUSSION

- Megan and Jennifer both noted FS and MVP have had meetings with the Appalachian Trail Conservancy (ATC) and NPS to discuss the FS role in managing the ANST within the Jefferson National Forest (JNF). Jennifer noted FS has regulatory authority over the ANST and Vicki noted BLM solicitors and United States Department of Agriculture (USDA) Office of General Counsel (OGC) are still discussing the regulatory authority, and no more information on BLM deliberations is available at this time. Megan questioned whether NPS's decision not to be a cooperating agency has been fully documented. Galileo was directed to review the FERC docket for documentation for MVP, as well as sample documentation for other projects.
- Megan noted MVP has provided updated route information in the FERC docket, but these latest changes do not occur on FS lands. Megan also noted MVP will be reevaluating the DCR alternate route to avoid running through Slusser's Chapel Conservation site, but it is unclear at this time if this will cause the pipeline to run through more of the JNF. Megan pointed out MVP will be submitting tables updated from the DEIS that pertain to its most recent filing, likely available in the docket tomorrow. MVP is also filing comments its own comments on the DEIS, available in the Docket net week. See action item above.
- On an Oct. 19th, 2016 call with FS and MVP, FS noted MVP needs to take a closer look at routing options around Craig Creek and Mystery Ridge in the JNF. Megan noted updated files will be available in the Docket next week. Jennifer noted FS comments on visual resources will be filed in the FERC docket in the coming weeks. FS Is also preparing comments on the Slusser's Chapel route variation as it relates to FS management of JNF lands.
- FS and MVP have spoken in the past about updating MVP's POD. MVP plans to make updates per pending FS comments, and provide an updated POD towards the end of November. FS and BLM will consider meeting in December for a page-turn review. Jennifer will check with staff for availability.
- Jennifer suggested to include Vicki and Miriam on future FS/MVP coordination calls as well as any relevant internal FS deliberative calls, with Galileo on as not-taker as needed.
- BLM and FS will be attending some of the DEIS public meetings. BLM has developed a handout for the meetings they will attend. Galileo can assist in development of a FS handout; Jennifer will check into whether FS will have a handout.

Mountain Valley Pipeline FS Decision File Call

Date/Time: Friday, October 21 @ 10:00-11:00am (Pacific, AZ)/ 1:00-2:00pm (ET)

Location: Conference Call & GoTo Meeting

Attendees	Forest Service	Jennifer Adams, Adam Felts, Alex Faught, Clyde Thompson, Jim Twaroski, JoBeth Brown, Joby TImm, Karen Stevens, Kent Karriker, Laura Hise, Paula Cote, Paul Arndt, Troy Morris
	BLM	Vicki Craft
	Galileo Project	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston, Alexa Esquivel

ACTIONS

- Galileo confirms decision file (DF) paper copy number for United States Forest Service (FS) offices.
- Jennifer will send electronic copies of emails to Galileo once organized.
- Jennifer forwards DF document submission guidelines to Regional Offices as soon as possible.
- Project participants forward new emails and documents directly to Galileo for inclusion in the DF.
- Galileo finalizes DF database structure and starts organizing and entering documents.

DECISIONS/DISCUSSION

- Galileo reviewed the DF proposal documents, including the data entry screen and methodology, document types and categories, document storage, Freedom of Information Act (FOIA) and privileged review process. Current proposal includes guidance from Forest Service (FS) Regional Office 8 and input from the Bureau of Land Management (BLM). Galileo confirmed they will adopt the FS preferred naming structure, and will have a delay in document entry to deal with backlog and will attempt to enter documents chronologically.
- FS approved merging DF documents with their attachments rather than requiring a separate DF entry for each attachment.
- FS requested the DF documents not have a nested file structure. Each link in the DF will lead directly to a document and all DF documents will be saved in a single folder.
- FS requested providing bookmarks for documents with many large attachments and/or appendices. Maria noted all documents are also keyword-searchable within the database.
- Jennifer noted Galileo can be copied on emails to Jennifer and/or emailed directly with feedback on the DF proposal.
- Galileo noted at the end of the project they will provide the offices with CDs that contain all of the DF documents as well as searchable, hyperlinked inventories of the documents. *Post meeting note: August 1, 2016 email guidance from Jim Twaroski confirmed that the Region 8 Office does not need a paper copy of the DF, so long as the electronic copy contains all documents in pdf, searchable files.*

Mountain Valley Pipeline: FS | 2016

Mountain Valley/Forest Service Update call
Date/Time: Tuesday, October 25, 2016 @ 11:00 am ET
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams
	Mountain Valley (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

Action Items

- **Jennifer** forwards preliminary acceptable seed mix list to Megan. *See discussion below.*
- **Jennifer** follows up with FS wildlife biologists to finalize seed mix list.
- **MVP** updates Plan of Development (POD) with new seed mix data.
- **Jennifer** confirms FS availability for POD page-turn in December.
- **Jennifer** follows up with FS team leads to clarify what's needed in Draft Environmental Impact Statement (DEIS) Biology review.
- **MVP** updates DEIS biology section to highlight needed data.
- **Jennifer** forwards FS POD comments to Galileo.
- **Galileo** sorts, formats, and removes duplicate comments from FS POD comments.
- **Galileo** drafts pending documents/data tracking sheet for FS.
- **Jennifer** confirms visual resource team availability for joint FS/MVP visuals update.
- **Jennifer** coordinates with Galileo to clarify comment and objection tracking process.

Decisions/Discussion

- In an effort to keep MVP's process moving Jennifer said she will forward preliminary seed mixes, organized by slope, soil type, etc. to Megan, with the caveat that FS wildlife biologists may provide updates.
- Jennifer noted the FS does not intend to comment on the Slusser's Chapel Alternate Route.
- Jennifer noted the FS plans to submit a data request for site-specific stabilization design methods to the FERC docket today.
- In future meetings with MVP and the FS, Jennifer requested MVP provide any meeting materials five business days in advance so the right FS team members can attend meetings and complete reviews on time.
- Jennifer requested any on-the-ground mitigations measures not in the DEIS or Biological Evaluation (BE) be highlighted in the next iteration of the BE. Jennifer requested MVP fill in any needed avoidance and mitigation measures based on their own research and/or past experience into the BE, so FS can edit them as needed and make sure the correct information gets into the EIS.
- Jennifer requested MVP list any missing documents and/or data so Jennifer can track what FS and MVP need to provide. This is an effort to make sure the FEIS is complete.
- Megan noted MVP wants to be sure they address all Appalachian Trail Conservancy (ATC) concerns, but ATC filings with FERC have not been specific. Jennifer encouraged Megan to reach out to ATC to address their concerns. Megan suggested a potential FS/MVP visual resources meeting, with follow up to ATC as appropriate.
- Jennifer noted Galileo will be helping organize FS comments, documents, and tasks in an effort to help FS identify public with standing to object to FS Land and Resource Management Plan (LRMP) amendments. Jennifer also said the FS is will be developing a Memorandum of Understanding (MOU) to clarify Galileo's relationship with FS and MVP.

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Thursday, Oct. 27, 2016 @ 11:00-12:00 (Pacific/AZ)/1:00-2:00 (CT)/2:00-3:00 (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft
	Forest Service (FS)	Jennifer Adams
	Mountain Valley (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTION ITEMS

- **Megan** forwards project map of FS parcel to BLM.
- **Galileo** coordinates with John Henson (DOI Office of the Solicitor) to amend Galileo's Scope of Work (SOW).
- **Galileo** uses BLM Memorandum of Understanding (MOU) to develop draft FS MOU.
- **Jennifer** circulates SOW amendment and MOU to regional forest office as needed when available.
- **Megan** updates data/document table and forwards to Vicki, Jennifer, and Galileo.
- **Galileo** consolidates FS comments on MVP's Plan of Development (POD).
- **Jennifer** coordinates scheduling of POD page-turn meeting.
- **Megan** forwards preliminary Timber Plan to Russ MacFarlane (FS) and Jennifer.
- **Jennifer** coordinates visual resources information request filing to the Federal Energy Regulatory Commission (FERC).
- **Jennifer** schedules visual resources meeting with Megan and FS specialists as needed.
- **Vicki** follows up with the Office of Environmental Policy Compliance (OEPC) to confirm their role in the project.
- **Galileo** forwards updated decision file guidance to Vicki , Vicki's Interdisciplinary Team, and Jennifer.
- **Vicki** sends any United States Army Corps of Engineers (COE) filings with FERC to Megan.
- **Jennifer** collects and emails guidance to Megan re MVP's response to FS's slope stability data request.
- **MVP** responds to FS slope stability data request; **Galileo** sets up GoTo meeting as needed.

DECISIONS/DISCUSSION

- Grace recounted a prior conversation with John Henson re Galileo's SOW. An amendment is needed to clarify Galileo's role in assisting the DOI Solicitors during the project. The DOI solicitor's office is also reviewing a FS/MVP MOU pertaining to use of Galileo as a 3rd party contractor. This will be adapted to create a FS version.
- Jennifer clarified she is attempting to track any missing data or documents from MVP in an effort to avoid supplemental analysis, and to prepare for any departmental or regional office briefings. Data tracking updates will be shared with Vicki. Jennifer also noted Cardno, the Environmental Impact Statement (EIS) contractor for FERC, is collecting any comments re FS involvement in the project and will allow FS, BLM, and Galileo access to those comments.
- Jennifer reiterated MVP's POD will need a few more drafts until FS finds it acceptable. BLM will defer comments to FS for the current draft, but will be included on POD review efforts in the future, including any meetings to discuss comments on the POD. Jennifer also noted the visual resources analysis needs more work. Megan confirmed MVP is

planning to take leaf-off pictures in the coming weeks, and submit an updated visual resources analysis before the end of the Draft EIS comment period. Jennifer committed to working with FS visual resources to clarify observation points needed for an updated analysis, including meetings if needed. Jennifer clarified their request for updated visual analysis will be filed in the FERC record to inform public and stakeholders more updated information is coming.

- Vicki updated that the BLM needs to coordinate with the OEPC (OEPC website: https://edit.doi.gov/oepc/resources/nepa-procedures) and will follow up with their representative in the coming weeks to clarify their role in the project.
- Megan noted she wants MVP's record of coordination with the COE to be complete, but she does not have all COE communications or filings. Vicki noted she has seen the COE conditions of approval and will look for other relevant COE documents.
- Jennifer attempted to answer Megan's question about a statement in the most recent FS information request filed on October 25, 2016. The FS must determine if the project could be made consistent with the Forest Plan via plan amendments described in the FERC's September 27, 2016 Draft EIS Notice of Availability in the Federal Register, and the October 14, 2016 joint FS/BLM Right of Way grant and Land and Resource Management Plan amendment notice in the Federal Register. Any further clarification needed would be provided in future MVP/FS calls.
- Jennifer noted the FS still requires a Timber Plan and further coordination between MVP and FS specialists is forthcoming to help MVP complete their Timber and Crews plans.

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Tuesday, November 1, 2016 @ 8-9am (Pacific/AZ)/10-11am (CT)/11 -12:00pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft
	Forest Service (FS)	Jennifer Adams
	Mountain Valley (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTION ITEMS

- **Alex Faught, Jennifer,** and **Vicki** meet to discuss MVP's application to the BLM for a Right of Way (ROW) grant. **Galileo** assists in scheduling.
- **Jennifer** schedules FS/MVP meeting to discuss site-specific design analyses.
- **Galileo** forwards compiled Plan of Development (POD) comments to Jennifer.
- **Jennifer** and **Alex** review FS POD comments.
- **Jennifer** forwards FS POD comments to DOI solicitors and **Vicki** for review.
- **Jennifer** submits solicitor-reviewed POD comments to Federal Energy Regulatory Commission (FERC) docket.
- **Vicki** confirms BLM signatory on Galileo's non-disclosure agreement (NDA). *Complete.*
- **MVP** reviews BLM version of Memorandum of Understanding (MOU).
- **Galileo** adapts BLM NDA and MOU to FS needs, when BLM MOU is complete.
- **Jennifer** forwards FS versions of MOU and NDA to solicitors for review and approval.
- **Galileo** sends updated Scope of Work per DOI Solicitor's comments to MVP. *Complete.*
- **Megan** distributes complete data/document tracking table by Nov. 7th (target) to Jennifer and Vicki, with cc to Lauren and Grace.
- **Jennifer** touches base with FS specialists re: Visual Resources analysis meeting.
- **Vicki** touches base with Peter DeWitt (BLM) for BLM Visual Resources discussion.
- **Galileo** completes 508-compliant version of BLM public meeting handout.
- **Galileo** includes list of agency & proponent public meeting attendees with notes.
- **Megan** compiles and forwards MVP's privileged documents filed with FERC to Lauren and Grace.
- **Galileo** schedules new meeting time for Agency/Proponent weekly check-in meetings.
- **Megan** forwards tribal communications to Jennifer and Vicki (cc to Lauren and Grace).
- **Jennifer** follows up with FS archaeologist to discuss tribal consultation updates
- **Vicki** follows up with John Sullivan (BLM) to discuss tribal consultation updates.
- **Galileo** schedules agency tribal consultation calls as needed.

DECISIONS/DISCUSSION

- Megan requested a meeting with MVP and FS (and potentially BLM) to discuss FS's Oct 24th request for site-specific design. Jennifer noted the necessary FS representatives might not be available immediately. Jennifer also noted the FS's POD comments contain some instruction necessary for the completion of the site-specific designs. The FS's preferred method for proceeding is for MVP to develop a sample site-specific design that would detail MVP's approach for developing the site-specific designs.
- Jennifer suggested Alex Faught and Vicki meet to discuss FS and BLM coordination re MVP's application to the FS for Special Use Authorization (SUA for a ROW grant. Megan noted she would like to talk with Alex to discuss the process.

- Grace noted the BLM version of an MOU for MVP is complete. See action items above re further MOU and NDA development.
- The DOI Solicitor's Office requested a contract modification between Galileo and MVP to more accurately express how Galileo can assist the DOI Solicitor's office during the project. See action items above.
- Megan requested a meeting with FS and BLM visual resources team to discuss visual resources analysis, especially in regards to upcoming leaf-off analysis.
- Jennifer noted the FS would also like to see updated analysis of the Craig Creek crossing. Megan said the Craig Creek and site-specific design need to be completed concurrently.
- Vicki noted she is waiting on confirmation from the DOI Office of Environmental Policy Compliance re their role in coordinating BLM's review of the project. Vicki reached out to United States Army Corps of Engineers (USACE) and encouraged USACE to formally submit their ROW grant stipulations to the FERC docket.
- Galileo requested MVP send any project-related privileged documents to Galileo for inclusion in the decision file (DF). Jennifer noted Galileo should get documents directly from MVP and not download documents from any website other than FERC's docket for inclusion in the official DF. Jennifer also requested MVP send privileged documents from all versions, not just final versions, of MVP-generated documents for inclusion in the DF.
- FS POD comments still require some additional internal FS and BLM review before submission to FERC. Megan, Jennifer, and Vicki agreed a page-turn of MVP's updated POD per FS comments would be helpful in upcoming months.
- Vicki clarified FS and BLM archaeologists will be working together to identify and address any potential gaps in FERC's tribal consultation. Megan noted recent interest in the project from a potential tribal representative. Vicki and Jennifer requested any documents or information MVP has re tribal input.

FERC's MVP DEIS Public Meetings: 5:00-10:00 pm Eastern Time As of 10/18/16							
	Tuesday, November 1		Wednesday, November 2		Thursday, November 3		Wednesday, November 9
	Chatham, VA	Weston, WV	Rocky Mount, VA	Summersville, WV	Roanoke , VA	Peterstown, WV	Coal Center, PA
Vicki Craft (BLM)					X		
Jeanette McGrew (BLM)					X		
George Matzke (BLM)	X					X	
Jennifer Adams (FS)						X	
Shayne Banks (BLM)				X			
Megan Neylon (MVP)		X					
JoBeth Brown (FS)					X		
Joby Timm (FS)					X		
Rebecca Robbins (FS)					X		
Jesse Howard (FS)					X		
Dan McKeague (FS)						X	
Karen Overcash (FS)						X	
Troy Morris (FS)						X	

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Wednesday, November 16, 2016 @ 11:00 am -12:00 pm (Pacific)/12:00-1:00 pm (MT/AZ)/1:00-2:00 pm (CT)/ 2:00-3:00 pm CT
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft
	Forest Service (FS)	Jennifer Adams
	Mountain Valley (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTION ITEMS

- **Alex Faught (FS), Jennifer,** and **Vicki** meet to discuss MVP's application to the BLM for a Right of Way (ROW) grant.
- **Galileo** updates "Upcoming Meetings" tracking table and helps with scheduling.
- **Vicki**, **Miriam**, and **Jennifer** provide availability via tracking table and/or doodle poll for upcoming meetings.
- **Megan** submit revised Plan of Development (POD) to FS and BLM by 12/15/16 (target).
- **Meeting participants** send holiday vacation schedules for **Galileo** to compile.
- **Megan** sends date-less missing documents tracking table to meeting participants.
- **Vicki** and **Jennifer** forward respective responses to the Federal Energy Regulatory Commission's (FERC) Fixing America's Surface Transportation Act (FAST-41) data request to Galileo.
- **Galileo** forwards FS 218 and 219 objection brochures to Megan. *Complete*
- **Megan** coordinates revisions to Phase II Archaeological Resources Protection permit.
- **Jennifer** follows up with FS hydrologist to review MVP's hydrological analyses.
- **Jennifer** follows up with Ted Coffman (FS) and Ginny Williams (FS) to assess when visual analysis observation points will be ready.
- **Megan** forwards CD and hard copy versions of MVP filings, including FS-relevant alignment sheets, to Vicki and Galileo.
- **Megan** forwards all alignment sheets related to FS lands to Jennifer.
- **MVP** updates Biological Evaluation (BE) per FS August 15 comments and other relevant updated analyses (target delivery date December 15 with updated POD).
- **Vicki** forwards BLM tribal consultation tribe list to meeting participants.
- **Galileo** assists BLM with tribal consultation as requested.
- **Galileo** develops FS-MVP Memorandum of Understanding (MOU) and FS-Galileo Non-disclosure agreement (NDA).
- **Jennifer** reviews FS-MVP MOU and NDA.
- **Megan** obtains MVP signature on BLM-MVP MOU.
- **Galileo** assists in BLM-MVP MOU signature as requested.
- **Galileo** sends updated Scope of Work (SOW) to Megan. *Complete*
- **Jennifer** forwards decision file submission guidance to FS team this week.

DECISIONS/DISCUSSION

- Jennifer requested meetings between BLM, FS, and MVP to review and help develop portions of the POD and project analysis documents. Meeting tracking table below.
- Jennifer noted the forest biologists are finalizing the seed mix document for MVP.
- FS submitted comments on the POD on November 14. Megan said an updated POD should be ready by mid-December. Jennifer noted the updated POD should include a discussion of re-marking FS boundaries post-construction as well as a date and version

number. Galileo will house the most updated version of the POD on its File Transfer Protocol (FTP) site. Jennifer requested a January page-turn meeting to review the new draft POD with MVP when available.

- On November 15 FS submitted an information request for site-specific design of stabilization measures at high risk areas along the proposed pipeline route. Jennifer noted the FS visual resources team is working on submitting observation points for visual analysis in the coming weeks. FS is also working on a request for any other outstanding analyses.
- Megan noted MVP will not be submitting any supplemental materials relevant to the FS in the coming weeks. Jennifer requested MVP separate out the FS-relevant documents when filed with the FERC docket so they are more readily available for review and inclusion in the decision file.
- Jennifer said FS has been receiving several comments specific to hydrology, wells, springs, and karst. FS is concerned about these comments as actions on FS lands can affect adjacent private lands, especially with respect to water and geology. Vicki echoed FS's concerns about gaps in visual analysis.
- MVP is coordinating with FS archaeologists to update Phase II ARPA permit applications. MVP is also working on updating the BE. *Before the BE can be completely finished, MVP needs to complete the hydrological studies, which also depend on the pending seed mix document and subsequent re-vegetation plan.* Megan stressed she would like to get as many updated studies into the FERC docket before the end of the Draft Environmental Impact Statement (DEIS) public comment review period on December 22.
- Megan noted the MOU between BLM and MVP has been approved with no changes. The "missing document tracking table" is still in review at MVP. Jennifer requested a copy of the document tracking table without deliverable dates to help manage FS workload. Grace and Megan are coordinating the update to Galileo's Scope of Work.
- BLM submitted response to the FERC's FAST-41 request for a permitting timeline. FS is also formatting a response to the FAST-41 request. Both FS and BLM note they could not provide a hard permitting timetable as permit requests are subject to flexible objection and appeals process, and contingent upon timely data submission and decisions by all parties involved.
- Vicki notified FS and MVP that BLM will be initiating tribal consultation with constituent tribes who have not already been contacted by the FERC or the FS. FS will not be reaching out to the Ponca Tribe as they are not and have not been a stakeholder in the Jefferson National Forest.
- Grace noted Galileo submitted their document request to Megan. Galileo received the media documents from the FS. Jennifer confirmed Galileo needs a paper and digital copy of all versions FS-relevant alignment sheets to date and going forward. Vicki requested paper and CD copies of all alignment sheets as well.
- The next BLM/FS/MVP coordination meeting is scheduled for ***November 30 at 2:00 pm Eastern Time.***

Mountain Valley Pipeline	2016

Mountain Valley Pipeline Project Coordination – Special Discussion
Date/Time: Friday, Nov. 18, 2016 @ 10:30 – 11:30 am ET
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Nicole Virella John Sullivan, George Matzke, Carol Zurawski, Justin Katusak
	Forest Service (FS)	Jennifer Adams, Alex Faught, Dawn Kirk, Jess Soroka, Dan McKeague, JoBeth Brown, Ted Coffman, Tom Collins, Russ McFarlane, Carol Croy, Mike Madden, Pauline Adams, Fred Huber, Karen Overcash, Tom Bailey, Rebecca Robbins
	Galileo Project	Grace Ellis, Lauren Johnston

Meeting Objectives:

- ✓ Identify any outstanding data and analysis gaps that need to be addressed for FS and BLM to comply with their National Environmental Policy Act (NEPA) process.
- ✓ Discuss a coordinated path forward for complying with NEPA.

Path Forward:

- ➢ FS continues to compile a list of outstanding data and submits necessary data requests to the Federal Energy Regulatory Commission (FERC) docket.
- ➢ BLM drafts official letter noticing FERC of deficiencies in the Draft Environmental Impact Statement (EIS) and requesting a Supplemental EIS.
- ➢ BLM and FS follow up with DOI and OGC, respectively, in addition to FS and BLM management, for continued coordination.
- ➢ BLM and FS explore coordination with proponent to request more time for complete analysis and review.

Decisions/Discussion

In an effort to ensure both parties meet specific agency and regulatory requirements for NEPA, BLM and FS agreed to further discuss and pursue a request to FERC for a Supplemental EIS. ***Agency Action Item***

BLM and the FS have the following criticisms and concerns that warrant this request.

General:

- Upon review of the Draft EIS, Plan of Development (POD), and other NEPA analysis documents the FS and BLM both identified significant deficiencies and inconsistencies in the data, analyses, and conclusions presented in the document. BLM and FS are concerned these problems preclude their agencies' making an informed decision and fully complying with NEPA. To date, the BLM has not yet received the updated SF-299

right of way grant application that includes changes to the proposed route through federal lands.

- An additional point of concern is public access to and ability to comment on additional data, analyses, and plans presented after the closing of the Draft EIS public comment period. While FS acknowledges stakeholders can object to the FS actions before the FS issues their final project decisions, on the whole BLM and FS agree the FERC's EIS is inadequate for BLM and FS NEPA requirements. The volume and severity of data inadequacies would prevent BLM and FS from adopting the FERC Final EIS.

Cultural Resources:

- Cultural resource surveys are constantly under revision and not up to date. Permits to survey have not included a complete record of sites to be surveyed, and mitigation measures have been inadequate or absent in reports.
- Agency staff need to be consulted in process of identifying which sites are potential for listing in the National Register of Historic Places (NRHP).
- BLM is in the process of reaching out to tribes the FERC had potentially missed in their consultation process, including reaching out to the Ponca Tribe. ***Agency Action Item***

Visual Resources:

- The proposed pipeline route has been under revision since the first visual analyses were completed in 2015. FS has requested the proponent re-run the seen area analysis and complete surveys at leaf-off. FS stressed new Key Observation Points (KOPs) still need to be identified for new route variations (***Agency Action Item)***, and the proponent needs to complete initial narrative and photographical visual surveys to determine if additional visual simulations are needed.
- Both BLM and FS note the lack of contingency plan for potential failure of the direct bore method under the Appalachian National Scenic Trail (ANST). BLM and FS cannot support an open cut contingency plan. FS has requested, in writing and verbally, an adequate contingency plan. Jennifer will follow up on this request. ***Agency Action Item***
- FS would also like to point out the ANST is under consideration for listing on the NRHP. This has not been discussed or reflected in the Draft EIS.
- FS and stakeholders are concerned the proposed route maps do not contain the most updated route of the ANST.

Waterbody Crossings:

- FS, contractors, and proponents have discussed the crossing of Craig Creek and its unnamed tributaries on multiple occasions, have met to review proposed crossings, and FS has filed requests in the FERC docket concerning the Craig Creek crossing. FS is still not satisfied that the latest proposed crossing is consistent with the forest plan for the Jefferson National Forest and is waiting for an updated proposed crossing of Craig Creek.
- FS is still missing an updated alignment for the Craig Creek Crossings and Mystery Ridge portions of the proposed route.
- The number and type of waterbody crossings on forest lands is inconsistent throughout the Draft EIS and resource reports. Modifications to waterbody crossings are incomplete as feasibility studies have not been finalized.
- FS is concerned actions taken on FS lands can nearly directly affect water flow and supply to adjacent non-FS lands and wants to be sure these concerns are addressed.

Geology and Soils:

- Schematics for soil and erosion plans are generalized and incomplete. Mitigations are not explained in full detail in the Draft EIS or the POD.
- FS requires plans for topsoil segregation along the entire route of the pipeline. These are not reflected in the proponent's application for a right of way grant or in the Draft EIS.
- Potential rerouting around the Slusser's Chapel Conservation Site could place the proposed pipeline route through karst terrain on FS lands, which would require additional analysis.
- FS has requested multiple times to see analysis of project-induced landslides and specific data on steep slope cuts and fills. This data is still outstanding and vital to FS review of potential debris flow outside of the right of way and other catastrophic hazards related to dangerous steep slope construction.

Biological:

- Biological analyses, including an updated Biological Evaluation and Biological Assessment, are still outstanding. Numerous biological surveys have not been completed, precluding completion of analyses and conclusions.
- Analysis and surveys for threatened and endangered species do not include species likely to be listed as endangered by the United States Fish and Wildlife Service.
- The FS may require herbicide use to control invasive species along the right of way. Herbicide use on FS lands requires additional NEPA action.

MVP Call Agenda **Monday 21 November 2016**

Attending: Mary, Pete, Frank, John H, Barry, Mark, Vicky, Andrew, Wendy, Denise, Lindy, Miriam, Nicole, Leta, John C, Jennifer, Dan, Justin, Carol, Nicole, Haninah, Alison

Please note: BLM and the Forest Service are cooperating agencies; NPS is not.

Agenda:

- Crossing of the Appalachian National Scenic Trail: Authority for Forest Service
- Overall Concerns about the MVP DEIS
  - Impact of WV Court Decision
- How Does the NPS Position on the DEIS Figure in BLM/FS Concerns about the DEIS
  - Open Trenching
  - More Info Needed
- Role of OEPC
- Next Steps

Notes: **Due dates are in red below so they are easy to find.**

1) **FS Authority for AT Crossing:**
   a. FS and BLM have authority for lands bought by the FS separately
   b. Writing a legal memo
   c. No disruption to current process
   d. Some MOA changes may occur (NPS/ FS MOA)

2) **Overall Concerns about the MVP DEIS:**
   a. BLM: inadequate DEIS, missing info, not enough info to adopt as is
      i. Next steps:
         1. Get data
         2. Considering deficiency notice to applicant, letter to FERC
   b. WV Supreme Court decision:
      i. MVP not in public interest, no connection in WV, no eminent domain for surveys until have certificate
      ii. Could affect routing
      iii. Additional info needed: would this include private property?
   c. Does the FS need info from private land? e.g. persistence of species
   d. FS/BLM: missing info: both along the pipeline and on FS land
      i. Soils, water crossings, geology, but every resource needs info on the FS and COE lands
      ii. Visual impact analysis also a concern

iii. Wildlife impacts also a concern; formal consultation to be done "at future time"; effect determinations done without FWS consultation; consultation must be done before DEIS so terms and conditions from Biological Opinion are in the DEIS for everyone to review.

3) NPS Position:

a. Visuals, cumulative effects, Section 106
b. Cumulative effects section missing any analysis: see EPA comments on Atlantic Sunrise for a good analysis
c. Construction method in question; inconsistencies in the DEIS
d. BLRI:
    i. Crossing not in the DEIS
    ii. Cultural resource concerns
e. AT:
    i. No consultation on visuals
    ii. Continuous tweaking of the route and the information provided
    iii. MVP contacted the BLRI, but not the AT.
f. Overall, the FERC DEISs have come out too early, missing critical information. MVP is 3rd of the big pipeline DEISs to come out.
g. Section 106 consultation missing from all of the three pipelines (and a host of others).
h. Construction method: conventional boring or open trench

4) Role of OEPC:

a. Filing comments for DOI? Role of BLM (FS, COE), NPS, FWS
b. What is FWS doing?
c. Reduce confusion. Will a joint Departmental letter do this?
d. OEPC would like to review comments beforehand, even if not joint Departmental letter. Won't need much time for review.
e. OEPC deadlines: 1 or 2 weeks for review in normal procedure, but some flexibility and can start with drafts.
f. Dec 7 deadline; could be the 15th? But need to coordinate on what we are saying (BLM, NPS). See below.
g. Tentative agreement (pending internal discussions at each bureau):
    i. Drafts to OEPC (and each other, NPS, BLM and FWS if applicable) by Dec 7 COB
    ii. Final versions to OEPC and each other by Dec 15 COB
    iii. Send to Lindy Nelson at OEPC: lindy_nelson@ios.doi.gov
    iv. Let the group know if these deadlines can't be met after internal discussions.
    v. Mary will send MVP FAST-41 info to Lindy.

5) Next Steps / Questions:

a. If BLM issues a deficiency notice, how does that affect the Dec 22nd deadline?
    i. Haven't decided for sure on the notice, but would be as soon as possible. Not sure how it would affect the Dec 22nd deadline for comments.

ii. BLM in strong position, but FERC may issue certificate anyway.

b. Deadlines:
    i. See above tentative agreement on due dates
c. MVP may change route to avoid BLM involvement.
d. NPS concern over Forest Service Forest Plan amendments.

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Wednesday, November 30, 2016 @ 11:00am – 12:00 pm (Pacific)/ 12:00-1:00 pm (MT/AZ)/ 2:00 – 3:00 pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Alex Faught, Karen Overcash, Mike Madden
	Mountain Valley Pipeline (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** files information request for visual resources and other outstanding information.
- **MVP** responds to topsoil segregation and herbicide data request filed by FS on November 15, 2016 (November 16, 2016 in docket CP16-10).
- **Galileo** follows up with Vicki re BLM's Tribal Consultation.
- **FS** continues to send MVP media documents to Galileo.
- **Grace** develops a draft contract modification to include expanded scope of work. Forwards to FS, then MVP for review.
- **Galileo** contacts Cardno, the Federal Energy Regulatory Commission's (FERC) contractor, to coordinate comment analysis. *Meeting set for 12/5.*
- **Jennifer** forwards any necessary archaeological or tribal documents to Galileo for inclusion in the decision file.
- **Jennifer** sends potential meeting dates for conservation measures to Galileo. *Complete*.
- **Galileo** schedules conservation measures meetings and other upcoming meetings as directed.

DISCUSSION/DECISIONS

- Megan notified FS MVP is anticipating an update to the Craig Creek Crossing next week or soon after. Megan also noted MVP is working on the Biological Evaluation, Hydrologic analysis, sedimentation plan, updated Plan of Development (POD), and cultural reports. MVP anticipates receiving data requests and Draft Environmental Impact Statement (EIS) comments. Jennifer expressed concern route modifications and additional information may be submitted by MVP after the end of the Draft EIS public comment period, precluding the public's ability to view and comment on the documents.
- Jennifer notified Megan the FS will be filing an information request for visual resources and other outstanding information, including comments on the Craig Creek Crossing, by the end of the week. Miriam noted she is not aware of any upcoming BLM filings.
- Jennifer requested Galileo help with comment and objection standing tracking on behalf of the FS, using FS comment response methods. Galileo requested to contact Cardno to help identify search requirements and deliverables to suit FS needs. Megan approved Galileo to submit a contract modification for comment and objection tracking work.

- Galileo received paper and digital copies of MVP filings with FERC for inclusion in the decision file. Jennifer noted Mary Helms (FS) will continue sending MVP news articles to Galileo.
- Mike clarified MVP needs to perform Phase II archaeological surveys on all cultural resource sites (not structures) within the Area of Potential Effect (APE). Mike said this includes sites not recommended (by the contractor) as eligible for listing in the National Register of Historic Places (NRHP) should still go through Phase II archaeological surveys to ensure all potential information is retrieved. Mike also instructed the Phase I surveyed sites need to include true site boundaries, not just boundaries within the APE. If the site boundary presents a safety issue, note that in the report.
- Mike recounted tribal consultation efforts by FS thus far have only resulted in telephone conversations with the Eastern Band of Cherokee. Grace requested Mike forward any relevant documents or notes to Galileo for inclusion in the decision file.
- Jennifer informed Megan the FS team will be ready to discuss conservation measures in the next few weeks. Future meetings will be scheduled around holiday and leave availability.

Upcoming Meetings:

Boundary Marking/Site-Specific Design Call – December 6, 2016 @ 11:00 am ET

BLM/FS/MVP Weekly Check-in – December 7, 2016 @ 2:00 pm ET

Mountain Valley Pipeline	2016

MVP & ACP: Pipeline Comment/Future Galileo task discussion
Date/Time: Wednesday, November 30 @ 9:00-10:30 am (MT/AZ)/ 11:00am – 12:30pm (ET)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Alex Faught, Karen Overcash, Karen Stevens, JoBeth Brown
	Galileo Project	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston, Ellen Hopp

Objectives:
- ✓ Review current scope of work (SOW)
- ✓ Identify additional project needs, including:
  - ✓ Tracking Filings
  - ✓ Objection Process Support
  - ✓ Additional Document Review Support
  - ✓ Additional Meeting Support
- ✓ Identify assumptions and deliverables for out of scope tasks
- ✓ Answer Questions About Project Assistance Contracts

Galileo Contract Modifications:
- ✓ Additional meetings each month
- ✓ Additional General Support Hours
- ✓ Comment & Objection Process Tracking
- ✓ Plan of Development (POD) support

ACTIONS

- **Galileo** writes draft contract modification for Mountain Valley Pipeline (MVP) and Atlantic Coast Pipeline (ACP) tasks.
- **Galileo** and **Megan Neylon (MVP)** discuss contract modification and reaching out to 3rd party contractors on weekly MVP/FS Check-in call. *Complete*
- **Galileo** drafts contract modification email for Jennifer to send to Richard Gangle (ACP).
- **Galileo** coordinates with Federal Energy Regulatory Commission FERC contractor, Cardno, to clarify comment tracking process and Forest Service deliverables.
- **Galileo** forwards draft contract mod to Jennifer, Karen S. and Karen O. for review
- **Galileo**, **Karen O.,** and **Karen S**., **Alex**, and **Kent Karriker** (FS) follow up on contract modification and objection process deliverables late next week.
- **Jennifer** forwards contract modification for internal review.
- **Galileo** schedules a call with Jennifer (Jan) to review the construction monitoring plan.
- **Jennifer** sends excel file of scoping comments to Galileo.
- **Jennifer** and **Galileo** follow up to confirm document access and reviews for FS.

DISCUSSION/DECISIONS

- Grace reviewed the meeting objectives and current scope of work, described in slides 3 and 4 of the attached PowerPoint. Maria confirmed additional out of scope support, including litigation assistance, is paid for by the proponent.

- Peter reviewed the reviews and searches FS has asked Galileo to perform, which include searching for government entity comments, tracking down FS-relevant filings from the proponent, and tracking documents which need FS review. These are to help the FS accurately and efficiently identify documents pertinent to their decision.
- Jennifer requested Galileo continue to review internal FS comments for formatting, duplication, and grammar, especially with future reviews of the POD. Jennifer also approved adding more hours for meetings and follow up as well as other general support for project teams to improve efficiency of action item follow up and other tasks.
- Grace reviewed the documents received from Cardno, which include twenty-one comment letters received since the Draft Environmental Impact Statement (DEIS) was released, and a comment-response document identifying comments that need response from the FS and/or the Bureau of Land Management. Jennifer echoed concerns the contractor might not be capturing all of the relevant comments. Jennifer also noted she will send Galileo the scoping comments for objection standing review and comment-response tracking.
- Jennifer approved Galileo to start working with Cardno to identify what the FS needs for comment analysis. FS requested contact information as well as comment compilation, content analysis, and assistance in identifying commenters with objection standing to the FS decisions (See conceptual draft output below). Galileo will also assist FS in tracking responses in the final NEPA document. These review efforts require additions to the Galileo SOW and would consist of the following effort:
    - Work with EIS contractors to find efficiencies in using their database to pull necessary information for inclusion in the objection tracking database.
    - Initiate compilation of scoping comments
    - Initiate preliminary identification/compilation of FS-associated comments, including identification of representative comments.
    - Develop preliminary list of comments that need FS response or action. Target: 2 weeks after contractors provide updated comment tables.
    - Populate objection tracking table once all DEIS comments are processed by contractors.
    - Assist FS with addressing decision points and responding to comments.
    - Work with EIS contractor to identify where comments were addressed in the EIS.
    - Develop standalone report with methodology, representative comments, and responses.

Draft Output Table

Name	Org.	Mail	Email	Date	Letter	Comment	Response	Action	EIS Reference

Mountain Valley Pipeline	2016

MVP: Boundary Call
Date/Time: Tue, Dec 6, 2016 @ 9-10am (MT/AZ)/ 11am-noon (ET)
Location: Conference Call & GoTo Meeting

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Alex Faught, Mitchell Kerr, Tom Collins, Mary Helms, Tom Bailey, Angela Parrish
	Mountain Valley Pipeline (MVP)	Megan Neylon, Jacob Sangermano, Melissa Fontanese, Ricky Myers, John Uhrin, James Kerns
	Draper Aden	Billy Newcomb, Mike Futrell
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:

- ✓ Discuss FS expectations for pre- and post-construction treatment of FS boundaries.
- ✓ Review MVP's preliminary site-specific stabilization designs & provide additional guidance.
- ✓ Update on FS topsoil segregation requirements and progress from MVP.

ACTIONS

- **Mitch** and **Megan** follow up this week to discuss FS requirements for marking boundaries.
- **MVP** ties routing to lines and corners.
- **Megan** follows up with consultants on survey methodology and delivery date for routing profile sheets.
- **Megan** updates tracking sheet for missing/outstanding documents to include completed surveys. *Time Sensitive*
- **Megan** updates Jennifer with target delivery date for site-specific stabilization designs.

DECISIONS/DISCUSSION

- FS stressed any corners disturbed, obliterated, or destroyed during the construction process will need to be restored, and the boundary lines re-marked to FS standards post-construction. Mitchell shared two documents outlining FS requirements for boundary marking. The requirements listed in this document should be part of MVP's POD as well as stipulations to the Right of Way grant.
- FS instructed routing and planning profile sheets need to be tied to property corners. Megan stated the surveying contractors have not been tying the routing to property corners, and this may take additional surveying work, which could delay delivery of the final routing planning profile sheets. Megan also stated the surveyors do not search for property corners on private lands unless they are visible or pointed out. Mitchell instructed all property corners in the FS corridor need to be marked to ensure accuracy.
- Megan confirmed the requested routes along Peters Mountain have been completed but the updated Craig Creek Crossing has not been completed.

- Jennifer updated MVP she will be submitting an information request to the Federal Energy Regulatory Commission (FERC) project docket for instructions on additional surveys and visual analysis.
- Melissa presented site-specific stabilization design drawings for a representative steep slope area of the pipeline route in the Jefferson National Forest (JNF), as requested in the Oct 24, 2016 information request from the FS. Tom C. said the drawings are a step in the right direction to meet FS needs to review designs. Tom C. requested more detail with regards to potential for project-induced cut-slope or fill-slope failures. He also instructed FS needs to see accurate and detailed representations of how the trenches may vary based on slope steepness and construction method. Tom C. requested mass balance accounting for cut and fill, and detailed descriptions of where all spoil piles, including trench spoils, topsoil spoils, temporary ROW spoils, and if applicable, ATWS spoils, will be located in order to help assess the need for geotechnical stabilization.
- Melissa and Billy summarized slope stability analysis and potential failure hazards. Billy stressed a key to slope stability will be keeping water out of the construction sites and material. Tom C. emphasized FS wants to see drawings for the restoration including cross-sections of restoration with its cut-and-fills in relation to original ground surface and analysis of the potential for failure and long term stability of any fill left on the slope.
- Miriam requested additional analysis of potential impacts to immediately adjacent slopes. Melissa ensured this analysis would follow if necessary, however most trench-fill will be in rock, not soil. Angela stressed she wants to see further details on construction sequencing and methodology specifically in relation to placement and storage of material removed from trenches, and further post-construction stability measures if needed. Melissa assured these concerns will be addressed in the full report, which will contain construction typicals for dealing with these issues. Melissa noted she expects to file the full site-specific stabilization report in the next few weeks.
- Jennifer inquired if MVP is planning to file a document with FERC stating topsoil segregation will be added to their project proposal. Jennifer stressed if this is not added to MVP's proposal it cannot be analyzed in the FERC's Environmental Impact Statement (EIS), and this may require additional supplemental analysis after the conclusion of the FERC's NEPA process. This is because objectors to the FS decision automatically have standing if they are objecting on the basis of missing data/analysis.
- Tom B. stressed concern there could be limitations to slope contour and topsoil restoration due to steepness of slope and removal of vegetation. Tom C. confirmed the FS wants topsoil segregated and replaced everywhere where slope steepness does not prevent it. Tom would like to see MVP analyze and determine the slope gradient at which topsoil would not be stable.

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Wednesday, December 7, 2016 @ 11:00am – 12:00 pm (Pacific)/ 12:00-1:00 pm (MT/AZ)/ 1:00-2:00 pm (CT)/ 2:00 – 3:00 pm (ET)
Location: Conference call

Attendees	BLM	Miriam Liberatore, Vicki Craft
	Forest Service	Jennifer Adams, Alex Faught
	Mountain Valley Pipeline (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Megan** reviews objection process procedures and reviews with internal legal team
- **Karen Overcash** (FS) forwards any other useful objection process regulations as needed.
- **Galileo** forwards objection process tracking methodology options to Jennifer for review.
- **Galileo** develops objection process tracking scope/contraction modification for MVP.
- **Galileo** emails Megan with interim use of general agency support hours to start objection process and comment tracking.
- **Megan** sends list of outstanding documents and target delivery dates to Jennifer
- **Jennifer** forwards Galileo's Nondisclosure Agreement and MVP-FS Memorandum of Understanding to FS legal team.
- **Megan** works with Jennifer to discuss submitting sedimentation analysis to FS before submitting the updated Biological Evaluation.
- **Jennifer** follows up with FS Biologists re: herbicide use on forest lands.
- **Galileo** schedules meeting for visual resources as needed.
- **Megan** forwards visual aids from Dec 6. Boundary/Survey call to Galileo. *Complete.*
- **Vicki** extends internal and external law enforcement call invitations to BLM law enforcement.
- **Megan** updates team re: visual resources after call with Tetra Tech (proponent contractor).
- **Vicki** invites **Peter DeWitt** (BLM Southeastern States) to Dec. 8 visual resources call.
- **Galileo** sends compiled Draft Environmental Impact Statement (EIS) comments to Vicki.

DISCUSSION/DECISIONS

- Grace summarized Galileo's Dec. 5 call with Cardno, the Federal Energy Regulatory Commission's (FERC) EIS contractor. Grace updated Galileo will be writing a contract modification to include efforts to help identify commenters who have standing for the FS's regulatory objection process and to help the FS and BLM respond to comments identified by Cardno as relevant to respective agencies.
- Galileo will need to identify comments from scoping and the Draft EIS comment period to establish a full list of commenters with objection standing. Megan approved in concept Galileo using current "General Agency Support" hours to continue developing a strategy for these efforts, but asked that Grace send an email making a formal request to that effect. The request should also include out of scope work to support response to comments and draft updated EIS text to address agency-relevant comments.

- Jennifer explained that in addition to commenters who have standing based on specific comments, any person can comment on the Final EIS and obtain standing based on missing information in the Draft EIS. Jennifer explained this is because the public needs an opportunity to provide comments on relevant studies and NEPA documents during an official public comment period.
- The Forest Service is discussing this internally how to proceed with allowing public comment on outstanding information presented after the Draft EIS comment period.
- Megan clarified MVP does not need to add an extra 25 feet to their Right of Way grant and proposal with FERC to accommodate topsoil segregation. Jennifer said MVP should submit a document to the FERC docket stating they plan to provide topsoil segregation (so it can be analyzed in the EIS). Jennifer also instructed MVP to explain in detail why their construction plans will not require extra width for topsoil segregation. Given FERC's Plan allows for the extra 25 feet and most companies use the extra space, the FS will need assurance from MVP that topsoil segregation could be accomplished without the additional workspace.
- Megan noted MVP explicitly stated in the October 2015 Resource Report #3 they would use herbicides on national forest lands at the direction of the forest service (text from October 2015 Draft Resource Report #3 pgs. 3-22 to 3-23 below).

"MVP has committed to not use pesticides or herbicides during routine right-of-way maintenance, unless requested by a land management agency. In its comments on draft Resource Report 3, the USFS notes there may be situations where using pesticides or herbicides will be desirable, for example control of nonnative invasive plants and treatment of insect infestations within Jefferson National Forest. If during project operation control of invasive species is requested by a landowner or land-managing agency, MVP will work with the respective landowner or agency to develop an agreed upon approach for control."

Megan stated this was not listed in the EIS. She plans to add the language back in to the EIS per the FS request. Jennifer noted that the language "*MVP has committed to not use pesticides or herbicides during routine right-of-way maintenance, unless requested by a land management agency" states that MVP will <u>not use</u>, though MVP's statement says it would address an agency's request, it doesn't specifically ask FERC to include herbicide use. It is MVP's responsibility to close this loop with FERC*

- Megan indicated MVP is working on updated visual analyses. Megan requested a call with Tetra Tech and FS resources specialists to discuss visual resources analysis. BLM will also attend the call.

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date/Time: Wednesday, December 7, 2016 @ 11:00am – 12:00 pm (Pacific)/ 12:00-1:00 pm (MT/AZ)/ 1:00-2:00 pm (CT)/ 2:00 – 3:00 pm (ET)
Location: Conference call

Attendees	BLM	Miriam Liberatore, Vicki Craft
	Forest Service	Jennifer Adams, Alex Faught
	Mountain Valley Pipeline (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Megan** reviews objection process procedures and reviews with internal legal team
- **Karen Overcash** (FS) forwards any other useful objection process regulations as needed.
- **Galileo** forwards objection process tracking methodology options to Jennifer for review.
- **Galileo** develops objection process tracking scope/contraction modification for MVP.
- **Galileo** emails Megan with interim use of general agency support hours to start objection process and comment tracking.
- **Megan** sends list of outstanding documents and target delivery dates to Jennifer
- **Jennifer** forwards Galileo's Nondisclosure Agreement and MVP-FS Memorandum of Understanding to FS legal team.
- **Megan** works with Jennifer to discuss submitting sedimentation analysis to FS before submitting the updated Biological Evaluation.
- **Jennifer** follows up with FS Biologists re: herbicide use on forest lands.
- **Galileo** schedules meeting for visual resources as needed.
- **Megan** forwards visual aids from Dec 6. Boundary/Survey call to Galileo. *Complete.*
- **Vicki** extends internal and external law enforcement call invitations to BLM law enforcement.
- **Megan** updates team re: visual resources after call with Tetra Tech (proponent contractor).
- **Vicki** invites **Peter DeWitt** (BLM Southeastern States) to Dec. 8 visual resources call.
- **Galileo** sends compiled Draft Environmental Impact Statement (EIS) comments to Vicki.

DISCUSSION/DECISIONS

- Grace summarized Galileo's Dec. 5 call with Cardno, the Federal Energy Regulatory Commission's (FERC) EIS contractor. Grace updated Galileo will be writing a contract modification to include efforts to help identify commenters who have standing for the FS's regulatory objection process and to help the FS and BLM respond to comments identified by Cardno as relevant to respective agencies.
- Galileo will need to identify comments from scoping and the Draft EIS comment period to establish a full list of commenters with objection standing. Megan approved in concept Galileo using current "General Agency Support" hours to continue developing a strategy for these efforts, but asked that Grace send an email making a formal request to that effect. The request should also include out of scope work to support response to comments and draft updated EIS text to address agency-relevant comments.

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- The Forest Service is discussing this internally how to proceed with allowing public comment on outstanding information presented after the Draft EIS comment period.
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Megan stated this was not listed in the EIS. She plans to add the language back in to the EIS per the FS request. Jennifer noted that the language "*MVP has committed to not use pesticides or herbicides during routine right-of-way maintenance, unless requested by a land management agency" states that MVP will <u>not use</u>, though MVP's statement says it would address an agency's request, it doesn't specifically ask FERC to include herbicide use. It is MVP's responsibility to close this loop with FERC*

- Megan indicated MVP is working on updated visual analyses. Megan requested a call with Tetra Tech and FS resources specialists to discuss visual resources analysis. BLM will also attend the call.

Mountain Valley Pipeline	2016

Mountain Valley Pipeline: Boundary Follow Up
Date/Time: Thursday, December 8 @ 11:00 am (Pacific, AZ)/ 1:00 pm (CT)
Location: Conference Call

Invitees	Forest Service (FS)	Jennifer Adams, Mitchell Kerr
	Mountain Valley Pipeline (MVP)	Megan Neylon, Kameron Barnhouse
	Allegheny Surveys, Inc. (Allegheny)	Bill Yetzer, Damon Wilkewicz
	Galileo Project	Lauren Johnston

Objectives:

- ✓ Clarify FS Surveying and boundary marking requirements with survey contractor
- ✓ Address any outstanding survey questions

ACTIONS

- **Mitch** forwards Peters Mountain deeds and plats to Bill and Damon.
- **Mitch** forwards needed shapefiles and plans to Bill and Damon as needed.
- **Mitch** forwards link to FS national online GIS service to Bill and Damon.

DISCUSSION/DECISIONS

- Mitch clarified the FS would need Allegheny to replace all disturbed or obliterated monuments and remark any exterior boundary lines disturbed by pipeline construction, if the project is approved. Mitch said FS would also require a boundary plat delineating the pipeline centerline, temporary workzone/use areas, and permanent use areas on impacted National Forest System lands. Acreage should be shown on the plat, for the different use types. This plat will be used to develop a special use permit for the pipeline project, if approved. Bill confirmed this could be completed, and for each replaced monument Allegheny would provide a plat.
- Bill confirmed most of the surveying work is complete however Allegheny will need to make sure they go back out and captured all corners. Megan noted the Craig Creek crossing route, and thus surveying, is not yet complete. Bill requested any deeds, plats, and survey information from Mitch to help in the process of surveying the final route and capturing all lines and corners.
- Mitch clarified for obliterated or disturbed corners, standard corner cards should be used for remarking. Mitch also clarified will supply replacement monuments that can be stamped if needed.

Mountain Valley Pipeline Project Coordination
Date/Time: Thursday, December 8, 2016 @ 12:00-1:00pm (PT)/ 1:00 – 2:00 pm (MT) 2:00-3:00pm (CT)/3:00-4:00pm (ET)
Location: Conference Call

Attendees	BLM	Vicki Craft, Kimberly Melendez-Rivera, George Matzke
	Forest Service	Jennifer Adams, Alex Faught, Jim Twaroski, Jess Saroka, Mitchell Kerr, Karen Overcash, JoBeth Brown
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** forwards government entities comment tracking table to Karen, Rebecca, Jennifer, and JoBeth. *Complete.*
- **Galileo** adds petition and form letter tracking to comment and objection process tracking.
- **Jennifer** emails Lavinia DiSanto (Cardno) requesting information on petition and form letter tracking in the Federal Energy Regulatory Commission (FERC) process. *Complete.*
- **Galileo** submits comment and objection process tracking strategy to FS next week.
- **Jennifer** submits Visual Resources information request to the FERC project Docket.
- **Galileo** compiles BLM comments on the Draft Environmental Impact Statement (DEIS) and drafts transmittal letter for BLM DEIS comments. *Complete.*
- **Vicki** submits BLM DEIS comments to the Office of Energy policy Compliance (OEPC) by December 12.

DISCUSSION/DECISIONS

- Vicki reiterated the BLM is concerned with the lack of data and analysis in the visual resources section of the DEIS. BLM is also concerned with the lack of contingency plan for crossing the Appalachian National Scenic Trail (ANST) and potential for open-trenching. BLM biologists have expressed concern over incomplete survey data and consultation with the United States Fish and Wildlife Service.
- FS reiterated concerns regarding the still outstanding updated Craig Creek crossing and overall lack of information in the DEIS. The new FS hydrologist is still reviewing the relevant data for accuracy and completion. Alex cited general concern from agencies and the public on the lack of analysis in the DEIS.
- Jennifer stated FS is expecting Mountain Valley Pipeline (MVP) to file a response to their information request for topsoil segregation and herbicide use to get both in the FERC proposal and in the EIS for analysis.
- Jennifer noted the FS met with MVP and contractors to discuss their progress on site-specific stabilization designs. Tom Collins (FS) was pleased with the drawings and requested additional information regarding analysis of potential for project-induced slope, analysis of trench variability based on slope steepness, achievable levels of slope

restoration post-construction, and mass balance accounting for spoil piles. Tom Bailey (FS) requested detailed representation and analysis of topsoil segregation and stressed concerns on limitations to replacing topsoil and slope contour post construction.

- Jennifer noted MVP expects to file updated slope-stability analyses in the coming weeks.
- Karen updated the FS is still discussing the threshold for requesting supplemental analysis due to information missing from the DEIS. The concerns are specific to availability of data and analysis relevant to the FS decision for public comment.
- Mitch provided an update from this week's boundary/survey calls. FS is working with MVP's contractor to assist in identifying property corners and provide the FS with plan drawings that include impacted acres on FS lands if the project is approved and constructed. Mitch cited minor tweaks to the proposed pipeline route but stated the study area and proposed and temporary easements have been adequately marked. He does not recommend monumenting the Right of Way (ROW) at this point.
- Jennifer clarified the pipeline route has minor variations on National Forest System lands however the variations are within the initial study corridor. The main concern at this point for the FS is the lack of acceptable alternative for the Craig Creek crossing.
- Grace summarized Galileo's tasks for helping the FS identify and respond to FS-relevant comments on the MVP project. Galileo is coordinating with Cardno and the FS to come up with a strategy to track comments and to streamline response to objections (if received) during the FS 218 and 219 objection processes. Karen requested Galileo submit a strategy for identifying whether or not objectors have standing once the objection process begins. Grace confirmed Galileo will also search for comments not captured by Cardno which contain FS-relevant information. Jennifer noted she would as Cardno for assistance in identifying commenters on petitions and form letters.

UPCOMING MEETINGS

Internal Law Enforcement Call: Monday, December 12 @ 12:00 ET
External Law Enforcement Call: Tuesday, December 13 @ 10:00 am ET
Visual Resources Call: Tuesday, December 13 @ 3:00 pm ET
Next FS/BLM Coordination Call: Thursday, January 12 @ 3:00 pm ET

Mountain Valley Pipeline	2016

Internal FS Law Enforcement Call
Date/Time: Monday, December 12 @ 12:00-1:30 pm (E)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Kent Karriker, Alex Faught, Julie Fosbender, Roni Etheridge, WJ Cober, Gavin Hale, Kim Stadtmueller, Mike Madden, Ted Coffman, James Willet, Rebecca Robbins, Peter Irvine, Katie Ballew
	Bureau of Land Management (BLM)	Miriam Liberatore
	Galileo Project	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston

Objectives:

- ✓ Determine agenda items for law enforcement discussions with pipeline proponents to consider if pipelines are approved through National Forest lands.

ACTION ITEMS

- **James** forwards Law Enforcement questions and needs document to Peter R. for distribution.
- **Maria** updates and forwards agenda to participants for review and edits.
- **Katie** confirms law enforcement cost recovery requirements for the proposed pipeline projects, if approved and constructed.
- **Jennifer** works with Department of Transportation to confirm any restricted activities in the construction Right of Way (ROW) for potential pipeline projects.
- **Participants** review relevant project documents prior to law enforcement discussion with pipeline proponents.

DISCUSSION/DECISIONS

- An updated external law enforcement call agenda reflecting FS concerns is attached to this agenda.
- FS expressed concerns about public exploitation of ROW to access the forest from sites not approved for public access, if pipeline projects are approved and constructed. This could result in damage to existing cultural, heritage, and archaeological sites; poaching; encroachment on wilderness areas; and unauthorized access via off-road vehicles. Mike emphasized concern about potential for archaeological sites to be raided stating significant monitoring would be needed. Mike also expressed concern for unapproved access to important sites during surveying or project implementation.
- Mike stated he is extremely concerned with the forest service Heritage team absorbing monitoring and ARPA related costs for this project long after potential project implementation. Cost recovery for long term heritage monitoring, site stabilization, etc.

need to be addressed looking not only at current issues but also those encountered much later on.

- Peter I. stressed proponent construction/development plans need to be updated to reflect law enforcement responsibilities along the entire proposed ROW, and not just at crossroads and likely access points, to ensure recreation only happens on appropriate roads and trails. Katie noted this will include surveillance camera work and increased FS law enforcement patrols.
- Katie noted that there will be long term effects from the potential pipeline construction long after it is completed. Increased levels of illegal activities will occur on pipeline route right-of-way requiring increased patrolling-monitoring by law enforcement (LEI) and increase the potential for other LEI costs that have occurred in similar environs (I.E. dumping of methamphetamine chemicals and lab equipment requiring clean up, illegal atv use requiring repair, poaching, etc.) These activities will increase costs for LEI not covered by forest budgets.
- The Forest Service noted that any closure orders will require additional NEPA documentation and analysis before they could be approved. The NEPA procedures for closure orders will be outlined in MVP's Plan of Development and the ACP COM Plan.
- Miriam stated the BLM will make sure FS law enforcement stipulations are in the ROW grant written by BLM.
- Katie stressed the FS is not equipped to handle protests and/or emergencies on its own. Allocation of law enforcement responsibilities, including cost recovery, in the short and long terms needs further discussion.
- James expressed a need for the proponent to identify needed safety measures for dangerous areas along the ROW if the pipeline if constructed. This includes road closures, extra enforcement, and proper regulations. James also noted the proponent needs to outline a plan to coordinate with agencies to make sure proponent employees/contractors know relevant regulations and restrictions during and after construction, if approved.

Mountain Valley Pipeline: FS Law Enforcement Call

Date/Time: Tuesday, December 13 @ 8:00-9:30am (M)/ 9:00-10:30am (C)/ 10:00-11:30am (E)

Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Alex Faught, Ted Coffman, JoBeth Brown, Mike Madden, James Willet, Kim Stadtmueller
	Bureau of Land Management (BLM)	Vicki Craft, Scott Peace
	Mountain Valley Pipeline (MVP)	Megan Neylon, Duane Moriarty, John Uhrin,
	Tetra Tech	Joseph Iozzi, John Scott
	Galileo Project	Maria Martin, Lauren Johnston

Objectives:

- ✓ Clarify agency and proponent responsibilities for law enforcement pre, during, and post construction on the MVP project *if approved*.
- ✓ Identify main FS law enforcement and safety concerns at the survey phase, and if the project is approved.
- ✓ Establish a baseline for further law enforcement discussions re agency and proponent safety and law enforcement responsibilities if the project is approved.

ACTIONS

- **FS** forwards the following to MVP to assist in updating the Plan of Development (POD):
  - Wheelchair access designs
  - List of allowed activities on the Right of Way (ROW) on FS lands
  - Preliminary list of necessary law enforcement equipment
  - Sample closure order
  - Required immediate emergency information
  - Law enforcement training templates
  - Law enforcement agreements between the FS and other entities
- **MVP** updates the POD per FS instruction provided during the meeting
- **Duane** forwards contact information to Jennifer.
- **Jennifer** schedules further law enforcement meetings as needed.

DISCUSSION/DECISIONS

- The FS expressed concern over encroachment on wilderness areas, inventoried roadless areas, and the Appalachian National Scenic Trail (ANST) especially when related to off-road vehicle access. Ted noted that FS is concerned about unauthorized access to the ROW along the entire route through FS land not just at road crossings. Mike noted his concerns about increased access to previously inaccessible cultural/heritage/archaeological sites and emphasized the need for long term monitoring of heritage and archaeological sites. FS is particularly concerned with inevitable long term increase in looting at these sites when information about them gets out.

- Jennifer instructed MVP to include a discussion of long term monitoring of cultural sites and other resources as identified in the next iteration of the POD. James emphasized long term monitoring is meant to protect both FS property and MVP assets in the forest.
- Megan noted MVP plans to update the POD to include clear descriptions of access road conditions during and post construction. This can help inform FS requirements and capabilities for long term monitoring. Alex stated the FS would require roads to be properly gated and signed and to include appropriate foot/wheelchair accessibility while limiting vehicular access.
- FS expressed the need for outlining in the POD which activities are allowed along the ROW. Jennifer noted this needs to include a discussion of FERC and DOT regulations. Megan requested details on allowed activities in the Peters Mountain and Brush Mountain areas. Alex and James emphasized the need to have a communication pathway for FS, proponent, and contractors to identify activities along the ROW that need to be prevented, i.e. mountain biking on unofficial trails created via changes to the FS lands in the ROW.
- Duane stated the MVP has the budget to provide security along the ROW as needed, including protest and emergency response. James and JoBeth emphasized the FS does not have the resources to act as an emergency response agency, and law enforcement and security on FS lands is a collaborative effort with local law enforcement and safety agencies. Duane and John U. stated MVP and contractors would provide assistance in regulation enforcement, i.e. gates and locks and signage along the ROW, per FS specifications. Jennifer instructed information specific to gates and locks needs to be in the next iteration of the POD.
- James noted the main FS enforcement tool is a closure order. James and Kim stated the FS has NEPA and civil rights regulations to follow as part of a closure order and this takes time and resources.
- Megan and Duane requested further meetings with the FS to discuss specifics of the FS-MVP relationship with regard to law enforcement roles and responsibilities and cost recovery. James requested FS be involved in any law enforcement meetings with county/local law enforcement to make sure the FS responsibilities are accurately represented.
- MVP confirmed any damage caused by the project, including fires or other disasters from construction and public safety emergencies are the responsibility of MVP. Megan requested FS add required information to an immediate emergency response sheet. James requested further conversations to identify communication points of contact and pathways for disclosing construction activities and emergencies in the project ROW.

Mountain Valley Pipeline	2016

Mountain Valley Pipeline: Visual Resources Call
Date/Time: Tuesday, December 13 @ 1:00 – 2:00 pm (MT)/ 3:00 – 4:00 pm (ET)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Ginny Williams, Ted Coffman, Karen Overcash
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani
	Tetra Tech	Lori Davidson, John Scott, Joseph Iozzi
	Galileo Project	Maria Martin, Lauren Johnston

Objectives:
- ✓ Review MVP's visual analysis
- ✓ Answer any MVP visual analysis questions
- ✓ Provide MVP with direction for any additional needed studies

ACTIONS

- **FS** sends utilities example of visual resources report to MVP visual resources team.
- **MVP** completes additional visual resources studies at leaf-off
- **MVP** completes seen area analysis studies for the final route.
- **Megan** updates Jennifer on ETA for updated visual resources report.
- **Megan** submits topsoil segregation letter to Federal Energy Regulatory Commission (FERC).

DISCUSSION/DECISIONS

- Lori reviewed a map of Key Observation Points (KOPs) and updated FS on current completed visual simulations. Lori noted KOPs would have to be re-photographed due to weather conditions.
- Ginny instructed the MVP visual resources team should drive and hike the route, noting in photograph and narrative the length and quality of visual exposure of the pipeline along the route. Ginny noted this exercise should include the road and proposed Craig Creek crossing. She also mentioned that the area along Route 42 between Rush Mountain and Sinking Mountain is of concern.Ted stated the observation points along trails, including the Appalachian National Scenic Trail should also include analysis at off-trail points at the discretion of the visual resources team. Ted also noted that if there are a lot of social media images of a particular place, it should be considered in the analysis.
- Ted requested a copy of the updated seen area analysis including the new route variation parallel along Mystery Ridge Road when available. FS filed a letter on Dec. 12, 2016 in the FERC Project docket requesting seen area analysis verification for the most updated route. Ted also reemphasized the need for completed leaf-off studies along the route through FS lands.
- Megan stated FERC has not instructed them to do any analysis on the Mt. Tabor Variation to avoid Slussers Chapel proposed by the Virginia Department of Conservation and Recreation in September 2016. They do not plan to do extra analysis. Ginny noted the variation would change FS visual resources concerns and analysis needs for that area.
- Ted reiterated the FS and FERC want to see visual simulations for several years into the future. Lori stated the visual simulations to date show 5-10 year duration.
- Jennifer reiterated MVP needs to submit an explanation of why MVP will not be requesting any additional Right of Way space to accommodate FS requests for topsoil segregation.

Mountain Valley Pipeline: Timber Plan Call

Date/Time: Thursday, December 15 @ 6:00-8:00 am (P)/ 7:00-9:00 am (M)/ 9:00-11:00 am (E)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Russ Macfarlane, Mark Miller, Karen Overcash*
	Bureau of Land Management (BLM)	Miriam Liberatore
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani, Brent Ladd
	Tetra Tech	John Scott, John Crookston
	Galileo Project	Grace Ellis, Lauren Johnston

*Partial Attendance re NEPA questions.

Objectives:

- Review FS requirements and expectations for Timber Plan and removal for the MVP project, if approved.
- Review FS comments on MVP's draft Timber Plan.
- Answer questions from and provide direction to MVP for further Timber Plan development.

ACTIONS

- **MVP** updates Timber Plan with information from today's call (see below).
- **MVP** submits Timber Plan to the Federal Energy Regulatory Commission (FERC) project docket for comment and review.
- **MVP** includes a request for site visits to review Timber Plan details in transmittal to FERC docket.
- **MVP** incorporates the Timber Plan into the next draft of the Plan of Development (POD).
- **MVP** updates the POD to include consideration of winter construction comments.
- **Jennifer** files updated seed mix document in the FERC docket. Sends to Megan. *Complete*.
- **FS** discusses Timber Plan details in the Inventoried Roadless Area (IRA) and methods for dealing with slash.
- **Brent** and **Megan** review proposed disturbance areas and timber landing locations.
- **Jennifer** schedules further Timber Plan comment review meetings as needed.

DISCUSSION/DECISIONS

- Russ specified the Timber Plan should incorporate both logging and removal plan details. FS expects a map that shows all locations where timber will be cut, where landing locations are, where temporary and skid roads will be located, how timber will be removed from FS lands, and harvesting methodology for standard areas as well as steep slopes.
- Russ and MVP agree collocating the landing areas and roads with construction staging/temporary work sites and access roads is environmentally favorable. MVP noted it is standard practice to collocate as much as possible and they don't perceive adding additional disturbance outside of their construction proposal, save for logistical complications on steep slopes.
- Russ stressed the FS wants merchantable timber to be purchased and milled, not left on FS lands. Russ noted MVP will purchase the timber under a separate contract with the

FS if the proposed project is approved. Jennifer clarified this timber harvest counts towards the annual FS timber sale target.

- FS noted soils, wildlife, and other resource specialists will provide input for best practices for handling non-merchantable tree products, i.e. slash. Brent noted it is standard MVP practice to use slash as erosion prevention along the Right of Way (ROW) and access roads as needed, with openings to accommodate wildlife. MVP will include a discussion of how best to deal with non-merchantable timber products with respect to FS resource concerns in the next iteration of the Timber Plan.
- Jennifer cited public comments concerning the project's effects in the Inventoried Roadless Area (IRA) and requested MVP work out a plan to use only the construction ROW for Timber Plan activities. Karen stated the regulations and a previous court decision provide for timber harvest in the IRA as part of another allowed activity. This allows timber clearing in the IRA for the proposed pipeline, if approved. Karen emphasized the need for minimal impact to the wilderness characteristics in the IRA.
- Megan noted MVP plans to use the ROW in place of roads in the IRA. Karen and Jennifer recommend making it clear MVP will work in that area with special concern for maintaining wilderness characteristics and provide any extra mitigation as necessary.
- Jennifer instructed MVP incorporate the Timber Plan as an appendix to the POD and file it in the FERC project docket so the public can access it. Jennifer also instructed the POD should articulate details of how and why MVP will use slash in the project, with considerations for wildlife and soil health, minimizing equipment passes and soil compaction, as well as a rough project schedule. Jennifer requested MVP keep consistent naming and scheduling in iterations of the POD and amendments.
- FS agrees more discussion is needed to determine how best to cruise and mark the timber in the IRA, as paint may not be allowed. ***Post-meeting note:*** *FS anticipates painting a boundary around project areas and installing plots to determine volume for appraisal. This will save painting every tree. Therefore, FS requests an accurate "Trimble-grade" traverse to create a shapefile for use with the cruise. Trimble-grade traverse has a high degree of accuracy. MVP GIS shop probably already has this available.*
- Mark stressed any ground disturbed must first be surveyed by archaeologists to address their concerns. FS needs to confirm internally what surveying/timber marking activities are allowed before the project is approved. FS prefers to not redo work as the route continues to change. Russ and Mark commented the full timber cruise, if the project is approved, could not begin until a decision on the ROW grant is finalized and signed. Mark noted it would take up to 60 days for FS personnel to complete the timber cruise prior to construction, if the project is approved.
- Mark notified MVP the FS will be inspecting logging/timber removal equipment either on or off site to help prevent the spread of nonnative invasive species (NNIS). Jennifer requested MVP include a note about logging/timber equipment inspection in the next iteration of both the Timber Plan and the NNIS plan.

Mountain Valley Pipeline	2016

Mountain Valley: BLM, USFS, EQT Check-In
Date: Wednesday, January 11, 2016
Time: 11:00am-12:00pm (PT)/ 12:00-1:00pm (MT)/ 1:00-2:00 pm (CT)/ 2:00-3:00 pm (ET)
Location: Conference call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore, Vicki Craft
	United States Forest Service (FS)	Jennifer Adams
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Megan** sends request to Jennifer for Joe Dawley (MVP general counsel) to meet with Joby Timm (FS Supervisor).
- **Megan** follows up with Melissa to review steep slope monitoring data in response to FS's DEIS comment information request on Dec. 22, 2016.
- **Megan** and **Jennifer** follow up re steep slope efficacy information request.
- **Jennifer** forwards MVP meeting request to FS Supervisor.
- **Jennifer** and **Karen Overcash (FS)** review Galileo's objection process strategy. Forwards to Regional Office (RO) for review as needed.
- **Jennifer** and **FS Biologists** finish Right of Way (ROW) rehabilitation suggestions.
- **MVP** completes and submits updated Plan of Development (POD), Biological Evaluation (BE), hydrological analyses, and visual analyses.
- **Jennifer** and FS biologists complete & submit herbicide plan comments to MVP docket.
- **FS RO** reviews MVP-FS Memorandum of Understanding (MOU) and Galileo-FS Nondisclosure Agreement (NDA).
- **Galileo** sends Decision File reminder email to FS teams early next week.
- **Galileo** sends Notice to Proceed graphic to BLM to potentially share with MVP.
- **Lauren** checks for BLM decision file documents & sends update to Vicki.
- **Jennifer** contacts law enforcement officials for meetings.
- **MVP** finalizes BE and sedimentation plans.
- **Megan** sends Craig Creek route map to Jennifer.
- **Jennifer** and **FS Biologists** review and discuss Craig Creek route map.
- **Grace** and **Jennifer** work through POD workshop meeting logistics.
- **Grace** and **Jennifer** schedule upcoming meetings starting next week (see table below).

DISCUSSION/DECISIONS

- Vicki emphasized the Department of the Interior's (DOI) concerns are expressed in the Office of Energy Policy Compliance (OEPC) Draft Environmental Impact Statement (DEIS) Comments. John updated he expects the Federal Energy Regulatory Commission (FERC) to submit an information request that may include the DOI concerns. John stressed if the FERC's request does not include all of those concerns MVP still plans to address them separately.
- Grace clarified Galileo is working with the FERC's contractor Cardno to help FS to review and respond to comments received on the DEIS. Galileo is also tasked with using a keyword search to make sure all FS-relevant comments are identified and addressed.

Grace confirmed this and the objection process effort will both be in a contract modification request from Galileo to MVP.

- Megan said MVP filed supplemental information relevant to the FS on December 22, 2016, including a POD response document and Craig Creek route information. Jennifer noted FS needs to review Craig Creek crossing information for compliance with the FS Land and Resource Management Plan and to ensure it addresses previously-voiced concerns.
- Megan updated MVP plans to file an updated POD, BE, and updated visual and hydrological analysis in the coming few weeks. Megan requested an in-person law enforcement meeting and conservation measures meeting be prioritized to help meet these deadlines with sufficient documents. Jennifer noted FS is working to complete their discussion on the ROW rehabilitation measures necessary to hold these meetings.
- Jennifer reiterated her request for a discussion of the efficacy of steep slope stabilization measures based on available monitoring data from EQT and/or other projects that have steep slopes.
- Miriam clarified pre-construction measures MVP needs to complete before a Notice to Proceed (NTP) can be issued will be given to MVP in advance and are usually included as conditions of the Record of Decision.

Next MVP/FS/BLM Meeting: January 18, 2017 @ 2:00 pm ET

Upcoming Agency/Proponent Meetings			
Meeting	**Attendees**	**Timing**	**Comments/Action Items**
Conservation Measures	FS Biologists, Vicki, Miriam, Megan, MVP contractors, Galileo	January	**Jennifer** works with FS specialists to complete internal conservation measures discussions.
Law Enforcement	FS Law Enforcement Officers, BLM Law Enforcement Officers, MVP contractors Vicki, Miriam, Galileo	January	**Jennifer** forwards sample Law Enforcement information to Megan as needed. **Jennifer** obtains law enforcement officer availability. **Megan** forwards portions of the POD relevant to FS law enforcement to Jennifer.
POD workshop	FS & BLM resource specialists, Vicki, Miriam, Megan, MVP contractors, Galileo	Mid/Late February	**MVP** completes edits to POD and submits to FS. Short successive meetings scheduled by resource. Combination of in-person and GoTo.
ROW Rehab	FS & BLM resource specialists, Vicki, Miriam, Megan, MVP contractors, Galileo	February	**Jennifer** works with FS specialists to complete ROW review.
Timber Plan	FS & BLM resource specialists, Vicki, Miriam, Megan, MVP contractors, Galileo	TBD	**Megan** and **Russ** follow up re Timber comment questions. Meeting can be avoided if Russ can answer Megan's questions, including concerns in the Inventoried Roadless Area.

Mountain Valley Pipeline	2017

Mountain Valley Pipeline Project Coordination

Date/Time: Thursday, February 2, 2017 @ 12:00-1:00pm (PT)/ 1:00 – 2:00 pm (MT) 2:00-3:00pm (CT)/3:00-4:00pm (ET)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Alison McCartney, Bruce Dawson
	Forest Service (FS)	Jennifer Adams, Jim Twaroski, Tim Abing, Joby Timm, Karen Overcash, Alex Faught
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Bruce** follows up with Karen Mouritsen (BLM) to initiate a second high level coordination meeting with the FS and the Federal Energy Regulatory Commission.
- **Jennifer** and **JoBeth Brown (FS)** coordinate with Vicki to invite the appropriate BLM personnel to next week's meetings with the Commonwealth of Virginia.
- **BLM** and **FS** meet with the Commonwealth of Virginia to discuss project progress and mitigations on Friday, February 10.
- **Mountain Valley Pipeline (MVP)** responds to FERC's Environmental Information Request by February 16, 2017.
- **Vicki** shares finalized BLM mitigation guidance with FS.
- **FERC** updates the project schedule based on quality of information received from MVP.
- **Galileo** continues work on pipeline effects and mitigation table.
- **Jennifer** and **Grace** follow up on the MVP-FS Memorandum of Understanding (MOU) status.
- **Galileo** adds "BLM document request update" to the next agency-MVP coordination agenda.
- **Vicki** and **Jennifer** coordinate any future deficiency notices.

DISCUSSION/DECISIONS

- FS is concerned MVP's most recently FERC-filed Craig Creek Crossing route is not
- Jennifer requested MVP send complete filings to the FS and Galileo to avoid missing any documents FS might want to review.

UPCOMING MEETINGS

MVP/Agency Coordination: Wednesday, February 8 @ 1:00 CT/2:00 ET
Agency Coordination: Thursday, February 16 @ 2:00 CT/3:00 ET

Mountain Valley Pipeline	2017

Mountain Valley: BLM, USFS, EQT Check-In
Date: Wednesday, January 25, 2017
Time: 11:00am-12:00pm (PT)/ 12:00-1:00pm (MT)/ 1:00-2:00 pm (CT)/ 2:00-3:00 pm (ET)
Location: Conference call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore, Vicki Craft
	United States Forest Service (FS)	Jennifer Adams, Alex Faught
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **FS NEPA specialists** discuss the Federal Energy Regulatory Commission's (FERC) comment period for newly identified affected landowners as it relates to the FS objection process.
- **MVP** updates and submits the Plan of Development (POD) and Standard Form 299 (SF-299) to FS and BLM.
- **Megan** sends shapefiles for constructible Craig Creek Crossing routes to FS and BLM.
- **Grace** and **Jennifer** coordinate a go-to meeting to discuss the Craig Creek crossing and hydrology concerns. *In Progress*.
- **FS** and **Galileo** coordinate updates to and signature of the MVP-FS Memorandum of Understanding (MOU).
- **Jennifer** meets with GAI to initiate 3rd party geotechnical review contract. *Complete.*
- **Jennifer** follows up with FS specialists to review MVP's emailed information requests on surveying (01/13) and law enforcement needs (01/18).
- **Vicki** and **Miriam** discuss BLM data needs for National Park Service (NPS) lands. *Complete.*
- **Megan** sends requested documents to Galileo.
- **Jennifer** forwards USFS comments on MVP's herbicide use plan to Megan.
- **Grace** updates meeting invite to reflect biweekly schedule.

DISCUSSION/DECISIONS

- Galileo is waiting for a full list of comments and needed responses from Cardno, the FERC's Environmental Impact Statement (EIS) contractor. Grace noted further guidance will be needed on handling FERC's comment period for newly affected landowners.
- Jennifer and Vicki stressed the need for an updated SF-299 and POD with the final route across federal lands in order to comply with agency norms and regulations. Vicki noted BLM has not seen a signed and completed SF-299 for the project.
- Megan said MVP is working on a contingency plan for crossing the Appalachian National Scenic Trail that does not include open trenching. This will be filed in the coming weeks and included in the next iteration of the POD.
- Jennifer stressed the FS is concerned about a Craig Creek route that includes crossing of an unnamed tributary. Jennifer suggested a go-to meeting with the FS specialists and MVP to review the two constructible Craig Creek crossings and identify any potential measures to make sure FS is happy with the route. Jennifer stressed stakeholder interest in and concern for this particular route segment as it relates to water issue.

- Jennifer updated some changes need to be made to the MVP-FS MOU. MVP's review is on hold until Galileo incorporates the changes.
- Jennifer notified MVP the FS will bring on a 3rd party contractor to provide assistance with geotechnical engineering, hydrology, soils, and other resources as determined. FS identified GAI as their preferred contractor with local experience. BLM and MVP supported the need for contractor involvement.
- Megan requested follow up from emails from FS specialists regarding materials from December meetings.
- Vicki reiterated a previous email request for documents regarding communication and filings between MVP and the United States Army Corps of Engineers (USACE). Megan informed MVP is working on updated project plans and permits related to USACE lands and will share them with the BLM when completed.
- Megan asked for clarification on Galileo's data request on behalf of the FS and BLM for documents related to the NPS lands on the project, and is working on getting documents sent to Galileo.
- Jennifer updated the FS has completed reviewing the herbicide use plan.
- Jennifer inquired if MVP had coordinated with The Appalachian Trail Conservancy (ATC) regarding visual surveys. Megan said they had not.

Next MVP/FS/BLM Meeting: February 8, 2017 @ 2:00 pm ET

FS Pipelines	2017

Internal FS Objection Process/Comment Response

Date/Time: Friday, January 27 @ 10:30am-12 pm (M)/ 12:30-1:30 pm (E)

Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Karen Overcash, Karen Stevens, Alex Faught, Kent Karriker, Mary Helms, Carrie Gilbert, Brenda Quale, Shawn Olson, Shannon Kelardy, Paul Arndt, Julie Fosbender
	Galileo Project (Galileo)	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston

Objectives:

- Review & Update Galileo's Objection Process tracking plan and proposal
- Review & Update Galileo's Comment-Response tracking plan
- Review FS requests for tracking project effects and mitigation measures

ACTIONS

- **Galileo** drafts list of potential new information to establish objection standing.
- **Galileo** refines key words for FS-relevant comment identification.
- **Galileo** updates and distributes the following for FS review:
  - Meeting notes and action items
  - Objection Process & Comment Response flowcharts
  - Environmental Consequences Tracking Table
  - Pipeline Project Mitigation Table
- **FS specialists** review and provide comments to Galileo on Environmental Consequences Tracking Table, Objection Process flowchart, and Pipeline Project Mitigation Table by February 3rd, 2017.
- **Galileo** drafts email for Jennifer to send to the Federal Energy Regulatory Commission (FERC) to determine how to handle:
  - Post- FERC Pre-FS deadline comments
  - Comments from specific landowners with a special comment period
  - Comments mailed directly to the FS but not to FERC.
  - Comments FS identifies as relevant that are not already addressed by FERC
- **FS specialists** discuss comment filter based on proclamation vs. owned lands.
- **Galileo** and **Jennifer** review Notice to Proceed graphic next week.
- **Brenda** sends new information question and answer document.
- **Galileo** develops statement of work for objection process coordination.

DISCUSSION/DECISIONS

- Grace reviewed the objection process graphic (attached). FS regional office NEPA and litigation specialists directed that commenters have standing if they are objecting on time and have made a previous pertinent comment on time, or if they are objecting on time based on new information not previously available for public comment. FS specialists stressed objectors have standing on these grounds whether or not the issue they object to has been resolved. FS specialists also stressed there is some grey-area in determining objection standing, which will be ultimately resolved by FS.

- Establishing what constitutes new information is up to FS discretion, favorable towards the public objectors. FS and Galileo agreed having a preliminary list of qualified new information would help streamline the eventual objection review process. Grace clarified roughly 1,000 objections of varying complexity is a reasonable estimate for this project and Galileo's scope of work contract modification.
- The FS noted their desired deliverable from the objection process is a project record index with objector information, objection, grounds for standing, status of resolution, and location of resolution within project documents. Galileo and FS agreed all final determinations will be made by FS.
- Grace reviewed Galileo's proposed comment response tracking graphic (attached). FS noted they would like to include all comment responses in a single document coordinated with FERC, but they are unclear of FERC's preference in handling additional comments. FS needs clarification on how FERC will handle comments submitted only to FS and/or BLM, and comments that FS finds relevant yet not already addressed by FERC.
- FS stated they would like Galileo to search the FERC docket using FS-identified keywords in an effort to make sure relevant comments are not missed.
- Galileo clarified their communication from here forward with proponents will not include discussion related to FERC's schedule or document release dates to cooperating agencies. FS clarified Galileo can talk with FERC's 3rd party contractors as an extension of FERC.
- Grace reviewed Galileo's draft Pipeline Project Mitigation Table. FS requested adding a section to identify what major issues the projects encountered and how the issues were resolved.
- Grace reviewed the updated Environmental Consequences Tracking Table. Alex requested adding columns to assess efficacy of current proposed mitigations and any future needed mitigations.

Mountain Valley Pipeline	2017

MVP FS Craig Creek Crossing Discussion
Date & Time: Wednesday, February 1@ 1:00-2:00pm (M)/3:00-4:00pm (E)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Alex Faught, Pauline Adams, Dawn Kirk, Dan McKeague, Jesse Overcash, Karen Overcash
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani, John Uhrin
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:
- ✓ Review MVP's Proposed Craig Creek Crossings
- ✓ Answer any FS questions concerning the proposed and alternative crossings
- ✓ Discuss the FS's continuing data needs

ACTIONS

- **MVP** confirms Craig Creek Crossing proposed and alternative route flagging. Time Sensitive.
- **FS specialists** visit Craig Creek Crossing site to review on the ground
- **MVP** and **FS** coordinate on sedimentation analysis model assumptions.
- **MVP** completes and submits sedimentation analysis to the Federal Energy Regulatory Commission (FERC) docket and to the FS.
- **MVP** completes Craig Creek Crossing package and sends to FS for review.
- **FS** reviews Craig Creek Crossing package once received.
- **MVP** includes Tom Collins on future Craig Creek Crossing data transmittals.
- **Megan** sends flagging schematics to FS.

DISCUSSION/DECISIONS

- Jennifer reiterated the FS's concerns with adding new information to the FERC's project docket so late in the project schedule. Jennifer stressed the FS wants to complete the Craig Creek Crossing as soon as possible and wants to find ways to make one of the crossings meet the Forest Plan and management standards, especially with regards to maintaining the riparian corridor. The FS wants to be sure the crossing can be adequately analyzed in the Final Environmental Impact Statement (FEIS).
- Megan reviewed the three current route alternatives for the Craig Creek Crossing. MVP's proposed route is the shortest route with the least amount of disturbance on NFS and neighboring lands. MVP does not believe alternative 1 is constructible as it goes over fairly steep and narrow slopes and would require winch construction as a result. Alternative 2 is longer than the proposed route but does not cross as steep or as narrow of a ridge as Alternative 1. Megan confirmed Craig Creek Crossing alternative 2 was not ever filed in the FERC docket as it presents conflict with the Preston Forest/Creek.
- MVP confirmed they do not plan to use Preston Forest or Brush Mountain Wilderness to access the site during construction. MVP plans to access the site by driving up the right-of-way (ROW) off of Craig Creek Road.
- Jesse stressed his concern the MVP's proposed route would not meet Forest Plan standards as proposed, especially as it relates to avoiding the riparian zone.

- Pauline and Dawn requested maps with clearer slope averages that match the topography to avoid confusion. MVP apologized for any confusion regarding the maps and the alternative crossing development process as a whole.
- The FS requested the following to be filed with the FS and in the FERC record so it can be analyzed completely and accurately as part of the DEIS:
    - Pull back flagging from Craig Creek and narrow the additional workspace
    - Blasting Plan for crossing the tributary to Craig Creek
    - Narrative stating why alternatives were dismissed in favor of the proposed route
    - Revised sedimentation analysis
    - Consultation on sedimentation analysis model inputs
    - Site-specific Best Management Practices for construction

Mountain Valley Pipeline Project Coordination

Date/Time: Thursday, February 2, 2017 @ 12:00-1:00pm (PT)/ 1:00 – 2:00 pm (MT) 2:00-3:00pm (CT)/3:00-4:00pm (ET)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Alison McCartney, Bruce Dawson
	Forest Service (FS)	Jennifer Adams, Jim Twaroski, Tim Abing, Job Timm, Karen Overcash, Alex Faught
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Bruce** follows up with Karen Mouritsen (BLM) to initiate a second high level coordination meeting with the FS and the Federal Energy Regulatory Commission (FERC).
- **Miriam** reaches out to BLM mitigation specialists for insight on compensatory mitigation.
- **Jennifer** and **JoBeth Brown (FS)** coordinate with Vicki to invite the appropriate BLM personnel to next week's meetings with the Commonwealth of Virginia.
- **BLM** and **FS** meet with the Commonwealth of Virginia to discuss project progress and mitigations on Friday, February 10.
- **Mountain Valley Pipeline (MVP)** responds to FERC's Environmental Information Request by February 16, 2017.
- **Vicki** shares finalized BLM mitigation guidance with FS.
- **FERC** updates the project schedule based on quality of information received from MVP.
- **Galileo** continues work on pipeline effects and mitigation table.
- **Jennifer** and **Grace** follow up on the MVP-FS Memorandum of Understanding (MOU) status.
- **Galileo** adds "BLM document request update" to the next agency-MVP coordination agenda.
- **Galileo** sends notes backlog to MVP along with new notes review protocol. *Complete*
- **Vicki** and **Jennifer** coordinate any future data requests or notices to MVP
- **Galileo** forwards objection process graphics to Vicki. *Complete*
- **Jennifer** sends email to IDTeam communicating the following:
    - Deadline reminder for reviewing Galileo's Objection Process graphics
    - FERC's answers as to how to handle FS-relevant comments
- **Galileo** starts processing comments from FERC (received 2/3) and schedule meetings as needed.

DISCUSSION/DECISIONS

- Vicki and Jennifer restated documents they still need from MVP in order to complete their analysis and review, including an updated SF-299 with a complete route and Plan of Development (POD) and associated project plans, a Biological Evaluation, Biological Assessment, visual analysis, hydrological analysis, an updated Craig Creek Crossing package (for all alternatives), and a contingency plan for potential boring failure under the Appalachian National Scenic Trail (ANST). Karen stressed the importance of the Craig Creek Crossing package since alternatives cross the Brush Mountain Wilderness

Inventoried Roadless Area and would need to be approved by the Chief of the Forest Service (30-day minimum process).

- Vicki cited BLM's comments in FERC's EIR requesting MVP provide a record of any consultation they have had with managing partners of the ANST, especially regarding visual impacts to the trail, mine pool protocol, and a final blasting plan.
- Vicki said the BLM believes an additional comment period for the public is warranted to improve transparency and relations with the public. Vicki suggested another meeting with FERC, BLM, and FS is needed to come up with a public involvement strategy to handle all of the new and piecemeal information after the end of the Draft Environmental Impact Statement (DEIS) public comment period. Bruce, Job, and Jennifer agreed another follow up meeting with FERC is warranted.
- Vicki and Jennifer said FERC committed to reviewing the quality of MVP's supplemental filings to inform an update to the schedule, which is still in flux.
- Job invited BLM to a meeting with the Commonwealth of Virginia to discuss the Commonwealth's path forward with mitigation and project plans.
- Vicki refined an earlier document request to MVP to include only essential documents to approving the grant, and to not include documents regarding National Park Service (NPS) lands in the project. If BLM needs any missing documents for review related to NPS lands. BLM will coordinate with the NPS to receive courtesy copies of NPS-relevant documents.
- Jennifer provided an update on how FERC and FS can coordinate responding to FS-relevant comments that don't meet FERC's requirements for a response in the DEIS comment response matrix. Galileo will identify comments received by FS but not filed with FERC and Jennifer will submit those to the record. Galileo will perform a keyword search to identify any comments that were not captured in FERC's comment response matrix and pass those on to FS for response. Galileo and FS will also watch for FS-relevant comments in the FERC's special comment period for newly affected landowners. Karen stated this helps ensure FS has done its due diligence with regards to public comments and the objection process.
- Jennifer reiterated she expects MVP to notify FS before they file any upcoming Craig Creek crossing information. Jennifer stated MVP will be submitting three alternatives for the FS to analyze, one which has not already been submitted to the FERC docket. Jennifer noted MVP's preferred route is not the FS's preferred route.
- Jennifer updated the notes sharing protocol to share notes with all meeting attendants first, receive comments, and then have Vicki and Jennifer approve any changes and finalize the notes for the decision file.

UPCOMING MEETINGS

Meeting with Commonwealth of Virginia: February 10
MVP/Agency Coordination: Wednesday, February 8 @ 1:00 CT/2:00 ET
Agency Coordination: Thursday, February 16 @ 2:00 CT/3:00 ET

Mountain Valley Pipeline	2017

Mountain Valley: BLM, USFS, EQT Check-In
Date: Wednesday, February 8, 2017
Time: 11:00am-12:00pm (PT)/ 12:00-1:00pm (MT)/ 1:00-2:00 pm (CT)/ 2:00-3:00 pm (ET)
Location: Conference call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Kimberly Melendez-Rivera
	United States Forest Service (FS)	Jennifer Adams
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofani
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **MVP** files a response to the Federal Energy Regulatory Commission's (FERC) Environmental Information Request (EIR). *Partially Complete*.
- **Megan** confirms the Craig Creek route flagging is updated. *Complete*.
- **FS NEPA specialists** review the updated Craig Creek Crossing on the ground.
- **Jennifer** and **Galileo** meet to discuss questions for FERC's contractor.
- **Galileo** adds Craig Creek Crossing discussion to meeting planning table. *Complete*.
- **Jennifer** follows up with FS specialists to respond to Megan's January email requests. *In Progress*
- **John** shares MVP leadership availability for meeting with BLM/FS/EQT management.
- **Jennifer** follows up with FS management to schedule a BLM/FS/EQT meeting.
- **Megan** forwards FS ANST data request question to Jennifer for clarification. *Complete*.
- **Jennifer**, **Galileo**, and BLM coordinate DEIS missing document list. *In Progress*
- **Jennifer** and **Galileo** coordinate document delivery to GAI consultants. *In Progress*
- **Jennifer** and **Galileo** coordinate final signature of the MVP MOU. *In Progress*
- **Grace** resends meeting invite to John. *Complete*.

DISCUSSION/DECISIONS

- Jennifer reiterated the FS wants to review MVP's updated Craig Creek package before it is filed in the FERC record. John confirmed MVP could deliver the updated information by close of business tomorrow.
- Vicki clarified the BLM does not need copies of National Park Service (NPS) documents relating to the Appalachian National Scenic Trail (ANST) or the Blue Ridge Parkway from MVP. BLM will file an official request of any of the documents are needed. John confirmed MVP will be filing a consultation record with the NPS in the FERC record as part of a response to a FERC data request.
- MVP confirmed they are planning to file an updated Craig Creek Crossing package for the FS by the end of this week. They are also planning to file a response to FERC's EIR by next week, which will include several of the analyses and missing documents (Plan of Development, Biological Evaluation, etc.) the FS and BLM have requested.
- Megan reiterated her request for additional information from FS regarding visual, law enforcement, and boundary survey needs. Jennifer confirmed this is in progress. Megan cited her concerns that FERC does not have the correct ANST shapefiles and requested clarification on a data request from FERC that originated with the FS.
- Vicki confirmed BLM is interested in having a meeting with MVP management. MVP and FS echoed the need for a meeting and agreed to discuss a joint management meeting.

Next MVP/FS/BLM Meeting: Wednesday, February 22, 2017 @ 2:00 pm ET

Mountain Valley Pipeline	2017

MVP PM Coordination Call

Date/Time: Tuesday, February 14 @ 12:00 – 1:00 pm (PT)/ 1:00-2:00 pm (MT)/ 2:00–3:00pm (CT)/ 3:00 – 4:00 pm (ET)

Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Karen Overcash
	Bureau of Land Management (BLM)	Miriam Liberatore
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:

- ✓ Finalize DEIS Comment Delivery Option to FS and BLM
- ✓ Discuss Upcoming Mitigation development
- ✓ Provide further direction on project schedule, reviews, and upcoming meetings.

ACTIONS

- **Jennifer** works with **Karen Stevens** (FS), **Karen O.**, **Kent Karriker** (FS), and **Alex Faught** (FS) to streamline keywords.
- **Grace** holds March 15-17th for in-person meeting with the FS and BLM to review Draft Environmental Impact Statement (EIS) comment responses. *Complete*.
- **Galileo** forwards DEIS comment response options to Karen O., Jennifer, Miriam, and Vicki. *Complete.*
- **Karen** provides guidance to Galileo re DEIS Comment Response tables. *Complete*.
- **Grace** provides preliminary suggestions on MVP mitigations table. Sends to Jennifer before 02/16 Mitigations Call.
- **Lauren** and **Jennifer** coordinate Mitigation and FS/US Fish & Wildlife Service calls.
- **FS specialists** provide DEIS comment responses to Cardno by end of March.
- **Miriam** and **Vicki** coordinate an email to Paul Friedman (Federal Energy Regulatory Commission) to request a meeting to discuss FS and BLM analysis of MVP's environmental information request (EIR) responses.
- **Grace** holds February 21st and 23rd for a FERC/Federal Cooperating Agency meeting to discuss MVP's EIR responses**.** *Complete*
- **Galileo** drafts Plan of Development (POD) review comment tables and transmittal email for FS and BLM. *Complete*

DISCUSSION/DECISIONS

- Miriam and Jennifer provided an update on FERC's tentative schedule revision. The Cooperating Agencies will receive a Preliminary Administrative Final EIS in the beginning of March, with a review deadline in the beginning of April. Miriam noted she expects FS and BLM to have until the first week of April to review comments on the DEIS, however FERC has not confirmed this deadline. Jennifer noted FERC has yet to publish a new Notice of Schedule.
- Grace stressed the importance of the schedule in determining how Galileo will prepare comments for FS/BLM processing. Lauren reviewed DEIS comment table options for FS.

Miriam suggested a series of DEIS comment review meetings in the middle of March to facilitate completion of review.

- Jennifer and Miriam agreed an email to Paul Friedman to request a meeting regarding MVP's EIR responses is needed to make sure FS and BLM can provide input as to the quality of responses.
- Jennifer reiterated the FS wants to be as thorough as possible in identifying any letters FERC potentially missed for FS and BLM to address. Grace suggested FS needs to streamline their search keywords to improve efficiency in the process.
- Grace summarized the list of documents and reviews FS and BLM will have to complete in the coming months. Jennifer agreed Galileo could help facilitate POD and MVP's EIR response reviews.

Mountain Valley Pipeline Project Coordination
Date/Time: Thursday, February 16, 2017 at 3:00-4:00pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Kimberly Melendez-Rivera
	Forest Service (FS)	Jennifer Adams, Karen Overcash, Alex Faught, Jess Saroka, Troy Morris, Joby Timm, Elizabeth LeMaster
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Grace** drafts brief list of reviews and schedule crunches for Agency conversation with Paul Friedman. (*Complete*).
- **Jennifer** follows up with Paul Friedman to confirm project schedule.
- **Vicki** follows up with Bruce re requesting an agency meeting with Paul Friedman. (*Complete*).
- **Vicki** and Jennifer email Paul Friedman re an agency meeting to discuss the project schedule and upcoming reviews.
- **Grace** works up a "Soils" sample of the Mountain Valley Pipeline (MVP) mitigation table for Jennifer and Karen to review. (*Complete*).
- **Karen** reviews Grace's "Soils" mitigation sample.
- **Jennifer** reviews MVP's Craig Creek Crossing package (sent 02/15/2017)
- **Jennifer** reviews MVP's requested additions to the Seed Mix document (sent 02/14/2017)
- **Vicki** touches base with Anita Bradburn at the United States Army Corps of Engineers (USACE) re MVP's Weston Gauley update (sent 02/15/217). (*Complete*).
- **Vicki** provides a Weston Gauley visuals review deadline to Peter DeWitt.
- **Galileo** sends comment/response table to project managers (*Complete*)
- **Galileo** overnights a jump drive with MVP's 02/09/2017 partial responses to the Federal Energy Regulatory Commission's (FERC) Post Draft Environmental Impact Statement (EIS) Environmental Information Request (EIR) to Vicki and Jennifer (*Complete*).

DISCUSSION/DECISIONS

- Vicki requested any reference to the FERC's EIR #6 be changed to FERC's Post DEIS EIR for filename consistency.
- Jennifer provided FERC's updated document review schedule for Cooperating Agencies (CAs):
    - Provide DEIS Comment Responses by March 6th
    - Review & Comment on Preliminary Administrative Final EIS March 6th – April 3rd
    - MVP's Post-DEIS EIR response review (unknown deadline)
- Jennifer noted it's likely April 6th is the last date CAs would have to review the EIS before it is finalized, which is scheduled to happen in May. FS and BLM personnel expressed concern that this would allow the FERC to change portions of the EIS that FS wouldn't have a chance to review.
- Karen, Jennifer, Vicki, and Miriam agree the FERC's review and comment response deadlines are not manageable, as there is missing information they need in order to correctly analyze documents and respond to comments. Participants agreed it is

necessary to start conversations with FERC regarding the project schedule and review times. Participants also agree review times may change based on the quality of information received from MVP in their response to FERC's Post DEIS EIR.

- Grace provided an update on the mitigation tracking table for MVP's EIS. Karen said she would like the document to point to direct environmental protection measures and mitigations in the EIS and the Plan of Development (POD). Jennifer noted this might not yet be possible as the POD and EIS are not yet complete. Joby confirmed the FS wants to have a strong mitigation framework in place that addresses both environmental and compensatory mitigations, and this document would help address that.
- Vicki and Jennifer agreed to halt scheduling additional meetings with MVP until they start providing documents for the agencies to review and comment on.
- Jennifer updated that Dawn Kirk (FS) and Jesse Overcash (FS) visited the Craig Creek crossing but could not identify all of the route flagging. Jennifer said FS still needs more time to review the Craig Creek crossing.

UPCOMING MEETINGS

MVP/Agency Coordination: Wednesday, February 22 @ 1:00 CT/2:00 ET
Agency Coordination: Thursday, March 2 @ 2:00 CT/3:00 ET

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Thursday, February 16, 2017 @ 2:00-3:00pm (E)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Bruce Dawson, Carol Zurawski, Deblyn Mead, Miriam Liberatore, George Matzke, Nicole Virella, Vicki Craft
	Forest Service (FS)	Jennifer Adams, Troy Morris, Joby Timm, Timothy Abing, Elizabeth LeMaster
	Commonwealth of Virginia (Commonwealth)	Rob Farrell
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:

- ✓ Provide an update from prior mitigation strategy meetings
- ✓ Discuss mitigation strategy coordination across state and federal agencies
- ✓ Discuss umbrella agreement for coordinating a unified mitigation plan

ACTIONS

- **Galileo** schedules future mitigation call for Thursday, February 23rd @ 12-1:00 pm PT/1-2:00 pm MT/2-3:00 pm CT/3-4:00 pm ET. *Complete*.
- **Troy** reaches out to Jennifer Stanhope at the FWS. *Complete*.
- **Bruce** coordinates BLM outreach to the United States Army Corps of Engineers (USACE) via the BLM Minerals Chief. *In Progress.*
- **Bruce** coordinates BLM outreach to the National Park Service (NPS) via Karen Mouritsen (BLM State Director). *In Progress.*
- **Participants** send relevant mitigations team contacts to Galileo.
- **Participants** copy Galileo on mitigations team communications.
- **Jennifer** coordinates with FWS via phone call on Friday, February 17th for an update on the Migratory Bird Plan. *Complete*.
- **Deblyn** forwards previous project Mitigation MOUs to participants. *Complete*.
- **Grace** forwards Ruby Pipeline mitigation coordination documents to participants. *Complete*.
- **Jennifer** forwards email re consultant help from Clyde to Job and Tim. *Complete*.

DECISIONS/DISCUSSION POINTS

- Tim has reached out to FS Washington Office specialists dealing with valuing ecosystems and developing mitigation for natural resource damage assessment. He shared the Commonwealth's Draft Environmental Impact Statement (DEIS) comments and methodology regarding forest fragmentation mitigation with the FS WO contact for review. Troy noted in a conversation with Jen Stanhope at the FWS that FWS had reviewed the Commonwealth's fragmentation mitigation suggestions and that they felt they were adequate for most of FWS needs.
- Troy updated that Mountain Valley Pipeline, LLC (MVP) wants to perform their own Habitat Evaluation Assessment. He also suggested Jen Stanhope is the most logical contact for the mitigations team and offered to reach out to her.
- Tim updated that MVP included voluntary mitigation measures regarding FWS concerns in their response to the Federal Energy Regulatory Commission's (FERC) Post DEIS Environmental Information Request. Tim noted the FWS accepts these mitigations, but as of

November 2016 FWS has policy in place to develop its own mitigation, including compensatory mitigation.

- Per previous mitigation discussions, Joby updated that the FS would like to develop a Mitigations Interdisciplinary Team, with Jennifer, Troy, and JoBeth Brown (FS) providing oversight for the George Washington and Jefferson National Forest. Galileo is helping to develop a mitigations table that shows effects and potential mitigation (and residual effects) for the team. The goal of this ID Team will be to identify mitigations, including compensatory mitigation, which can be rolled into MVP's Plan of Development (POD). Then the FS would bring in an economics consultant to help with the compensatory mitigation process. The team would then develop a mitigation framework and crosscheck it with the Commonwealth.
- Joby suggested including the US Fish and Wildlife Service (FWS) in the mitigation development process could be beneficial. He also suggested reaching out to the NPS and the USACE. Bruce agreed and offered to work with Deblyn and Carol to appropriately reach out to the other agencies and potentially setup a mitigations team agreement.
- Joby inquired about the FERC's environmental review schedule and Jennifer updated that an official change has yet to appear on the docket.
- Joby suggested keeping track of other parties' mitigation efforts. Rob suggested the FWS is probably the only other entity with a broad suite of mitigation requirements the Commonwealth would want to consider, and most of the other efforts he has seen from other agencies are highly specific and/or are on hold.
- Rob and Tim discussed FERC's role in making sure the Commonwealth's mitigation concerns are addressed. Rob stated he felt confident FERC understood their position but did not have any details as to whether they supported compensatory mitigation.
- Joby, Bruce, and Tim agree there is value in coordinating a mitigation framework between federal agencies and the Commonwealth as each group moves forward with development. For the FS, USACE, and BLM, all mitigations would eventually need to be included in the BLM's Right of Way (ROW) Grant if the project is approved. Bruce stressed he doesn't want to let any single agency's requirements fall through the cracks.
- Deblyn cited several examples of coordination between state and federal agencies related to Sage Grouse mitigations in the Western US. She suggested a Memorandum of Understanding (MOU) could serve as an umbrella agreement for coordinating mitigations. Grace cited efforts on the Ruby Pipeline Project to meet and discuss mitigations, including compensatory mitigations, between several agencies.
- Tim stated he envisions two agreements, a landscape-scale mitigation plan and a plan between participating regulatory agencies, on how the plan will be implemented on land. He suggests the plans be referenced as a requirement of BLM's ROW grant and FERC's Certificate, if the project is approved.

MVP FS BLM Biweekly Coordination Call
Date/Time: Wednesday, February 22, 2017 at 2:00-3:00pm (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Tom Collins, Alex Faught
	MVP	John Centofani, Megan Neylon
	Galileo Project	Lauren Johnston, Maria Martin

ACTIONS

- **Megan** sends CD copies of recent Federal Energy Regulatory Commission (FERC) docket filings to BLM and FS.
- **Tetra Tech** sends paper copies of recent filings to BLM, FS, and Galileo later this week.
- **MVP** updates missing filings, including Plan of Development (POD) and SF-299, for submittal to FS and FERC docket.
- **Jennifer** files Appalachian National Scenic Trail (ANST) coordination and authority corrections to the FERC docket.
- **MVP** follows up with the National Park Service (NPS) and the Appalachian Trail Conservancy (ATC) re ANST consultation.
- **Jennifer** follows up with Forest Supervisor re Office of General Counsel (OGC) review of the FS-MVP Memorandum of Understanding (MOU).
- **MVP** updates and files Craig Creek Crossing package in the FERC docket per FS feedback. *Complete.*
- **Jennifer** follows up with Dawn Kirk and Jesse Overcash re re-staking Brush Mtn. Alt 2.
- **Jennifer** emails any FS specialist requirements regarding the Craig Creek Crossing to MVP.
- **Jennifer** emails to Megan long term monitoring text for inclusion on the POD.
- **Jennifer** instructs Ted Coffman to forward visuals information to MVP.
- **FS specialists** perform a detailed review of Craig Creek Crossing Package.
- **Galileo** schedules Monday, February 27th 3:00 – 4:00 pm ET meeting with MVP, BLM, and FS. *Complete.*
- **Vicki** forwards invite for 02/23 call to Miriam and Jennifer. *Complete.*
- **John** drafts agenda topics for 02/23 and 02/27 meetings. Forwards to FS, BLM, and Galileo.

DECISIONS/DISCUSSION POINTS

- Jennifer updated that MVP's coordination with the NPS and ATC, management partners of the ANST, has been inadequate, and reiterated it is not the job of the FS to coordinate with NPS and ATC on behalf of MVP for the proposed project. She also cited MVP has previously incorrectly referred to the FS's role in and authority over managing the ANST.
- MVP stated they thought their coordination had been adequate, per documentation provided in their February 17, 2017 filing (FERC docket accession # 20170217-5199). John recounted they received feedback from the ATC after site-visits and adjusted their

buffer zones according to ATC's concerns. John also said MVP performed visual analysis at Key Observation Points (KOPs) provided by ATC. Jennifer stated the KOPs were provided by FS and not ATC or NPS.

- John said MVP would follow up with both the NPS and ATC and FS to get back on track. In reference to the ATC's response to MVP's Post-Draft Environmental Impact Statement (EIS) Environmental Information Request (EIR) responses (FERC docket accession # 5062-31983142) MVP noted they would contact the ATC and obtain the correct ANST alignment files. Jennifer stated FS could not provide any confirmation of the routing until MVP coordinates further with ATC and NPS. This is a change to Jennifer's previous notification to MVP stating they could confirm the route by February 27, 2017.
- Jennifer corrected an assertion by MVP in MVP's February 17, 2017 filing (FERC docket accession # 20170217-5199) that FS approves of the current ANST crossing, to clarify that FS still requires additional work concerning the boring location on one side of the trail and further visual analysis at leaf-off, which had previously not been available for review. Jennifer reiterated she will correct this assertion in the FERC record if needed.
- Jennifer and Vicki requested MVP continue to send paper copies and CD versions of all of MVP's FERC filings, as the agencies have not been receiving them. Megan confirmed Tetra Tech will be providing paper copies hopefully by the end of this week, and that she would send CD copies to the agencies by 02/23/2017.
- Lauren inquired about expected due dates for missing responses to FERC's Post DEIS EIR. Megan stated the delivery dates in the responses are accurate, and that MVP is working hard to complete the SF-299 and POD.
- Vicki updated that she scheduled an in-person meeting between MVP management and BLM's Eastern States Director, Karen Mouritsen, and Forest Supervisor Joby Timm for Thursday, February 23rd at 10:00 am Eastern. Jennifer and Vicki agreed to an additional coordination meeting with MVP on Monday, February 27th at 3:00 pm Eastern.
- Jennifer confirmed the FS has everything they need to complete their review of the Craig Creek Crossing alternatives sent 02/15/2017 and that MVP should file the package into the FERC record. She indicated initial feedback on the package was largely positive. FS needs to complete a full technical review and additional specialists need to provide input.
- Tom provided comments from his initial review of MVP's updated Craig Creek Crossing from 02/15/2017. Tom suggested and MVP agreed it would be beneficial to add a short discussion of how reducing the total number of Craig Creek crossings from three to one crossing is a benefit of the newly proposed routes.
- Tom stated he is concerned about the side slope construction at or near the top of hollows just below the crest of Brush Mountain in Alternatives 1 and 2. Side slope construction at or near the top of hollows has the potential to result in fill slope failures and/or diversion of surface and subsurface drainage which might trigger debris slides and debris flows at the top of the hollows. A debris flow initiated at the top of a steep hollow could gouge a destructive path hundreds or thousands of feet downslope, possibly reaching Craig Creek. . The proposed route and Alternatives 1 and 2 each ascend a steep ridge between Craig Creek and the top of Brush Mountain, and so, have some similar slope stability issues. But the proposed route does not have the additional

slope stability issues of side slope construction at or near the top of hollows in Alternative 1 and 2, or the winch construction of Alternative 1. Tom requested, and MVP agreed, to discuss steep slope work in each alternative for an accurate comparison.

- Jennifer cited Dawn Kirk's request to review Erosion and Sedimentation (E & S) plans. John noted E & S plans start on page 29 of the updated Craig Creek crossing package. Jennifer reiterated Dawn and Pauline need to confirm the routes meet FS requirements for riparian corridors. John cited site-specific erosion control details from the Craig Creek package for FS specialists to review.
- Megan indicated MVP would like feedback from the FS on MVP's site-specific designs. A follow-up meeting with Tom Collins (FS) would follow as needed.

Upcoming Meetings:

BLM-MVP WO Meeting – Thursday, February 23rd @ 10:00 am EST
BLM-MVP-FS Coordination – Monday, February 27th @ 3:00 – 4:00 pm EST
BiWeekly Coordination Call – March 8 @ 2:00 – 3:00 pm EST

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Thursday, February 23, 2017 @ 3:00-4:00pm (E)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Carol Zurawski, Deblyn Mead, Miriam Liberatore, Nicole Virella, Vicki Craft, Kimberly Melendez-Rivera
	Forest Service (FS)	Jennifer Adams, Troy Morris, Joby Timm, Timothy Abing, Elizabeth LeMaster
	Commonwealth of Virginia (Commonwealth/VDOF)	Rob Farrell
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** schedules future call for Thursday, March 2nd @ 2:00 – 3:00 pm Eastern. *Complete*.
- **Grace** forwards sample Ruby-State-Federal mitigation Memorandum of Understanding (MOU) that includes both FS and BLM lands to Tim. *Complete*.
- **Grace** tracks down word-document version of Nevada sage-grouse mitigation MOU and forwards to Tim. *Complete*.
- **Galileo** includes Jen Stanhope on next week's meeting invitation. *Complete*.
- **Tim** develops a draft mitigation team MOU.
- **Jennifer** invites US Fish and Wildlife Service (FWS) contact, Lesley Kordella, to next mitigation call meeting.
- **FS Southern Research Center** reviews Virginia Department of Forestry's (VDOF) mitigation methodology.
- **Tim** provides contact information for Rob Farrell, Troy Morris, and Jen Stanhope to FS Southern Research Center.
- **Vicki** follows up with the National Park Service (NPS) and United States Army Corps of Engineers (USACE) contacts for involvement in mitigation team.
- **Participants** send relevant mitigations team contacts to Galileo.
- **Participants** copy Galileo on mitigations team communications.

DECISIONS/DISCUSSION POINTS

- BLM reached out to NPS and USACE re participating in the mitigation team but they have not yet received any feedback.
- Jennifer contacted Leslie Cordera at the FWS headquarters to get the FWS perspective on mitigation. Tim and Jennifer agreed to have Leslie Cordera and Jennifer Stanhope (FWS Gloucester Field Office) coordinate their participation in the mitigation team and provide perspective on Migratory Bird Treaty and other species mitigations.
- Tim forwarded the Virginia Department of Forestry's (VDOF) mitigation methodology to the FS's Southern Research Station (Station) for review and comment. The team identified Rob, Troy, and Jen Stanhope as points of contact for VDOF, FS and FWS, respectively, in case the Station has any questions regarding methodology or prior approvals. Tim and Rob confirmed the VDOF Methodology does not contain any specific compensatory mitigation numbers, just a way to determine direct and indirect effects.
- Tim reviewed the BLM-Nevada MOU (Nevada CCs provided by Deblyn). Tim noted he would like to emulate the methodology for calculating debits and credits associated with project impacts. The team agreed a draft MOU, built from the BLM-Nevada MOU sample

and a sample MOU with Federal Agency, State Agency, and State Government partners from the Ruby Pipeline Project. Tim said he envisioned two agreements total:

1. A cooperative mitigations development agreement
2. A final mitigations agreement to be included as part of the BLM's Right of Way (ROW) Grant if the project is approved and FS and USACE concur with BLM's Record of Decision (ROD).

- Grace summarized the reference documents provided from the Ruby Pipeline Project as examples for developing the necessary mitigation agreements and plans. The documents consist of the following:
  - A voluntary proponent-agency conservation and mitigation plan, including compensatory mitigation;
  - A cooperative conservation agreement to identify and provide funds for proposed conservation projects post-ROD and pre-Notice to Proceed (NTP).
    - This cooperative conservation agreement included avoidance, mitigation, and off-site conservation measures in addition to the voluntary conservation plan.
    - The plans and measures were itemized by state to accommodate differing state laws in regards to conservation funds, planning, and calculation of per-acre mitigation methods.
  - Proposed mitigation measures for temporally sensitive activities that consisted of a per-acre disturbance compensation chart to allow for conservation measures, called a Limited Operating Period (LOP) Conservation Agreement.
- Mitigation plans and measures for the Ruby Pipeline Project were part of both the Plan of Development and the Environmental Impact Statement (EIS). Grace noted the conservation plan allowed the Final EIS for the Ruby Project to show positive environmental effects, and that this finding stood up against subsequent litigation.
- Grace stated the participants in the Ruby Pipeline Project conservation effort started with a workshop to develop strategy, then cooperatively developed a series of agreements to establish how the states, NGOs, and agencies could work together to propose and carry out mitigation. Each state agreement included previously identified candidate projects specifically targeted to address potential impacts to affected species. The agreements included protocol to choose from and fund the projects that would be used.
- Rob noted the VDOF strategy in the mitigation recommendations contained in the Commonwealth of Virginia's Draft EIS comments (accession # 20161222-5394) was to identify specific criteria for conservation projects to serve as part of the conservation plan, rather than providing an approved list of projects.

Mountain Valley Pipeline	2017

MVP-FS-BLM High Level Coordination

Date/Time: Monday, February 27, 2017 @ 12:00-1:30pm (PT)/1:00 – 2:30 pm (MT)/2:00-3:30pm (CT)/3:00-4:30pm (E)

Location: Conference Call

Attendees	BLM	Miriam Liberatore, Bruce Dawson, Vicki Craft
	Forest Service	Jennifer Adams, Joby Timm, Karen Overcash, Troy Morris, Ted Coffman, Tim Abing
	MVP/EQT	Megan Neylon, John Centofanti, Joe Dawley
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **MVP** files an updated Plan of Development (POD), SF-299, and Biological Evaluation (BE) in the Federal Energy Regulatory Commission (FERC) docket.
- **MVP** continues to send paper copies and CDs of filings to BLM, FS, and Galileo.
- **John** follows up with the Appalachian Trail Conservancy (ATC) to set a meeting and to discuss with Andrew Downs the potential for Roanoke Appalachian Trail Club (RATC) involvement.
- **John** drafts an agenda for a meeting with ATC and forwards to Jennifer.
- **Jennifer** touches base with Karen and Ted to schedule FS participation in a meeting with MVP, ATC, and the National Park Service (NPS) as needed.
- **FS specialists** review MVP's updated visual impact analysis (accession # 20170217-5199). FS schedules visual impact analysis review meetings with MVP as needed.
- **Ted** and **Peter Irvine** (FS Regional Office) complete and file a visual analysis clarification letter to the FERC docket for MVP and Cardno to review.
- **MVP** responds to the FS's 02/27 letter (accession # 20170227-5074).
- **MVP** coordinates with Mike Madden (FS Archaeologist) and Jennifer to complete Phase II Cultural Resource Surveys.
- **Jennifer** forwards relevant cultural resource emails to Galileo.
- **MVP** includes scientific literature citations for proposed conservation measures in the next version of the BE.
- **Galileo** schedules a POD review meeting with MVP, FS, and BLM after MVP submits the next iteration of the POD.
- **Paul Arndt (FS Regional Office)** and **Karen** coordinate briefing for Forest Chief for the project's compliance with the FS's 2001 Roadless Rule for the length of the project that runs through the Brush Mountain Inventoried Roadless Area (IRA).
- **MVP** completes a Habitat Equivalency Analysis (HEA) for the pipeline corridor by the end of March 2017.
- **Joe** forwards HEA service area categories to the call's participants.
- **Galileo** forwards BLM's mitigation manual to MVP with today's meeting notes.
- **GAI Consultants** review project documents.
- **Jennifer** and **Galileo** coordinate re internal discussions concerning the Appalachian National Scenic Trail (ANST).
- **Megan, Jennifer,** and **Mike Madden** (FS Archaeologist) coordinate re National Historic Preservation Act (NHPA) Section 106 compliance.

- **Galileo** schedules a conference call and GoTo meeting with MVP, FS, and BLM to review the FS plan amendment decision, objection, and review processes as needed.

DECISIONS/DISCUSSION POINTS

- Joe noted MVP is new to the FS permitting process and wants to make sure the FS has what they need for their analysis. Jennifer and Vicki reiterated paper and CD copies have not been distributed for the last several filings. FS and BLM appreciate MVP following up with their contractor to make sure the agencies get what they need for review. John stressed FS and BLM should follow up to make sure they get the paper copies they need.
- Joe provided an update on the project's progress, stating the initial published schedule had the Final Environmental Impact Statement (EIS) ready for publication in March of 2017. Given the POD and SF-299 are still outstanding, this is not practical.
- MVP has continued to collect data beyond the DEIS comment period. MVP submits new data as it comes available. Joe stated MVP believes they have finished their responses to agency information requests. Jennifer noted she filed an information request (02/27) requesting additional information on visual analysis (accession # 20170227-5074). Joe stressed he wants to provide agencies with the information they need to have a defensible decision.
- Joe said there have been technical difficulties with aspects of the sedimentation analysis. This has delayed delivery. He noted there is a mini sedimentation analysis in the Craig Creek Crossing/Brush Mountain alternative package sent to FS and BLM on February 17th, 2017. This is an update to the initial sedimentation analysis.
- John summarized the sedimentation analysis in the Craig Creek Crossing alternatives in the study corridor. MVP's findings suggest the biggest factor in determining sedimentation impacts is the amount of time needed to cross Craig Creek and setup sedimentation barriers. John stated according to their analysis their proposed sediment control measures would capture 79% of the sediment, which exceeds the Environmental Protection Agency's recommended baseline capture of 70%. John also noted no James Spinymussel was found in the study area. John reiterated MVP still proposes the same Craig Creek Crossing route as they proposed initially.
- Jennifer thanked MVP for providing the updated Craig Creek Crossing package before filing it in the FERC docket. Jennifer said she passed additional comments from FS specialists to MVP via email last week. Additional FS specialists need to fully review the crossing and provide their recommendation to BLM and the Forest Supervisor as to which crossing alternative the agencies prefer.
- Karen updated that the FS is working through a briefing package to present to the Forest Chief for review of MVP's proposed crossing of the Brush Mountain IRA. At this time FS does not need anything additional from MVP for this process, and FS does not anticipate any problems. Tim confirmed Paul Arndt (FS Regional Office) is reviewing the briefing package for consistency with the 2001 Roadless Rule. The FS is trying to make sure to minimize potential impact to roadless area characteristics.
- John stated MVP's preference to meet with the Appalachian Trail Conservancy (ATC), National Park Service (NPS), and FS. The purpose of the meeting would be to review

the updated Visual Impact Analysis (VIA) for the trail. John previously sent out a meeting request to the agencies and ATC. He did not reach out to the Roanoke Appalachian Trail Club (RATC), as he thought it best for Andrew Downs (ATC) to reach out to them.

- Job clarified RATC is a separate 501c (3) organization that is not represented by the ATC, but acts as a separate club. Jennifer stated the FS would need more information on the meeting's purpose in order to confirm FS's participation in a potential meeting, as they are a cooperating agency and not responsible for MVP's coordination with the other quasi/agencies. Jennifer said if the FS decides to participate in such a meeting, the agency would need additional time to review MVP's updated VIA. Jennifer stressed that MVP is capable of meeting with ATC and NPS without FS involvement.
- John recounted MVP's previous meetings with ATC last spring. MVP updated the crossing, based on feedback from that meeting, would be perpendicular. John acknowledged there were problems with the trail alignment and forest borders. He also said MVP tried to use the VIA to address ATC's publicly filed concerns. He stated MVP should possibly have participated in closer coordination with the ATC as MVP waited to complete additional visual and leaf-off analysis.
- John responded to FS's visual information request from 02/27 stating MVP previously provided the needed answers in their response to the FERC's January 27th, 2017 Post-Draft EIS Environmental Information Request (EIR), accession 20170127-3018, in the Land Use 10 attachment to the narrative comments. Troy said FS reviewed the filing and worked with visual consultants but still requests answers to FS's 02/27 filing to make the document clearer. Ted said the FS is working on a letter from visual specialists to file in the FERC record for MVP to review in the coming days.
- Jennifer notified MVP she will be filing a correction to MVP's assertion that FS was consulting with MVP on ATC's behalf. Jennifer wants it to be clear that the FS does not consult on the ANST on any other managing partners' behalf.
- Megan updated MVP on the Phase II Cultural Surveys, which are taking much longer than previously anticipated. Megan stated the crews will continue their work within the Area of Potential Effect (APE) at this time and will return at a later date to determine the site's boundary and complete surveys. Megan confirmed the APE is the entire 125 foot study corridor. Megan said MVP and contractors are coordinating with Mike Madden (FS Archaeologist) to properly document their findings and proposed survey schedule. Jennifer noted she and Galileo need to be copied on all related emails for inclusion in the decision file.
- Megan said she received Jennifer's email and is aware of the damage to FS roads caused by survey access and will work with her team to determine next steps for repair and prevention of further damage.
- MVP still has a lot of data to incorporate into the POD. Megan received the long-term monitoring language form Jennifer and will incorporate it into the next draft POD. Jennifer reiterated the FS would like MVP to propose site-specific conservation measures that FS can then comment on. FS would like the proposed measures to be scientifically supported and cited. Jennifer also said the measures should be filed so they are visible to the public before FS can comment on them.

- MVP updated that they expect to file all remaining outstanding documents (i.e. the SF-299, BE, and POD) by the end of this week. Jennifer stated once FS has had time for a preliminary review of MVP's filing FS will schedule a POD page-turn with MVP that Megan requested..
- Joe said MVP is working with their contractor, Environmental Sciences, INC (ESI), to design and perform a HEA analysis along the entire length of the project. This was in response to multiple agencies and government stakeholders (namely the US Fish and Wildlife Service and the Virginia Department of Forestry) requesting mitigation and studies to support mitigation proposals. Joe summarized the goal of the study is to look at all direct impacts of pipeline construction, obtain a raw number of disturbed acres, the services provided by those acres (across 5 categories, TBD), and then loss in those services provided by the project.
- The output of the analysis will be a net service acres lost from direct project effects over the 5 service categories. Joe stated MVP hopes to have the HEA analysis completed by the end of March, and that it should incorporate concerns about Threatened and Endangered Species, the Roanoke Logperch.
- Bruce and Joby suggested the best way to approach mitigation is through a collective effort, but FS and BLM are not prepared to open mitigation discussions with MVP at this time. The agencies would like to see all outstanding documentation from MVP before they initiate mitigation discussions.
- Tim notified MVP that the BLM has prepared a public mitigation policy manual. Tim also said a landscape-scale HEA analysis is a good starting point to determine project effects and, from that, potential mitigations. Tim stated the BLM requires the mitigations be included in the BLM Right of Way (ROW) grant, and that BLM has authority to review the FS permits for mitigations that avoid, minimize, and compensate for residual project effects. With that in mind, BLM would need the mitigation plan before the end of the project and before FS can issue permits and BLM can issue a ROW grant.
- FS reiterated that ability for public comment, timely information delivery, and adequate review times will all be necessary for the FS and BLM to adopt FERC's Final Environmental Impact Statement (EIS). Karen stressed effects need to be adequately analyzed and appropriate mitigation needs to be proposed in the POD, BE, and FEIS for FS to justify relaxing their Forest Land and Resource Management Plan standards via the plan amendments (notified in the Federal Register by FERC and the BLM/FS Notice of Availability for the Draft EIS). Karen emphasized FS's concern about safety with construction in karst terrain.
- Jennifer confirmed GAI consultants are working with FS to review project documents. Jennifer said the FS needs to be able to review MVP's documents in order to meet FERC-imposed deadlines, and that FS needs to have several discussions with FERC about the representation of FS concerns in the Draft EIS. The FS is cognizant of the public's concerns with regards to springs and drinking water contamination, and notes this will be difficult to analyze. Troy reiterated the FS needs the BE and sedimentation analysis to they can perform their own analysis.
- Tim stated that any resource issues not reflected in the FEIS will result in additional questions and objections from the public. Bruce agreed both agencies want to avoid

missing resource concerns in the FEIS, and both agencies want to be able to provide meaningful feedback to avoid missing any resource. Jennifer echoed concerns regarding the agencies' efforts to respond to Draft EIS comments are on hold as they need updated documents from MVP in order to provide adequate comments. MVP agrees with the agencies that they want to provide a defensible environmental document.

- Joe expressed concern regarding NHPA Section 106 compliance, especially with regards to the ANST and NPS's assertion the ANST is eligible for listing in the National Register of Historic Places. Joby stated any concerns MVP has regarding NPS issues should be directed to the NPS, and Jennifer stated FS and BLM are discussing ANST issues internally.

Mountain Valley Pipeline	2016

MVP FS-BLM Coordination Pre Meeting

Date/Time: Monday, February 27, 2017 @ 11:30am-12:00pm (PT)/12:30 – 1:00 pm (MT)/1:30-2:00pm (CT)/2:30-3:00pm (E)

Call-in: 866.906.9888 Code 9493642#

Invitees	BLM	Miriam Liberatore, Bruce Dawson
	Forest Service	Jennifer Adams, Joby Timm, Karen Overcash, Troy Morris, Ted Coffman
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **Jennifer** and **Karen** discuss DEIS comment response and keywords. Coordinate with Galileo.
- **Jennifer** forwards house bill proposing changes to BLM mitigation policy to Bruce, Vicki, and Galileo.
- **Galileo** includes a link to the BLM mitigation manual for MVP in the High Level Meeting coordination notes.

DECISIONS/DISCUSSION POINTS

- Karen stated the FS needs additional information from MVP, including the updated Plan of Development (POD), SF-299, and Biological Evaluation (BE) before they can provide full comment responses.
- Joby cited a proposed change to BLM's mitigation policy circulating in the government. Bruce stated the policy was developed as a response to an executive order. Bruce stressed one of the stated purposes of the policy is to start considering mitigation early on in the EIS process. FS and BLM agree it is prudent to start including the proponent in mitigation discussions as soon as they provide essential missing project documents – for example the BE, POD, and SF-299.
- Jennifer reviewed the current project schedule and updated that FS and BLM are not being given adequate review time or review materials in order to meet their NEPA requirements.
- Jennifer reviewed MVP's proposed Craig Creek Crossing route and reiterated the FS cannot complete its review of the updated alternatives until they receive the full sedimentation analysis. Jennifer also said MVP has identified their preferred route for the Craig Creek Crossing. The FS has not yet identified the FS's preferred route. Jennifer notes this may be a Forest Supervisor decision based on specialist recommendations
- Jennifer said MVP has requested meetings with the FS and other Appalachian National Scenic Trail (ANST) managing partners, including the National Park Service (NPS) and the Appalachian Trail Conservancy (ATC). Jennifer reiterated it is not the job of the FS to consult with these groups on behalf of the proponent. Jennifer has also requested MVP provide a purpose and agenda for the meeting to determine what, if any, FS participation would be required.

Mountain Valley Pipeline	2017

Mountain Valley Pipeline Project Coordination
Date/Time: Thursday, March 2, 2017 at 3:00-4:00pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Kimberly Melendez-Rivera
	Forest Service (FS)	Jennifer Adams, Karen Overcash, Joby Timm, JoBeth Brown
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **BLM resource specialists** review DEIS comments – due March 27th, 2017 to Vicki
- **Karen**, **Vicki**, **Miriam**, and **Jennifer** review refined keywords for DEIS comment search
- **Jennifer** reviews available MVP EIR responses and distributes to FS specialists as needed
- **Bruce** and **Vicki** touch base with Karen Mouritsen re Galileo help with March 17th monthly high-level call
- **Bruce** follows up on responses for additional public meetings
- **Jennifer** requests and distributes updated timeline from FERC (when available)
- **Galileo** works up a project milestones timeline and distributes to BLM and FS
- **Karen** reviews MVP Environmental Consequences/Mitigation table with Ava Turnquist and provides guidance to **Galileo**
- **Galileo** develops in-depth briefing paper and PowerPoint for **Vicki;** helps with **FS** briefings as needed
- **Job** considers additional FS stakeholder mtgs/participation in County BOS meetings
- **Jennifer** coordinates with Russ and Troy to complete DEIS missing pieces list
- **Jennifer** sends DEIS missing pieces list to Galileo
- **Galileo** drafts an agenda for the MVP FERC DEIS Comment Coordination call

Post Meeting Update:
Early Friday, 03/03/2017, MVP submitted the following to the FERC docket:

- *Updated POD & SF-299*
- *Updated BE (Public and Privileged versions)*
- *Response to NPS letter*
- *Updated Sedimentation Analysis*

UPCOMING MEETINGS

- Short Road Damage Discussion **– Fri., March 3 @ 10-11 am ET**
- MVP FS Cultural Survey Call **– Tues., March 7 @ 10 am ET**
- FERC Schedule/DEIS Comment review call **– Wed., March 8 @ 2-3 pm ET**
- ANST Stakeholder Call **– Thurs., March 9 @ 1:30 – 2:30 pm ET**
- Mitigation Coordination Call **– Thurs., March 9 @ 3:00 pm ET**
- FERC DEIS Geology Discussion **– Fri., March 10 @ 11 am ET**
- GAI Internal Discussion of ANST review **– Thurs., March 16 @ 12:30 – 2:30 pm ET**
- Biweekly BLM/FS Coordination call – **Thurs., March 16 @ 3-4 pm ET (**cancelled in lieu of the call with BLM/FERC/FS)
- FS/FWS/BLM Coordination Call **– Mon., March 20 @ 11am-1pm ET**
- Biweekly BLM/FS Coordination & DEIS Comment review – **Thurs., March 30th, 3 - 5 pm ET**

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Thursday, March, 2 2017 @ 3:00-4:00pm (E)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Bruce Dawson, Kimberly Melendez-Rivera, Nicole Virella, George Matzke
	Forest Service (FS)	Jennifer Adams, Job Timm, JoBeth Brown, Tim Abing
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Bruce** touches base with Karen Mouritsen (BLM Eastern States) re timeline for including MVP in mitigation discussions.
- **Job** follows up with FS regional foresters re timeline for including MVP in mitigation discussions.
- **Jennifer** touches base with Clyde Thompson (FS), Lesley Kordella (US Fish and Wildlife Service, FWS), and Kevin Bowman (Federal Energy Regulatory Commission, FERC) re participation in the next mitigation team call. *Complete.*
- **Karen Overcash** and **FS specialists** complete review of Galileo's environmental consequences/mitigation table soils example.
- **Tim** continues Memorandum of Understanding (MOU) development.

DECISIONS/DISCUSSION POINTS

- Tim updated that he needs more time to author a sample MOU for mitigation development and eventual implementation.
- Jennifer noted that for natural gas pipeline projects there is no law, such as the Federal Power Act for hydropower projects that requires FERC to consider management requirements of resource-managing agencies. Jennifer said FERC has never required compensatory mitigation. Jennifer suggested reaching out to Kevin Bowman (FERC) to answer mitigation and regulatory authority questions.
- Jennifer suggested inviting Lesley Kordella from the FWS headquarters to discuss the FWS MOU with FERC regarding mitigation and the Migratory Bird Treaty Act.
- Job, Tim, and Bruce agree there is value in bringing state agencies into the mitigation discussion, and that it is encouraging that MVP has committed to developing a Habitat Equivalency Analysis and associated mitigation plan for the entire pipeline route.
- Bruce noted the BLM would strongly prefer a coordinated, landscape-scale approach to mitigation. Bruce also stressed the BLM needs to have their mitigation plan in their Right of Way Grant Record of Decision (ROD), so mitigation timing is important.
- Grace updated that on the Ruby Pipeline Project (Ruby) the proponent sent a letter to the FERC noting they planned on working with land and resource management partners at the state and federal levels to develop a mitigation agreements, which didn't have to be finalized until the ROD was signed. This allows more time for mitigation development. Grace also suggested she could reach out to Gene Seidlitz (BLM) as needed for more insight into the specifics of how the Ruby mitigation MOUs and plans took form.

- Bruce noted that BLM still has not yet heard back from the US Army Corps of Engineers Norfolk, Huntington, and Pittsburgh districts, or the National Park Service regarding participation in the mitigation meetings.
- Tim sent contact information for Jennifer Stanhope (FWS) and Troy Morris to the FS's Southern Research Center to assist in review of the Virginia Commonwealth's mitigation methodology.
- Grace updated she is still waiting on additional guidance with how to proceed with the environmental consequences/mitigation tracking table. Tim noted he would like it to be very straightforward with regard to what residual impacts exist after mitigations are in place. Grace, Jennifer, and Tim agreed this would be difficult to address as the Draft EIS is not straightforward with regard to impacts, and several analyses are still outstanding.

Next Mitigation Meeting: Thursday, March 9 @ 12:00 – 1:00 PT/ 1:00 – 2:00 MT/ 2:00 – 3:00 CT/ 3:00 – 4:00 pm ET

Mountain Valley Pipeline	2017

MVP FS Road Damage Discussion

Date/Time: Friday, March 3, 2017 @ 7:00 - 7:30am (PT)/ 8:00 – 8:30am (MT)/ 9:00 - 9:30 am (CT)/ 10:00 - 10:30 am (E)

Location: Conference Call

Attendees	Forest Service	Jennifer Adams, Dan McKeague, Shamina Dillard, Ted Coffman
	MVP/EQT	Megan Neylon
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **MVP** and **FS specialists** coordinate road damage site visit for next week.
- **Megan** forwards pictures of road damage to FS.
- **FS Specialists** photograph road damage during site visit. Forward pictures to Jennifer and Galileo.
- **MVP** and **FS** develop and agree on scope of work for road repairs.
- **MVP** repairs road damage according to FS survey permit and FS specialist guidance.

DECISIONS/DISCUSSION POINTS

- Repeated use of Pocahontas and Mystery Ridge Roads during off-season regular use and maintenance schedules has resulted in additional damage and failing culverts.
- Dan pointed out some of the culverts along the road had already failed or needed to be replaced. Megan stated MVP has documented their plan for road improvements in their Plan of Development (POD). Dan stated those road improvements are in addition to the repairs that need to happen now due to increased access for MVP's cultural surveys.
- Dan said the next step is to review the damage in the field with MVP's road engineers and to develop a scope of work for the repairs under the authority of MVP's cultural survey permit. Shamina and Dan agreed the road repairs could include anything from road grading to additional stone improvements or culvert cushioning or replacement.

Mountain Valley Pipeline	2017

MVP Cultural Survey Discussion

Date/Time: Tuesday, March 7, 2017 @ 8:00 - 9:00am (PT)/ 9:00 – 10:00am (MT)/ 10:00 - 11:00 am (CT)/ 11:00am - 12:00 pm (E)

Location: Conference Call

	Forest Service (FS)	Jennifer Adams, Mike Madden, Rich Guercin
	Bureau of Land Management (BLM)	Vicki Craft, John Sullivan
	MVP/EQT	Megan Neylon
	GAI	Evelyn Tidlow
	SEARCH, Inc.	Jacob Freedman
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **SEARCH** completes cultural surveys according to survey permit terms and conditions
- **FS specialists** visit MVP survey sites.
- **Jacob** continues forwarding daily survey progress updates.

DECISIONS/DISCUSSION POINTS

- Megan expressed concern that MVP's surveys are taking a lot longer than expected and are extending out of the survey corridor and area of potential effect (APE). Megan suggested it might be helpful to give FS their cultural survey reports as they are finished.
- Mike and Rich confirmed the FS needs the entire report as a single submission once the entire cultural survey has been completed. They also confirmed SEARCH needs to continue surveying the sites until they are completely delineated, even if they run outside of the survey corridor and/or APE.
- Mike and Rich confirmed MVP and SEARCH need to follow survey protocols as outlined in their permit and in the FS memorandums of understanding with the State of Virginia State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Officers (THPOs).
- Mike specifically noted that the potential grave site at 44GS0243 should be tested with a auger to determine if it is in fact a burial. Jacob indicated SEARCH may actually do some linear trenching to accomplish the same objective.
- John stated there is no additional BLM requirement regarding the survey report.
- Mike confirmed he would be the signatory for the FS approving MVP's final cultural survey report, and would be passing the report on to the Virginia SHPO and THPOs needed per their MOUs.

Mountain Valley Pipeline	2017

MVP FS BLM Biweekly Coordination Call

Date/Time: Thursday, March 9, 2017 @ 1:30 – 2:00 pm EST

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore
	Forest Service (FS)	Jennifer Adams,
	MVP	John Centofani, Megan Neylon
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **John** schedules an in-person meeting with the Appalachian Trail Conservancy (ATC) and other stakeholders/managing partners for the week of April 3-10th in Roanoke, VA.
- **Galileo** takes notes at ATC meeting.
- **Megan** forwards notes and photos from Pocahontas and Mystery Ridge Road damage site visit.
- **Shamina Dillard** (FS) and **Alex Faught** (FS) review Megan's site-visit notes.
- **Shamina Dillard** (FS) and **Alex Faught** (FS) determine the appropriate permitting method for handling road repair work.
- **Jennifer** briefs the Forest Supervisor re the ATC coordination meeting requested by MVP to discuss the Appalachian National Scenic Trail (ANST).
- **Jennifer** and **Mike Madden** (FS) follow up to discuss submitting an architectural resource letter to the Federal Energy Regulatory Commission (FERC) docket.
- **Grace** sends reminder email to Vicki re Galileo helping with March 17th meeting support.
- **FS specialists** complete review of MVP's proposed woody trees and shrubs.
- **MVP** completes Phase II cultural surveys, target filing date in April.
- **MVP** completes updates to the Biological Assessment. Target filing date by mid March.

DECISIONS/DISCUSSION POINTS

- Megan and John said they were working with Andrew Downs at the ATC to come up with a good in-person meeting date to replace yesterday's cancelled ANST managing partners coordination call. Jennifer reiterated it needs to be clear to all internal and external personnel that FS did not request this meeting and is not in charge of scheduling it. She requested and John agreed to remove the FS from the meeting name.
- John said coordination with Andrew Downs (ATC) is ongoing but that the ATC turned down MVP's offer for a page-turn overview of the relevant analyses regarding the ANST.
- Megan said the site-visit to view road damage along Pocahontas and Mystery Ridge roads was productive and she is coordinating with FS to come up with a complete road repair plan. *Post Meeting note: Shamina Dillard (FS) sent road repair requirements to MVP on 03/09/2017 along with approval to start repairs under the existing survey permit.*
- Jennifer reiterated the FS is not ready to schedule a Plan of Development (POD) page-turn until FS has had adequate time to start their POD review.

Upcoming Meetings:

BiWeekly Coordination Call – Wedesday, March 22 @ 2:00 – 3:00 pm EST

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Thursday, March 9, 2017 @ 3:00-4:00pm (E)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore, Bruce Dawson, Kimberly Melendez-Rivera, Nicole Virella, George Matzke
	Federal Energy Regulatory Commission (FERC)	Kevin Bowman
	US Fish and Wildlife Service (USFWS)	Liz Stout
	US Army Corps of Engineers (USACE)	Todd Miller, Joshua Shaffer
	Forest Service (FS)	Jennifer Adams, Job Timm, JoBeth Brown, Tim Abing, Kent Karriker, Beth LeMaster
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Tim** continues Memorandum of Understanding (MOU) development.
- **Bruce** follows up with Tim for an update on the MOU framework.
- **Bruce** follows up with Grace re Galileo participation in upcoming BLM-MVP high-level coordination meetings.
- **Bruce** discusses meeting format for bringing in MVP to the mitigation discussions with Karen Mouritsen (BLM).
- **Job** and **Tim** continue briefing FS regional foresters on mitigation development.
- **Galileo** assists BLM with briefings for Karen Mouritsen (BLM).
- **Karen Overcash (FS)** and **Ava Turnquist (FS)** continue review of and additions to the MVP environmental consequences/mitigation table.

DECISIONS/DISCUSSION POINTS

- Job reviewed that the purpose of these meetings is to discuss how federal land management agencies and state-level stakeholders could work together to develop a project or landscape-level mitigation framework. Final participants and their authorities for mitigation, as well as an overarching agreement are still in flux. Bruce noted the BLM is discussing how best to bring the applicant into mitigation discussions, which would likely need to happen soon to accommodate BLM's new mitigation guidance.
- Kevin stated that, because FERC does not manage any lands or have any easements under their authority, they do not have management plans to meet. FERC relies on other federal laws (i.e. the Environmental Species Act, Section 106) to require some type of mitigation plan, which they put the onus on the proponent to propose. FERC stated if they require mitigation as part of their certificate for a particular resource, the mitigation applies to the entire project. It is FERC's expectation the federal land management agencies will supply necessary mitigation measures in their records of decision and associated grants/easements that go above and beyond, and possibly duplicate any mitigation in FERC's orders. Mitigations required by other federal agencies would only apply to those agencies' jurisdictional lands.
- Tim and Joby questioned whether FERC could ask proponents for any additional mitigation beyond what the proponents initially propose. Kevin said FERC has been pushing applicants to provide mitigation plans for impacts to forested and interior forest lands, but

cannot provide additional recommendations regarding those mitigation plans per their legal authorities. FERC cannot tell applicants how to formulate their mitigation plans or estimates for compensatory mitigation (nor can they require compensatory mitigation).

- Kevin stated the FERC does not have a clear answer as to whether another federal agency's statutory policy (i.e. mitigation policy in FWS for effects to migratory birds) with regards to resource management and mitigation plans for a specific resource provides grounds for FERC to require mitigation. Kevin stressed if another agency wants to require mitigation, including compensatory mitigation, for a specific resource, that agency must tie the mitigation to its project-related permit(s).
- Kevin stated the proponents with the most projects approved propose a certain amount of mitigation from the start of the application process to try and offset project impacts from the start. FERC can ask for mitigation plans through data requests, but the requests are not binding and responses are not necessarily contingent upon approval.
- Tim inquired if a proponent's proposed mitigation impacts would be analyzed in the environmental impact statement (EIS). Kevin said a high-level summary of the proposed mitigation would be included but the impacts would not be fully analyzed.
- Joby and Tim met with the regional foresters last week to discuss how an interagency mitigation framework would look, when mitigation should be brought into the NEPA framework, and authorities to require mitigation, including compensatory mitigation. Tim said it's BLM's policy to achieve no net loss of a resource, which would include compensatory mitigation efforts. It is unclear how to determine what resources have residual impacts, or what constitutes a residual impact.
- The team acknowledged they need to know more about what the residual impacts are in order to determine what will need compensatory mitigation. Jennifer said Ava Turnquist (FS) and Karen Overcash (FS) are coordinating review and additions to the MVP environmental consequences/mitigation table in order to try and determine appropriate mitigations.
- Tim said that upon their initial review, the FS's Southern Research Station specialists feel that the Commonwealth of Virginia's methodology for determining impacts that will need compensatory mitigation is reasonable. They are still working on a full report.
- Joshua stated in an email during the meeting that, *"any stream/wetland (Waters of the U.S.) permanent impacts will be mitigated per the 2008 Mitigation Rule found at 33 CFR 332. I have a revised set of information for MVP dated February 2017 and it has a revised mitigation plan for stream and wetland losses. I have no areas of concern regarding mitigation efforts with this project and plan on moving forward as things progress. Not sure that the Corps really has any value to bring to the table for this working group as we already have a mitigation frame work to follow."*
- Tim updated that he needs more time to author a sample MOU for mitigation development. Grace offered to get Tim into contact with Gene Seidlitz (BLM) as a resource. Tim is reviewing MOUs from the Ruby Pipeline Project as a starting point.

Next Mitigation Meeting: Friday, March 17 @ 12:00 – 1:00 PT/ 1:00 – 2:00 MT/ 2:00 – 3:00 CT/ 3:00 – 4:00 pm ET

Mountain Valley Pipeline	2017

Internal FS Law Enforcement (LE) Call
Date/Time: Tuesday, March 14 @ 3:00-4:00 pm (E)
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Kent Karriker, Alex Faught, James Willet, Katie Ballew, Joe "Tony" McGallicher
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTION ITEMS

- **James** & **Katie** develop a law enforcement operations plan, clarifying especially that the George Washington and Jefferson National Forest (GWJNF) Forest Supervisor, Job Timm, wants authority, in coordination with LE, to make decisions on pre-construction law enforcement and safety for the Forest Supervisor's Office. *In progress*
- **James** & **Katie** develop separate lists of pre- and post-construction equipment needs to assist in FS comments on the Plan of Development (POD). *In progress*
- **Jennifer** forwards updated project timeline out to call participants.
- **Alex, Kent, Katie, James,** and **Public Affairs Officers (PAOs)** review the draft schedule for potential protest and other trigger points for LE needs.
- **Katie** and **Tony** send estimate to Jennifer for hours spent developing a LE operations plan as well as for reviewing the proponent's LE materials.
- **Jennifer** informs Megan that enforcement and closure & security measures will be considered on a case by case basis and samples don't need to be included in the POD.
- **Jennifer** reaches out to LE officers to assist in review of LE sections of the POD.
- **Katie** forwards cost recovery agreement contact for Virginia State Police to Alex.
- **Alex** confirms that cost-recovery allows for protest response billing.
- **Jennifer** contacts MVP to figure out what coordination they have already completed with local law enforcement.
- **James** coordinates with Jennifer and local crime analysts to plan LE needs.

DISCUSSION/DECISIONS

- Katie and James met with the GWJNF forest supervisor, Job Timm, to discuss how LE would work with the forest to decide on a law enforcement/security plan. Job would have authority, with LE help, to make decisions regarding safety at the forest supervisor's office. Line officers have authority to close facilities they supervise.
- Katie noted the PAOs had a plan in place in the case of peaceful protests, however it would not be sufficient for the paid protests the FS law enforcement anticipates. Katie said LE is planning for significant protests.
- Tony stressed the protests will be given an adequate first amendment site that takes safety, traffic, movement into consideration. Tony said worker safety is handled on a case by case and site specific basis with regards to protests during business hours. How the forest deals with a particular protest is determined, at least in part, by what intelligence the FS gathers up front. Jennifer stated the FS has received notification up front that FS stakeholders are planning protests on the forests. James notified that he is working with the Virginia Fusion Center to monitor potential protests and other activities related to pipelines on National Forest System lands.

- Jennifer restated there are multiple cultural sites of concern on the GWJNF that FS wants to be sure to protect and monitor long term. Katie said this has been well discussed and long term monitoring plans will be included in the POD.
- Katie said LE personnel could come from several sources, with FS federal officers providing last minute planning to protect FS resource, similar to the arrangement with fire enforcement. LE options for the GWJNF include State Police, Troopers in riot gear on two week rotations, FS LE personnel, and, county response teams. Katie plans to rely on tactical field forces for any problems on the GWJNF. Additional roving troopers can also provide support. Katie said FS is coordinating with Virginia regarding available law enforcement personnel and their fees. Virginia State Police also work with local landowners.
- Alex stated it would be helpful for LE planning purposes to know the schedule of FERC and FS decisions and objection/appeals processes. She noted FERC's practice is to publish their decision without warning or notice to FS. Jennifer said FS would issue its draft decision shortly after the FERC. Alex said he would expect protestors to start showing up shortly after the FERC decision.
- Alex said he is nearly done with a cost recovery agreement with the proponent from now until the FS's final decision. Participants discussed the possibility of reimbursement vs. upfront payment from the proponent to cover LE needs for such events as protests. The agencies also need to work with local LE to determine how they would like to be compensated for their work on the project, whether through cost recovery with FS or with the proponent. Alex stressed that for the current cost recovery agreement he needs to know how many hours the LE officers are spending writing and reviewing operations plans. Equipment needs, review needs, and additional LE personnel cost recovery for construction phase is all addressed in a separate cost recovery agreement for after the FS signs their decision, if the project is approved.
- James updated that the proponent has already been working with other local LE entities and it would be beneficial to coordinate with them. Jennifer said she has previously asked the proponent to provide a list of their LE coordination activities to FS.
- Jennifer stated the proponent is expected to pay for and manage security for its own equipment and personnel. This has been documented in conversations with the proponent. Jennifer said she would like to have a list of what law enforcement needs specified in the POD so the proponent can update the POD.
- Tony, Katie, and Jennifer discussed the potential need for closure orders during construction, if approved. Tony stated the FS might be able to make use of emergency closure orders on a rolling basis.
- Tony and Katie agreed barriers and closure notices, etc., will be determined on a site by site basis. At this time the proponent does not need to have samples in their POD.

Mountain Valley Pipeline Project Coordination
Date/Time: Thursday, March 16, 2017 at 3:00-4:00pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Bruce Dawson, Miriam Liberatore, Kimberly Melendez-Rivera, George Matzke
	Forest Service (FS)	Jennifer Adams, Karen Overcash, Alex Faught, Troy Morris, Ava Turnquist
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** sends the draft environmental impact statement (EIS) comment keyword spot check to Karen. *Complete.*
- **Karen** and **Ava** review Galileo's keyword search spot check documents. *In Progress.*
- **Galileo** updates federal energy regulatory commission (FERC) draft EIS comment meeting agenda to include "Schedule Concerns" and "changes to the EIS".
- **FS specialists** review MVP's recent filings, comments due April 6th.
- **Galileo** helps combine and clean FS comments on MVP's recent filings.
- **Jennifer** forwards FS's comments on the SF-299 to BLM for review.
- **Jennifer** touches base with Vicki Craft (BLM) to discuss BLM-FS Plan of Development (POD) comment submission.
- **Miriam** touches base with Vicki Craft (BLM) to discuss obtaining Draper Aden geologist credentials. *Complete.*
- **Miriam** sends credential request to MVP. *Complete.*
- **Galileo** updates Decision File document request per FS/BLM guidance and sends to Project Managers for review. *In Progress.*
- **Galileo** schedules FERC draft EIS comment response and FERC draft EIS Geology section calls. *Complete.*

DISCUSSION/DECISIONS

- Jennifer said the FERC plans to issue the preliminary administrative final EIS on April 7th, with comments due from the Cooperating Agencies (CAs) on May 8th. Jennifer said the FS hopes to complete review of MVP's recently filed documents before April 7th.
- Grace summarized Galileo's spot check for keywords on Cardno's draft EIS comment database identified over 300 additional potentially FS-relevant comments. Karen stated she also identified several letters that Cardno did not give to the FS for response. Karen emphasized she is concerned about the comment response process.
- Miriam stressed FS and BLM need to continue to push FERC to allow the CAs to review the Final EIS one last time before it's published to make sure FERC doesn't make changes that cause the analysis to be incorrect.
- Grace recounted the FS and BLM are continuing mitigation talks and plan to broach the mitigation topic with MVP in an upcoming high level meeting. The internal mitigation discussions currently center on identifying needed mitigations and statutory authority to require mitigations. During the 03/09 mitigation call Kevin Bowman (FERC) answered several of FS's questions about agency authorities to request mitigation. FS has requested the US Fish and Wildlife Service (USFWS) participate in the mitigation calls as well to coordinate mitigation efforts. The United State Army Corps of Engineers

- BLM said they are still discussing internally how to handle public requests for additional public meetings.
- Jennifer stressed the need for FS and BLM to receive from MVP copies of the communication that MVP has with state and federal agencies, including the Virginia Department of Environmental Quality and the USFWS, to check for any issues relevant to the FS and BLM. Bruce agreed and stressed this is particularly important for National Historic Preservation Act Section 106 consultation issues, threatened and endangered species issues, in addition to USACE correspondence.

UPCOMING MEETINGS

- High Level BLM Director Call – **Mon., March 20 @ 11am-12pm ET**
- FS/FWS/BLM Coordination Call **– Mon., March 20 @ 12-1pm ET**
- Biweekly BLM/FS Coordination & DEIS Comment review – **Thurs., March 30 @ 3-5 pm ET**
- FERC DEIS Comment Response Call – **Tues., March 28 @ 1:30-3pm ET**
- FERC Geology Call – **Thurs., March 30 @ 12-1pm ET**

Mountain Valley Pipeline	2017

ANST Crossings Internal Discussion

Date/Time: Thursday, March 16, 2017 @ 12:30-1:30 pm (E)

Location: Conference Call & GoTo meeting

Attendees	Forest Service (FS)	Jennifer Adams, Tom Collins, Kent Karriker, Troy Morris
	Bureau of Land Management (BLM)	Miriam Liberatore
	Galileo Project	Lauren Johnston, Grace Ellis, Maria Martin

Objective:

- ✓ FS reviews GAI recommendations on the Appalachian National Scenic Trail (ANST) crossing and contingency for the MVP project

ACTIONS

- **GAI** continues review of MVP's proposed ANST crossing and contingency plan. Provides review to FS by Wednesday, March 22.
- **Miriam** drafts an email for Vicki Craft's (BLM) review requesting MVP provide credentials for the Draper Aden consultants that prepared and field-reviewed MVP's proposed conventional bore ANST crossing plan.

DECISIONS/DISCUSSION POINTS

- Tom updated GAI is reviewing MVP's proposed and contingency plan ANST crossings.
- Miriam and Jennifer agreed the FS and BLM want additional clarification as to the credentials of the geologists and/or engineers who visited the proposed ANST crossing site to confirm MVP's confidence in their conventional bore crossing method.

Mountain Valley Pipeline FS-BLM Mitigations Call

Date/Time: Friday, March 17, 2017 @ 3:00-4:00pm (Eastern)

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Bruce Dawson, Kimberly Melendez-Rivera, Nicole Virella, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Tim Abing
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** emails Paul Friedman (Federal Energy Regulatory Commission, FERC) and Lavinia DiSanto (Cardno) requesting their availability for Draft Environmental Impact Statement (DEIS) comment and Geology discussion calls. *Complete.*
- **Galileo** updates the 03/20 High-level coordination meeting agenda to include "Response to Comments" and "Mitigations". *Complete.*
- **Galileo** drafts an annotated agenda for the 03/20 High-level coordination meeting. *Complete.*
- **Karen** considers next steps for addressing DEIS response to comments with FERC.
- **Tim** drafts mitigation Memorandum of Understanding (MOU) for team review.
- **Jennifer** emails Mary Krueger (National Park Service, NPS) re the planned upcoming Appalachian National Scenic Trail (ANST) crossing meetings with MVP, informing her of FS participation plans. *Complete.*
- **Jennifer** continues to update FS management on attendance at the ANST crossing meetings in early April.

DECISIONS/DISCUSSION POINTS

- Tim updated that the FS is no longer pursuing a formal mitigation rule. Tim expressed his concerns over the MOU development as related to which parties should be involved and have regulatory authority to require mitigation.
- Jennifer stated FERC has not yet updated the schedule and that the initial key milestones in the Notice of Schedule issued by FERC have already passed and are no longer valid. For example, FERC's original schedule showed March 10, 2017 as the issuance date for the FEIS. Jennifer and Tim stressed concerns regarding the DEIS comments and project schedule.
- Grace reviewed that Galileo identified additional potentially-relevant FS comments using the short list of FS-approved keywords in Cardno's master comment list. After removing the comments previously sent to the FS for review, Galileo identified roughly 300 additional potentially relevant comments. Jennifer stated Karen Overcash also identified comments she was expecting to receive from Cardno for the official DEIS comment response but did not. Tim expressed concern over the missing comments and stressed the need to meet with Cardno and FERC to discuss their comment forwarding process.
- Galileo reviewed and BLM/FS provided updates to the high level coordination agenda. Bruce's requested additions are listed in the action items above. Tim and Bruce confirmed BLM and FS want to discuss mitigation with MVP at their next high level meeting on Monday, March 20th.
- Tim noted MVP is performing a Habitat Equivalency Analysis (HEA) for the length of the pipeline route. BLM and FS hope to discuss this with MVP on the upcoming high level coordination call to get more detail about how the HEA was performed and how the

output will be used for mitigation determinations. Tim said he would like to see a breakdown of the HEA by land ownership/regulatory authority. Tim also said it's important for FS to express their preference for a landscape-scale mitigation strategy.

- Jennifer updated that the NPS is requesting FS participate in two day-long meetings to discuss the MVP project and the ANST with managing partners. BLM and FS are concerned the meeting would detract from FS efforts on document reviews and is not necessary for FS and/or BLM personnel to attend. Jennifer suggested it might be appropriate for a Public Affairs Officer to attend, and that she would follow up with FS management accordingly. Bruce said BLM feels the meeting might pose more risk than reward given the FS and BLM are cooperating agencies for the MVP project while the rest of the ANST managing partners are not. ***Post Meeting Note:*** *Jennifer requested and still has not received an agenda from Mary Krueger (NPS) re the meeting's purpose. Jennifer will continue to coordinate with NPS via phone.*
- Jennifer confirmed the FS is responsible for issuing the Special Use Permit to cross the ANST and the NPS will not be involved with that permit.

Mountain Valley Pipeline	2017

MVP FS-FWS Coordination
Date/Time: Monday, March 20, 2017 @ 12-1:00pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Alison McCartney, Miriam Liberatore, Vicki Craft
	US Fish and Wildlife Service (FWS)	Jennifer Stanhope, Sarah Nystrom, Sumalee Hoskin
	Forest Service (FS	Carol Croy, Dawn Kirk, Fred Huber, Jennifer Adams, Jesse Overcash, Steve Croy
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **FS** and **FWS** continue review of MVP's most recent Biological Assessment (BA).
- **FS** completes its review of MVP's most recent Biological Evaluation (BE) and Sedimentation analysis.
- **Jennifer** confirms with Karen Overcash (FS) whether or not the FS needs additional biological surveys or review of the Slussers Chapel Conservation Site alternative proposed by the Virginia Department of Conservation and Recreation (VDCR).
- **Jennifer** coordinates with Karen Overcash (FS) and Ava Turnquist (FS) to update the FS's environmental effects chart as FS specialists review new MVP documents.
- **Jennifer** emails Job with FS and FWS input on mitigation.
- **Federal Energy Regulatory Commission** (FERC) finalizes the BA and initiates consultation with the FWS.
- **FWS** meets with MVP to review MVP's Habitat Equivalency Analysis (HEA).
- **BLM and FS** meet with MVP to review MVP's HEA.
- **FWS** anticipates requesting an Environmental Constraints Map for MVP to help resolve potentially conflicting seasonal restriction recommendations.

DECISIONS/DISCUSSION POINTS

- Carol said she wants to be sure MVP is not missing any priority birds covered under the Migratory Bird Treaty Act (MBTA). Carol also stated the FS recommends MVP have a biological monitor onsite during winter construction. In addition Carol said she wants MVP to know that golden and bald eagles could be found anywhere along the route and bald eagles could start breeding activities early in the calendar year.
- Carol said the FS and FWS recognizes the need to evaluate and prioritize resource-based (T&E, slope stability, soil movement concerns) seasonal construction restrictions as several of the recommended restrictions are in conflict.
- Dawn noted Craig Creek is considered potential Threatened and Endangered (T&E) Species habitat for the James spinymussel, although the documented occurrence of the species is located 21km downstream of the project. Jen S. expressed concern that in the draft BA, MVP did not look at species occurrence for the James spinymussel in the Natural Heritage Database, which puts the closest occurrence of the mussel at approximately 7 kilometers downstream from the project action area (Note: this includes the area where MVP modeled sedimentation impacts). MVP did not conduct mussel habitat assessments within the original action area from the draft sediment analysis. However, MVP has indicated to FWS that they have reduced the sediment impacts to within the mussel survey area. Jen S. said she needs to read through MVP's recent filings, including the revised BA, to determine if their sedimentation load assumptions

and construction window make sense. Jen S. noted she thought MVP would be constraining their construction window to 8 weeks around Craig Creek.

- Dawn and Jen S. stated they need to review MVP's sedimentation analysis before they can determine if the analysis is complete, and, if so, which alternative represents the preferred crossing for the agencies. Dawn said upon preliminary review, the FS recommends different alternatives based on which resource (i.e. biology, hydrology, geology, etc.) is being considered.
- Jen S. requested Dawn keep her in the loop re FS's sedimentation analysis. Dawn stressed she wants to be sure the sedimentation load from the different alternatives is properly assessed, and that the sedimentation analysis considers construction on private lands that would have an impact on FS lands.
- Jen S. confirmed she asked MVP to include the Candy Darter and Yellow Lance as well as other petitioned species in the BA analysis. FWS will make sure these species are adequately addressed.
- Sarah updated that the Rusty Patched Bumblebee will not be listed in Montgomery County, however FWS has stressed to proponents that pesticide use and widespread herbicide use on the right of way is of concern. Sarah said FWS prefers MVP use targeted herbicides in order to promote early successional habitat that encourages pollinator occupancy. Sarah stressed FWS does not anticipate the Rusty Patched Bumblebee returning to the MVP project area before it is complete, and as such the proponent should not have to worry about the bee becoming a regulatory species for their project, even if pollinator habitat is encouraged and develops.
- Sarah confirmed there is no need for FS to consult with FWS regarding the Rusty Patched Bumblebee.
- Steve said the bat surveys turned up evidence of a small footed bat (a FS sensitive species) but no evidence of federally listed bats. Sumalee confirmed MVP has done their due diligence with mist net bat surveys and that she believes where bats are concerned the project is in good shape. Sumalee added she will review the BA to confirm.
- Vicki recounted that BLM and FS are coordinating with the Commonwealth of Virginia on mitigation, and that MVP has now been looped into the conversations. Vicki said MVP is working on a HEA to evaluate direct and indirect impacts to federal lands, and will be scheduling a meeting with FS and BLM to review the analyses. Jesse stressed he is in favor of a landscape scale mitigation plan that substitutes affected landscape features accordingly. Jesse said he is concerned an edge effects analysis of acres is inadequate to determine impacts, especially to shellfish.
- Sumalee? said the FWS is requesting an environmental constraints map to look for potential impacts to migratory birds due to fragmentation and early seasonal impacts. These impacts and environmental constraints will also need to be addressed for other species.
- Sumalee confirmed MVP has a meeting with FWS to review the HEA. She said FWS is open to looking at edge effects and fragmentation and in assisting FS in mitigating habitat effects on FS lands.
- Sarah confirmed there is no authority for FWS to issue or enforce a permit for incidental take of certain species under the MBTA.

- Jen S. confirmed FERC has not finalized the BA to initiate formal consultation, but that FERC is currently developing a consultation timeline.
- Steve, Jesse, and Carol asked whether there were any outstanding surveys the FS needed, especially in regard to the VDCR's Slussers Chapel alternative route.

Mountain Valley Pipeline	2017

MVP FS BLM High Level Coordination Call
Date & Time: Monday, March 20, 2017 @ 11:00am – 12 pm Eastern
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Barbara Eggers, Bruce Dawson, Karen Mouritsen, Vicki Craft, Miriam Liberatore, Elizabeth Ivy, Sally Spencer
	Forest Service (FS)	Jennifer Adams, Job Timm, Timothy Abing
	USDA Office of General Counsel (OGC)	Jay McWhirter, Sarah Kathmann
	BLM Solicitor's Office	John Henson, John Austin
	Mountain Valley Pipeline (MVP)	Joe Dawley, John Centofanti, Megan Neylon
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** schedules call with MVP to discuss their HEA model*. Update: Per FS, on hold until submittal date is confirmed.*
- **BLM** and **FS personnel** continue reviewing MVP's Plan of Development (POD), Biological Assessment, and SF-299. Comments due back to Vicki & Jennifer early April.
- **MVP** provides BLM and FS with conventional bore and contingency plan failure thresholds for the Appalachian National Scenic Trail (ANST) crossing.
- **MVP** provides BLM and FS with credentials for specialists who confirmed desktop geology of ANST crossings on site. *Complete.*
- **MVP** updates the ANST Contingency plan and POD with additional agency-requested data. MVP files this same data in the FERC docket as a discrete update.
- **Jennifer** follows up with FS law enforcement and MVP to schedule a call re requirements for law enforcement in MVP's POD.
- **Jennifer** and **Vicki** monitor Interdisciplinary Team (IDTeam) comments on the POD and SF-299 for any 'red flag' revisions MVP needs to be aware of.
- **MVP** responds to the Federal Energy Regulatory Commission's (FERC) 03/20 Post-DEIS Information Request #2 within 10 days.
- **Mike Madden (FS)** and **Jennifer** finalize letter for the FERC docket re National Historic Preservation Act (NHPA) Section 106 Consultation and Cultural Resource Surveys.
- **BLM** and **FS** coordinate re timing of next high-level coordination meeting as it relates to MVP's responses to FERC's 03/20 Post-DEIS Information Request.

DECISIONS/DISCUSSION POINTS

- John C. reviewed MVP's 03/14 meeting with FS and BLM regarding the ANST conventional bore and contingency plans. John C. stressed MVP will maintain a 300 foot buffer on either side of the trail crossing that will never involve an open trench. Tim relayed concern from the Appalachian Trail Conservancy (ATC) regarding the technical limits of a conventional bore. John C. confirmed MVP's consultants are confident in the conventional bore strategy.
- John C. stated MVP is working on representative failure thresholds for agency review to help explain how MVP would be able to monitor the success of the conventional bore

during construction. John explained MVP can monitor the drill bit using GPS and reposition the bit as needed.

- Miriam stressed that it wasn't immediately clear to the agencies that a registered, credentialed professional was on site to confirm MVP's desktop geology analysis. John C. confirmed credentials and field notes from the site visit will be made available to the agencies and the public via updated filings in the FERC docket (see action items above).
- Karen updated that BLM has received several inquiries for additional public meetings. BLM is still discussing internally how to handle and respond to these requests within the purview of the agency's National Environmental Policy Act (NEPA) process. Karen said the BLM and FS are planning a meeting with FERC to discuss this further as well. Karen said she wants to be sure stakeholders are clear on when and where they can comment on the project, as BLM stakeholders particularly might not be as familiar with the FERC policy of accepting comments on the docket daily. Jennifer stressed proper public outreach and comment opportunities are needed to have a defensible decision for the FS plan amendments and the BLM right of way grant, if the project is approved.
- Job updated that the BLM and FS have had several meetings with the Commonwealth of Virginia and FERC to discuss a potential mitigation framework. Tim said the FS and BLM need to work within the hierarchy of avoiding, minimizing, then mitigating potential effects as outlined in the Draft Environmental Impact Statement (EIS). Job stressed no official conclusions have yet been drawn about how a mitigation strategy across several agencies would look.
- MVP said they are preparing an HEA for the entire project corridor, with an emphasis on impacts to interior forest, as the Commonwealth of Virginia and West Virginia Division of Natural Resources (WVDNR) have expressed concern regarding that interior forest resources. MVP met with the WVDNR and the US Fish and Wildlife Service (FWS) to discuss the HEA model and assumptions. MVP is incorporating their feedback.
- Joe said MVP is still unclear how the HEA will be used to establish specific mitigation measures given the number of land management agencies and authorities. He said MVP's preference is to come up with a stacked comprehensive plan that utilizes identified mitigation projects rather than simple cash payments. MVP plans to engage with each agency to determine how best to move forward once the HEA is complete. John H. suggested a meeting regarding the HEA should also include a discussion of environmental standards that need to be met under the Mineral Leasing Act of 1920.
- Tim stressed the FS needs to see a breakdown of impacts specifically on National Forest System (NFS) lands as this is where the FS has the authority to require mitigation. He clarified that while the FS can mitigate for impacts to NFS lands, the actual mitigation projects do not necessarily need to take place on NFS lands. Tim added the FS is in favor of a landscape-scale approach.
- Jennifer and Vicki said FS and BLM specialists are reviewing MVP's most recent filings, including the POD and SF-299, Biological Assessment (BA) and Biological Evaluation (BE). Jennifer and Vicki agreed it would be beneficial to have a POD page-turn meeting with MVP once MVP has incorporated the agencies' most recent round of comments. BLM and FS plan to deliver comments to MVP in early April. Jennifer and Vicki agreed to

send any high priority comments to MVP as their specialists work on review. This is in an effort to help MVP stay on top of changes that need to be made to the POD.

- Vicki updated that the BLM has completed its review of the BA. FS specialists are currently still reviewing the BA.
- Tim and Vicki reviewed the next steps in the NEPA process for both agencies, if the project is approved. Tim updated the FS is waiting on sending the Brush Mountain Inventoried Roadless Area package to the FS Washington Office until after the FS meets with the Wilderness Society. He said this will not impact the timeline. Miriam said the BLM decision is appealable to the Interior Board of Land Appeals. John H. noted that if the FS and USACE do not concur with the BLM's findings, then the BLM decision authority for the right of way grant is transferred to the Secretary of the Interior.
- Jennifer confirmed the FS is responsible for NHPA Section 106 consultation regarding cultural resources on NFS lands and the ANST crossing on the George Washington and Jefferson National Forest. Jennifer said the FS is still receiving cultural resource survey information to date.

Mountain Valley Pipeline: FERC & Cooperating Agencies Call
Date/Time: Tuesday, March 28, at 1:30-3pm (E)
Location: Conference Call

Invitees	Forest Service (FS)	Troy Morris*, Jennifer Adams, Karen Overcash
	Bureau of Land Management (BLM)	Miriam Liberatore, George Matzke, Nicole Virella
	Federal Energy Regulatory Commission (FERC)	Jim Martin, Paul Friedman*
	Cardno	Lavinia DiSanto, Doug Mooneyhan
	Galileo Project	Grace Ellis, Lauren Johnston

*Partial Attendance

ACTIONS

- **Karen** identifies which comments FS needs to adequately answer the comments designated by FERC as requiring a FS response. *Complete*.
- **Karen**, **Lavinia**, and **Galileo** coordinate any future document and coding needs for comment responses. *In Progress.*
- **FS** continues writing comment responses for inclusion in the Final EIS.

DECISIONS/DISCUSSION POINTS

- FERC confirmed the Administrative Final Environmental Impact Statement (EIS) will not include FERC's Response to Comments (RTC) table or side-by-side comment response appendix. These documents will only be available electronically at a later date.
- FS and BLM noted some of the comments to which FS has been asked to respond reference responses FERC will provide or has provided partway into the comment response process. FERC clarified FS is welcome to include additional responses to comments FERC has already addressed.
- FS and BLM noted some of the comments to which FS has been asked to respond include information MVP has yet to provide or provided very recently (i.e. the Biological Evaluation, Hydrological Analysis, etc.). This makes writing complete comment responses difficult.
- FS reiterated their need to know what changes FERC plans to make to the Administrative Final EIS (AFEIS) in order to properly respond to some comments. FERC clarified FS and BLM can have additional time after the AFEIS to complete their portions of the RTC. A final RTC due date was not specified.
- Karen reviewed the FS did a spot check of comments and identified an additional 72 comments FS feels should have been assigned to FS for comment, but were not. FS stressed their concerns over litigation based on some of these comments. FERC said FS is welcome to respond to these additional letters, including letters submitted outside of FERC's comment period.
- Cardno agreed to code any additional letters the FS needs, which were not initially included in the master RTC table. FERC will cross-reference their own responses with FS responses as needed to produce a final RTC appendix to the Final EIS.
- FS said they are concerned the comment responses they have from Cardno were written in January, and that some of Cardno's answers may have changed. Paul assured

he has not edited any responses and Lavinia said the edits Cardno has made were minor and not substantive.

- FS asked how much of the AFEIS the FS would be expected to update for National Forest System (NFS) Lands. Lavinia said FIS is welcome to edit NFS-related sections of the AFEIS. Lavinia does not anticipate her team updating those sections.
- Jennifer noted MVP has yet to submit for review analyses and reports that meet FS needs. She is concerned FS will be finished with AFEIS review before FS receives necessary documents from MVP. FS is battling a heavy work load and inadequate work submitted by MVP. BLM and FS reiterated they need to be able to make sure the analysis complies with their standards and cannot rely on FERC to make sure the National Environmental Policy Act (NEPA) documents meet these standards. FS needs time to evaluate project documents as they relate to Forest Plan standards, especially as the MVP project as proposed necessitates several Forest Plan amendments.
- Jennifer expressed FS concerns regarding future litigation due to inadequate analyses and NEPA documents. At this time the FS does not feel they have enough information from MVP to properly edit the FS-relevant sections of the AFEIS. FS and BLM are concerned about the breadth of new information that still needs to be incorporated into the Final EIS. New information is a key point of litigation.
- Jennifer suggested additional issues-based meetings and continued coordination in an effort to assure the Final EIS meets FS needs to assess their NEPA requirements for the proposed MVP project.

Mountain Valley Pipeline	2016

MVP BLM/FS Biweekly Coordination Call
Date/Time: Thursday, March 30, 2017 @ 3:00-4:30pm (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Miriam Liberatore, John Sullivan, Vicki Craft
	Forest Service (FS)	Jennifer Adams, Karen Overcash
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **FS Specialists** complete review of MVP documents by April 9th.
- **BLM Specialists** complete review of MVP documents by April 6th.
- **Galileo** compiles FS and BLM comments on MVP documents and flag comments that require additional input.
- **Karen** continues FS response to Draft Environmental Impact Statement (DEIS) comments.
- **Jennifer** files visual resources analysis comments in the Federal Energy Regulatory Commission (FERC) docket on March 31, 2017.
- **Jennifer** follows up with Job to close the loop regarding FS needs for Hybrid Alternative analysis.
- **Jennifer** forwards archaeological updates to Vicki, John, and Miriam and requests they be added to the archaeological update distribution list. *Complete.*
- **Jennifer** sends list of potential restricted activities to Forest leadership.
- **Jennifer** sends table of project issues to Forest Supervisors for review.
- **Jennifer** follows up with Katie to review LE-related MVP project documents.
- **Vicki** sends comments on briefing PowerPoint to Galileo. *Complete*.
- **Vicki** and **Miriam** identify outstanding issues with the MVP project for inclusion in project briefings.
- **Galileo** incorporates Vicki's comments into the briefing PowerPoint. *Complete*.
- **Galileo** repurposes briefing PowerPoint for Karen Mouritsen as directed.
- **Galileo** shares issues briefings with BLM as needed.
- **Jennifer** shares GAI's Appalachian National Scenic Trail (ANST) crossing and contingency plan review with Galileo and the BLM.
- **Jennifer** files GAI's ANST crossing and contingency plan review in the FERC docket.
- **Galileo** forwards a list of priority tasks to be completed in April and May of 2017 to Jennifer, Vicki, and Miriam for approval.
- **MVP** completes and submits an updated Cultural Survey permit to the Jefferson National Forest (JNF). *In Progress*.

DECISIONS/DISCUSSION POINTS

- Jennifer suggested FS and BLM management work with FERC management to request more time for agency reviews of MVP's and FERC's project documents. Vicki noted that Karen Mouritsen (BLM) is planning to reach out to the Regional Forester by April 7th and have a meeting with FERC as soon as possible to negotiate more time for agency reviews. Vicki noted that she and Miriam have been tasked with helping direct updates to the briefing PowerPoint by April 10th in order to facilitate Karen Mouritsen's talk with FERC.
- Miriam said BLM plans to push for additional review of FERC's Final Environmental Impact Statement (EIS) after FERC management review. BLM is considering questions of how to engage the public given the breadth of new information added to the project after the DEIS public comment period ended. BLM is concerned that FERC has yet to issue a Biological

Assessment, which means that consultation with the US Fish and Wildlife Service (FWS) has not yet taken place.

- Neither BLM nor FS has yet determined what avenue to take in regards to public involvement and requests for additional public meetings.
- Vicki updated that Bruce Dawson (BLM) is retiring. Mark Mackiewicz (BLM) will be working in an as yet to be determined advisory capacity moving forward.
- Karen stated that after meeting with FERC and Cardno to review DEIS response to comment needs, she feels confident she can complete the comment responses. She noted there were additional letters the FS wanted to review but that Cardno did not identify as warranting a FS response.
- Vicki questioned if FS talked with FERC about the Hybrid 1A and Hybrid 1B Alternatives. Karen said they had not. Jennifer noted she is coordinating the Job Timm (FS) to get a final FS decision on what FS wants to see in the Final EIS regarding the Hybrid alternatives. Karen stated FERC should be analyzing the alternatives in the Final EIS.
- Jennifer updated that Cultural Surveys on the JNF are ongoing, and that MVP's survey permit expires on April 29th. Alex Faught (FS) is tracking the survey update. Vicki requested BLM be added to the daily survey progress updates.
- Jennifer and Vicki agreed that Tom Collins (FS) did an excellent job during this morning's meeting with FERC regarding geological impacts analysis in the EIS. She summarized that FERC did not initially include FS input, but that FS and FERC are now working together to update the Administrative Final EIS with the information that FS initially requested. Jennifer also noted she asked for this meeting several weeks ago, and that FERC only provided two business days to attempt to incorporate FS's comments, with FS help. Jennifer said if the Administrative Final EIS still does not meet FS needs, the FS can file the additional analysis in the FERC docket.
- Miriam, Jennifer, and Vicki agreed that mitigation discussions will remain on hold until further instruction from BLM and FS management.
- Jennifer and Vicki agreed meeting scheduling should remain on hold until after April 21st to allow for adequate project document review. Jennifer said the only meeting that could be potentially scheduled before April 21st would be a law enforcement follow-up meeting. Jennifer also said she will follow up with law enforcement and National Environmental Policy Act specialists to determine what the FS needs to accomplish regarding law enforcement.
- In conversations with the National Park Service (NPS), Jennifer said meetings to discuss the ANST with managing partners are on hold until a later date to allow for adequate document review. Jennifer and Vicki agreed a meeting with only federal management partners and solicitors would be helpful before the managing partners meeting to make sure all federal agencies are on the same page about treatment of the ANST for the MVP project. Jennifer stressed that it is not the job of FS to consult with MVP on behalf of NPS or the Appalachian Trail Conservancy. Jennifer said she has encouraged NPS to file their comments in the FERC docket as FS cannot pass them on to MVP on NPS's behalf.

Mountain Valley Pipeline	2017

MVP FS FERC Geology Call
Date/Time: Thursday, March 30th @ 12:00 – 1:00 pm ET
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, William (Bill) Bagnall
	Forest Service (FS)	Jennifer Adams, Tom Collins
	Federal Energy Regulatory Commission (FERC)	Tony Rana, Jim Glaze, Paul Friedman
	Cardno	Lavinia DiSanto, Doug Mooneyhan
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Lavinia** shares Geology and Soils sections of the Administrative Final Environmental Impacts Statement (EIS) draft with FS and BLM. (*Complete*).
- **FERC** and **FS** review and coordinate needed updates to Draft EIS Geology and Soils sections. (*In Progress*).
- **Participants** include all call attendees on future communications regarding the Geology and Soils EIS sections.

DECISIONS/DISCUSSION POINTS

- Tom reviewed that the FS has been asking for FERC to assess potential impacts from project-induced landslides and slope failures since MVP submitted their initial Resource Reports in October of 2015. Tom said his comments on the Geology section of the Administrative Draft EIS (ADEIS) were not taken into account in the Draft EIS.
- Tom submitted roughly 10 pages of comments during the ADEIS comment period to explain why the FS wanted project-induced geologic impacts to be analyzed in the EIS, with supporting documentation from nearby areas with similar geology. Tom stressed the FS wants fill failures during and after construction, and long term slope stability analyzed in the AFEIS. Landslides are a big concern to the FS, and landslides that happen off of Jefferson National Forest (JNF) lands can still affect JNF Lands.
- Tom said Section 4.1.2.9 in the Draft EIS is brief and inadequate to assess potential geologic impacts. Tony said Tom's comments on the cut and fill slopes were incorporated, and additional relevant comments were added in, time permitting. Tony and Tom agreed more fine-scale mapping of the area, in addition to the United State Geologic Survey 2014 Landslide overview map, is needed for appropriate impact analysis.
- Tony and Paul said the timing of FS comments and the tight deadlines made review of Tom's ADEIS comments difficult to incorporate. Jennifer said she would expect FERC to follow up with FS if they had not received comments they were expecting, and has since required read-receipts for comments emailed to FERC (to be sure they are received).
- Tony and Paul said information in Tom's comments was irrelevant to impacts to Jefferson National Forest (JNF) lands and could not be incorporated into the EIS, as it cited examples from North Carolina. They said FERC management would excise this information and stressed they want FS to focus on impacts within the JNF jurisdiction. Tony and Paul also said Tom's ADEIS comments were too long and submitted too late to be fully incorporated.
- Tom and Jennifer reiterated that information in Tom's comments provides context and support from other similar landscape and issues from the same FS region, and is relevant and appropriate as scientific basis for Tom's request for a finer-scale analysis of potential geologic impacts caused by the proposed project.

- Jennifer noted MVP has only recently submitted geologic information, including site-specific stabilization measures at certain high hazard areas along the route for the JNF. Tony questioned what additional information the FS wanted if the site-specific designs weren't enough. Tom reiterated the geologic impacts (i.e. debris flow, slope failure, etc.) from MVP's project need to be assessed and analyzed in the Final EIS.
- Tony said he didn't see any mitigation recommendations in Tom's ADEIS comments. Tom and Jennifer said they want to see impacts analyzed before they can propose mitigation. Tom also stressed that not all impacts can be mitigated. Jennifer said the FS is concerned about safety associated with project-induced geologic impacts. Tony and Paul agreed safety is a concern.
- Tony, Paul, and Tom agreed to collaboratively edit the Administrative Final EIS documents by Monday, April 3rd to allow for Cardno to edit and incorporate the FS's needs into the Administrative Final EIS. Tony said some of Tom's example text may be incorporated by reference. Tom and Jennifer said they reserve the right to still review and comment on the Administrative Final EIS once it is released to Cooperating Agencies. Vicki agreed this would be a good approach to meet FS needs on short notice, but that more time to review documents would be preferable.

Mountain Valley Pipeline	2017

MVP FS BLM Biweekly Coordination Call

Date/Time: Wednesday, April 5, 2017 @ 1:30 – 2:00 pm EST

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Kimberly Melendez-Rivera
	Forest Service (FS)	Jennifer Adams
	MVP	Megan Neylon
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **Grace** schedules a call with MVP, BLM, and FS to review FS's comments on MVP's Visual Impacts Analysis (VIA) (*In Progress*).
- **BLM specialists** submit comments on MVP's Plan of Development (POD) to Vicki by Thursday, April 6.
- **Jennifer** files FS's soils report comments in the Federal Energy Regulatory Commission (FERC) docket.
- **Jennifer** touches base with Mitchell Kerr (FS) to confirm FS has everything it requested for boundary surveys and updated maps.
- **Jennifer** emails Shamina Dillard (FS) for confirmation on how road-repair contractors will be hired to fix problems on Mystery Ridge and Pocahontas roads (*Complete*).
- **MVP** completes road repairs.
- **Participants** send April 21 executive team call agenda items to Grace.
- **Megan** confirms MVP has all comments they need from the FS.
- **Megan** confirms MVP has the information to respond to Galileo's decision file document request.

DECISIONS/DISCUSSION POINTS

- The FERC published a Notice of Schedule on the FERC docket this week. The Draft Environmental Impact Statement (DEIS) is scheduled for release on June 23rd, 2017. The Agency decision deadline is scheduled for September 21, 2017. Jennifer clarified the FS is not committed to that deadline as it has its own internal review process.
- BLM, FS, and Galileo confirmed they have received paper and CD copies of MVP's most recent filings.
- Megan confirmed she received the FS's comments on MVP's VIA and requested a meeting to discuss them. BLM requested to attend as well.
- Megan confirmed MVP is planning to file in the FERC docket additional outstanding documents, including the updated Appalachian National Scenic Trail (ANST) Contingency plan.
- Megan confirmed MVP has completed boundary surveys and included the updated information in the most-recently filed POD (May 3rd, 2017). Jennifer stated she wanted to confirm the FS had everything they asked for with regard to boundary surveys. Megan said she is happy to deliver anything else the FS might need.
- Megan updated that MVP is waiting on comments from the Virginia Department of Conservation and Recreation (VADCR) on MVP's Habitat Equivalency Analysis (HEA) and Migratory Bird Conservation Plan. While Megan doesn't anticipate any of VADCR's comments affecting the FS-section of the HEA analysis, all parties agreed FS and BLM should wait to review the HEA once it is completely finalized.
- Megan confirmed MVP received comments on the Biological Assessment (BA) from the United States Fish and Wildlife Service, and that these comments were filed in the

FERC docket on February 9, 2017, and incorporated in the latest version of the BA, filed March 14, 2017.

- Jennifer said FS will file official comments on MVP's soils report in the coming weeks.
- Jennifer updated that the FS is moving forward with internal conversations regarding law enforcement needs for the project and will soon be ready to schedule that meeting.
- Jennifer suggested the FS, BLM, and MVP target a POD page-turn meeting for mid-late June, 2017. This would allow MVP time to incorporate the latest round of FS and BLM comments on the POD before the meeting. Jennifer stated she wants FS's comments on MVP's March 3 POD to be filed in the record.

Upcoming Meetings:

Executive Team Call – Friday, April 21@ 11 am –noon EST

Mountain Valley Pipeline	2017

MVP FS National Environmental Policy Act (NEPA):
Land and Resource Management Plan (LRMP) Amendment Discussion
Date/Time: Thursday, April 6, 2017 @ 11:00-1:00pm (AZ)/2:00-3:00pm (E)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Karen Overcash, Pauline Adams, Dawn Kirk, Tom Bailey, Ginny Williams
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:
- ✓ Determine which Forest-Wide and Management Standards are still violated by the MVP project.
- ✓ Determine which plan amendments are still necessary to the MVP Project.

ACTIONS

- **Karen** confirms whether or not MVP crosses any wetlands with the wetland report.
- **Karen** confirms whether or not the pipeline would be an approved facility, if permitted.
- **Ginny** meets with MVP to discuss MVP's Visual Impacts Analysis (VIA).
- **Ginny** follows up with FS landscape architects to discuss any additional visual amendments needed.
- **Ginny** follows up with FS GIS specialists to fix glitches in Scenic Class data layers.
- **MVP** updates VIA per FS instruction.
- **FS Specialists** analyze MVP's updated visual analysis to determine if Scenic Integrity Objectives Will be met and determine if additional amendments are needed.
- **FS Specialists** send any additional standards and/or amendments to carry forward to Karen by April 21st.
- **Karen** reviews the Inventoried Roadless Area briefing paper for visual impacts.
- **Karen** finalizes which FS standards and project amendments will be carried forward for the Final Environmental Impact Statement (FEIS).
- **Karen** facilitates publication of a Federal Register notice discussing the Plan Amendments as they relate to the 2012 Planning Rule.

DECISIONS/DISCUSSION POINTS

- Karen reiterated that the Proposed Amendments for the Proposed MVP projects were based on scant information in the Draft Environmental Impact Statements (EIS). She updated the Proposed Amendments need to follow the updated 2012 planning rule. Decisions on standards that will be violated by the projects and which amendments will be carried forward to the Final EIS are tracked in the accompanying plan amendment summary document.
- Karen said the FS deadline for final plan amendments to include in the Final EIS are due April 21st. Karen clarified the Plan-Level Utility Corridor amendment did not need to be discussed today and that changes were already in progress.
- See Attached MVP DEIS Plan Amendment Description Document for decision and discussion points. Edits to the initial document noted in green text.

Mountain Valley Pipeline	2016

MVP Sedimentation Discussion

Date/Time: Thursday, April 6, 2017 @ 7-8 am PT /8-9am MT /9-10am CT /10-11am ET

Location: Conference Call

Attendees	Forest Service (FS)	Dawn Kirk, Pauline Adams
	GAI Consultants	Joshua Noble, Kevin Bortz
	Galileo Project	Lauren Johnston

Objectives:

- ✓ Discuss whether MVP's Sedimentation and Hydrological Analyses are sufficient to accept as part of the Final Environmental Impact Statement, or if more analyses are warranted.
- ✓ Discuss whether MVP's Sedimentation and Hydrological Analyses can be appropriately translated for Biological impacts assessment.

ACTIONS

- **Dawn** and **Pauline** check Environmental Protection Agency 2003 article reference to determine adequacy of 10% sedimentation load impact threshold.
- **Dawn** and **Pauline** confirm aquatic biota sediment standards.
- **Pauline** and **Dawn** complete and send Sedimentation and Hydrological Analysis comments to Jennifer.
- **GAI** starts review and modifications of MVP's sedimentation analysis section in the Administrative Final Environmental Impact Statement (AFEIS) as it becomes available.

DECISIONS/DISCUSSION POINTS

- Kevin Summarized his comments with MVP's analysis as follows:
  - MVP uses broad mapping and a large, watershed-scale with averaged input values across the landscape and lack of localized conditions.
  - MVP's use of analysis model is appropriate to predict erosion due to construction, but he hasn't before seen it applied to a linear project.
  - MVP's analysis may not adequately capture episodic higher intensity events and their effects on the landscape.
  - It is unclear how MVP estimated where 10% increase in sediment load would occur, without more specific analysis of stream characteristics.
- Dawn and Pauline agreed they are concerned MVP's analysis doesn't capture high intensity episodic events or localized conditions. In addition, Dawn expressed concern that cumulative effects are not evaluated far enough off of National Forest System (NFS) lands to address biological concerns and impacts downstream. Dawn emphasized aquatic species the FS is concerned about are mostly found off NFS lands, yet FS need to manage activities on NFS lands to reduce or impacts off Forest.
- Dawn and Pauline expressed concern about MVP's use of sediment threshold increase of 10% to determine where impacts would occur. Kevin said the usual standard in Virginia is to keep sediment load less than 2 tons/acre/year in order to obviate the need for mitigation. Kevin stated this standard is used to prevent impacts to downstream neighbors, and is not specific to Biology. Dawn stressed organisms respond differently to increases in sedimentation, and a 10% impact threshold to determine when impacts would occur is likely

not relevant. Dawn expressed concern that because impacts are at the watershed level, localized impacts will be hard to determine.

- Dawn expressed concern MVP's analysis might not meet her needs to estimate biological impacts, as the cumulative effects area doesn't include Stony Creek and Craig Creek.
- Pauline clarified inspection of erosion control measures and sedimentation mitigation measures needs to be specified in the FS's Special Use Permit and/or Bureau of Land Management's Record of Decision.
- Joshua, Kevin, Pauline, and Dawn agree the following points in MVP's Sedimentation and Hydrological Analyses need to be addressed:
    - Lack of background data to confirm analysis results.
    - How cumulative effects analysis areas were determined and why.
    - Potential over- and underestimate of impacts from construction activities on sedimentation.
    - Clarification on construction starting point and timeline throughout the analysis area; instruction to make sure analysis includes data for 5-7 years post-construction.
    - Clarification on whether MVP included all disturbance within the watershed, even if it was off NFS lands, in impacts analysis as previously instructed by FS.
    - Whether MVP needs to run a limited disturbance scale model to adequately address effects to smaller scale areas in addition to a whole watershed analysis.
    - Accuracy of analysis of efficacy of erosion control measures
- Pauline clarified there has not previously been a sedimentation analysis analyzed in the AFEIS, and that FS has been waiting for a sedimentation analysis for over a year.

Mountain Valley Pipeline	2017

MVP BLM/FS Biweekly Coordination Call
Date/Time: Thursday, April 13, 2017 @ 3-4pm (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Sally Spencer, Mark Mackiewicz, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Alex Faught, Troy Morris
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Karen Mouritsen (BLM)** works with the Federal Energy Regulatory Commission (FERC) for an extension to the Administrative Final Environmental Impact Statement (AFEIS) review.
- **Vicki** follows up with John Henson (DOI Solicitor) re clarification on whether or not the Office of energy Policy Compliance (OEPC) needs notification of BLM's AFEIS comments.
- **Miriam** drafts disclaimer letter re OEPC notification on BLM's AFEIS comments.
- **Jennifer** peruses and edits FS comments on MVP's Plan of Development (POD).
- **Grace** forwards BLM's compiled POD comments to Vicki. *Complete***.**
- **Vicki** forwards BLM's compiled POD comments to Stephen Fusilier (BLM).
- **FS** and **BLM** continue review of the AFEIS – due April 24th.
- **Jennifer** and **Vicki** copy Galileo on AFEIS comment transmittal to the FERC.
- **Grace** follows up with Karen Overcash to get an update on Draft EIS comment responses.
- **Lauren** completes Draft EIS "Recommendations" table by end of next week.
- **Vicki** and **Jennifer** track photo delivery from TetraTech/MVP. *In Progress.*
- **FS** and **BLM** review MVP's updated visual analysis photos. *In Progress.*
- **Galileo** sends Appalachian National Scenic Trail (ANST) meeting poll to Jennifer**.** *Complete***.**
- **Jennifer** forwards ANST doodle poll to Job Timm (FS) to schedule. *Complete***.**
- **Galileo** sends out ANST meeting invites as directed.
- **GAI** Consultants review Sedimentation/Hydrology sections of the AFEIS.
- **Jennifer** and **Troy** discuss stump grubbing and topsoil segregation with FS specialists.
- **Jennifer** follows up with Megan Neylon (MVP) for re MVP's soils report. *Complete***.**
- **Jennifer** completes and files a soils report approval letter in the FERC docket.
- **Alex** continues to coordinate with Megan Neylon (MVP) to obtain the most recent and correct Craig Creek shapefiles.
- **Jennifer** completes Craig Creek briefing package.
- **Mark** follows up with BLM FAST-41 Act specialists re an update to the project schedule.
- **Karen Overcash (FS)** continues to coordinate updates to the FS Land and Resource Management Plan (LRMP) amendments necessary for the MVP project, if approved.
- **Jennifer** meets with Karen Overcash (FS) re LRMP amendment and Draft EIS comments.

DECISIONS/DISCUSSION POINTS

- Vicki updated that BLM briefed Mike Nedd (BLM Washington Office) on Monday and identified next steps forward for requesting an extension to the AFEIS review period.
- Vicki updated that BLM has not received any additional POD, SF-299, or MVP response to Environmental Information Request document comments. She said BLM is focusing review now on the AFEIS, and that Stephen Fusilier (BLM) is will provide his POD, SF-299, and AFEIS comments all at once. Jennifer updated that she has yet to review the FS's POD. Galileo offered to help with any comment compilation as needed.
- Vicki said that it was unclear whether the BLM needs to coordinate with the OEPC for comments on the AFEIS. Miriam said the BLM could say there are no new controversial

issues in the AFEIS, and this could preclude OEPC involvement. Mark, Miriam, and Vicki agreed the best path forward is to have Miriam draft a disclaimer explaining why OEPC coordination is not needed, and to have Vicki follow up with John Henson (DOI Solicitor) as needed.

- Grace updated that Galileo has provided Karen with the following sets of comments:
  - FERC-identified comments for FS response
  - Additional Keyword-search comments for FS response
  - Additional comment period comments for FS/FERC response
- Grace said Galileo offered assistance Karen if she needs it to respond to these additional comments. Most of the Additional comment period comments Galileo identified appear to be substantive comments requiring a FERC, and not a FS, response. The response to comments is due May 12th at the latest to FERC.
- Lauren updated that Galileo is developing a tracking table for FERC's recommendations listed in Section 5.2 of the DEIS.
- Grace updated that BLM and FS met with MVP about the visual report. MVP committed to augment their Visual Impact Analysis to include more photos and simulations. It will also be formatted to address both agencies' visual resource analysis protocol. A follow up call is scheduled for Thursday, April 20 (11 am E) to go over the updated information. Jennifer added the FS has requested MVP provide their new photographs before the meeting, as the photos in the past have not been acceptable.
- Grace updated the ANST managing partners meetings are proving difficult to schedule. Jennifer suggested passing the scheduling off to Job Timm (FS). Vicki clarified the BLM and Department of Interior have concluded the FS has authority to consider concurrence with the BLM's record of decision regarding whether or not to grant a Right of Way to MVP across Federal Lands, including the ANST crossing and other FS lands.
- Grace updated there was a meeting to discuss concerns about the Sedimentation and Hydrological Analyses. The FS's main concerns are about whether episodic events or localized conditions are captured in the analysis, and if the analysis translates for the aquatic analysis. Pauline and Dawn will follow up on action items and send their comments to Jennifer.
- FS discussed they need to follow up with MVP to clarify their plans with regards to stump grubbing and topsoil segregation.
- Jennifer said she is concerned that formal documentation and filing of MVP's soils report with the FS and in the FERC docket has not occurred. Jennifer noted she is specifically concerned that the soils report has not been filed in the FERC docket and is not currently present in the decision file. She updated she has asked FS personnel to forward any soils documents they have to Galileo.
- Galileo updated that MVP's contractor, Apex will be on site on the Forest to repair road damage to Pocahontas and Mystery Ridge roads start Monday, April 17th.
- Jennifer clarified the George Washington and Jefferson National Forest (GWJNF) does not need to perform a carbon analysis as there are no Spruce forests on the GWJNF that sequester more carbon than other forest types.
- Jennifer updated that Karen Overcash (FS) met with FS Washington Office to discuss the LRMP amendments, and that she can provide an update on the next biweekly call. Jennifer said the LRMP amendments for the project will likely change, largely due to public input.

Next Meeting: Thursday, April 27th @ 3-4 pm ET

Mountain Valley Pipeline	2017

MVP FS BLM Coordination Call
Date/Time: Wednesday, April 19, 2017 @ 11am-noon (P)/noon-1pm (M)/1-2pm (C)/2-3pm (E)
Conference Call: 866-906-9888; code 1603852#

Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore
Forest Service (FS)	Jennifer Adams, Ginnie Williams
Mountain Valley Pipeline (MVP)	Megan Neylon
Galileo Project	Grace Ellis

Action Items:

Megan: File the Migratory Bird Conservation Agreement(MBCA) and the Habitat Equivalency Analysis (HEA) once they have received comments from the Commonwealth of Virginia.

Megan: Send paper copies of the soils report to Jennifer (2) and Galileo (1)

Jennifer: Review figure in Tree Stand Report and request updated figure, if necessary.

Megan: Find and file Tree Stand Report, with updated figure if necessary.

Jennifer and **Vicki**: Coordinate internal review of Plan of Development, SF-299, and other documents. ***Target***: April 28, 2017.

Galileo: Assists with compiling/formatting comments as requested.

Grace: Send out visual call agenda.

Jennifer: Coordinates scheduling of ANST meeting (**Galileo** assists).

Grace: Sends Friday's Executive Team agenda, once approved by **Jennifer.**

Vicki: Follows up on whether Galileo needs to go to Atlanta for high level meeting.

Jennifer: Coordinates timing/availability for Law Enforcement call (**Galileo** assists)

Megan: Sends additional decision file documents to **Galileo** in the coming weeks.

Megan: Sends email regarding National Register eligibility of Mystery Ridge Road to PMs.

Megan: Coordinates with Michael on Mystery Ridge eligibility.

Galileo: Sends government shut down contingency actions to **Jennifer** and **Vicki** for approval.

Discussion Points:

- MVP is still waiting on comments from the Commonwealth of Virginia before they can update and submit their MBCA and HEA. Anticipated submittal is next week.
- MVP filed the Soil Profile Descriptions Report for Jefferson National Forest yesterday. Megan will send paper copies to Jennifer and Galileo.
- Megan anticipates filing the Tree Stand report, first developed in early 2016. Jennifer is reviewing the location figure in the Tree Stand and will file a request for the updated data, since the figures show two parcels of land in the wrong place. ATC has brought

this to FS attention several times. Megan will update the figures in the report. Jennifer noted that FERC needs to make sure the updated figures make their way into other reports that may also be incorrect.

- Agency specialists are reviewing the Plan of Development and the SF-299. Alex is working on the SF-299. Galileo is compiling and formatting comments as requested. Target date for transmittal is April 28. If agencies notice any "red flag" comments, they will submit those to MVP as soon as possible.
- BLM and FS received MVP's updated visual resource files, although Vicki's cd cases were shattered. Grace confirmed the agenda for the 4/20/17 visual call.
- Jennifer noted there has been some difficulty scheduling the ANST meetings, but the FS is close to scheduling the meetings.
- Grace said she would send out the agenda for Friday's Executive Team call as soon as she gets some feedback from Jennifer.
- BLM and FS are having a high level meeting in Atlanta next week. BLM may ask Galileo to attend to help facilitate, capture action items, and take notes. Megan approved the out of scope attendance. Vicki will follow up.
- Jennifer has been discussing a meeting with law enforcement. She will confirm with the Captain that FS is ready to schedule this. Galileo will send out a doodle.
- MVP recently sent Galileo a batch of documents and will be sending additional correspondence documents in the next few weeks.
- Alex is out so Megan is hoping to get the SF299 next week. She said Alex approved initiating the roadwork repair and crews have begun the work, but they may need to put off some of the work till next week due to weather. Megan will send photos later.
- MVP hopes to wrap up cultural surveys this week, weather permitting.
- MVP's internal cultural team is contemplating the National Register eligibility of Mystery Ridge road. Megan will touch base with Michael on this, in hopes of avoiding any issues with the road maintenance planned for this project.
- Galileo is working on a contingency plan to keep working if the government shuts down.

Mountain Valley Pipeline	2016

Mountain Valley Pipeline: Visual Impacts Assessment (VIA) Update Call
Date/Time: Thursday, April 20 @ 11am - 1pm (ET)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Ginny Williams
	Bureau of Land Management (BLM)	Vicki Craft
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofanti
	Tetra Tech	Bob Evans, Sean Sparks, John Scott
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:
- ✓ Preview MVP's VIA and provide initial feedback
- ✓ Clarify any FS questions on the VIA
- ✓ Review any points FS is interested in discussing.

ACTIONS

- **MVP** updates, completes and submits to the FERC docket a VIA, target date April 28, 2017. See discussion below for requested updates.
- **Ginny** identifies additional Key Observation Points (KOPs) from Craig Creek Road for MVP to include as a supplement to the VIA. *Complete.*
- **MVP** supplements the VIA with additional Craig Creek Road KOP photos and visual simulations and submits to the FERC docket as soon as practicable.

DISCUSSION/DECISIONS

- John C presented MVP's updated VIA maps, spreadsheets, and photographs, stressing Tetra Tech attempted to get exhaustive coverage of the route and to present the most reasonable worst-case scenarios with regard to visual simulations for viewshed analysis. John C said MVP wants to make sure FS knows why they picked certain points and photographs for further visual analysis by providing extensive background data for all points in spreadsheet format.
- FS expressed their overall approval of the preliminary VIA, citing good quality, extensive photographs, and a good amount of visual simulation points. Ginny suggested the following to improve the format:
  - Increase font size of narrative on photograph sheets.
  - Add distance of KOPs to proposed pipeline views.
- Tetra Tech and MVP agreed they are not sure how to incorporate points not related to the Jefferson National Forest (JNF) into the VIA. Ginny suggested this is good information to demonstrate they tried to truly capture the visual impacts, but that FS is mainly concerned with where the proposed project is visible on JNF lands.
- Ginny clarified she does not see a lot of value in photographs that show the Appalachian National Scenic Trail (ANST) path, but would rather see photographic simulations from the ANST path towards the bore points on JNF lands.
- Ginny further clarified one of FS's goal with the VIA is to show exactly how many spots from the ANST one could potentially view the proposed project row, getting as specific as possible in a concluding narrative and/or table. She stressed interested parties will be looking for this type of information.
- Ginny and Jennifer stressed the need for additional KOPs on Craig Creek road, which they note are absent from the analysis. MVP requested help in identifying points from which to take photographs and committed to taking additional photographs and providing additional visual simulations along Craig Creek Road.

- Ginny suggested it would be informative for MVP to show where the proposed pipeline would not affect viewsheds, especially at locations of high public interest. This could help prevent future comments stating analyses at these points were missed. Ginny said MVP also needs to disclose where the proposed pipeline project could be visible under perfect or near perfect conditions, but with disclaimers concerning distance from viewpoint to the project right of way, potential for screening vegetation, etc.
- MVP clarified their VIA will include images showing proposed road improvements on Mystery Ridge and Pocahontas roads.
- See attached visual simulations, pre-simulations, PDF of excel table data, and KOP map reviewed during this meeting.

MVP FS BLM Executive Team Coordination
Date & Time: Friday, April 21, 2017 @ 11:00am – 12 pm Eastern
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Karen Mouritsen, Mark Mackiewicz, Vicki Craft, Sally Spencer
	Forest Service (FS)	Jennifer Adams, JoBeth Brown, Joby Timm, Karen Overcash, Tim Abing
	USDA Office of General Counsel (OGC)	Sarah Kathmann
	BLM Solicitor's Office	John Henson
	Mountain Valley Pipeline (MVP)	Joe Dawley, John Centofanti, Megan Neylon, Rebecca Watson
	Galileo Project, LLC	Grace Ellis, Lauren Johnston

ACTIONS

- **FS** and **BLM** continue internal mitigation discussions.
- **FS** and **BLM** continue review of MVP documents (POD, SF-299, etc).
- **FS** and **BLM** continue discussion National Historic Preservation Act (NHPA) Section 106 consultation needs.
- **John** and **Megan** forward potential Appalachian National Scenic Trail (ANST) meeting agenda topics to **Galileo.**
- **MVP** submits the Habitat Equivalency Analysis (HEA) and Migratory Bird Conservation Agreement (MBCA) by the first week of May.

DECISIONS/DISCUSSION POINTS

- Karen updated that BLM will continue to work with MVP, as appropriate, to complete Endangered Species Act Section 7 Consultation, NHPA Section 106 Consultation, and edits to MVP's Plan of Development (POD) in an effort to stay on the Federal Energy Regulatory Commission's (FERC) schedule and issue a Record of Decision (ROD), with decisions on concurrence, from the FS and United States Army Corps of Engineers.
- Mark said FERC can issue their Certificate of Convenience and Public Necessity with conditions to complete Section 7 Consultation and Section 106 Consultation afterwards, but it is the BLM's policy to have complete Section 7 and Section 106 consultation before signing a ROD on the application for a Right of Way (ROW) grant.
- Joe questioned why BLM could not go forward with their ROD since FERC is the lead for Section 106 consultation per the Natural Gas Act (NGA) and has conducted consultation for the FS lands affected by the project. Joe also expressed concern that MVP cannot complete Section 106 or Section 7 surveys on the entire route as MVP has been denied access to some private lands in West Virginia, which they can only access if they are given eminent domain per a FERC Certificate.
- Mark said BLM needs to have additional conversations with FS and BLM cultural specialists to determine if FERC's Section 106 consultation is adequate for BLM's and FS's needs. Mark also said he is concerned there doesn't appear to be Memorandums of Agreement between Section 106 consulting parties. He noted these agreements take time. BLM will determine if MOAs need to be completed for BLM to sign a ROD or ROW.
- Rebecca expressed her concern that the fundamental process questions, the likes of which the NGA tries to streamline, are being raised very late in the National Environmental Policy Act (NEPA) process. This could lead to financial penalties for MVP through fault of federal agencies. Karen and John H agreed the process concerns are important and being discussed internally. The BLM's focus is developing an adequate,

defensible document that meets FS and BLM needs as the basis for their respective decisions on the project.

- Rebecca questioned the need for an Interior Board of Land Appeals (IBLA) appeal process, and cited cases against the Ruby Pipeline Project which were taken directly to the relevant circuit courts. Mark confirmed the BLM is discussing the appeals process and procedures internally.
- John Henson clarified the FS objection process is required before the FS can issue their ROD for their plan amendments associated with the project, and subsequently consider concurrence with the BLM's ROD. Tim clarified the FS objection process is a pre-decisional process, meaning their decisions on the Land and Resource Management Plan (LRMP) amendments are not final until after the objection process.
- Joe said MVP hopes to have all federal permits completed, signed, and received by November 1, 2017.
- Joe expressed his concern that FS and BLM have MVP stuck in a "do-loop" with open-ended and dynamic data and analysis requests, citing the FS's recent request for additional photographs in the Visual Impacts Assessment. He stressed the agencies need to be happy at some point with the data and analyses they have, and that MVP feels they have provided adequate data and analysis.
- Jennifer and John C agreed MVP's VIA was well-received by the FS, and that MVP can submit the VIA once completed, adding additional requested photos in the near future. Jennifer noted the analysis needs to meet FS standards in order for them to make a defensible decision. Jennifer clarified FS offered to help identify points for additional requested photos, and MVP and FS have already agreed on a path forward regarding this concern. Job stressed, especially with regard to visual impacts, there is a very high level of public attention on the Jefferson National Forest.
- Jennifer clarified FS and BLM want to see all MVP-agency correspondence, as some of it might tie into the FS's LRMP amendment decision and/or BLM's ROW grant. Jennifer also clarified MVP needs to correct the GIS data layers from the April 2016 soil report recently filed in the FERC docket. She said she wants MVP to make sure the incorrect data layers are corrected in any other documents in which they might have been used.
- Karen updated BLM and FS are working on determining what mitigation measures need to be included in the Plan of Development and as conditions on the ROW grant. Tim clarified FS will need to see the HEA to help assess needed mitigation measures. MVP confirmed the HEA is done, however they are still waiting on comments from the Virginia Department of Conservation and Recreation. Joe said information from the HEA will be included in the MBCA as well. He expects both documents to be filed by early May.
- Karen concluded the discussion saying the BLM is concerned about the volume of information that the public has not had a formal opportunity to comment on. Joe said MVP is aware the project could be litigated and wants to help make sure the NEPA process and document are defensible.

Upcoming Meetings:

ANST Managing Partners Discussion **- Friday, May 12th @ 8:30am – 12:30 pm (ET)**
HEA update **– Friday, May 12th @ 1:30-2:30 pm (ET)**
Executive Coordination Update **– Friday, May 12th @ 2:30 – 3:30 pm (ET)**

MVP FS FERC Wetlands Call
Date/Time: Friday, April 21 @ 1-2pm (PT)/2-3 (MT)/ 3-4 (CT)/ 4-5 (ET)
Location: Conference Call

	Forest Service (FS)	Jennifer Adams, Pauline Adams
	MVP	Megan Neylon
	Tetra Tech	Sean Sparks, Jim Herning, Kevin Culver, Henry Shumacher
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **MVP** sends updated shape files with metadata to participants
- **Tetra Tech** updates wetlands report to include:
  - Results of revisit to stream SSS3, including any changes to classification
  - Mileposts on the maps
  - Clarification on timing of field visits
  - Any new information needed based on the updated shape files
  - Potential impacts and proximity to corridor (in Table 1)
  - Information about SSS2 in Table 2

DECISIONS/DISCUSSION POINTS

- Pauline had several questions for Tetra Tech after reading their Wetlands Report. She asked if anyone on the call had been on the survey. Kevin indicated he had been on the survey of a 300ft corridor along the pipeline route.
- Pauline asked why SSS3 was indicated as an ephemeral channel rather than an intermittent stream and why no other springs or wetland areas were identified in proximity to the SSS3 location. Tetra Tech answered they saw only a dry stream bed on the survey. Pauline noted that she documented active live water on June 26, 2016 and multiple stream channels coming from a cluster of springs at the head of the drainage. Additionally, there is riparian vegetation, one indicator of a wetland. She questioned whether surveyors had looked beyond the stream channel in their survey. Tetra Tech indicated they had used US Army Corps (Corps) protocol, including survey for indicators. While there can be some subjectivity in survey, Tetra Tech had a soils and wetland scientist on their survey crew.
- There was some confusion on when the survey actually happened, since crews were present at various dates. Tetra Tech said they would clarify that, but believed the survey in question took place in Oct. Megan noted the Corps protocol take seasons into account and they the crews don't typically do delineations past October.
- Megan indicated the route was rerouted to parallel Mystery Ridge road to avoid impacts to the stream. FS said the shape files don't reflect that change and requested updated versions. Megan agreed to update the shapefiles and have crews review them to see if they could make a determination. If not, the crews would revisit the site to re-assess the stream the classification and provide additional clarification to the documentation.
- Pauline noted W-HH14 seems to have been excluded from the fisheries report. Tetra Tech explained that it was not included because it is an ephemeral drainage, but it is noted in Table 1B of the fisheries table as an emergent wetland that won't support fish. Pauline noted the table is confusing.
- Tetra Tech noted wetland H14, Stream HH14, and the wetland are not in the corridor, so they won't need mitigation. Pauline asked if Table 1 – Wetlands could be updated to indicate impacts and where it falls in the corridor. Tetra Tech agreed to update the table, noting they can only provide information on what has been delineated.
- Pauline noted that SSS2 in Giles County had fallen out of recent versions of the report. Tetra Tech noted that resource is technically on private property, but agreed to include it.

FS-FWS-FERC-BLM ESA Coordination Call
Date/Time: Tuesday, April 25, 2017 @ 1-2:30pm (ET)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Alison McCartney
	US Fish and Wildlife Service (FWS)	Glen Smith, Tiernan Lennon, Liz Stout, John Schmidt, Jennifer Stanhope, Troy Andersen, Cindy Shulz
	Federal Energy Regulatory Commission (FERC)	Kevin Bowman, Paul Friedman
	Forest Service (FS)	Doug Chaltry, Kent Karriker, Paul Arndt, Clyde Thompson, Karen Stevens, Laura Hise, JoBeth Brown, Tim Abing, Peter Gaulke, Mike Katharning, Dawn Kirk, Ava Turnquist, Carol Croy, Beth LeMaster, Jennifer Adams, Joby Timm, Karen Overcash, Steve Croy, Troy Morris
	Merjent	Jeff Mackenthun, Kristen Lintz
	Cardno	Lavinia DiSanto, Doug Mooneyhan, John Brewer
	Galileo Project, LLC	Lauren Johnston, Maria Martin, Peter Rocco

Objectives

- ✓ Discuss FERC role as lead agency for Endangered Species Act (ESA) Section 7 consultation.
- ✓ Clarify any questions regarding ESA Section 7 consultation.
- ✓ Clarify the application of the 4(d) rule

DECISIONS/DISCUSSION POINTS

- Kevin and Paul F confirmed the Natural Gas Act and the Energy Policy Act give FERC the authority to complete ESA Section 7 (Section 7) consultation for the entire route. FERC will produce one Biological Assessment (BA) and the FWS will produce one Biological Opinion (BO). Kevin also confirmed FERC completes a separate rare and/or sensitive species consultation component outside of the Section 7 consultation process.
- FWS confirmed it's the agency's responsibility to use the best available information in order to complete the BA and Section 7 consultation. Glen said it is much faster and with less work for the FWS if new information is used. Glen also said this avoids the problems associated with assuming species presence without recent studies, as this also creates undue work and might result in the proponent taking unnecessary conservation actions. He noted it is the proponent's decision whether or not to assume presence vs. conduct new surveys.
- Doug C noted assuming species presence can complicate the FS process. This is because if the proposed project is determined to have a substantial adverse effect on a species, the FS must then determine if that species will become of conservation concern, and additional planning rules with additional National Environmental Policy Act (NEPA) and public decision objection processes must be applied. It is thus also in FS interest to not assume presence absent recent surveys or additional research on best available information.

- Kevin and Paul F. confirmed the FERC can issue the Final Environmental Impact Statement (FEIS) with conditions on the FERC's order for a certificate of public convenience and necessity that construction cannot begin until Section 7 consultation and/or other consultations are complete.
- In the context of reducing impacts to the Indiana bat, the FS asked if time of year (TOY) restrictions on tree clearing in the proposed right of way (ROW) are necessary if the FS were to issue an incidental take permit (ITP). FWS confirmed the TOY restrictions are meant to reduce indirect impacts to a species, in this case the Indiana bat, by reducing indirect impacts due to habitat loss as a compounding factor.
- Glen confirmed the TOY restrictions are a standard impact mitigation and/or avoidance measure. Lavinia confirmed MVP has agreed to a tree clearing window to help minimize indirect effects to the Indiana bat. Glen confirmed the TOY restrictions apply to the entire route, as FERC has authority for Section 7 consultation and impact mitigation over the entire route.
- Paul F. said FERC plans to initiate consultation with the FWS by delivering a BA before the release of the FEIS in late June, 2017. He confirmed all surveys on the Jefferson National Forest are complete for the MVP project.
- Jennifer said there are still ACP surveys for Section 7 species that are not anticipated to be completed until July or August, 2017. Jennifer said she is concerned about these surveys and resulting reports being included in the BA if they are not yet complete. The FS is concerned they would not be able to propose an informed determination of effects if the BA is not complete. Jennifer noted that in her conversations with the FS Regional Office she was told the FS could not address the late studies through the permitting process for a project this large, in contrast to FERC's ability to include a condition their order.
- Kevin noted FERC allows project changes per the conditions of their Order after it is issued. Kevin said he understands the issue for the FS is that the FEIS needs to establish statutory authority for the FS to make amendments to their land and resource management plan (LRMP) in order to make the proposed project consistent with the plan, if approved.
- Kevin asked if FERC would be putting the FS in a position where they could no longer amend their LRMPs if the FEIS doesn't have all of the necessary data. Kent answered that the FS will be able to provide a better answer to Kevin's question after their review of the ACP Administrative FEIS. Kent's concern is the FS cannot complete analysis for a proposed amendment change if the impacts are not yet fully disclosed in a NEPA document. He added the proposed ACP project and associated potential LRMP amendments are under a high amount of public scrutiny. Doug C. said the FS is not regulated as the FERC is regulated, meaning FS does not have the same flexibility to make changes once their decision is made that FERC does per the Natural Gas Act directive to balance public necessity with environmental impacts. Kevin noted that FERC's flexibility is primarily designed to help deal with unanticipated discoveries rather than to 'fix' things or incorporate late information after the certificate has been issued.
- Paul F suggested the FS review the Grapevine, Texas vs. the DOT case regarding conditions to permits allowing survey and consultation completion post-decision.
- Kevin could not commit to a Section 7 consultation initiation timeline or document trigger for the ACP project, but that it's always FERC's preference to use theFEIS as a trigger. He said it will depend on when surveys are completed if they can be included in the FEIS, and this used to initiate consultation.
- Doug M summarized the FWS 4(d) rule as a standard list of restricted activities to reduce impacts to the northern long eared bat. The rule is meant to streamline consultation. The 4(d) rule includes restrictions on construction activities near occupied hibernacula and

maternity roost trees, in addition to restrictions on tree clearing between June 1st and July 31st.

- Doug M and Liz noted tree clearing for large projects usually occurs all at once along the project ROW. Doug said the TOY restrictions on clearing also help account for necessary mitigation measures required by the Migratory Bird Treaty Act.
- The FS asked if a Habitat Conservation Plan (HCP) was necessary for the project as there is an ITP being considered. The FWS confirmed an HCP is not necessary for this project as the FERC leadership provides a federal nexus for Section 7 consultation, even on private lands.
- Glen summarized the FWS Section 7 consultation timeline as follows (total 135 days):
    - Issuance of triggering document and formal letter from FERC requesting consultation
    - 30 days for FWS to review and determine if the triggering document meets their needs to initiate the consultation process.
    - 60 additional days to review available documents, request additional info, and fill in gaps.
    - 45 days to write the BO.
- FERC said the surveys on the MVP route are mostly complete. Any remaining biological surveys are not on public lands, and the lands they cover are not likely to have any regional forester sensitive species and/or species of conservation concern.

Mountain Valley Pipeline	2017

MVP Maps and Figures

Date/Time: Thursday, April 27, 2017 @ 2-3 pm ET

Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Alex Faught
	Mountain Valley Pipeline (MVP)	Megan Neylon
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:

- ✓ Review FS's 04/24/2017 Maps and Figures letter in the Federal Energy Regulatory Commission (FERC) docket.
- ✓ Discuss upcoming FS comments on National Environmental Policy Act documents for the MVP project.

ACTIONS

- **Alex** sends latest cost recovery (CR) statement for FS activities associated with processing MVP's Bureau of Land Management Right of Way grant (ROW) to Megan. *Complete.*
- **Megan** circulates CR within MVP to discuss payment options and timing.
- **Jennifer** sends privileged FS National Historic Preservation Act Section 106 (Section 106) letters to Galileo.
- **Jennifer** asks FS specialists if FS can share the Tribal Historic Preservation Officers' (THPO) concurrence letter with MVP.
- **Jennifer** coordinates with Troy Morris to schedule a call with MVP re biological reports.
- **Jennifer** reviews and files in the FERC docket FS comments on MVP's Plan of Development.
- **Jennifer** files in the FERC docket FS comments on updating MVP's Visual Impacts Analysis.
- **Jennifer** files in the FERC docket FS instructions for evaluating topsoil segregation and herbicide use on species within the Jefferson National Forest. *Complete.*
- **MVP** updates maps and figures in the FERC docket and references this conversation to correct the record re FS comments.

DECISIONS/DISCUSSION POINTS

- Jennifer updated that FS received concurrence letters from the Virginia State Historic Preservation Officer (SHPO) and from the Eastern Band of Cherokee THPO. FS filed the letters in the FERC docket on 04/21/2017. Megan reported MVP's parent company, NextEra, had several conversations with tribes and SHPOs in Virginia and West Virginia.
- Jennifer clarified to which map the FS was referring in their comment regarding inaccurate ownership data as a Cardno-produced map from the DEIS Appendix B Map 28 of 50. Megan said MVP has generated and submitted to the FERC docket maps with correct data, but that Cardno has not revised their maps with the correct data.
- Jennifer clarified that the FS comments on final resource reports submitted May 9th, 2016, should be the FS comments on final resource reports submitted March 9th, 2016.

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Mountain Valley Pipeline: Visual Impacts Assessment (VIA) Update Call
Date/Time: Tuesday, May 2 @ 3 pm (ET)
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Ginny Williams, Karen Overcash
	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Mark Mackiewicz
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** amends language in FS's VIA letter.
- **Ginny** completes reviewing MVP's updated VIA.
- **MVP** continues to update the VIA with additional Craig Creek Road and Peters Mountain Key Observation Points (KOPs)
- **Mark** continues coordinating with the Federal Energy Regulatory Commission (FERC) for access to the camera ready Final Environmental Impact Statement (FEIS).

DISCUSSION/DECISIONS

- Ginny reviewed FS has been working with MVP since February 2017 to improve MVP's VIA. Ginny cited poor photograph and visual simulation quality in the initial VIA. To date MVP has added significant KOPs and better quality photographs however MVP still did not include additional KOPs from Craig Creek Road and the Peters Mountain Area in their 05.01.2017 updated VIA.
- Ginny said the VIA is roughly 95% complete, but the additional 5% to completion will take a few more rounds of additional coordination and revision between FS and MVP. Ginny added she doesn't agree with all of MVP's conclusions concerning the proposed project's effects on FS Scenic Integrity Objectives (SIOs).
- Ginny added she and Karen had previously written language to include in the Final Environmental Impact Statement (FEIS) if the FS did not receive the VIA at all. The language would state FS would not amend the LRMP to lower SIOs, and the project would have to meet current SIOs.
- Mark asked if the FS would need to change any piece of the FEIS to make it support the FS decision on LRMPs in regards to visual resources. Karen said the land use section, visual section, executive summary, and conclusions would have to be updated. Ginny said FS would also have to add significant information regarding mitigation for visual impacts. Mark suggested these mitigation measures could be added on as stipulations.
- Mark asked if the FS thinks the VIA is ready to be rolled into the FEIS analysis. Ginny reiterated FS is still waiting on additional KOPs along Craig Creek, and will be filing additional guidance for MVP this week. Jennifer added Tim Abing (FS) added language to the guidance letter notifying FERC that "given the high level of public concern on visual impacts, it's important that the FEIS fully disclose the potential effects of the project in order to support timely decisions by agencies…" etc. Jennifer said she could amend the language to include a request to MVP to consult with FERC regarding a deadline to turn in a complete VIA to be included in the FEIS.
- Mark said James Martin (FERC) is willing to work with FS and BLM to make sure the FEIS meets their needs. Jennifer added she will notify Paul Friedman (FERC) and Lavinia DiSanto (Cardno) to continue coordination on this topic.

MVP FS BLM Biweekly Coordination Call

Date/Time: Wednesday, May 3, 2017 @ 1:00 – 2:00 pm EST

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Alex Faught, Karen Overcash, Ginny Williams, Ava Turnquist
	MVP	Megan Neylon, John Centofanti
	Galileo Project	Lauren Johnston, Grace Ellis

ACTIONS

- **Galileo** coordinates with Jennifer to schedule a call to discuss FS's comments on MVP's Hydrological Analysis of Sedimentation. (*In Progress*).
- **Jennifer** and **Mary Krueger** (National Park Service) complete the agenda for MVP's meeting with Appalachian National Scenic Trail (ANST) managing partners on May 12. (*In Progress*).
- **Galileo** modifies ANST meeting and Executive Team Call/Habitat Equivalency Analysis (HEA) call invitations for May 12 as directed by FS. (*Complete*).
- **Jennifer** sends draft Regional Forester Sensitive Species (RFSS) to MVP.
- **Galileo** prepares/prints meeting agendas and attendance sheets for ANST meetings.
- **MVP** prepares and prints meeting presentation materials for ANST meeting on May 12th.
- **MVP** submits to FS and BLM the HEA and the Migratory Bird Conservation Plan (MBCP).
- **MVP** updates and submits the Visual Impact Assessment (VIA) ASAP.
- **MVP** completes Phase II Cultural Survey Report and provides FS with ETA update.
- **Jennifer** contacts FS law enforcement to schedule a second coordination meeting with MVP.
- **Jennifer** and **Vicki** coordinate Plan of Development (POD) comment review and submittal to Federal Energy Regulatory Commission (FERC) docket and to MVP in the coming weeks.

DECISIONS/DISCUSSION POINTS

- Vicki and Jennifer updated that they are still internally reviewing comments on MVP's POD.
- MVP said they are working on updating the hydrologic analysis of sedimentation per FS comments. John noted FS's main concern appears to be estimating impacts around Craig Creek, and proposed a meeting with FS specialists and consultants to avoid an impasse at this report. John said MVP is willing to add additional controls, monitoring, etc. to meet FS's standards. Jennifer agreed to set up a call to further discuss this report.
- Jennifer confirmed the FS needs to be sure any actions on FS lands comply with the Endangered Species Act water quality standards. FS is also aware that actions on FS lands can have effects downstream and off the forest on Threatened and Endangered Species, and FS is responsible for mitigating those impacts. Jennifer said she is concerned that pervious determinations with regard to the FS's preferred Craig Creek crossing may change per changes to the sedimentation analysis.
- Jennifer stressed that MVP's priority should be updating the VIA per Ginny's comments. Jennifer suggested MVP contact FERC to determine when the latest possible date that MVP could submit the VIA to the FERC docket to have the analysis included in the Final Environmental Impact Statement (FEIS).
- Ginny summarized her comments on the VIA as requesting additional Key Observation Point (KOP) photographs and simulations along Craig Creek Road, WV Road 219, and the Peters Mountain Area, especially near Camp Tuckaway. Ginny also requested, and

provided an example of, summary describing potential impacts to visual resource on major travel-ways. She noted this summary does not need to accompany every KOP. Jennifer suggested an additional call may be needed once MVP turns in a completed VIA.

- Megan said MVP is still working on and awaiting full comments from the Virginia Department of Conservation and Recreation on the HEA and MBCP.
- Jennifer updated that the ANST meeting with MVP will now likely be a full day at the request of the National Park Service. FERC representatives have agreed to attend via conference call line. Jennifer reiterated she is expecting MVP to present their updated route and any additional materials related to the MVP project and the ANST. This includes the updated VIA. John said he would also like to describe the steps in developing the route and the ANST crossing up to this point.
- Jennifer notified MVP that the Regional Forest office is preparing an update to the RFSS list, however it is unlikely that this will affect the MVP project. Jennifer offered to provide MVP with any proposed new species in the project area so that MVP could do some preliminary analysis.
- John asked if there was a path forward to include and late-in-the-game changes, i.e. changes to the RFSS list, to the project analysis requirements as conditions to the BLM's Right of Way grant. Jennifer said this question is for BLM to answer, and noted that a clean step forward would be to request a supplemental EIS, but that this was not the preferred route forward.

Upcoming Meetings:

ANST Managing Partners Meeting: Friday, May 12 @ 8:30 – 3:30 pm ET

Biweekly coordination call: Wednesday, May 17 @ 2-3 pm ET

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MVP BLM/FS Biweekly Coordination Call
Date/Time: Thursday, May 4, 2017 @ 3-4pm (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Mark Mackiewicz
	Forest Service (FS)	Jennifer Adams, Jim Twaroski, Job Timm, Karen Overcash, Mike Madden, Ginny Williams, Chris Sporl, Tim Abing
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Jennifer** forwards FAST-41 ACT transmittal email from Tim to Galileo. *Complete.*
- **Galileo** captures a screen shot of FAST-41 planning dashboard website.
- **Mike** touches base with Melissa Twaroski (FS) to discuss National Historic Preservation Act (NHPA) Section 106 (Section 106) agreement document timing and path forward.
- **Jennifer** contacts Paul Friedman (Federal Energy Regulatory Commission, FERC) to setup a conference call to discuss Section 106 consultation compliance.
- **Grace** drafts an email reminder for Jennifer to send to FS specialists re submitting documents to Galileo for the decision file.
- **Karen Mouritsen (BLM)** briefs BLM upper management re the MVP project.
- **Galileo** assists Vicki in developing a briefing for BLM upper management.
- **Galileo** includes Tim and Karen on Communication Plan and notes distribution.
- **Mark** continues coordination with James Martin (FERC) re access to visual resources section of the Final Environmental Impact Statement (FEIS) as needed.
- **Jennifer** finalizes review of FS comments on MVP's Plan of Development (POD).
- **Jennifer** ensures long-term monitoring is defined appropriately in FS's POD comments.
- **Vicki** reviews FS's POD comments and coordinates to update/clarify BLM's POD comments for consistency.
- **Jennifer** and **Vicki** touch base before submitting comments on MVP's POD to MVP and the FERC docket.
- **Ginny** completes notes on MVP's Visual Impact Assessment (VIA).

DECISIONS/DISCUSSION POINTS

- BLM and FS confirmed agencies submitted comments on FERC's Administrative Draft FEIS.
- Jim said that FERC is the lead agency responsible for National Historic Preservation Act Section 106 (Section 106) consultation. He said his understanding of the Section 106 consultation process going forward is FS will review MVP's Phase II Cultural Survey reports, undergo consultation with affected parties, and then sign a Memorandum of Agreement (MOA). FERC will be the lead for the MOA but FS will be heavily involved in its development. Jim updated FERC will extend a separate invitation to the FS for Section 106 consultation. Mark stressed the BLM cannot sign a Record of Decision unless they have completed, signed consultation documents.
- Mike and Tim confirmed the FS has two sites requiring section 106 consultation, the Appalachian National Scenic Trail (ANST) and the recently-discovered archaeological site near the ANST. FS hopes to include both consultation processes in a single MOA.
- FS and BLM said they believe Tribal consultation has been adequate. Mike said consultation is ongoing with the Eastern Band of Cherokee Indians Tribe. Mike updated he is planning on additional interest from the Cherokee nation and the Kahtua Tribe. Mark reiterated he doesn't believe BLM needs to do any additional tribal consultation.

- Galileo updated that BLM and FS have started coordination on their communication plans going forward. JoBeth Brown (FS) indicated Tim and Karen would be working on the FS's Record of Decision, which would serve as the basis for all other news releases, frequently asked questions, and overall communication plan. Galileo said JoBeth is planning on having a draft communication plan ready for internal review on May 19.
- Jennifer confirmed she is finalizing the FS's comments on MVP's POD. Vicki and Jennifer confirmed neither agency has comments to submit on the SF-299.
- Ginny confirmed the FS filed additional guidance with MVP re their VIA, prior to receiving an updated VIA. Ginny requested a potential page-turn meeting with MVP to review the final VIA. Jennifer suggested this would be a good way to wrap up the VIA quickly, hopefully in time to incorporate it into the FEIS.
- Karen updated she has been working through the FS Draft EIS comment response, due May 12. Galileo offered to assist Karen as needed. Grace reiterated FS needs to consider how they will be structuring their comment addendum.
- Jennifer updated that, per National Park Service's request, FS will extend the May 12 ANST meeting with MVP to be all day long. This requires cancelling a previously-scheduled executive team call.
- Tim stressed he wants to review the Habitat Equivalency Analysis in order to have a better understanding of the mitigation process going forward.

Next Meeting: Thursday, May 18 @ 3-4 pm ET

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MVP BLM/FS Public Involvement Coordination Call

Date/Time: Thursday, May 4, 2017 @ 10-11am (E)

Location: Conference Call

Attendees	(Bureau of Land Management BLM)	Sally Spencer, Vicki Craft, Carol Zurawski, Kimberly Melendez-Rivera, Devita Carnahan, Shayne Banks, Nicole Virella
	Forest Service (FS)	Jennifer Adams, JoBeth Brown
	Galileo Project	Grace Ellis, Lauren Johnston

Communication Plan Documents

- **Galileo** develops public involvement plan tracking structure, designating the LRMP ROD the central document.
- **JoBeth** follows up with FS to determine if they want to publish a news release for the draft Record of Decision (ROD) on the Land and Resource Management Plan (LRMP) amendments.
- **JoBeth** completes a draft communication plan by May 19 for internal review.
- **JoBeth** submits communication plan to FS Washington Office (WO) on June 1.
- **JoBeth** introduces FS WO to Galileo prior to June 1.
- **Galileo** sends invitation for follow up call on Thursday, May 25 @ 10 am ET. *Complete*.
- **Grace** reviews public outreach and Notice to Proceed procedures from the Ruby Pipeline Project. Includes reference materials in public involvement plan tracking structure.
- **JoBeth**, **Devita**, and **Galileo** coordinate update to Frequently Asked Questions document.
- **Galileo** assists FS with any last-minute updates to communication plan and accompanying documents.
- **Jennifer** finalizes any last-minute updates to communication plan and accompanying documents.
- **Galileo** processes communication plan documents for 508 compliance.

NEPA

- **JoBeth** touches base with FS NEPA specialists re need for a joint FS-BLM Final Environmental Impact Statement (FEIS) Notice of Availability in the Federal Register.
- **JoBeth** follows up with NEPA specialists to determine what outreach is needed for publication of the FS's final ROD.
- **FS NEPA** team coordinates legal notices and objection process.
- **FS NEPA** team assists in review of Communication Plan.
- **Tim Abing** (FS) writes FS's ROD on LRMP amendments.
- **Karen Overcash** (FS) writes legal notices for FS's ROD on LRMP amendments.
- **Shannon Kelardy** (FS) coordinates FS's LRMP draft ROD objection process.

Website Outreach

- **Devita** updates project website to include a spotlight on the MVP project, link to FS's project website, link to ePlanning, and link to FERC's FEIS when available.
- **Kimberly** update ePlanning website as appropriate.
- **FS** uploads communication plan to FS website.
- **FS** updates project website with links for objection process information and submittals as appropriate.

Mountain Valley Pipeline	2017

MVP FS BLM Biweekly Coordination Call

Date/Time: Monday, May 8, 2017 @ 1:30 – 2:00 pm EST

Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, Mark Mackiewicz
	Forest Service (FS)	Jennifer Adams, Ginny Williams, Tim Abing
	MVP	Megan Neylon, John Centofanti, Joe Dawley
	Galileo Project	Lauren Johnston, Grace Ellis

Objectives:
✓ Discuss critical analyses missing in the Final Environmental Impact Statement (FEIS)

ACTIONS

- **MVP** completes the Habitat Equivalency Analysis (HEA) and shares FS-related sections with FS and BLM as soon as possible.
- **MVP** completes Visual Impact Assessment (VIA) addendum/amendment by May 10, 2017.
- **FS/BLM** start next steps for National Historic Preservation Act Section 106 (Section 106) consultation compliance.
- **FS/BLM**, and **MVP** meet to discuss**:**
  - VIA – Tuesday, May 9, 2017 12:00 – 2:45 pm
  - HEA - TBD
  - Sedimentation analysis – Tuesday, May 9, 2017 3:00 – 4:00 pm

DECISIONS/DISCUSSION POINTS

- Mark said he has been coordinating with FERC to get more time for MVP to submit additional analysis, especially the VIA, for inclusion in the FEIS. BLM and FS stressed it is imperative to complete the VIA as soon as possible, preferably by Wednesday, May 10, so it can be included in the FEIS.
- Joe reiterated MVP feels they have completed the necessary analysis and are frustrated that the bar for the level of detail, format of analyses, etc. keeps changing. He said it is MVP's perspective that they are following the law, and that FS and BLM are asking for a higher level of detail than required by law. Tim said it's the FS's and BLM's job and obligation to follow their respective agency standards and help develop a defensible FEIS to ensure a defensible decision for each agency. He also said FS is willing to work with MVP to update the analysis documents to FS's standards but that it's an iterative process that requires collaboration and thorough review and feedback.
- Tim and Mark stressed they feel MVP has been responsive to data requests and that most of the analysis work has been completed, but that final polishing work still needs to be done. Mark said BLM and FS are working with FERC in an attempt to get MVP's outstanding analyses into the FEIS after the deadline so BLM and FS can use the FEIS for their purposes.
- Joe updated that MVP's consultant is eager to start review of the Phase II Cultural Surveys for sites on the Jefferson National Forest (JNF). Joe stated MVP's concern that FS has not been working with MVP's contractors to do incremental review of the cultural surveys. Jennifer said this is incorrect, and that FS has been working through incremental review. Jennifer said FS has been actively providing written and verbal feedback to MVP throughout the process with myriad environmental and cultural documents.

- Tim said the next step for Section 106 consultation is to complete review of the Phase II reports and then develop a Memorandum of Agreement (MOA) with the affected parties. Mark and Tim stressed the MOA does not need to be completed until the FS and BLM sign their final records of decision, but that the process should be on MVP's radar as it takes significant review time to develop an appropriate MOA.
- John reiterated previous concerns about the FS's comments on MVP's initial sedimentation analysis. John said he wants to work with the FS to avoid having to lower the capture efficiency of erosion control measures in the sedimentation analysis as this would fundamentally change impacts to species. Jennifer said FS comments on MVP's analysis were prepared by FS's own resource experts and are written to help guide MVP on how to structure analysis for FS's needs to address impacts. Jennifer suggested scheduling an additional call with resource experts to discuss John's questions on the sedimentation.
- Tim and Ginny clarified there are only a few additional points in the VIA that FS still wants to see MVP analyze. John confirmed MVP's contractor added additional photo locations on Craig Creek Road and WV 219 roadway. John said the photo simulations take roughly 8 hours to complete per photo. Ginny agreed to review pre-simulations to help MVP determine which photo locations require complete simulations. Ginny updated that her comments on MVP's most recent VIA are specific and brief and should be quick to incorporate into a complete VIA. Jennifer suggested a page-turn meeting to edit the final VIA would be the most efficient path forward.
- Joe updated that MVP has completed a HEA for the entire proposed pipeline route and is awaiting feedback from several agencies and state governments, not including BLM and FS. MVP has not yet shared the VIA with the FS or BLM, and has not solicited comments from the FS or BLM on the HEA development or report. Joe said MVP is willing to pull out the sections of the HEA pertaining to JNF lands and share it with the FS. He also said the HEA is being used to help create a Migratory Bird Conservation Plan. Joe stressed that given the recent changes in mitigation directives and policy across federal agencies it has been difficult to finalize and apply the HEA.
- Tim said it's encouraging that MVP has used the FWS's methodology to develop the HEA model. Tim reiterated the FS is mainly concerned with how the project will impact core forest and how MVP would plan to mitigate those impacts.

MVP Sedimentation Discussion
Date/Time: Tuesday, May 9, 2017 @ 3-4 pm ET
Location: Conference Call

Attendees	Forest Service (FS)	Dawn Kirk, Pauline Adams, Jennifer Adams, Karen Overcash
	GAI Consultants	Joshua Noble, Kevin Bortz
	MVP	Megan Neylon, John Centofanti, John Uhrin, Megan Stahl, Brian Clauto
	Holland and Hart	Sandi Snodgrass
	Tetra Tech	Sean Sparks
	ESI	Taina Pankiewicz
	Galileo Project	Lauren Johnston

Objectives:
✓ Discuss path to addressing FS's 04/25/2017 comments on MVP's Sedimentation Analysis

ACTIONS

- **Taina** sends the following to meeting participants:
  - Sedimentation Analysis reference documents
  - Example United States Geological Survey (USGS) study
  - MVP Erosion and sediment control plan
- **FS specialists** and contractors review sedimentation analysis reference documents
- **FS contractors** review Erosion and Sedimentation Control Plan.

DECISIONS/DISCUSSION POINTS

- Pauline summarized her concerns that the sedimentation analysis utilized annual averages to model sedimentation risks and doesn't take into account seasonal weather changes. FS and GAI were also concerned there was no way to know when construction would take place, if this was considered in the model, and if so, how time of year was taken into account. Kevin suggested without any data to backup how MVP came to its figure for percent containment, FS has no way of knowing if MVP's assumptions are accurate.
- John C and Taina said they are concerned that lowering the containment value from 79% to 48%, as was recommended in FS's comments on the sedimentation analysis, would have ramifications for the entire project analysis and would not accurately reflect the work that MVP has already done. Taina explained the 79% containment figure was based on a field test thesis paper study.
- Dawn stressed FS wants to be sure the sedimentation analysis can provide the most accurate description of impacts on the Jefferson National Forest (JNF) and in areas downstream from the forest. She cited concerns that MVP's analysis shows an increase of greater than 10% sedimentation in several areas. Taina and John C said the 10% increase figure shouldn't be limiting, and can provide USGS and FS documents that show an increase of 10% will not have a measurable effect on species for over 100 years. Pauline said FS wants to be sure the analysis presents close to a real-world scenario and not the best-case scenario for sediment containment and impacts on the JNF.
- Pauline said she would like to see additional supporting documentation for how MVP came up with their model assumptions, in particular containment efficiency. She cited a high level of public interest in waterbody crossings on the JNF and impacts to aquatic species on the JNF. Jennifer and Dawn stressed public interest is piqued due to a recent and catastrophic sedimentation control failure on JNF lands, despite monitoring and industry-standard control

plans. Dawn stressed good plans aren't enough and must be bolstered by consistent monitoring and accurate implementation.

- John C said MVP is happy to provide additional documentation to FS and to the Federal Energy Regulatory Commission docket so that FS has a defensible impacts analysis.
- Jennifer and Karen agreed filing additional sedimentation documents is not as high priority as completing the visual impacts analysis. Karen confirmed any needed changes to the sedimentation controls to mitigate for impacts can be rolled into MVP's plan of development at a later date.

Mountain Valley Pipeline	2017

Mountain Valley Pipeline: Visual Impacts Assessment (VIA) Update Call
Date/Time: Tuesday, May 9 @ 12 – 2:45 pm (ET)
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Ginny Williams
	MVP	John Centofanti, Megan Neylon
	Tetra Tech	Bob Evans, Chris Lawson, Sean Sparks
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:
- ✓ Identify additional photos from Craig Creek Road and West Virginia 219 to include with photo simulations.
- ✓ Page-turn update of VIA per Ginny Williams comments.

ACTIONS

- **MVP** updates VIA and Appendices A and B per Ginny's comments (see attached VIA comments in track changes).
    - Changes to Appendix A:
        - Figure 4 - Add Mountain Lake Wilderness Boundary
        - Figure 12 – shift map to the SW to include the top of Peters Mountain
    - Changes to Appendix B:
        - Figure 1A – consider adjusting arrow to point the correct way
        - Figure 3B – add an arrow to delineate bore locations
        - Figure 5B – check for elevation vs. visual horizon location discrepancy
        - Figure 8B – FS is concerned this location would not meet the high Scenic Integrity Objective
        - Figure 12B – Ginny verifies if there is any visibility on Sugar Run Mountain 2
        - Figure 14B – clarify in narrative that the peal is 5 miles away but the closest viewpoint is 2.5 miles away.
        - Figure 15B – Ginny questions the location of the photo simulation; cited similar concerns from ATC and FS Regional Officers.
        - Figure 16B – add arrow showing the National Forest
- **Jennifer** forwards mitigation language to John.
- **MVP** makes pre-simulations for photos at photo locations 701, 709, 714, and 720 by noon ET on May10, 2017.
- **Ginny** reviews MVP's additional pre-simulations.
- **MVP** submits additional pre-simulations and narrative as a supplement to the VIA in the Federal Energy Regulatory Commission (FERC) Record by Wednesday, May 10.

Mountain Valley Pipeline: Visual Impacts Assessment (VIA) Update Call
Date/Time: Wednesday, May 10 @ 4:15 pm (AZ)/7:15pm (ET)
Location: Conference Call

Attendees	Forest Service (FS)	Jennifer Adams, Ginny Williams
	MVP	Megan Neylon
	Tetra Tech	Sean Sparks
	Galileo Project	Grace Ellis

ACTIONS

- **Megan** checks with MVP team on incorporating edits from FS.(complete)

DISCUSSION

Jennifer noted that the new language in the Visual Impact Assessment did not consistently reflect the language given to Tetra Tech and MVP by the FS. Specifically, the new language does not indicate that only 10 ft would be mowed on FS lands. The report indicates that 50 ft would be mowed across all lands, including FS lands.

FS indicated the 10 ft requirement, as well as text indicating small bushes and shallow rooted trees would be in the remaining 40 ft, is a condition of approval. This is consistent with FERC wetland procedures, which should be used instead of the upland procedures, and are they are necessary to mitigate visual effects.

Sean indicated he understood the direction and that he had made this change in some places in the report. Ginny and Jennifer noted the change had not been made on pages 1, 4, 8, and 42. Megan indicated that she needed to check in with others on her team before committing to make the change globally.

Mountain Valley Pipeline	2017

MVP BLM/FS Public Involvement Coordination Call

Date/Time: Monday, May 15, 2017 @ 11am – noon (ET)

Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, JoBeth Brown, Stephanie Chapman, Rebecca Robbins, Tim Abing, Job Timm, Beth LeMaster
	Galileo Project	Grace Ellis, Lauren Johnston

ACTION ITEMS

- **Tim** forwards preliminary research on FS's draft Record of Decision (ROD) to Galileo.
- **Galileo** forwards draft ROD to Tim by May 17, 2017.
- **Galileo** sends draft Land and Resource Management Plan (LRMP) Amendment Fact Sheet sample to JoBeth by May 22, 2017.
- **Galileo** drafts Frequently Asked Questions for FS review by May 22, 2017.
- **Galileo** edits and sends communication plan to JoBeth as soon as possible
- **JoBeth** assigns a Point of Contact in the FS Washington Office.

FPISC Call

Date/Time: Thursday, May 18 @ 1 – 2 pm (CT)

Location: Conference Call

Attendees	Forest Service (FS)	Tim Abing, Greg Smith, Reggie Woodruff
	Federal Infrastructure Permitting Improvement Steering Council (FPISC)	Janet Fleeger, Meghan Edwards, Karen Hanley, Amber Levofsky
	Council on Environmental Quality (CEQ)	Michael R Drummond, Edward Boling
	Department of the Interior (DOI)	Erika Vaughan
	Bureau of Land Management (BLM)	Mark Mackiewicz, Stephen Fusilier
	US Army Corps of Engineers (USACE)	Meg Gaffney-Smith, Amy Klein, Chris Carson, Mike Hatten, Suzanne Chubb, Jeff Hopkins, Brian Denson, Phil Tilly, Steve Gibson
	Galileo Project	Lauren Johnston

Objective:

✓ Review MVP's schedule inquiries sent to FPISC

I. National Historic Preservation Act Section 106 (Section 106) compliance

a. BLM/FS Update: Tim indicated there is a site in the proposed Right of Way (ROW) that has undergone Phase II testing and the report is forthcoming. This site may be National Register of Historic Places (NRHP) eligible. A NRHP eligible site with an adverse effect would need a Memorandum of Agreement (MOA) to mitigate that particular site.

The newly identified site is on JNF lands in the Commonwealth of Virginia. Both agencies and the Commonwealth of the Virginia would be signatories. The FS's blanket MOA will not be sufficient. In addition, the State Historic Preservation Office has final say as to whether the Appalachian National Scenic Trail is eligible for listing on the NRHP, which would require additional Section 106 consultation.

The MOA development process should not, but could impede the 90-day decision deadline after the Final Environmental Impact Statement (FEIS) release. BLM's required 60-day congressional notification cannot be streamlined and could impede the schedule. There was a question about whether BLM can issue their ROW grant prior to completion of the Section 106 compliance. FPISC requested the agencies keep them updated on the process and corresponding time table for completing Section 106.

Post meeting note from Mark Mackiewicz: The Ruby Pipeline project offers a precedent for issuing a ROW grant for NRHP properties that would be affected by construction. MOA's for that project were issued after the ROW Grant but before any Notice to Proceed. An MOA for any sites on Federal Lands would need to be completed for the MVP project prior to an issuance of a Notice to Proceed on any Federal Lands.

b. USACE Update: USACE is waiting for the Federal Energy Regulatory Commission (FERC) to complete Section 106 consultation, as FERC is the lead agency. USACE defers to FERC regarding Section 106 completion. FS and USACE agree FERC has decided Section 106 consultation cannot be completed in pieces, but rather will review a Section 106 report when it is fully complete.

Action Item: BLM and FS continue to update FPISC re Section 106 consultation needs and progress.

Action Item: USACE follows up with FERC to determine Section 106 consultation progress.

II. Endangered Species Act Section 7 (Section 7) consultation

a. FS Update: FERC has indicated the biological surveys are complete. FERC plans to initiate formal consultation with the US Fish and Wildlife Service (FWS) when the FEIS is released, scheduled for June 23, 2017.

III. Sedimentation Analysis

a. FS recounted they have previously asked MVP for a more realistic assessment of sediment control measures in MVP's Hydrological Analysis of Sedimentation. It was settled in previous meetings that MVP would provide additional documentation and studies to the FS for review. Greg confirmed MVP and FS Washington Office have settled on a consistent and acceptable methodology for the Hydrological Analysis of Sedimentation.

IV. USACE Permitting

a. USACE said site access for surveys is limited, and the USACE 404 water permit decision cannot be complete until Section 106 and Section 7 consultation are completed by FERC.

b. USACE noted they have previously asked for additional information on how MVP plans to construct through karst and other landscape hazards the MVP project will encounter. MVP has chosen mitigation banking to mitigate the projects impacts, but USACE is unclear as to whether the MVP has purchased the necessary credits, or if the credits are available.

c. USACE said they do not foresee impacts that would delay the schedule unless MVP needs to reroute the pipeline, and as such redo surveys.

d. Meg updated the Huntington District has a 408 permit decision that will need to be included in BLM's Right of Way (ROW) grant, but they cannot complete the authority determination until the final alignment on USACE lands is complete. The Huntington district will provide BLM with any requirements for USACE lands that need to be in the ROW grant.

e. Meg stressed the USACE will, unlike FS and BLM, rely on FERC's Section 7 and Section 106 consultation processes and trust they are complete. USACE does not plan to do any additional consultation.

f. USACE updated they have been providing information directly to FERC and BLM and do not have any lingering information requests they can identify at this time.

Action Item: FIPSC plans future schedule and update calls as needed.

Action Item: BLM Huntington District follows up with FERC and BLM re ROW grant needs as needed.

Mountain Valley Pipeline	2017

MVP BLM/FS Public Involvement Coordination Call
Date/Time: Thursday, May 24, 2017 @ 7-8am (PT)/8-9am (MT)/9-10am (CT)/10-11am (ET)
Location: Conference Call

Attendees	Forest Service (FS)	JoBeth Brown, Tim Abing
	Bureau of Land Management (BLM)	Kimberly Brubeck, Kimberly Melendez-Rivera, Miriam Liberatore, Davita Carnahan, Vicki Craft, Sally Spencer
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Vicki** follows up with Karen Mouritsen (BLM Eastern States) re the following:
  - Need/logistics for additional post-Final Environmental Impact Statement (FEIS) comment period.
  - Need/logistics for a separate BLM/FS Notice of Availability (NOA) vs. adding language to the Federal Energy Regulatory Commission's NOA for the FEIS.
  - Need/logistics for Post-FEIS public meetings; responses to Karen Overcash's (FS) request for Draft EIS comment response language re requests for additional public meetings.
- **Tim** coordinates FS Washington Office and Regional Office review of the draft Record of Decision (ROD).
- **Tim** coordinates with FS Regional Office re the need for a separate BLM/FS NOA.
- **Jennifer Adams** (FS) and Vicki follow up with FERC for access to the FEIS (Or at least Ch. 1) for review.
- **Galileo** cross-checks public involvement documents with the FEIS.
- **Jennifer Adams** (FS) coordinates with FS personnel re need for Galileo's assistance with the FS objection process.
- **Galileo** coordinates with FS and BLM public affairs for NOA support and review as needed.
- **Galileo** 508s all applicable public involvement documents as needed.
- **JoBeth** and Galileo continue to coordinate updates to the communication plan.
- **JoBeth** follows up with Tim and Davita to answer additional public involvement questions.
- **JoBeth** drafts News Release. Finalizes when issues regarding the NOA and comment period/objection process, and public meetings are complete.
- **JoBeth** follows up with the FS National Environmental Policy Act (NEPA) team re need for an additional NOA.
- **JoBeth** updates Frequently Asked Questions (FAQs) as needed.
- **Galileo** updates FAQ briefing/issue papers as directed by FS.
- **JoBeth** follows up with FS NEPA team re ROD distribution and notification materials.

MVP Executive Team Call
Date & Time: Monday, June 5, 2017 @ 10:00-11:00 am (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Elizabeth Ivy, Legion Brumley, Karen Mouritsen, Miriam Liberatore
	Forest Service (FS)	Jennifer Adams, Job Timm, Tim Abing
	DOI Solicitor's Office	John Henson
	Mountain Valley Pipeline (MVP)	Megan Neylon, Rebecca Watson, Megan Stahl, John Centofanti, Joe Dawley*
	Galileo Project	Grace Ellis, Lauren Johnston

*Partial Attendance

ACTIONS

- **FS** contacts John C re any needs for reviewing MVP's Habitat Equivalency Analysis (HEA).
- **Megan S**. extracts HEA information relevant to the FS into a separate package for the FS.
- **FS** and **BLM** review the HEA.
- **MVP** provides HEA slide deck to FS/BLM as needed.
- **Tim** reviews 36 CFR 800 re National Historic Preservation Act Section 106 (Section 106) compliance options for FS and BLM.
- **John H** consults Office of General Counsel (OGC) and DOI Solicitors Office specialists re the Section 106 consultation process, specifically as it relates to 36 CFR 800.4 par. B2.
- **John H** shares name of government attorney Section 106 specialists with Rebecca.
- **John H** shares results of Section 106 research with FS OGC.
- **John C** follows up with the Federal Energy Regulatory Commission FERC re their Section 106 compliance completion process timeline.
- **Jennifer**, **Grace**, and **Vicki** coordinate availability for a series of POD review meetings, including the Visual impacts and ROW rehabilitation.
- **John C** shares National Park Service (NPS) Appalachian National Scenic Trail (ANST) Crossing Authority letter with Galileo. *Complete.*
- **Galileo** distributes NPS ANST crossing authority letter with meeting notes.
- **John C** provides updated sedimentation analysis and POD to FS and BLM this week.
- **Megan N** provides ETA for final Phase II Archaeological Report as soon as possible.
- **MVP** completes and distributes updated Biological Evaluation (BE) by the end of this week.

DECISIONS/DISCUSSION POINTS

- John C said MVP produced the HEA to assist in developing mitigation measures for the entire length of the project. MVP filed their HEA on May 10th, with paper and CD copies sent directly to FS and BLM. John C summarized the HEA is a process used by government agencies as well as the private sector to estimate an action's impacts to ecological services. MVP utilized a calculation called the Visual HEA developed by the National Oceanic and Atmospheric Administration. This calculation evaluates functional aspects of ecology, such as runoff, carbon sequestration, etc., to model changes in ecological services based on temporary, permanent, and indirect impacts from the proposed project.
- MVP estimated the total acres of impact on the Jefferson National Forest (JNF) to be:
    - Permanent impact = 42 acres.
    - Temporary impact = 42 acres.
    - Indirect impact = 524 acres.

- Megan S clarified the indirect impacts are accounted for by assessing impacts to an area within the 100 m buffer limit of disturbance. This category of impacts tries to capture phenomena such as edge effects from forest fragmentation, for example.
- John C clarified the total impact acres for the entire 300+ mile pipeline ROW was calculated at 6,271 acres.
- Megan S clarified the 6,271 acre figures takes into account permanent, temporary, and direct impact acres, restoration efforts, planting areas, extra work spaces, etc., to arrive at a net impact figure, in this case 6,271 for the whole project. The 6,271 acre figure thus factors in the impacts and recovery efforts. John C said of the 6,271 acres, 1600 represent permanent impacts, 2100 represent temporary impacts, and approximately 2500 represent indirect impacts.
- Rebecca inquired as to the FS's proposed plan forward with regard to mitigation, and suggested it would be in MVP's best interest to coordinate mitigation with the different federal parties involved, including the Virginia Department of Environment Quality, the US Fish and Wildlife Service, and the West Virginia Division of Natural Resources.
- Tim recounted previous FS efforts to coordinate mitigation on FS lands with the broader mitigation effort, but said the discussion was tabled due to complications resulting from the current administration's repeal of the executive order on mitigation for the FS. Tim said that in addition to that complication each agency has its own authorities and standards to implement mitigation. At this time the efforts are not being coordinated across federal and/or state agencies. John C suggested and Tim agreed that MVP and FS continue the FS-relevant mitigation process through POD discussion and revision.
- John C expressed MVP's desire to complete Section 106 compliance regarding FS lands from the FS before the entire Section 106 process for the whole pipeline is completed. This is in an effort to avoid schedule delays due to private lands MVP has not yet been able to access to survey.
- Tim cited 36 CFR 800.4 paragraph B2 as potentially providing a framework for phased Section 106 compliance. Tim and John H agreed further consultation with DOI solicitors and OGC attorneys was warranted to provide MVP with a concrete path forward. Tim recounted recent conversations with FERC during which FERC expressed their desire to complete the Section 106 consultation process all at once.
- John C stated the ultimate Section 106 compliance responsibility falls to FERC, and they may decide, if they approve the project, to issue phased notices to proceed for areas where Section 106 consultation has been completed.
- Jennifer restated the FS expects, and FERC has agreed to allow, MVP to maintain the ROW across all miles on JNF lands, including uplands, according to the Wetland ROW Operation & Maintenance/Rehabilitation Protocol. These provisions are required to uphold the Scenic Integrity Objectives on the JNF. Jennifer said these provisions were approved by FERC after lengthy conversation, and were determined to still meet the Pipeline and Hazardous Materials Safety Administration regulations.
- John C said MVP cannot accept applying the Wetlands ROW operation and maintenance protocol to the entire length of the ROW on FS lands, as this would provide an operation and maintenance hazard. John C also stressed that MVP concluded from the VIA that even with reducing the permanent ROW to 50 feet, the proposed project would still meet the FS's SIOs. Jennifer disagreed and said FS specialist analysis indicated that reducing the ROW area played a large part in determining FS SIOs would be met over time. Job suggested and Jennifer and John C. agreed to continue the ROW and visuals discussion at a later date.
- John C said that MVP received feedback from the NPS Northeast Region stating they agree the FS has the authority to authorize the ANST crossing at MVP's proposed crossing area.
- John C provided the following update re FS's April 2017 data requests:

- MVP provided Management Indicator Species (MIS) and Locally Rare Species (LRS) reports on May 25, 2017.
- The herbicide use and topsoil segregation plan was included in the MIS and LRS reports, and will be incorporated in the BE as requested.
- MVP submitted the updated ANST bore contingency plan on May 25, 2017. Jennifer confirmed FS is pleased with the plan.
- MVP submitted the requested maps and figures on May 25, 2017. Jennifer confirmed she and Megan are coordinating to make sure the FS has the maps, plats, and other figures it needs.
- MVP plans to submit the updated Sedimentation Analysis at the end of this week.
- MVP provided agency correspondence to Galileo for the decision file. Galileo confirmed receipt.
- MVP is incorporating property boundary changes into the latest version of the POD.
- MVP is incorporating a comment on noise mitigation into the updated POD.
- MVP submitted a preliminary Phase II Archaeological report on May 25, 2017.
- MVP plans to submit the updated BE by the end of this week.

Upcoming Meetings:

Executive Team Call: Section 106 **– *Monday, June 12* @ *3 pm ET***

Mountain Valley Pipeline	2017

MVP: Culvert Design Call
Date/Time: Monday, June 5, 2017 @ 2 - 3 pm (ET)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Dan McKeague, Mike Owen, Tim Tully, Pauline Adams, Dawn Kirk, Jesse Overcash, Shamina Dillard
	Galileo Project	Grace Ellis, Lauren Johnston, Peter Rocco

Objectives:

- ✓ Discuss FS requirements for culvert placement and upgrades for the MVP project.

ACTIONS

- **Jennifer** and **Galileo** schedule a culvert discussion with MVP representatives for Friday, June 9 @ 11 am ET. *(Invite pending Jennifer's approval)*
- **Jennifer** asks MVP if the Plan of Development (POD) section on culverts has changed since the last FS round of comments.
- **FS specialists** meet in the field to visit culvert locations on Monday, June 12.
- **FS specialists** identify on a map preferred culverts at specific locations.
- **FS specialists** share necessary FS guidance for stream construction on Galileo FTP site. *Complete.*

DECISIONS/DISCUSSION

- Shamina, Jesse, and Dawn agreed specialized culverts may be needed along the project in order to maintain stream flow appropriate for resident aquatic species. Dawn clarified FS has been asking for specialized culvert designs since the MVP scoping period.
- Jennifer suggested a follow up call with FS specialists and MVP representatives and contractors to communicate specific culvert needs. During this call FS can share stream construction requirements with MVP and make a formal request for culvert designs. This is the best way to ensure the FS gets the appropriate culverts in place in areas affected by the proposed project, if approved.
- Pauline and Jesse agreed MVP's POD needs an update with regard to culvert location. Jennifer requested FS specialist finalize culvert locations and types as soon as possible so these efforts can be polished with the next round of revisions in the POD. Jennifer stressed the POD needs to be finalized as soon as possible.
- Shamina specified FS needs to see actual construction plans and drawings in the POD for FS review. She stated missing plans and drawings have been a problem in the past. Shamina agreed to share sample plans with MVP as necessary.

Mountain Valley Pipeline	2017

MVP BLM/FS Biweekly Coordination Call
Date/Time: Thursday, June 8, 2017 @ 3-4pm (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, George Matzke, Elizabeth Ivy, Legion Brumley, John Sullivan
	Forest Service (FS)	Jennifer Adams, Jim Twaroski, Job Timm, Karen Overcash, Tim Abing, Shannon Kelardy, Ava Turnquist
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Karen** confirms FS has the required sedimentation analysis documents.
- **Vicki** and **Karen Mouritsen (BLM)** discuss rescheduling the National Historic Preservation Act Section 106 (Section 106) Executive Call with MVP on Monday, June 12.
- **Vicki** follows up with Karen Mouritsen re: meeting with the Federal Energy Regulatory Commission (FERC) to discuss Section 106 concerns.
- **Galileo** assists in scheduling an internal FS/BLM Right of Way (ROW) Rehabilitation planning call.
- **Jennifer** sends Section 106 clarifying email to John and Vicki with a cc to Galileo.
- **Vicki** forwards BLM comment period language submitted to FERC by Mark Mackiewicz and coordinates additional request to review FERC's Notice of Availability (NOA).
- **Shannon** & **Karen** coordinate review, edit, and final approval of NOA objection process text.
- **Vicki** forwards updated NOA to Galileo.
- **Grace** sends Postcard first draft to Shannon and Karen with a cc to Jennifer. *Complete*
- **Tim** sends Draft Record of Decision (ROD) map to Galileo.
- **Tim** forwards final Draft ROD to Galileo by June 21.
- **Galileo** 508s Draft ROD and Draft ROD map.
- **Galileo** forwards Draft ROD distribution logistics questions to Tim.
- **Tim** follows up on Draft ROD FAQs and needed edits.
- **Galileo** schedules Objection Process/Comment Period meeting with Karen, Shannon, Jennifer, Vicki, Carol Zurawski (BLM) and Kimberly Melendez-Rivera (BLM) for early next week.
- **Jennifer** and **Galileo** coordinate Plan of Development (POD) meeting scheduling.
- **Jennifer** requests POD word documents from MVP for ease in editing. *Complete*
- **FS** and **BLM specialists** provide POD edits in track changes once received from MVP.
- **Galileo** assist with making sure the final NOA BLM comment period changes get incorporated into public involvement and notification documents.

DECISIONS/DISCUSSION POINTS

- Galileo noted the following documents are still outstanding, potentially with the exception of the sedimentation analysis:
    a. Habitat Equivalency Analysis FS-specific package
    b. Sedimentation Analysis
    c. Final Phase II Archaeological Report
    d. Biological Evaluation
    e. POD (expected 6/9/17)
- Jennifer and Vicki agreed that, once received, BLM and FS personnel should edit MVP's POD in track changes to facilitate a quicker turnaround. Vicki and Jennifer said the POD is almost where it needs to be.

- Jennifer said she is working on scheduling resource-specific calls to review the MVP POD via conference call as needed. She noted MVP's concern about the ROW rehabilitation requirements would be assuaged once MVP fully understands what the FS is asking for. Jennifer is confident the FS requirements are not egregious, and there is precedent for FERC requiring what the FS is asking MVP in terms of maintaining and rehabilitating their ROW.
- Karen confirmed the new documents being sent to FS by MVP (i.e. the sedimentation analysis, updated POD, etc.) should not affect the language in the draft ROD. Tim said comments from the FS regional office and BLM are due by ***Tuesday, June 13***, so he can update the draft. Galileo reiterated they need the final draft ROD by ***June 21*** to have it prepared for web viewing by ***June 23***. Galileo confirmed they need a copy of the draft ROD maps as well.
- John noted the preliminary Phase II Archaeological Report contains language stating FERC defers to FS for all Section 106 matters on JNF lands. Jennifer insisted this was carry-over language from an earlier document, and that FS identified language in a regulation that superseded this assertion.
- Vicki reiterated Karen Mouritsen's concern about the timing and completeness of the FERC's Section 106 consultation process. There is concern that FERC won't initiate formal consultation until their certificate is issued, which would put a time crunch on developing a Section 106 Memorandum of Agreement. BLM doesn't think they can issue a ROD on the ROW grant until Section 106 is complete, which would disrupt MVP's schedule of having all approvals received by November 1, 2017. Vicki noted that BLM and the Department of the Interior's Solicitor's Office are still in conversation as to the best path forward for addressing the Section 106 consultation concerns and needs before the BLM can issue a ROD on a ROW grant. Vicki suggested the meeting with MVP to discuss Section 106 should be postponed until this issue has been resolved.
- Miriam and Vicki expressed concern that FERC has not yet shared their FEIS NOA with the agencies, and that FERC has not yet formally provided an opportunity or deadline to FS and BLM for including language about the objection and comment processes, respectively. Karen stressed she needs to be sure the language describing the objection process and FS Land and Resource Management Plan amendment is correct. Miriam said it's critical to review the NOA before it's published to ensure FERC has not misrepresented comments or language from the cooperating agencies.
- In an email last week JoBeth Brown (FS) asked Galileo to prepare a Draft ROD notification postcard. Karen confirmed Galileo should send the postcard to the entire FERC mailing list. Galileo suggested an additional meeting to finalize public outreach for the FEIS release.

Mountain Valley Pipeline	2017

MVP: Culvert Design Call
Date/Time: Friday, June 9, 2017 @ 11 – 11:30 am (ET)
Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Jennifer Adams, Pauline Adams, Jesse Overcash, Shamina Dillard, Dawn Kirk
	Bureau of Land Management (BLM)	Miriam Liberatore
	Mountain Valley Pipeline, LLC (MVP)	Megan Neylon, John Uhrin, Bryan Clato, Melissa Fontanese
	Galileo Project	Grace Ellis, Lauren Johnston

Objectives:

- ✓ Per FS Plan of Development (POD) comments, discuss FS requirements for culvert design and placement for the MVP project.
- ✓ Schedule time with MVP to review specific culvert designs and locations.

ACTIONS

- **Galileo** shares information re culvert designs and courses with MVP (Access included in notes transmittal). *Complete.*
- **Melissa** confirms culvert design calculations include FS-identified constraints.
- **MVP** and **FS** meet on Friday, June 16 @ 1 pm in the field to discuss culvert design and placement needs.
- **Galileo** sends an invite for Friday, June 16 meeting. *Complete.*
- **MVP** brings several copies of culvert Plan of Development (POD) section and maps to field discussion to facilitate review.
- **Pauline** and **MVP** take notes at field visit and share with Galileo for the Decision File.
- **MVP** provides FS with word document versions of the updated POD to facilitate review and edits.

DECISIONS/DISCUSSION

- Pauline noted there are several locations on the Jefferson National Forest where MVP did not identify culverts currently in place or locations that need new culverts. Pauline and Jesse said there are also potential errors in maps used to design culverts that misidentify perennial vs. intermittent streams. Pauline and Dawn stressed the need for culvert designs to accommodate aquatic species. MVP confirmed they have been working with specialists who have experience in design and construction for the types of products FS would like MVP to use.
- FS specialists would like MVP to include in their calculations the need to plan for a 10-year flood. Melissa said MVP calculated their culvert designs using a 25-year flood estimation.
- Jesse stressed the need for MVP to maintain their culverts and other road improvements/changes as the roads MVP will be using are not FS priorities. The FS's goal is to make sure the forest maintains proper drainage and stream flow. Jesse added this means other tools and design features besides culverts may be needed.
- Megan suggested a site-visit with FS and MVP representatives to solidify culvert design needs and locations that meet FS requirements.

Mountain Valley Pipeline	2017

MVP FS BLM Coordination Call
Date/Time: Wednesday, June 14, 2017 @ 11am-noon (P)/noon-1pm (M)/1-2pm (C)/2-3pm (E)
Conference Call: 866-906-9888; code 1603852#

Attendees	Bureau of Land Management (BLM)	Vicki Craft
	Forest Service (FS)	Jennifer Adams, Karen Overcash, Mike Madden
	Mountain Valley Pipeline (MVP)	Megan Neylon, John Centofanti
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **MVP** completes and uploads Plan of Development, Biological Evaluation, Habitat Equivalency Analysis, and Sedimentation Analysis to Galileo's FTP site. *In Process*
- **Lauren** notifies agencies when MVP documents are available on the FTP site, including review deadlines (June 21) and instructions.
- **Jennifer** works with **Galileo** to schedule resource-specific POD meetings.
- **MVP** submits final Phase II Archaeological Report after meetings with the National Park Service (NPS) and BLM Executive Team.
- **Galileo** sends meeting invite for the Executive and Biweekly agency proponent calls to Mike. *Complete*.
- **Galileo** distributes agenda for Executive Call on **Monday, June 19, 2017 @ 2 pm ET**.
- **Galileo** sends updated Culvert Site Visit meeting invite (**6/19 @ 10-2 ET**). *Complete*.
- **FS**, **BLM**, **MVP**, and **Galileo** send representatives in person or via phone to tomorrow's Appalachian National Scenic Trails meeting with the NPS and Appalachian Trail Conservancy.

DECISIONS/DISCUSSION POINTS

- Megan updated the HEA and Sedimentation Analysis are all going through final review. The POD and BE are ready for distribution to FS and BLM. Jennifer reminded Megan the files should be word documents for ease of editing.
- Mike complimented MVP on SEARCH's preliminary Phase II Cultural Report. He stated the report is very well done and will only potentially require closer review of a few small details. FS agreed they plan to share the final Phase II report with the State Historic Preservation Officers and Tribal Historic Preservation Officers once received. Jennifer requested MVP remove references to Federal Energy Regulatory Commission (FERC) transferring National Historic Preservation Act Section 106 (Section 106) responsibilities to the FS for Jefferson National Forest lands. This is no longer accurate (see accompanying email).
- John noted MVP has requested FERC to provide more finite information regarding Section 106 consultation completion. All agreed the best course forward is to talk about Section 106 on the upcoming call Executive Team call. Vicki noted BLM is working internally with their solicitors and with the Advisory Council on Historic Preservation to identify an appropriate path forward. BLM hopes to have more solid answers for MVP next week.

- John and Megan noted MVP did complete a study of the Weston and Gauley Trail, included in the West Virginia Criteria of Effects Report.
- Jennifer said the FS is planning on resource-specific grouped meetings to address final edits to MVP's latest POD, once delivered. Jennifer is assessing staff availability.
- John noted MVP has been working to identify alternatives to reducing the permanent Right of Way width on Jefferson National Forest lands in order to address visual impacts. He suggested by not trimming the canopy MVP would be able to maintain the 50 ft ROW in a mowed state to comply with US Department of Transportation' Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations.
- Jennifer countered that the FS has worked with FERC to develop the ROW rehabilitation restrictions that would still meet PHMSA regulations. She also said MVP's proposed alternative measure would not work, as trees would be cleared anyway for the construction phase. Jennifer also said this matter relates to the BLM and FS decisions regarding the ROW and plan amendments, respectively, and should not concern discussions with the NPS at tomorrow's meeting.
- John said the MVP's Visual Impact Assessment concluded that no additional mitigation measures or stipulations, in this case a reduced permanent ROW width, would be needed to meet the FS's Scenic Integrity Objectives. Jennifer clarified the ROW width reduction and subsequent seed mixes and rehabilitation measures requested by the FS are part of the analysis that showed reduced impacts to not only visual resources, but also sedimentation and wildlife impacts. Jennifer restated the rehabilitation measures are approved by FERC and comply with PHMSA regulations.
- Jennifer concluded that the FS needs to complete internal conversations on the best way to visualize and describe the FS's ROW restriction and rehabilitation methods, and later meet with MVP to clarify FS requests.

FS Pipelines	2017

Internal FS Objection Process/ BLM Comment Call

Date/Time: Monday, June 19 @ 11 am – noon ET

Location: Conference Call & GoTo Meeting

Attendees	Forest Service (FS)	Shannon Kelardy, Jennifer Adams, Alex Faught, Karen Overcash
	Bureau of Land Management (BLM)	Vicki Craft, Kimberly Melendez-Rivera, Jason Ross
	Galileo Project (Galileo)	Grace Ellis, Maria Martin, Peter Rocco, Lauren Johnston

Objectives:

- Clarify BLM objectives for 30-day Final Environmental Impact Statement (EIS) comment period.
- Clarify workflow for addressing objections sent to FS and comments sent to BLM.

ACTIONS

- **Vicki** confirms whether there is a waiting period between the BLM Record of Decision and the Right of Way Grant. *Complete*.
- **Kimberly** confirms with National Environmental Policy Act (NEPA) planners the path forward for addressing comments and FS objections.
- **Galileo** includes Ruby Pipeline Project comment response document, NEPA decision flow chart, and FS objection process flow chart with notes transmittal. *Complete.*
- **BLM** confirms Point of Contact for comment processing.
- **Galileo** provides Shannon with a list of new project documents released after the Draft EIS. *Complete.*
- **Shannon** sends FS definition of "new information" to Galileo. *Complete.*
- **Shannon** forwards FS objection process timeline to Galileo. *Complete.*
- **Participants** send any clarifying language re the objection process for Karen to include in the project legal notice as needed. *Complete.*
- **Jennifer** completes email transmittal to Galileo for the decision file.
- **Galileo** sends a reminder email to FS personnel and to BLM ID-Team to submit emails and documents for the decision file. *Complete.*
- **Alex** sends permit copies to Galileo for inclusion in the Decision file. *Complete.*

Follow up meeting: Friday, June 30th @ 11 am ET.

DISCUSSION/DECISIONS

- Galileo suggested they could assist BLM in tracking, coding, and packaging comments received during the 30-day final EIS comment period. BLM agreed, however needs to confirm the exact pathway forward for comment processing.
- Kimberly said that BLM will update the ePlanning website with links to the Final EIS and opportunities for comment. BLM will provide Galileo with PDF version and/or an excel file to help track the comments. Galileo stated they could then code the comments and check for any misfiled FS objections in the BLM comment pool. BLM, FS, and Galileo agreed the most efficient way to make sure FS and BLM get the appropriate comments and/or objections is to have BLM and FS points of contact check for new submittals in frequent intervals.
- Kimberly noted BLM has not decided on a pathway for addressing USPS-mailed comments.

- FS confirmed Galileo's approach to identifying objections with standing. Galileo said they could create a cross-walk to assist FS in categorically grouping objections. FS will be responsible for coding, reviewing, and replying to objections. FS said Galileo must provide all objections to FS regardless of standing in order to provide an appropriate response.

Mountain Valley Pipeline	2017

MVP BLM/FS Biweekly Coordination Call
Date/Time: Thursday, June 22, 2017 @ 3-4pm (E)
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Sally Spencer, Kimberly Melendez-Rivera, Dominica Van Koten
	Forest Service (FS)	Jennifer Adams, Jim Twaroski, Karen Overcash, Alex Faught, Mike Madden
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Galileo** sends out Draft Record of Decision (ROD) notification postcards. *Complete*
- **Galileo** sends completed 508-compliant Draft ROD to FS and BLM. *Complete*
- **Jennifer** sends Draft ROD to Paul Friedman (Federal Energy Regulatory Commission [FERC].
- **Vicki** confirms BLM policy regarding congressional notification wait period and right of way (ROW) grant publication. *In Progress*
- **Galileo** sends decision file document request reminder emails to FS Regional Office.
- **Galileo** sends objection process tracking sheet to FS for review. *Complete*
- **Karen** works with Appalachian Trail Conservancy (ATC) to schedule Visual Impact Assessment (VIA) /Land and Resource Management Plan (LRMP) amendment meeting.
- **Vicki** updates BLM specialists with June 27 Plan of Development (POD) review date. *Complete, but changed to June 30*
- **Galileo** performs a technical edit on the POD.
- **Galileo** cancels July 6 biweekly meeting. *Complete*
- **Participants** in the 06/15 ATC - National Park Service meeting with MVP review notes and send any edits to Lauren.

DECISIONS/DISCUSSION POINTS

- FS and BLM confirmed they will be providing a link to the FERC Final Environmental Impact Statement (EIS) on their own project websites when it is posted.
- Kimberly confirmed the BLM will be updating the BLM ePlanning website with the Final EIS information. The public will be able to comment through the ePlanning website. BLM will initially download comments daily and share with Galileo for sorting and cataloging. FS confirmed Shannon Kelardy (FS) will forward objections to Galileo for sorting and cataloging. Both FS and BLM agreed Galileo can facilitate comment-objection sharing between agencies as needed.
- Vicki updated that Karen Mouritsen (BLM) has not yet met with Paul Friedman (FERC) in person to discuss National Historic Preservation Act Section 106 (Section 106) consultation. Galileo offered to take notes in case of a meeting. Vicki confirmed BLM will not be able to make a decision on the method of Section 106 consultation compliance until they have discussed the matter with FERC.
- Vicki updated that current BLM guidance negates the need for a 60-day wait period after congressional notification. This means BLM would be able to publish their ROW grant shortly after their ROD.
- Karen stated ATC has contacted Job Timm (FS) to schedule a meeting to discuss the VIA and FERC LRMP Amendments, but no further progress has been made.
- Karen confirmed FS would not be utilizing the ATC email list for public notification for the draft ROD, as FS is using the FERC mailing list and will have notifications in the newspaper of record and on the FS website.

ATTACHMENT JJ

Notice of Objection to the Draft Record of Decision for the Mountain Valley Project Land
Objecting Parties: Preserve Craig, Inc., Save Monroe, Inc., and The Wilderness Society
July 31, 2017

Mountain Valley Pipeline	2017

MVP FS FERC Geology Call
Date/Time: Thursday, March 30th @ 12:00 – 1:00 pm ET
Location: Conference Call

Attendees	Bureau of Land Management (BLM)	Vicki Craft, Miriam Liberatore, William (Bill) Bagnall
	Forest Service (FS)	Jennifer Adams, Tom Collins
	Federal Energy Regulatory Commission (FERC)	Tony Rana, Jim Glaze, Paul Friedman
	Cardno	Lavinia DiSanto, Doug Mooneyhan
	Galileo Project	Grace Ellis, Lauren Johnston

ACTIONS

- **Lavinia** shares Geology and Soils sections of the Administrative Final Environmental Impacts Statement (EIS) draft with FS and BLM. (*Complete*).
- **FERC** and **FS** review and coordinate needed updates to Draft EIS Geology and Soils sections. (*In Progress*).
- **Participants** include all call attendees on future communications regarding the Geology and Soils EIS sections.

DECISIONS/DISCUSSION POINTS

- Tom reviewed that the FS has been asking for FERC to assess potential impacts from project-induced landslides and slope failures since MVP submitted their initial Resource Reports in October of 2015. Tom said his comments on the Geology section of the Administrative Draft EIS (ADEIS) were not taken into account in the Draft EIS.
- Tom submitted roughly 10 pages of comments during the ADEIS comment period to explain why the FS wanted project-induced geologic impacts to be analyzed in the EIS, with supporting documentation from nearby areas with similar geology. Tom stressed the FS wants fill failures during and after construction, and long term slope stability analyzed in the AFEIS. Landslides are a big concern to the FS, and landslides that happen off of Jefferson National Forest (JNF) lands can still affect JNF Lands.
- Tom said Section 4.1.2.9 in the Draft EIS is brief and inadequate to assess potential geologic impacts. Tony said Tom's comments on the cut and fill slopes were incorporated, and additional relevant comments were added in, time permitting. Tony and Tom agreed more fine-scale mapping of the area, in addition to the United State Geologic Survey 2014 Landslide overview map, is needed for appropriate impact analysis.
- Tony and Paul said the timing of FS comments and the tight deadlines made review of Tom's ADEIS comments difficult to incorporate. Jennifer said she would expect FERC to follow up with FS if they had not received comments they were expecting, and has since required read-receipts for comments emailed to FERC (to be sure they are received).
- Tony and Paul said information in Tom's comments was irrelevant to impacts to Jefferson National Forest (JNF) lands and could not be incorporated into the EIS, as it cited examples from North Carolina. They said FERC management would excise this information and stressed they want FS to focus on impacts within the JNF jurisdiction. Tony and Paul also said Tom's ADEIS comments were too long and submitted too late to be fully incorporated.
- Tom and Jennifer reiterated that information in Tom's comments provides context and support from other similar landscape and issues from the same FS region, and is relevant and appropriate as scientific basis for Tom's request for a finer-scale analysis of potential geologic impacts caused by the proposed project.

- Jennifer noted MVP has only recently submitted geologic information, including site-specific stabilization measures at certain high hazard areas along the route for the JNF. Tony questioned what additional information the FS wanted if the site-specific designs weren't enough. Tom reiterated the geologic impacts (i.e. debris flow, slope failure, etc.) from MVP's project need to be assessed and analyzed in the Final EIS.
- Tony said he didn't see any mitigation recommendations in Tom's ADEIS comments. Tom and Jennifer said they want to see impacts analyzed before they can propose mitigation. Tom also stressed that not all impacts can be mitigated. Jennifer said the FS is concerned about safety associated with project-induced geologic impacts. Tony and Paul agreed safety is a concern.
- Tony, Paul, and Tom agreed to collaboratively edit the Administrative Final EIS documents by Monday, April 3rd to allow for Cardno to edit and incorporate the FS's needs into the Administrative Final EIS. Tony said some of Tom's example text may be incorporated by reference. Tom and Jennifer said they reserve the right to still review and comment on the Administrative Final EIS once it is released to Cooperating Agencies. Vicki agreed this would be a good approach to meet FS needs on short notice, but that more time to review documents would be preferable.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 45

February 21, 2023

July 26, 2017

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission (FERC)

Washington, DC 20426

Re: Docket CP16-10
Mountain Valley Pipeline
Comments on Final Environmental Impact Statement (FEIS) – missing responses to RATC comments on Draft Environmental Impact Statement (DEIS)

Dear Ms. Bose,

After reviewing all documents included in the Final Environmental Impact Statement (FEIS) for the proposed Mountain Valley Pipeline, the Roanoke Appalachian Trail Club (RATC) finds that numerous and significant filings and comments made by RATC were neither addressed directly nor handled indirectly by FERC and the cooperating agencies. Although federal enabling legislation specifically mentions maintaining clubs along with the National Park Service and the Appalachian Trail Conservancy (ATC) as key partners in the management of the Appalachian National Scenic Trail (ANST), our comments were barely acknowledged, and our representation was incorrectly attributed to someone who never submitted comments to the DEIS and who has not been a member of the RATC board since early 2015.

The entire process for making comments and for reviewing voluminous, untimely, scattered and poorly described filings from the applicant on a website that was frequently "down" made it impossible for the average citizen to understand what is being proposed by Mountain Valley Pipeline. **RATC joins numerous government agencies, organizations and individuals in calling for a Supplemental Impact Statement that includes all information from the applicant presented in an orderly, easily searchable and well-indexed format.**

We would particularly note that **filings by Mountain Valley Pipeline that were originally filed as public and which are directly relevant to impacts on the Appalachian National Scenic Trail (ANST) have since been reclassified as privileged so that they are unavailable for review by RATC or other members of the public.** For example:

- **20170217-5199**, **Visual Impact study** published by the applicant on February 17, 2017


E-mail this page

File List

Accession Number: 20170217-5200
Description: Response to January 27, 2017 Data Request of Mountain Valley Pipeline LLC under CP16-10.

Type	File Name	Size
All PDF		
	PRIV_MVP 02172017 DRs Cultural Attach Part 14.PDF No description given	42101530
		13761818

(since made Privileged on the FERC eLibrary under **20170217-5200**)

- Numerous portions of **20170630-5393**, that were originally public have now been reclassified under **20170630-5394** as privileged, yet the content is vital for an understanding of planned actions that directly affect the ANST.

With rare exceptions, FERC did not respond to RATC's comments in a thorough or specific manner

FERC states in comments to the Department of the Interior[1] that, "All comments received on the draft EIS were considered by FERC staff in preparing the final EIS. Those received during the comment period, which ended on December 22, 2016, received direct responses by FERC staff in Appendix AA of the final EIS." Unfortunately, this was not true of comments offered by RATC.

We list RATC comments that were ignored in individual detail below. First, we want to summarize overriding weaknesses in both the DEIS and the FEIS:

- **Continual new, lengthy, completely disorganized filings by the applicant, long after the time when they should have been made available to the public, which meant the public did not have a chance to review and comment on them.** For example, the applicant was allowed to post vital information about the ANST very late in what was perceived to be the final day of public comment (December 22, 2016) using extremely vague descriptions that did not correctly characterize the topics being covered. As a result, neither FERC nor the partners that manage the ANST knew what was in the filing (**20161222-5442**).
- **Failure of the applicant to discuss any aspect of impacts to the ANST with RATC from early May 2016 until June 15, 2017**, despite written instructions in the FERC e-Library from FERC to do so.
- **The High Hazard Areas identified in Jefferson National Forest are an unsafe, unsuitable location for crossing the ANST.**
- **Poorly executed and continually changing visual assessments of visual impacts from the project, never in consultation with RATC.**
- **In discussion of alternatives, applicant dismissal of co-location with existing Columbia/Celanese pipeline on Peters Mountain due to use of inaccurate map of ANST.** Applicant stated in June 15, 2017 meeting that the route would be inappropriate because it would involve crossing a "sensitive resource" (presumable the ANST) twice. In fact, only an outdated map of the ANST would show that impact.
- **Location and major impacts of permanent access road (**MVP GI-232 and MVP GI-233) **on Peters Mountain.**
    - The applicant used an outdated map of the ANST and co-located a permanent access directly on the ANST at the base of Peters Mountain.

[1] FERC 20170623-4000(32228895), FA11-2, response to Department of Interior filing.

- Widening of a dirt road that is currently about 7 to 12 feet wide in to a permanent road 25 feet wide with a total impact width of 40 feet is <u>not</u> a minor construction project. It <u>would likely involve a significant amount of blasting and grading</u> on
  - Very steep grades
  - With high water erosion potential
  - And high landslide potential
  - In karst topography
  - In the approximate epicenter of the Giles County Seismic Zone (GCSZ)
- The upper part of the project appears to be located in a High Hazard Zone.
- It appears likely that this portion of the project could only be completed safely by seriously damaging the existing habitat. The applicant seems unconcerned about this prospect.

<u>RATC filings before December 23, 2016 and FERC responses</u>

RATC made 5 filings totaling 56 pages in length by December 22, 2016:

- **20161018-5006** (13 pages). RATC board's scoping comments were Fed Exed to FERC on 6.11.16 and received by FERC on 6.12.16 but were never acknowledged by FERC and could not be found on the FERC e-Library. Resubmitted 10.18.2016, including Fed Ex receipt
- **20161018-5082** (17 pages) - Comments of Roanoke Appalachian Trail Club re the Mountain Valley Pipeline Project under CP16-10.
- **20161019-5044** (4 pages) - Comments of Roanoke Appalachian Trail Club. Cover letter explaining background to RATC board decision to oppose Mountain Valley Pipeline under CP16-10.
- **20161019-5046** (2 pages) - Statement of opposition to Mountain Valley Pipeline as proposed by RATC Board of Directors under CP16-10.
- **20161221-5276** (20 pages) – RATC major response to DEIS.

We did our best to comb through the 36 separate, unindexed online documents in the FEIS that contained responses to DEIS comments (Appendix AA), and as far as we can tell, the only responses from FERC staff were brief and fragmentary discussion to one October 2016 filing (20161019-5046) in APP AA CO3.

Vague references to sections of the FEIS do not constitute appropriate, specific responses to concerns expressed by RATC. The only concern directly addressed was a minor correction to location of the proposed bore pit on top of Peters Mountain. Other responses included:

- CO3-1 contains a resolution from RATC with references to previous letters to FERC in late 2015. FERC's response to the resolution refers the reader to various sections of the EIS (4.7, 4.12, 4.8, 4.3, 4.1 and 4.13). FERC did not update or revise the EIS to address RATC's comments.
- CO3-2 contains comments related to the **<u>proposed boring under the ANST</u>**. FERC's response is as follows: "MVP crossing of the AT was modified in June 2016. The current alignment is now 500 feet west of the October 2015 proposal; is a straight line rather than diagonal; and the undisturbed buffer was increased to from 100 feet to 300 feet." FERC

does not refer the reader to any portions of the EIS where this alignment change is analyzed.

- CO3-3 contains comments related to **compliance with Department of Transportation safety standards related to hikers on the AT**. FERC responds by referring the reader to section 4.12 of the EIS. FERC is responding as if the ANST is a vehicular road rather than a national scenic trail. Elsewhere, FERC has allowed MVP to list the ANST as a dirt road owned by the state of Virginia that would be crossed by an open cut.
- CO3-4 contains comments related to **views from specific places**. FERC's response says the EIS now contains revised visual simulations. FERC did not specify how the revision responds to RATC's comments, which were specific about potential impacts.

FERC staff did not acknowledge or respond to the RATC's major filing on December 21, 2017. (20161221-5276 (20 pages). They did respond in a very fragmentary manner to the Appalachian Trail Conservancy's filing of the same document with a cover letter

- APP A CO 46-1. FERC responded to the cover letter from ATC and one page of the 20-page RATC filing. There was no substantive response to this filing.

RATC filings after December 23, 2016. In response to late filings from the applicant, RATC also filed two further comments (61 pages):

- **20170223-5090** (7 pages) - In response to a **20170217-5199**, **Visual Impact study** published by the applicant on February 17, 2017 (since made Privileged on the FERC eLibrary under **20170217-5200** – and therefore inaccessible to RATC). We are refiling both the RATC comments and the applicant's original Visual Impact study.
- **20170620-5108** (54 pages) – In response to the untimely December 22, 2016 filing **(20170224-5038)** of the **High Hazard report for Jefferson National Forest** under the misleading title, "Attach C_JNF Priority Sites." Even FERC was unaware of this report's location and asked for it in their 1/26/17 query to the applicant. RATC, ATC, and NPS were unaware of this report until May 2017.

We believe that all of these comments are highly relevant to impacts of the proposed project on the ANST and that they have been largely ignored. In addition, FERC continued to list Larry Austin as the contact for RATC (A-33) even though he never filed any comments on behalf of RATC to the DEIS and even though both Roger Holnbrook and Diana Christopulos both since filed comments as Presidents of RATC, 2015-2017.

We are therefore refiling all of our comments to assure that the following points are on the record with accompanying details:

20161018-5006 (13 pages). Original RATC scoping comments from RATC (6.11.15) that were neither acknowledged nor posted to the FERC eLibrary, although sent by Fed Ex. Key points:

- Necessity of compliance with the National Environmental Policy Act of 1970 and the Endangered Species Act of 1973 to examine cumulative impact of all proposed major natural gas pipeline crossings of the Appalachian Trail.
- Avoidance of threats to regional air quality and human health
- Satisfaction of criteria in the Appalachian Trail Conservancy's 2015 Policy on Pipeline Crossings of the Appalachian Trail.

- Avoidance of threats to regional water supplies and to drinking water for Appalachian Trail hikers
- Avoidance of karst topography and active seismic zones in the proposed AT crossing locations
- Avoidance of specific impacts, including scenic impacts, likely with currently proposed AT crossing alternatives

20161019-5044 (4 pages) – FERC did not respond to:

- Negative impacts and safety hazards to hikers presented by the proposed crossing of the ANST on Peters Mountain.
- Negative impacts of Alternate 200 on the ANST.
- Reiteration on all points made in 6.11.15 scoping comments (**20161018-5006**)

20161019-5046 (cover letter and RATC board's Resolution of opposition – 2 pages) – FERC did not respond in any meaningful manner to:

- Concerns about visual impacts in specific locations
- Safety hazard to AT hikers of highly volatile natural gas under 1,440 psig of pressure, located in karst topography near the middle of the Giles County Seismic Zone, scene of the largest earthquake in Virginia's recorded history. The US Forest Service has already expressed deep reservations about construction in this environment in its March 9, 2016 comments to the Federal Energy Regulatory Commission. In addition:
    a. The 2014 edition of the Pipeline Association for Public Awareness "Pipeline Emergency Response Guidelines" minimum evacuation distance for natural gas pipeline leaks and ruptures for pipelines of the size (42 inches – largest shown on the guidelines chart) and pressure (1,440 psig) is approximately 3,600 feet – about 0.68 mile on foot.
    b. AT hikers on Peters Mountain would have to walk miles on steep terrain to evacuate the area around the proposed pipeline. The closest evacuation route – via Pocahontas Road – would take hikers closer to the pipeline rather than away from it. The Groundhog Trail, providing access to the West Virginia side, is over a mile away. There is no sensible evacuation route, and hiker safety does not appear to have been considered in selecting the construction location and method
- Reiteration on all points made in 6.11.15 scoping comments (**20161018-5006**)

It is difficult to provide substantive comment on the DEIS due to the fact that the document is fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way meets the needs of the National Environmental Policy Act or the National Forest Management Act.

It is difficult to provide substantive comment on the DEIS due to the fact that the document is fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way meets the needs of the National Environmental Policy Act or the National Forest Management Act.

It is difficult to provide substantive comment on the DEIS due to the fact that the document is fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way

meets the needs of the National Environmental Policy Act or the National Forest Management Act.

20161019-5046 (Detailed RATC comments on DEIS – 20 pages) - FERC did not acknowledge or respond to this filing, including:

Concurrence with the Appalachian T fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way meets the needs of the National Environmental Policy Act or the National Forest Management Act.

fundamentally deficient and lacks even the most basic analysis of impacts to the Appalachian National Scenic Trail. Further, much of the information that is included is incorrect and in no way meets the needs of the National Environmental Policy Act or the National Forest Management Act.

- The DEIS lacks clarity, accuracy and transparency regarding the proposed crossing of the ANST on Peters Mountain,
- The DEIS fails to disclose numerous impacts and threats of the proposed project to almost 100 miles of the ANST in this region, including
    - Visual impacts
    - Geologic impacts and hazards
    - Threats to the safety of ANST hikers, especially if there is an accident or failure of the pipeline. Referring to Department of Transportation Minimum Federal Safety Standards in 49 CFR 192 in no way addresses the predicament of long distance hikers (and there are thousands every year) who might be stranded with no escape route in or near the blast zone or evacuation zone of this pipeline if it were built. This response shows no understanding of the on-the-ground situation.
- The applicant has failed to coordinate with ATC and RATC and to produce visual representations of the proposed pipeline's visual impacts as required in the DEIS and in further comments from FERC.
- RATC objects to the inclusion of four highly destructive proposed changes to the Forest Plan for Jefferson National Forest and the plan to construct the pipeline through an Inventoried Roadless Area.

20161018-5082 (Detailed comments on Alt 200 and on responses to RATC comments of 6.11.15 in DEIS)

- Comments on Alternate 200 as presented by Mountain Valley Pipeline (MVP) and the potential impact of Alternate 200 on the Appalachian National Scenic Trail (the Trail). MVP already proposes to cross the Appalachian National Scenic Trail on Peters Mountain and run the pipeline extremely close to the Peters Mountain Wilderness in that segment. With Alternate 200, MVP almost certainly reenters the viewshed of the Appalachian National Scenic Trail in Sinking Creek Valley, near Newport and Huffman. Details are provided below.
- Comments on Mountain Valley Pipeline's June 30, 2015 responses in regards to our comments of June 11, 2015. We would characterize Mountain Valley Pipeline's responses as perfunctory and highly incomplete. Specifically, MVP ignored our responses in 5 out of the 6 areas where we made comments. Details are provided below.

20170223-5090 (7 pages) - In response to **20170217-5199**, **Visual Impact study** published by the applicant on February 17, 2017 (since made Privileged on the FERC eLibrary under **20170217-5200** – and therefore inaccessible to RATC). We are refiling both the RATC comments and the applicant's original Visual Impact study. Key points:

- Concurrence with ATC comment that "In response to the January 26th data request, the applicant filed hundreds of pages of critical information five months after the publication of the DEIS and over one month after the close of the DEIS comment period. This filing includes the bulk of analysis relative to the Appalachian Trail and topics vital to public health. In many instances, this filing is significantly more substantive than the DEIS itself. ATC asks the FERC and the USFS to clarify to the public how long the comment period will be on this significant filing since it constitutes a de facto re-write of the original DEIS and as demonstrated here, clearly includes incorrect information that must be identified and corrected."
- RATC reiterates that the applicant made no contact at any time with RATC regarding visual analysis by Tetra Tech of the proposed route – despite clear direction from the FERC to do so.
- RATC did independent mapping and research with help from outside experts and RATC volunteers to identify 19 potential Key Observation Points (KOPs).
- Visual simulations conducted for ATC and other organizations in this region shared some characteristics that do not appear to be present in the applicant's report (even though 3D modeling, mapping and other technologies were quite similar). These include:
    - Selecting KOPs that appear to have the highest chance of significant visibility (number of viewers, relative distance of viewer from change, potential sensitivity of the viewer to change)
    - Using a camera lens that would portray what a visitor would actually see
    - Taking photos on a clear day with good visibility
    - Accurately modeling of the likely contrast between the change and the existing environment, with a color palette that accurately reflects how the change might appear
- RATC identified numerous other very specific deficiencies in the applicant's study, including the fact

20170620-5108 (54 pages) – In response to the untimely December 22, 2016 filing **(20170224-5038)** of the **High Hazard report for Jefferson National Forest** under the misleading title, "Attach C_JNF Priority Sites." Even FERC was unaware of this report's location and asked for it in their 1/26/17 query to the applicant. RATC, ATC, and NPS were unaware of this report until May 2017. **RATC submitted three documents**[2]:

- **A text document describing the two PowerPoint attachments** that were shared with the applicant and federal agencies at a meeting in Salem, Virginia on June 15, 2017.

[2] Note that all three documents are corrected to show that the Columbia/Celanese currently in its fourth year on Peters Mountain is a 12" pipeline.

- **Slides taken from Google Earth screen shots of the Columbia/Celanese pipeline currently in its fourth year on Peters Mountain**, showing the massive erosion, despite use of Best Management Practices and direct oversight from US Forest Service in project construction. The ROW is probably wider today than it was immediately following construction. The pipeline can be found on Google Earth: 37.367491° -80.772918°.
- **Analysis of the applicant's study titled "Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Route Of the Proposed Mountain Valley Pipeline Project in the Jefferson National Forest"** (**20161222-5442(31856030**)). Using the best available scientific information, RATC asserts that:
    - Due to cumulative and interactive risk factors, the proposed Peters Mountain crossing is too hazardous for safe construction and operation of a very large natural gas pipeline with a very large impact area.
    - Due to the magnitude of potential impacts, there is no logical basis for mitigation of impacts.
    - Little or no concern has been demonstrated for the safety of the thousands of people who hike this section of the ANST each year.

We are attaching all 7 filings that the RATC placed in the record of the Draft Environment Impact Statement of the Mountain Valley Pipeline as well as the February 17, 2017 Visual Impact assessment filed by the applicant as a public document and since reclassified as privileged.

Sincerely,

Dr. Diana Christopulos
President
Roanoke Appalachian Trail Club

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 46

February 21, 2023

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
844-MVP-TALK | mail@mountainvalleypipeline.info
www.mountainvalleypipeline.info

October 17, 2018

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Re: Mountain Valley Pipeline, LLC
Docket No. CP16-10-000
Weekly Status Report No. 48

Dear Ms. Bose:

On October 13, 2017, the Federal Energy Regulatory Commission issued an order granting a Certificate of Public Convenience and Necessity to Mountain Valley Pipeline, LLC ("Mountain Valley") for the Mountain Valley Pipeline Project in the above-identified docket. On October 31, 2017, Mountain Valley submitted its Implementation Plan for the Project. In compliance with Environmental Condition Nos. 8 and 14, Mountain Valley submits its status report for the week ending September 28, 2018.

If you have any questions, please do not hesitate to contact me at (412) 553-5786 or meggerding@eqt.com. Thank you.

Respectfully submitted,

MOUNTAIN VALLEY PIPELINE, LLC
by and through its operator,
EQM Gathering OPCO, LLC

By:

Matthew Eggerding
Senior Counsel, Midstream

Attachments

cc: All Parties
Paul Friedman, OEP
Lavinia DiSanto, Cardno, Inc.
Doug Mooneyhan, Cardno, Inc.

FEDERAL AUTHORIZATIONS

All federal authorizations have been received.

CONSTRUCTION STATUS

Construction activities and progress are included in Appendix A.

WORK PLANNED FOR NEXT REPORTING PERIOD

Mechanized clearing will continue on all spreads except G. Prepare ROW, Trenching, Stringing, Welding, Coating & Wrapping, and Backfilling and tying-in will continue on all Spreads. Site construction will continue at the authorized compressor stations and interconnects. Road construction will continue in West Virginia and Virginia.

SCHEDULE CHANGES

There are no required schedule changes for waterbody crossings or work in other environmentally sensitive areas.

ENVIRONMENTAL ISSUES

The table in Appendix B summarizes problem area reports (PAR) and noncompliance reports (NCR) issued for the Project during the reporting period, as well as corrective actions taken to resolve the issue (including the cost and effectiveness of the corrective actions).

In the event Mountain Valley receives correspondence from other federal, state, or local permitting agencies concerning instances of noncompliance during the reporting period, Mountain Valley will include or reference such correspondence, as well as Mountain Valley's response thereto, in Appendix C.

LANDOWNER RESOLUTIONS

The table in Appendix D includes information regarding landowner concerns and how they were resolved.

VARIANCE CONDITIONS

In the event Mountain Valley is required to provide supplemental documentation as a condition to a variance request granted by the Federal Energy Regulatory Commission, Mountain Valley will include or reference such variances, as well as the required reporting, in Appendix E.

Mountain Valley PIPELINE

Appendix A
Construction Status

Docket No. CP16-10-000
Weekly Report No. 48
Report Period: 09/22/18 - 09/28/18

Activity Name	Activity Status	% Complete
Compressor Stations		
Bradshaw		
Bradshaw Civil - Tree Felling	Completed	100%
Bradshaw Civil - Road Construction	Completed	100%
Bradshaw Civil - Site Construction	Completed	100%
Bradshaw Civil - Post Site Construction/Reclamation	Completed	100%
Bradshaw Mechanical - Office Building Area	In Progress	21.34%
Bradshaw Mechanical - Discharge Filter Area	In Progress	60.97%
Bradshaw Mechanical - Auxiliary Equipment Area	In Progress	8.52%
Bradshaw Mechanical - Blowdown Silencer Area	Not Started	0%
Bradshaw Mechanical - Gas Cooler Area	In Progress	4.09%
Bradshaw Mechanical - Compressor Building Area	In Progress	42.78%
Bradshaw Mechanical - Suction Filter Area	In Progress	69.92%
Bradshaw Mechanical - Launcher/Receiver Area	In Progress	27.54%
Bradshaw Mechanical - Produced Fluids Area	Not Started	0%
Bradshaw Mechanical - Site Work Area	Not Started	0%
Bradshaw Mechanical - Commissioning	Not Started	0%
Harris		
Harris Civil - Tree Felling	Completed	100%
Harris Civil - Road Construction	Completed	100%
Harris Civil - Site Construction	Completed	100%
Harris Civil - Post Site Construction/Reclamation	Completed	100%
Harris Mechanical - Office Building Area	In Progress	36.47%
Harris Mechanical - Auxiliary Equipment Area	In Progress	43.09%
Harris Mechanical - Blowdown Silencer Area	Not Started	0%
Harris Mechanical - Gas Cooler Area	In Progress	32.99%
Harris Mechanical - Compressor Building Area	In Progress	40.5%
Harris Mechanical - Suction Filter Area	In Progress	48.38%
Harris Mechanical - Launcher/Receiver Area	In Progress	8.09%
Harris Mechanical - Produced Fluids Area	Not Started	0%
Harris Mechanical - Site Work Area	In Progress	25%
Harris Mechanical - Commissioning	Not Started	0%
Stallworth		
Stallworth Civil - Tree Felling	Completed	100%
Stallworth Civil - Road Construction	In Progress	97.37%
Stallworth Civil - Site Construction	In Progress	99.83%
Stallworth Civil - Post Site Construction/Reclamation	In Progress	29.77%
Stallworth Mechanical - Office Building Area	In Progress	4.2%
Stallworth Mechanical - Auxiliary Equipment Area	In Progress	29.5%
Stallworth Mechanical - Blowdown Silencer Area	Not Started	0%
Stallworth Mechanical - Gas Cooler Area	In Progress	13.74%
Stallworth Mechanical - Compressor Building Area	In Progress	24.61%
Stallworth Mechanical - Suction Filter Area	In Progress	14.82%
Stallworth Mechanical - Launcher/Receiver Area	In Progress	21.21%
Stallworth Mechanical - Produced Fluids Area	Not Started	0%
Stallworth Mechanical - Site Work Area	Not Started	0%
Stallworth Mechanical - Commissioning	Not Started	0%

Activity Name	Activity Status	% Complete
Interconnects		
Mobley		
Mobley Civil - Tree Felling	Completed	100%
Mobley Civil - Road Construction	Completed	100%
Mobley Civil - Site Construction	Completed	100%
Mobley Civil - Post Site Construction/Reclamation	Completed	100%
Mobley Mechanical - GC Building Area	In Progress	30.85%
Mobley Mechanical - CV Building Area	In Progress	18.67%
Mobley Mechanical - Meter Building Area	In Progress	33.3%
Mobley Mechanical - Filter Area	In Progress	50.58%
Mobley Mechanical - Launcher/Receiver Area	In Progress	2.33%
Mobley Mechanical - Site Work Area	Not Started	0%
Mobley Mechanical - Commissioning	Not Started	0%
Sherwood		
Sherwood Civil - Tree Felling	Not Started	0%
Sherwood Civil - Road Construction	Not Started	0%
Sherwood Civil - Site Construction	Not Started	0%
Sherwood Civil - Post Site Construction/Reclamation	Not Started	0%
Sherwood Mechanical - GC Building Area	Not Started	0%
Sherwood Mechanical - CV Building Area	Not Started	0%
Sherwood Mechanical - Meter Building Area	Not Started	0%
Sherwood Mechanical - Filter Area	Not Started	0%
Sherwood Mechanical - Launcher/Receiver Area	Not Started	0%
Sherwood Mechanical - Site Work Area	Not Started	0%
Sherwood Mechanical - Commissioning	Not Started	0%
WB		
WB Civil - Tree Felling	Completed	100%
WB Civil - Road Construction	In Progress	100%
WB Civil - Site Construction	Completed	100%
WB Civil - Post Site Construction/Reclamation	In Progress	99.04%
WB Mechanical - GC Building Area	In Progress	85%
WB Mechanical - CV Building Area	In Progress	84.1%
WB Mechanical - Meter Building Area	In Progress	92.5%
WB Mechanical - Filter Area	In Progress	81.45%
WB Mechanical - Launcher/Receiver Area	In Progress	67.5%
WB Mechanical - Site Work Area	Not Started	0%
WB Mechanical - Commissioning	Not Started	0%
Transco		
Transco Civil - Tree Felling	Completed	100%
Transco Civil - Road Construction	In Progress	62.88%
Transco Civil - Site Construction	In Progress	33.08%
Transco Civil - Post Site Construction/Reclamation	In Progress	98%
Transco Mechanical - GC Building Area	Not Started	0%
Transco Mechanical - CV Building Area	Not Started	0%
Transco Mechanical - Meter Building Area	Not Started	0%
Transco Mechanical - Filter Area	In Progress	0.67%
Transco Mechanical - Launcher/Receiver Area	Not Started	0%
Transco Mechanical - Site Work Area	Not Started	0%
Transco Mechanical - Commissioning	Not Started	0%

Activity Name	Activity Status	% Complete
Spreads (Pipeline)		
Spread A		
Spread A - Tree Felling	In Progress	99.9%
Spread A - Clearing	In Progress	97.93%
Spread A - Prepare right-of-way	In Progress	67.68%
Spread A - Trenching	In Progress	21.94%
Spread A - Stringing	In Progress	58.7%
Spread A - Welding	In Progress	40.79%
Spread A - Coating & Wrapping	In Progress	28.53%
Spread A - Backfilling & Tying-in	In Progress	16.83%
Spread A - Internal Cleaning	Not Started	0%
Spread A - Final Restoration	Not Started	0%
Spread B		
Spread B - Tree Felling	Completed	100%
Spread B - Clearing	In Progress	89.01%
Spread B - Prepare right-of-way	In Progress	69.75%
Spread B - Trenching	In Progress	26.18%
Spread B - Stringing	In Progress	59.36%
Spread B - Welding	In Progress	55.76%
Spread B - Coating & Wrapping	In Progress	51.78%
Spread B - Backfilling & Tying-in	In Progress	18.75%
Spread B - Internal Cleaning	Not Started	0%
Spread B - Final Restoration	Not Started	0%
Spread C		
Spread C - Tree Felling	Completed	100%
Spread C - Clearing	In Progress	59.25%
Spread C - Prepare right-of-way	In Progress	43.23%
Spread C - Trenching	In Progress	23.05%
Spread C - Stringing	In Progress	38.05%
Spread C - Welding	In Progress	29.54%
Spread C - Coating & Wrapping	In Progress	23.06%
Spread C - Backfilling & Tying-in	In Progress	17.59%
Spread C - Internal Cleaning	Not Started	0%
Spread C - Final Restoration	Not Started	0%
Spread D		
Spread D - Tree Felling	In Progress	99.9%
Spread D - Clearing	In Progress	79.98%
Spread D - Prepare right-of-way	In Progress	56.35%
Spread D - Trenching	In Progress	44.05%
Spread D - Stringing	In Progress	47.72%
Spread D - Welding	In Progress	44.31%
Spread D - Coating & Wrapping	In Progress	20.65%
Spread D - Backfilling & Tying-in	In Progress	12.82%
Spread D - Internal Cleaning	Not Started	0%
Spread D - Final Restoration	Not Started	0%
Spread E		
Spread E - Tree Felling	Completed	100%
Spread E - Clearing	In Progress	78.58%
Spread E - Prepare right-of-way	In Progress	63.37%
Spread E - Trenching	In Progress	15.73%

Activity Name	Activity Status	% Complete
Spread E - Stringing	In Progress	31.21%
Spread E - Welding	In Progress	21.62%
Spread E - Coating & Wrapping	In Progress	18.25%
Spread E - Backfilling & Tying-in	In Progress	10.78%
Spread E - Internal Cleaning	Not Started	0%
Spread E - Final Restoration	Not Started	0%
Spread F		
Spread F - Tree Felling	Completed	100%
Spread F - Clearing	In Progress	86.46%
Spread F - Prepare right-of-way	In Progress	56.57%
Spread F - Trenching	In Progress	38.48%
Spread F - Stringing	In Progress	34.57%
Spread F - Welding	In Progress	29.32%
Spread F - Coating & Wrapping	In Progress	25.72%
Spread F - Backfilling & Tying-in	In Progress	20.8%
Spread F - Internal Cleaning	Not Started	0%
Spread F - Final Restoration	In Progress	0.79%
Spread G		
Spread G - Tree Felling	Completed	100%
Spread G - Clearing	In Progress	63.77%
Spread G - Prepare right-of-way	In Progress	43.29%
Spread G - Trenching	In Progress	10.83%
Spread G - Stringing	In Progress	33.86%
Spread G - Welding	In Progress	20.88%
Spread G - Coating & Wrapping	In Progress	19.01%
Spread G - Backfilling & Tying-in	In Progress	7.8%
Spread G - Internal Cleaning	Not Started	0%
Spread G - Final Restoration	In Progress	2.51%
Spread H		
Spread H - Tree Felling	In Progress	99.9%
Spread H - Clearing	In Progress	46.4%
Spread H - Prepare right-of-way	In Progress	31.72%
Spread H - Trenching	In Progress	26.2%
Spread H - Stringing	In Progress	27.51%
Spread H - Welding	In Progress	22.45%
Spread H - Coating & Wrapping	In Progress	20.17%
Spread H - Backfilling & Tying-in	In Progress	20.38%
Spread H - Internal Cleaning	Not Started	0%
Spread H - Final Restoration	In Progress	2.82%
Spread I		
Spread I - Tree Felling	In Progress	99.9%
Spread I - Clearing	In Progress	60.33%
Spread I - Prepare right-of-way	In Progress	48.75%
Spread I - Trenching	In Progress	4.5%
Spread I - Stringing	In Progress	25.97%
Spread I - Welding	In Progress	13.36%
Spread I - Coating & Wrapping	In Progress	12.1%
Spread I - Backfilling & Tying-in	In Progress	3.22%
Spread I - Internal Cleaning	Not Started	0%
Spread I - Final Restoration	Not Started	0%

Activity Name	Activity Status	% Complete
Contractor Yards		
West Virginia Locations		
MVP-LY-013	Completed	100%
MVP-LY-003	Completed	100%
MVP-LY-031	Completed	100%
MVP-LY-057	Completed	100%
MVP-LY-068	Completed	100%
MVP-LY-059	Completed	100%
MVP-LY-038	Completed	100%
MVP-LY-069	Completed	100%
MVP-LY-027	Completed	100%
MVP-CY-002A	Completed	100%
MVP-CY-002	Completed	100%
MVP-LY-030	Completed	100%
MVP-LY-025	Completed	100%
MVP-LY-022	Completed	100%
MVP-LY-005	Completed	100%
MVP-LY-004	Completed	100%
MVP-LY-021	Completed	100%
MVP-LY-001A	Completed	100%
MVP-LY-017	Completed	100%
MVP-LY-001	Completed	100%
MVP-RD-001B	Completed	100%
MVP-LY-051	In Progress	95%
MVP-LY-050	In Progress	55%
MVP-LY-070	In Progress	50%
MVP-LY-058	In Progress	10%
MVP-LY-052	Not Started	0%
MVP-LY-065	Not Started	0%
MVP-LY-037	Not Started	0%
MVP-LY-016	Not Started	0%
MVP-AP-002	Not Started	0%
MVP-SA-001	Not Started	0%
MVP-LOG-001	Not Started	0%
MVP-AP-001	Not Started	0%
MVP-RD-001A	Not Started	0%
MVP-LY-024	Not Started	0%
MVP-LY-002	Not Started	0%
Virginia Locations		
MVP-LY-046	Completed	100%
MVP-LY-048	Completed	100%
MVP-LY-1019	Completed	100%
MVP-LY-028	Completed	100%
MVP-LY-026	Completed	100%
MVP-LY-034	Completed	100%
MVP-LY-033	Completed	100%
MVP-LY-032	Completed	100%
MVP-PY-006	In Progress	99%
MVP-LY-029	Not Started	0%
MVP-LY-035	Not Started	0%

APPENDIX B

ENVIRONMENTAL COMPLIANCE

The following table summarizes problem area reports (PAR) and noncompliance reports (NCR) issued for the Project during the reporting period, as well as corrective actions taken to resolve the issue (including the cost and effectiveness of the corrective actions).

Compliance	Spread	Location	Description and Date	Correction and Date
FERC Communication	Harris CS	76+00	9/27/2018 - Due to recent rain events in the area, the site observed heavy run off onto ROW resulting in overburdened ECD's. Roughly 1 1/2'' of rain was observed.	9/28/2018 – ECD's were reinforced on 9/27/2018. New ECD's were installed on 9/27/2018 and 9/28/2018 in previous problem areas to help filter during heavy rain events.
PAR	A	201+00	6/22/2018 - Slip began on row and overwhelmed and removed diversion berm. Material left the LOD.	Pending – Material will be retrieved off the LOD after a variance is obtained.
PAR	A	424+94	9/25/2018 - Impact to stream with sediment.	9/28 – Cleaned up with vac truck.
PAR	A	117+00	9/26/2018 - Return sediment from slipped area.	Pending –Pending variance.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	A	AR MVP-WE-12	9/28/2018 - Sediment needs to be cleaned away from filter sock at access road.	10/3/2018 – Sediment was cleaned away from filter sock at access road
PAR	A	265+00-238+00	9/28/2018 - Filter sock is undermined at the outlet of numerous waterbars in this area.	10/3/2018 – Filter sock repaired.
PAR	A	238+00	9/28/2018 - Sediment needs to be cleaned out of temporary diversion berm. Sediment has yet to leave the ROW.	10/4/2018 – Sediment was cleaned out of temporary diversion berm.
PAR	A	44+00	9/28/2018 - Slip has increased in size since previous inspection.	10/5/2018 – Pending variance for slip.
NCR	B	Access Road MVP-LE-054	6/6/2018 - Contractor built four pull offs and a turnaround on LE-054, outside of the LOD and without obtaining approval first.	Pending – Pending approval of a variance request.
NCR	C	3782+00	8/30/2018 - Construction debris off LOD.	Pending – Pending FERC variance and land signature.
PAR	D	6301+00	4/3/18 - Tree fell off LOD. No ground disturbance off ROW. Can be moved back onto ROW with equipment.	Pending – Will be moved onto ROW during mechanical process.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	D	6457+20	4/4/18 - Tree fell off LOD. No ground disturbance off ROW. Can be moved back onto ROW with equipment.	Pending – Will be moved onto ROW during mechanical process.
PAR	E	6898+00	8/17/2018 - Sediment in wetland W-CD44.	9/22/2018 – Sediment was cleaned out.
FERC Communication	E	Fab Yard	8/17/2018 - Vehicles have pushed stone in ditch in front of culvert.	9/22/218 – Stone cleaned out of in front of the culvert. Addressed vehicles being cautious near the culverts.
FERC Communication	E	7925+50 - 8014+00	8/17/2018 - Slope breaker outlets not installed per typical. Breakers need repair.	9/22/2018 – Outlets installed per typical.
PAR	E	6898+40	9/18/2018 - Soil along edge of access road needs stabilization.	9/22/2018 – Cleaned along the edge of access road.
PAR	E	6910+00	9/15/2018 - Outlet is damaged.	9/26/2018 – Outlet was repaired.
PAR	E	6948+00	9/15/2018 - Slope breaker without outlets.	9/22/2018 – Slope breaker repaired.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	E	6992+00	9/18/2018 - Sump with no drain nor Jhook.	9/25/2018 – Drain installed.
PAR	E	6998+40	9/18/2018 - Ripped CFS.	9/25/2018 – CFS Replaced.
PAR	E	7000+00	9/18/2018 - Waterbar with no outlet.	9/21/2018 – Per PGI this is a berm that was installed between waterbars in order to break up the flow down the slope. Waterbars up/down are functional.
PAR	E	7000+40	9/18/2018 - Waterbar with no outlet.	9/21/208 – Per PGI this is a berm that was installed between waterbars in order to break up the flow down the slope. Waterbars up/down are functional.
PAR	E	7079+70	9/21/2018 - CFS busted.	9/21/2018 – CFS replaced.
PAR	E	7125+00	9/21/2018 - This area is holding water on the ROW. Need additional waterbars installed and triple stack CFS.	9/25/2018 – Waterbars and CFS installed.
PAR	E	7500+00	9/21/2018 - Sediment off ROW. Hay bales need to be replaced with CFS.	9/25/2018 – Sediment cleaned up and CFS installed.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	E	7627+60	9/18/2018 - Water standing on CFS, P1 is not allowing water to pass through.	9/22/2018 – Dewatered and repaired.
PAR	E	7632+20	9/18/2018 - Water standing between CFS and P1.	9/22/2018 – Dewatered and repaired.
PAR	E	7728+00	9/15/2018 - Add safety fence around sump hole.	9/22/2018 – Safety fence installed around sumps.
PAR	E	7808+00	9/16/2018 - Silt fence needs to be replaced in section that was previously repaired.	9/22/2018 – Silt fenced replaced and reinforced.
PAR	E	7837+25	9/15/2018 - Install new waterbar and sump hole. Increase ECD's at out take.	9/25/2018 – Additional ECD's installed.
PAR	E	7903+15 - 8802+00	9/21/2018 - Install safety fence around sumps at these stations.	9/26/2018 – Safety fence installed around the sumps.
PAR	E	7933+00	9/21/2018 - Needs waterbar added.	Pending – Work pending.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	E	7978+00	9/21/2018 - Needs waterbar added.	Pending – Work pending.
PAR	E	7983+50	9/21/2018 - Needs waterbar added.	Pending – Work pending.
PAR	E	6910+00	9/22/2018 - Outlet is damaged.	9/25/2018 – Outlet repaired and functional.
PAR	E	6948+00	9/22/2018 - Slope breaker without an outlet.	Pending – Work pending.
PAR	E	6992+00	9/22/2018 - Sump with no drain nor Jhook.	9/25/2018 – PGI reviewed and did not find waterbars without sumps or Jhooks.
PAR	E	6998+40	9/22/2018 - Ripped CFS.	9/25/2018 – CFS repaired and functional.
PAR	E	Yard 30	9/24/2018 - This is a low flood area. The P-1 is being knocked down in the same area every time. Need to repair gate so that it can be locked to prevent any trespassing.	Pending – P-1 reinforced.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	E	7904+00	9/24/2018 - Fix water bar where equipment was tracked through.	Pending – Work pending.
PAR	E	Davis yard	9/24/2108 - Compost sock needing mulch/repair, P-1 silt fence has a broken stake, seed and straw slip soils.	9/26/2018 – P-1 silt fence re-staked, seeded and straw bales placed.
PAR	E	8010+00	9/24/2018 - Travel lane needs water bars and or hydromulched.	Pending – Work pending.
FERC Communication	E	7278+00	9/21/2018 - CFS are placed open allowing water to flow outside of the socks.	Pending – Work pending.
PAR	E	7983+00	9/25/2018 - Waterbar missing per plans.	Pending – Work pending.
PAR	E	7984+00	9/25/2018 - CFS at end of the waterbar is undercut instead of filtering. Needs repaired. Install sump at end of waterbar.	Pending – Work pending.
PAR	E	6941+53	9/25/2018 - Stabilize impacted access road AR-167 where water is bypassing installed filter outlet at the end of the waterbar culvert pipe. Additional sock is needed.	9/26/2018 – Installed additional sock and stabilize areas near AR-167.

Compliance	Spread	Location	Description and Date	Correction and Date
FERC Communication	E	6965+91	9/25/2018 - Water needs to be pumped off of ROW and a temporary sump is needed to prevent impact to S-H67.	9/26/2018 – Water pumped off ROW and sediment cleaned up.
PAR	E	7983+00	9/25/2018 - Waterbar missing per plans.	Pending – Work pending.
PAR	E	7984+00	9/25/208 - CFS at end of the waterbar is undercut instead of filtering. Needs repaired. Install sump at end of waterbar.	9/26/2018 – CFS repaired.
PAR	E	7085+00	9/25/2018 - RCE needs more rock.	Pending – Work pending.
PAR	E	7115+30	9/25/2018 - Sump is full of water allowing water to flow back on to ROW. Drain needs to be lowered.	Pending – Work pending.
PAR	E	6789+67-6789+68	9/26/2018 - Improper installation of curlex at stream S-VV1.	9/26/2018 – Curlex repaired.
PAR	E	6781+70	9/27/2018 - Flowing water eroding additional work space and ponding along P-1 silt fence. Super silt fence needs to be installed and CFS triple stack needs to be installed at filter outlet.	Pending – Work pending.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	E	6990+43	9/27/2018 - Waterbar outlet needs to drain water off the ROW.	Pending – Work pending.
PAR	E	7015+00	9/27/2018 - Water running around the J-hook. Improperly installed.	Pending – Work pending.
PAR	E	7134+50	9/27/2018 - Ponding water to the side of Bamboo School Rd, not far from cresting the top soil and running over side of mountain.	Pending – Work pending.
NCR	F	MVP-LY-31	7/17/2018 - Pavement was added but was not mentioned in the variance. Need to write an after the fact variance for the pavement.	Pending – Pending variance approval.
NCR	F	10130+65	9/26/2018 – Crew did not install waterbars.	9/27/2018 – Crew installed waterbars.
NCR	G	11407+61 to 11409+00	6/21/2018 - Livestock fence installed off ROW.	Pending – Fence will be moved to LOD following approval of Level 2 variance request.
PAR	G	11427+00	7/24/2018 - Sediment off ROW.	Pending - Added ECDs to end treatment on 7/24/2018 - waiting on landowner approval to recover off ROW sediment.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	G	11704+10	7/26/2018 - Sediment deposited in Stream S-MN22.	Pending – Recovered sediment within the LOD on 7/27/2018 - waiting on landowner approval to recover sediment outside the LOD.
PAR	G	10920+50 to 10923+00	8/6/2018 - Water bar and end treatment failure resulted in sediment leaving the ROW.	9/22/2018 - Upgraded ECDs. Off ROW sediment recovered 9/22/2018.
PAR	G	10955+74	8/9/2018 - No RCE in place at road crossing.	Pending – Work pending.
PAR	G	11015+50	8/22/2018 - Priority one silt fence undermined at stream bank. Sediment impacted stream S-RR5 at 11015+50.	9/22/2018 – Sediment retrieved on 9/22/2018.
PAR	G	11711+00	8/31/2018 - End treatment undercut; sediment off ROW.	Pending – Work pending.
PAR	G	11686+81	9/18/2018 – End treatment failure— overtopped/undercut. Impacts to S-MN21.	Pending – Work pending.
PAR	G	11697+50	9/18/2018 – End treatment failure resulting in sediment off ROW.	Pending – Work pending.
NCR	G	10930+00	9/22/2018 - Super silt fence not installed per the spec.	9/25/2018 – Reinstalled super silt fence per spec.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	G	11687+50	9/24/2018 - Waterbar/sump failure resulted in buffer zone ECD failure, and impact to stream S-MN21.	Pending – Work pending.
PAR	G	11711+00	9/24/2018 - End treatment failure and compost sock overtopped resulting in sediment off ROW.	Pending – Work pending.
PAR	G	11772+50	9/26/2018 - Overwhelmed/full sump and end treatment failure resulting in sediment off ROW.	Pending – Work pending.
PAR	G	11941+00	9/28/2018 - ECD failure resulting in sediment off ROW near karst feature.	9/29/2018 – Upgraded/repaired ECD's and retrieved off ROW sediment.
PAR	G	11950+00	9/28/2018 – ECD's overwhelmed resulting in sediment off ROW near a karst feature.	9/28/2018 – Upgraded ECD's and retrieved off ROW sediment.
PAR	G	11704+10; 11687+42	9/28/2018 - ECD failure resulting in sediment impact to stream S-MN21 and S-MN22.	Pending – Work pending.
PAR	G	11674+00 to 11746+00	9/28/2018 - Multiple waterbar end treatment failure resulting in sediment off ROW.	9/29/2018 – ECDs repaired and off ROW sediment recovered.
PAR	G	11615+33	9/28/2018 - ECD failure resulting in sediment off ROW within buffer of stream S-RR14.	9/29/2018 – ECDs repaired and off ROW sediment recovered.
NCR	G	11435+00	9/28/2018 - Perimeter controls not installed resulting in sediment off ROW.	Pending – Work pending.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	G	11407+00	9/28/2018 - Perimeter controls overwhelmed; sediment off ROW.	9/29/18 – Retrieve off ROW sediment; reinstall ECDs
PAR	G	ATWS 633	9/28/2018 - Perimeter control failure; Sediment off ROW.	Pending – Work pending.
PAR	G	11330+00	9/28/2018 - Waterbar end treatment failure; sediment off ROW.	Pending – Work pending.
PAR	H	13473+16 and 13489+16	8/1/2018 - Sediment overtopped ECDs traveling into a non-delineated drain.	Pending – Contractor removed silt from ECDs on 8/2/2018. Working on plan to remove silt from drains. Pending Landowner approval as of 10/4/2018.
PAR	H	1321+00	9/17/2018 - Six inches of rain from Hurricane Florence blew out a curlex lined channel and sediment overtopped super silt fence ECD's and went 30' beyond the LOD.	Pending – ECD's were repaired within the ROW limits. The National Park Service has not given permission to retrieve the sediment as of 9/21/18.
PAR	H	12959+00	9/17/2018 - Six inches of rain from Hurricane Florence caused stream S-Q20 to swell out of its banks and wash road base material and compost filter sock into wetland W-IJ10.	Pending – Waiting on L/O approval to retrieve ECD's and remove road base/rocks from stream and wetland outside of the ROW. ECD's and access road within the ROW were repaired on 9/18/18.
PAR	H	13009+00	9/17/2018 – Six inches of rain from Hurricane Florence blew out compost filter sock and washed sediment and native rock approximately 125' beyond the ROW limits.	Pending – ECD's were repaired within the ROW limits. The National Park Service has not given permission to retrieve the sediment as of 9/21/18.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	I	13670+00 to 14650+00	7/25/2018 - Documented silt entering streams from flash flooding received during rain event. ECDs were in place prior to rains.	8/1/2018 – Silt removed from streams.
PAR	I	14176+50	8/1/2018 - Sediment overtopped ECDs and entered stream crossing.	8/7/2018 –Silt removed from stream crossing.
PAR	I	14321+79-14326+19	9/11/2018 – Due to heavy rains in the area, ECD's were overwhelmed resulting in sediment off ROW.	9/18/2018 – ECD's cleaned out and improved on 9/12/2018. Sediment retrieved from off ROW.
PAR	I	13817+00	9/24/2018 - Due to heavy rains, ECD's overrun with silt and traveled off ROW with some silt getting into S-C12.	9/25/2018 – ECD's were cleaned and new ECD's were added. Silt removed from off ROW.
PAR	JNF	11584+02	6/25/2018 - Runoff undermined silt fence along the LOD and allowed sediment to migrate off ROW at 11584+02.	Pending – The silt fence was backfilled but sediment cannot be retrieved until variance request from the Forest Service is received.
PAR	JNF	11580+01	6/27/2018 - Runoff undermined silt fence along the LOD and allowed sediment to migrate off ROW at 11580+01.	Pending – The silt fence was backfilled, but sediment cannot be retrieved until variance request from the Forest Service is received.

Compliance	Spread	Location	Description and Date	Correction and Date
PAR	JNF	11620+62	9/18/2018 - End treatment failed allowing small amount of sediment to migrate beyond LOD.	Pending – ECD's were repaired on 9/18/2018. Pending variance approval to retrieve sediment off LOD.
PAR	JNF	11649+00	09/24/2018 - End treatment failed allowing sediment to migrate beyond approved LOD.	Pending – ECD's were repaired on 9/26/18. Variance from USFS to retrieve sediment requested.
PAR	JNF	11580+00	09/28/2018 - ECD failed allowing sediment to migrate beyond the approved LOD.	Pending – Scheduled for repair on 10/1.
PAR	JNF	11576+80	09/28/2018 - ECD failed allowing sediment to migrate beyond the approved LOD.	Pending – Scheduled for repair on 10/1.
PAR	JNF	11556+20	09/28/2018 - ECD failed allowing sediment to migrate beyond approved LOD.	Pending – Scheduled for repair on 10/1.
Note: PAR – Problem Area Report; NCR – Noncompliance Report.				

APPENDIX C

AGENCY CORRESPONDENCE AND RESPONSES

Spread JNF

MVP Environmental Coordinator Megan Neylon received an NCR from the U.S. Forest Service (USFS) dated September 21, 2018. The work was completed following USFS approved emergency work allowing MVP to perform the activities outside of LOD and compliance inspection contractor recommendations. All work was performed on foot and with hand tools. A copy of the NCR is included in Appendix C.

TRANSCON environmental

Non-Compliance Report

Inspector: D. Danko, and N. Amick Date: 09/21/2018

Mile Post: 218.86-219.79

Description (On-site Conversation Records and Photos Required)

This non-compliance is issued for six (6) instances of sediment moving off the Limits of Disturbance (LOD). The following locations were confirmed to contain sediment off of the LOD:

1. MP 219.36
   -30'x8' area with 1.5" depth
   -Most sediment is on private but origin of sediment comes from sump just within FS lands.
2. MP 219.22
   -50'x10' area with 1" depth
3. MP 218.86
   -60'x5' area
   -Turbid water actively flowing from spring that undermined silt fencing. Areas of pooling showed 1/4" thick deposition of sediment.
4. MP 219.79
   -5'x5' with 1/8" depth
5. MP 219.09
   -Turbid waters observed in 4 j-hooks outside of LOD. Source of sediment came from the LOD.
6. MP 219.03
   -30'x6' area with 1/8" depth

On September 21, 2018, in order to protect resources and prevent sediment from traveling into streams S-PP21, the FS approved emergency work allowing MVP to perform the below activities outside of LOD. All work will be performed on foot and with hand tools.

1. Replace existing 4 silt fence runs outside of the LOD at MP 219.09.
2. Retrieve sediment captured by silt fences with shovel and bucket. Sediment will be brought back into the LOD
3. Install an additional 20' silt fence to the existing silt fence that is second from the LOD at MP 219.09 (see Photo 2, page 6). This will extend the silt fence to 45' in length.

These emergency activities have only been approved by the FS for the following reasons;

1. MVP has shutdown construction operations on JNF.
2. Allowing MVP to perform the above work protects FS sensitive resources.

Compliance Inspection Contractor (CIC) Recommendations

Did the non-compliance result in surface disturbance?	☑ Yes	☐ No
Was the activity within an area previously analyzed in the FEIS?	☑ Yes	☐ No

1. All work outside of the LOD will be performed on foot.
2. MVP EIs will be on site to assist the crew with minimizing impacts outside of the LOD and document the activity.
3. Transcon inspectors will be on site to monitor the activities.
4. MVP will move the sediment back into the LOD and ensure that sediment will not erode off of the LOD.
5. MVP EIs to inspect all ECDs on JNF and ensure the ECDs are in working order and are in compliance with the governing documents (POD, ROD, SWPPP, etc.).
6. MVP to document and map out all areas where sediment has left the LOD and provide to the Forest Service.

Date	Location	Description	Issue	Stream Impacted
Week of 3/12/2018				
3/15/2018	Station #153+26 on FR 972	Sediment-laden water observed to be conveying over 1,000' down Pocahontas Road and underneath failing erosion control sock. Sediment-laden water observed to enter stream crossing S-PP19.	Failing Erosion Control Sock	S-PP19
3/15/2018	#153+26 on FR 972	Observed sediment laden water entering stream crossing S-PP19 from runoff off of Pocahontas Road (FR 972).	Erosion - Sed in Stream	S-PP19
Week of 3/19/2018				
3/22/2018	Road Sta 289+70	Rutting with channelized runoff flowing through the tire ruts on Pocahontas Road	Rutting	N/A
3/22/2018	N/A (Pocahontas Road)	Sediment-laden water runoff from Pocahontas Road was observed behind erosion filter sock at station 289+70. Area on road in front of erosion sock has standing water and runoff flowing from both directions to this spot. MVP EI was notified of erosion control failure due to high volume of water.	Failing Erosion Control Sock	N/A
Week of 3/26/2018				
3/26/2018	Pocahontas Road	Sediment runoff in stream station at 152+00	Erosion - Sed in Stream	S-PP19
3/26/2018	Pocahontas Road	Sediment runoff at around station 160+00 down hill in woods.	Erosion - Sediment Runoff	N/A
3/27/2018	Pocahontas Road	Turbid water 300 feet down stream of stream crossing SPP19	Erosion - Sed in Stream	S-PP19
3/27/2018	Pocahontas Road	Station 155+91 down hill below water bar outlet 150 feet in woods.	Failing Water Bar	N/A
Week of 4/2/2018				
4/2/2018	Station 103+50	Sedimentation observed in ditch flowing off of LOD. Sediment is traveling down side ditch, into culvert under Pocahontas Road, then runs downslope.	Erosion	N/A
4/4/2018	197.60	Sediment-laden runoff observed to flow off of LOD and disperse into vegetation after flowing approximately 1,000' down Mystery Ridge Road in rutted areas.	Erosion - Sediment Runoff	N/A
Week of 4/16/2018				
4/16/2018	N/A (Pocahontas Road)	Concentrated flow or runoff observed it flow beyond existing J-hook of erosion filter sock and off of the LOD. J-hook observed to be filled with sediment and needs proper maintenance.	Failing J-Hook	N/A
4/16/2018	N/A (Pocahontas Road)	Sediment observed to enter stream S-PP19 at the culvert outfall. Sediment has run over and underneath failing erosion filter sock. Sedimentation observed in stream bed well beyond LOD. Station 152+69	Erosion - Sed in Stream	S-PP19
4/18/2018	N/A (103+50 on Pocahontas Road)	Culvert outfall, facing downstream in drainage ditch. Heavy sedimentation observed at outfall and in drainage off of LOD. Culvert itself has large amount of deposition at either opening and within the culvert.	Failing Culvert	N/A
Week of 5/7/2018				
5/9/2018	197.65 (Mystery Ridge Road)	Sediment observed beyond silt fence and continues beyond LOD from Mystery Ridge Road. Silt fence was not able to handle the amount of sediment running down the road despite adding 5 more water bars to slow/divert runoff. Road is still being utilized routinely by FS LEOs and MVP security.	Failing Silt Fence	N/A
Week of 6/18/2018				
6/23/2018	219.93	Failure at silt fence allowing water under and around silt fence. Location is above stream S-HH18 crossing and on south west corner with flow into Stream S-HH18.	Failing Silt Fence	S-HH18
6/23/2018	220.68	Failed silt fence allowed sediment to run about 20 feet outside the LOD	Failing Silt Fence	N/A
6/23/2018	220.41	Failed silt fence allowed sediment to run about 20 feet outside the LOD.	Failing Silt Fence	N/A
6/23/2018	219.60	Sediment in woods 150 feet below LOD at station 11619+50 on Brush Mountain side of Craigs Creek.	Sediment Off LOD	N/A
Week of 6/25/2018				
6/25/2018	N/A (110+59 on Pocahontas Road)	Sediment laden runoff observed to convey down Pocahontas Road beyond a water bar. Sediment entered side drainage beyond water bar and conveyed off the LOD via a culvert. Runoff is slowed slightly from the placement of filter sock within the drainage; however, sediment laden runoff was still observed to convey off of the LOD.	Failing Water Bar	N/A

6/26/2018	219.03	Overwhelmed silt fence at the receiving end of a temporary slope breaker located on the travel lane. Sediment continues to travel towards the LOD at station 11584+02, where failed super silt fence has allowed sediment to flow beyond the LOD.	Failing Silt Fence	N/A
6/26/2018	219.09	Hole was found under silt fencing leading to water going under super silt fence and leading to sediment deposition.	Failing Silt Fence	N/A
6/26/2018	220.41	Sediment deposition was found extending 25 feet outside of LOD. Erosional rilling showed where water bypassed silt fencing shown in picture.	Sediment Off LOD	N/A
6/27/2018	219.91	Location of the majority of sediment within S-HH18.	Erosion - Sed in Stream	S-HH18
6/27/2018	219.11	Undermining of silt fence at station 11584+02, first discovered on 6/25. MVP EI has continued to notify contractor of issues with perimeter controls and the need to repair features.	Failing Silt Fence	N/A
Week of 7/23/2018				
7/23/2018	Near 197.4	Storm water urnoff has carried sediment into the woods in two locations on Mystery Ridge Road.	Erosion - Down Rd	N/A
7/23/2018	N/A (Pocahontas Road)	Sediment laden runoff was observed entering S-HH16 during heavy rain event. Runoff continued into and then down the stream. Sediment laden run off was observed entering S-MN17 and running down stream.	Erosion - Sed in Stream	S-HH16; SMN17
7/23/2018	N/A (Pocahontas Road)	J-hook at the end of the waterbar located at station 164+27 was discovered to have been "blown out" leading to sediment deposition 5 feet off of access road LOD.	Failing J-Hook	N/A
Week of 8/1/2018				
8/1/2018	N/A (Mystery Ridge Road)	Newly installed water bars on Mystery Ridge Road have conveyed sediment laden runoff off of the side slope of the road. Sediment was observed to convey over 50' downslope into vegetative matter.	Erosion - Down Rd	N/A
8/1/2018	Vicinity 196.9	This ECD serves as a visual representation of all ECDs on Mystery Ridge Road however this is the only one to suffer a failure. Minimal sediment escaped the LOD.	Failing ECD	N/A
8/1/2018	196.89	Overwhelmed double stacked j-hook filled with sediment from recent rainfall. Small amounts of sediment were observed beyond the LOD. The second j-hook clearly shows that sediment has traveled over the top of the receiving device.	Failing J-Hook	N/A
8/1/2018	N/A (190+47 on Pocahontas Road)	Sediment laden runoff was observed to bypass the j-hook at the receiving end of the water bar, causing sediment to runoff beyond the LOD. A small amount of sediment was observed up to 10' off the LOD prior to dispersing into vegetative matter.	Failing J-Hook	N/A
8/2/2018	219.21	Sediment-laden runoff observed traveling off of the right of way through wetland crossing W-CD46. Sediment traveled over 100' through the delineated wetland prior to dispersing into vegetative matter.	Erosion - Sed in Wetland	W-CD46
8/2/2018	219.14	Heavy sedimentation of stream S-PP21 was observed due to runoff from failed sump upslope. Sediment entered the waterway approximately 60' upstream from where S-PP21 enters the right of way. Sediment proceeds to flow through the right of way and continues to carry sediment beyond the LOD.	Erosion - Sed in Stream	S-PP21
8/2/2018	Road Sta 172+05	J-hook failure on Pocahontas Road at station number 172+05 allowed sediment 3 feet off the LOD.	Failing J-Hook	N/A
8/2/2018	218.82/218.88	Water from stream S-PP22 is flowed underneath pipe and down the graded right of way. Stream S-PP22 is not delineated past the bridge crossing. Water from S-PP22 and runoff from slope breakers conveyed into a natural depression. The perimeter silt fence was overwhelmed by the volume of runoff received and allowed sediment to pass trough into the drainage off of the LOD.	Failing Silt Fence-Sed in Stream	S-PP22
8/2/2018	219.92	Runoff took sediment over the side of the bridge at S-HH18. This provided the majority of sedimentation into S-HH18.	Erosion - Sed in Stream	S-HH18
8/2/2018	218.88	Sediment-laden runoff in the natural drainage approximately 450' below the delineated portion of S-PP22. Several pockets of sediment were observed within the drainage.	Erosion - Sed in Stream	S-PP22
8/2/2018	219.05/219.04	Slope breakers filled with sediment and allowing runoff to continue to flow downslope towards stream S-PP21. Three straight slope breakers failed upslope of S-PP21, which contributed to the failed sump that allowed sediment to enter stream S-PP21.	Failing ECD-Sed in Stream	S-PP21
8/2/2018	218.88	Sediment compromised the perimeter of a silt fence. Sediment traveled down a natural drainage off of the LOD. Sediment-laden runoff traveled approximately 100' off of the LOD before the water flow disappeared into the ground.	Failing Silt Fence	N/A
8/3/2018		Sediment has left FS road 188 and gone down the side of Brush Mountain over 150' into wooded area.	Failing ECD	N/A
8/3/2018	197.20/197.15	Failing silt fence j-hooks allowed sediment-laden runoff to flow beyond devices onto the pipeline LOD.	Failing J-Hook	N/A

8/3/2018	196.76	Heavy sedimentation off of the LOD within the cultural resource area. Concentrated flow continued downslope for more than 200' off of the LOD.	Erosion - Off LOD	N/A
8/3/2018	219.11	Silt fence j-hooks that were installed off of the LOD in an effort to reduce impacts to S-PP21. Silt fence in the foreground allowed runoff to pass on the left side before allowing sediment to drop out of the water column. The third run of silt fence in the background was undermined, allowing sediment to pass through into S-PP21. MVP EI directed contractor to install a 4th run of silt fence, and also installed 9 straw bales behind silt fence.	Failing J-Hook	N/A
8/3/2018	196.76/196.73	Sediment off of the right of way within the cultural resource area. Sediment flowed onto the pipeline LOD from Mystery Ridge Road between the ROW and Symm's Gap.	Erosion - Down Rd	N/A
8/3/2018	219.14	Heavy sedimentation of stream S-PP21 was observed due to runoff from failed sump upslope, despite contractor's efforts to reduce impacts by installing three runs of silt fence off of the LOD. Sediment entered the waterway approximately 60' upstream from where S-PP21 enters the right of way. Sediment proceeds to flow through the right of way and continues to carry sediment beyond the LOD.	Erosion - Sed in Stream (noted 8/2)	N/A
8/3/2018	219.11	Failing silt fence allowed sediment to pass through and into S-PP21.	Erosion - Sed in Stream	S-PP21
8/3/2018	219.19	Water bar sump became filled and sediment escaped the LOD.	.	N/A
8/3/2018	220.40	Filter sock was overrun upslope causing rilling along the LOD. This eventually carried sediment 25 feet outside LOD.	Failing Erosion Control Sock	N/A
8/3/2018	N/A (106+50, 139+50 on FS 972)	Failed silt fence j-hook allowed runoff to pass underneath the fabric and off of the LOD.	Failing J-Hook	N/A
8/3/2018	197.61/197.52	Overwhelmed silt fence j-hooks caused sediment-laden runoff to flow over the top of silt fence. Heavy sediment deposition was observed in water bars and in j-hooks. Runoff conveyed downslope off of the LOD. Runoff continued to flow down Mystery Ridge Road due to the water bar being filled with sediment	Failing J-Hook	N/A
8/3/2018	196.76	Sediment-laden runoff was observed to flow more than 50' into the pipeline LOD and underneath felled timber due to a failed silt fence j-hook. The high water marks on silt fence shows that runoff initially conveyed off of the LOD. Runoff at the time of inspection had rilled into sediment, and conveyed back onto Mystery Ridge Road, where it flowed into the cultural resource area	Failing J-Hook	N/A
8/3/2018	220.78	Silt fence was undercut allowing sediment off the LOD.	Failing Silt Fence	N/A
8/4/2018	218.63	Sediment was found 5 feet outside of the LOD in the Northeast corner of the temporary workspace that connects to the LOD. Sediment originated from overwhelmed sumps along northeast edge of LOD on steep section between workspace and summit of Sinking Creek Mountain.	Erosion - Down LOD	N/A
8/4/2018	Stream S-PP21	Sediment in stream-bed observed over 300 feet down stream.	Erosion - Sed in Stream	S-PP21
8/4/2018	Stream S-PP22	Stream S-PP22 flow directly above timber mat bridge in delineated stream bed (Previously reported 8/2).	Erosion - Sed in Stream	S-PP22
8/4/2018	219.09 and 219.02	Plugged and failed pipe embankment flumes.Water and sediment overtopped silt fence below sump and pipe. Sediment below erosion control sock left right of way	Failing ECD	N/A
8/4/2018	219.15	Sediment was found to have filled sump, bypassed j-hook, overwhelmed check dam, and deposited up to 7 feet off of the LOD on the northeast edge. Stress cracks can also be seen forming along fill bank.	Failing ECD	N/A
8/4/2018	Wetland W-CD46	Sediment off right of way below silt fence.	Failing Silt Fence	N/A
8/5/2018	220.78	Silt fence was undermined by heavyweight rains however sediment particle size was so fine there is no visible deposition outside the LOD.	Failing Silt Fence	N/A
Week of 8/6/2018				
8/6/2018	196.76	Sediment leaves the LOD at station number 10399+95 and travels into the cultural area for an unknown distance.	Erosion - Down LOD	N/A
Week of 8/10/2018				
8/13/2018	106+50 on Pocahontas Road	Silt fence j-hook received heavy flows as evidenced by rock aggregate within the device and beyond the silt fence off of the LOD. Silt fence suffered a blow out from concentrated flow off of road, and sediment/rock aggregate was observed more than 20' off of the LOD.	Failing Silt Fence	N/A
8/13/2018	106+50 on Pocahontas Road	Sediment and rock aggregate from the road surface was observed more than 20' off of the LOD beyond the silt fence j-hook located at station 106+50.	Failing Silt Fence	N/A
8/13/2018	134+50 on Pocahontas Road	Silt fence j-hook received heavy flows as evidenced by rock aggregate within the device and beyond the silt fence off of the LOD. Silt fence suffered a blow out from concentrated flow off of road, and sediment/rock aggregate was observed more than 15' off of the LOD.	Failing Silt Fence	N/A
8/13/2018	139+54 on Pocahontas Road	Silt fence j-hook overwhelmed by concentrated flow from upslope rilling (see bottom right photo in photo box 1). Sediment consequently flowed over the top of silt fence and continued approximately 5' off of the LOD.	Failing Silt Fence	N/A
8/13/2018	196.89	Overwhelmed silt fence structure on Mystery Ridge Road that allowed sediment to flow off of the LOD beyond the structure. Flow has created a channelized path for sediment laden runoff to convey downslope off of the LOD. Corresponding station number on the pipeline LOD 10408+38.	Failing Silt Fence	N/A

8/13/2018	218.96	Sump was found to be completely filled in with sediment causing runoff to undermine j-hook. Runoff then carried sediment over check dam behind and sediment was deposited off of the LOD. Area of sediment deposition off of the LOD measured 1 foot wide and 10 feet in length.	Failing ECD	N/A
8/13/2018	131+90 on Pocahontas Road	Silt fence failure	Failing Silt Fence	N/A
8/13/2018	131+90 on Pocahontas Road	Silt fence failure	Failing Silt Fence	N/A
Week of 8/17/2018				
8/20/2018	219.93	Sediment in streambed upstream of bridge crossing in Stream S-HH18 at station 11626+00	Erosion - Sed in Stream	S-HH18
8/20/2018	219.93	Sediment/turbidity in streambed of Stream SHH18.	Erosion - Sed in Stream	S-HH18
8/20/2018	219.93	Station 11626+50 overwhelmed erosion controls allowing sediment to enter stream SHH18. Same location where sediment entered stream previously in June.	Erosion - Sed in Stream	S-HH18
8/20/2018	219.98	View of steep hill south of Stream S-HH18. Sumps on left with sediment deposits prior to corner on left were ECD's allow water into stream.	Erosion - Sed in Stream	S-HH18
8/20/2018	219.96	Overwhelmed sump allowing water to flow behind top soil pile and over ECD sock into woods at station11628+50.	Failing Erosion Control Sock	N/A
8/20/2018	219.84	Station 11620+62 Sediment moving past LOD under soil fence.	Failing Silt Fence	N/A
8/20/2018	219.89	Station 11624+80 Sediment moving off LOD under silt fence.	Failing Silt Fence	N/A
8/20/2018	11628+00	At station 11628+00 behind top soil piles water is overtopping erosion control socks and flowing off right of way down steep side slope towards Craig Creek tributary. Very little sediment was observed off right of way.	Failing Erosion Control Sock	N/A
8/20/2018	11588+00	Sediment 5-10' off LOD from overwhelmed sump at 11588+00	Failing ECD	N/A
8/20/2018	11582+40	Sediment 5-10' off LOD from overwhelmed sump at 11582+40	Failing ECD	N/A
8/20/2018	11581+40	Undermining of super silt fence with minor sedimentation off LOD 11581+40	Failing Silt Fence	N/A
8/20/2018	11581+00	Undermining of super silt fence with minor sedimentation off LOD 11581+00	Failing Silt Fence	N/A
8/20/2018	11580+01	Undermining of super silt fence with minor sedimentation off LOD 11580+01	Failing Silt Fence	N/A
8/20/2018	11579+60	Sediment 5-10' off LOD from overwhelmed sump at 11579+60	Failing ECD	N/A
8/20/2018	11576+75	Sediment 5-15' off LOD from overwhelmed sump at 11576+75	Failing ECD	N/A
8/20/2018	11570+97	Undermined silt fence with sediment off LOD in drainage 11570+97	Failing Silt Fence	N/A
8/20/2018	11561+93	Undermining of silt fence with minor sedimentation off LOD 11561+93	Failing Silt Fence	N/A
8/20/2018	11561+30	Sediment 5-10' off LOD from overwhelmed sump at 11561+30	Failing ECD	N/A
8/20/2018	11556+65	Undermining of silt fence with minor sedimentation off LOD 11556+65	Failing Silt Fence	N/A
8/20/2018	11556+05	Sediment 5-10' off LOD from overwhelmed sump at 11556+05	Failing ECD	N/A
8/20/2018	11555+50	Sediment 5-20' off LOD from overwhelmed sump at 11555+50	Failing ECD	N/A
Week of 9/17/2018				
9/18/2018	219.36	Sediment was observed in a 30'x8' area and 1.5" in depth outside of the LOD. Most sediment was on priv	Failing ECD	N/A
9/18/2018	219.22	Sediment was observed in a 50'x10' area and 1" in depth outside of the LOD.	Failing ECD	N/A
9/18/2018	218.86	Sediment was observed in a 60'x5' area outside of the LOD.	Failing ECD	N/A
9/18/2018	219.79	Sediment was observed in a 5'x5' area and 1/8" in depth outside of the LOD.	Failing ECD	N/A
9/18/2018	219.09	Turbid waters observed in 4 j-hooks outside of LOD. Source of sediment came from the LOD.	Failing ECD	N/A
9/18/2018	219.03	Sediment was observed in a 30'x6' area and 1/8" in depth outside of the LOD.	Failing ECD	N/A

Date: 9/18/18

Photograph  	GPS Coordinates: See photos Aspect: Facing Southeast Photo Number: 1 Mile Post: 219.09 Description: Photo at top left shows turbid water pooling in silt fence j-hooks that were preciously installed upslope from S-PP21 off of the LOD. Photo at bottom right shows slightly turbid water beyond the silt fence j-hooks entering stream S-PP21; however, no sedimentation was observed within S-PP21.
Photograph 	GPS Coordinates: See photo Aspect: Facing Southeast Photo Number: 2 Mile Post: 219.09 Description: Turbid water has pooled off of the LOD in the 4 silt fence j-hooks. These silt fences were previously installed as a result of a previous rain event. Sediment deposits within the j-hooks measured 1-3” in depth. MVP has requested that the second silt fence shown in the photo be extended 20' by installing additional silt fence.

Date: 9/18/18

Photograph  	GPS Coordinates: See photos Aspect: Facing Northwest/East Photo Number: 3 Mile Post: 219.03 Description: Turbid runoff was observed exiting LOD and flowing downslope into vegetative matter on he backside of super silt fence. A 'skim' of sediment was observed 5-10' off of the LOD; however, no measurable sediment deposition was observed and no aquatic resources were impacted.
Photograph 	GPS Coordinates: See photo Aspect: Facing East Photo Number: 4 Mile Post: 218.98 Description: A 'skim' of sediment was observed off of the LOD from an overwhelmed silt fence j-hook. Sediment was observed approximately 30' off of the LOD but was less than 1/2" in depth. Sedimentation did not impact any aquatic resources.

Date: 9/18/18

Photograph 	GPS Coordinates: See photo Aspect: Facing Northwest Photo Number: 5 Mile Post: 218.86 Description: Water flowing beyond an undermined silt fence barrier was observed to be flowing off of right of way. Water was not turbid and is flowing from springs and seeps near stream S-PP22.
Photograph  	GPS Coordinates: See Photos Aspect: Down and Southwest Photo Number: 6 Mile Post: 218.86 Description: Turbid water was found actively flowing under silt fence and off the LODat station 11570+87. Area measured 60'x5'. Sediment measuring 1/4" was found where water was pooling. Inspection on a later date will be needed to verify if sediment settles out of said water.

Date: 9/18/2018

Photograph  	GPS Coordinates: See Photo Aspect: Southeast and West Photo Number: 7 Mile Post: 219.86 Description: Sediment was found off the LOD at station 11597+00. Majority of the sediment was found to be on private lands but the source of the sediment was found to be just inside Forrest lands. Sediment measured 30'x8' with a depth of 1.5".
Photograph  	GPS Coordinates: See Photo Aspect: Southwest and Down Photo Number: 8 Mile Post: 219.22 Description: Sediment was found outside the LOD at station 11589+26. Sediment measured 50'x10' with a depth of 1".

Date: 09/18/2018

Photograph	GPS Coordinates:
 	Aspect: Facing east.
	Photo Number: 9
	Mile Post: 11620+61. 219.70
	Description: Runoff water overtopped silt fence. Small 5x5 area behind fence with silt skim adjacent to power line right of way at bottom of Brush Mountain near where vehicles parked.

Photograph	GPS Coordinates:
	Aspect:
	Photo Number: 2
	Mile Post:
	Description:

APPENDIX D

LANDOWNER CONCERNS

The following table includes information regarding landowner concerns and how they were resolved.

Tract ID	Spread / Facility	Station/ MP	Date of Concern	Date of Resolution	Issue and Resolution
VA-MO-025	Spread H	237.3	3/20/2018	Pending	**Issue:** Survey was approached by L/O stating that the property lines were incorrect in the maps. The L/O said that the lines were off about 100' and the neighbors have not been compensated. **Resolution:** MVP is currently reviewing the property boundary information to determine if the claim is accurate. • **4/15/2018 -** Agent met with VA-MO-025 L/O along with L/Os of VA-MN-5233 and VA-RO-5805. The stakes were reviewed that the L/O was referring to and walked the route L/O preferred. These stakes were from a previous survey and do not reflect the filed route. The filed route does appear to enter VA-RO-5805 and VA-RO-5806. If the L/O's preferred route is accepted, it will require signatures from VA-MO-025 and VA-MO-023. Further discussions will proceed through both L/O's attorneys. • **4/20/2018 -** MVP is currently working with the L/O to identify potential alternatives to the route in the area of concern. • **4/27/2018 -** Land and construction have met with the L/O and the adjacent L/O to correct the route and are meeting with the adjacent L/O's to acquire rights**.** • **5/4/2018** - Still working with L/Os and reviewing alternatives. • **5/11/2018-** Still have an issue with the route. One neighbor has signed to fix part of the issue, but the other neighbor, documents are still in process. • **5/18/2018**- Still processing documents. • **5/25/2018**- the route has been corrected but this is still being negotiated • **6/8/2018**- Still being negotiated. • **6/15-29/2018-** MVP is coordinating with the attorney to come to an agreement.

Tract ID	Spread / Facility	Station/ MP	Date of Concern	Date of Resolution	Issue and Resolution
VA-MO-025	Spread H	237.3	3/20/2018	Pending	• **7/6/2018-** Lead land agent is still waiting on responses from the attorneys. • **7/13/2018-** Lead land agent is still waiting on responses from the attorneys. • **7/20/2018-** Pending legal's response. • **7/27/2018-** Pending legal's response. • **8/3/2018-** Pending legal's response. • **8/10/2018**- Waiting for negotiation/litigation results to proceed with acquisition. • **8/17/2018-** Currently being negotiated. • **8/24/2018-** Pending update on progress of negotiation. • **8/31/2018-** Pending update on progress of negotiation. • **9/7/2018-** Pending update on progress of negotiation. • **9/11/2018-** The L/O has signed the documents regarding the new route. Pending on the neighbor's signature. • **9/21/2018- O**ffice received the signed agreement. • **9/28/2018-** Pending.
VA-MO-057	Spread G	227.3	6/1/2018	Pending	**Issue:** Rocks slid off the ROW 100' to 150' down the slope. **Resolution:** EI, Land and FERC are working on a plan to either retrieve the rock or compensate the L/O. • **6/8/2018**- No further update. • **6/15/2018-** Agent met with the L/O and could not travel to the affected area due to construction clearing/grading nearby. Agent will return in a couple days to review. • **6/22/2018-** Met to discuss with foreman from Precision. • **6/29/2018-** No update from Precision. • **7/6/2018-** Land agent is waiting on photos of documentation of the cleanup efforts to present to the L/O. • **7/13/2018-** Agent received pictures of the cleanup efforts on the L/O property and sent them to the L/O to review. • **7/20/2018** – No update from land agent.

Tract ID	Spread / Facility	Station/ MP	Date of Concern	Date of Resolution	Issue and Resolution
VA-MO-057	Spread G	227.3	6/1/2018	Pending	• **7/27/2018** – No update from land agent. • **8/3/2018** – No update from land agent. • **8/10/2018**- Documents are being generated for sediment area and ATV/footpath access road. • **8/11/2018-** Total compensation amount was decided, and new exhibits are being generated. • **8/24/2018**- Documents need to be signed by the L/O. • **8/31/2018**- Pending update. • **9/7/2018-** Pending update. • **9/11/2018**- Waiting on documents to be generated. • **9/18/2018-** Exhibit was created for the sediment/rock off the ROW that was disturbed. • **9/28/2018-** Agent is to have new exhibit signed.
VA-GI-008	Spread G	198.7	7/27/2018	Pending	**Issue:** There is a large amount of rock that was installed off ROW in the pasture and in the horse pasture across from the house. The L/O's chicken coop was flooded. Vehicles parked in their driveway had a lot of gravel and rocks piled next to them as well. The L/O wanted to get a "Class A" contractor to fix the road. **Resolution:** The land agent informed him that he could not do that since the road is our easement and that we will fix it after looking at on Monday. He denied any access off ROW to retrieve the rocks or to do any work but is expecting the road to be fixed. • **7/29/2018-** The road has been in the process of being fixed since July 27th. Since the agent last checked, they made it past the double silver gates near the house and are up to the first turn. They dug out the ditch on the right-hand side and have laid out more stone and reworked the stone that was left on the ROW. The stone that went off the ROW, the L/O gathered and re-spread elsewhere on the property. • **8/10/2018**- The road is currently being worked on. If it rains hard again, the same issue could occur. • **8/12/2018-** Road and the property flooded again. • **8/14/2018-** Land agent assessed property and sediment drained down into the creek. PPL started the re-grading and sloping of the road towards the ditch. They plan to cut water diversions and water bars into the road once its sloped.

Tract ID	Spread / Facility	Station/ MP	Date of Concern	Date of Resolution	Issue and Resolution
VA-GI-008	Spread G	198.7	7/27/2018	Pending	• **8/24/2018-** PPL is still working on the road. There is still no approval to retrieve sediment that is off the ROW. • **8/29/2018**- Agent emailed the L/O's attorney to follow up on the status of the sediment retrieval letter. • **9/7/2018-** No further erosion of the access road. The land agent still has not heard back from the attorney giving approval to retrieve sediment but will be getting in touch with them this week. • **9/12/2018-** Land agent attempted to get permission to install super sacks off the LOD to prevent erosion, but L/O would not provide written permission. Land agent is contacting the attorney. • **9/15/2018-** The L/O's attorney gave approval to have the super sacks installed and they were to be installed the next day. As for the sediment off the ROW, the attorney said we must better define the locations. • **9/28/2018-** The road has held up and has not been washed out. The L/O wants the super sacks removed and silt fence installed.
VA-FR-5493	Spread I	266	8/27/2018	Pending	**Issue:** Agent met with the L/O and the L/O stated that 6 or 7 stumps have not been removed after clearing was completed. L/O wants stumps removed. **Resolution:** Agent is to discuss with management. • **9/5/2018-** Construction would like to wait to pull stumps during restoration process which is fine by the L/O. Land agent is to meet with the L/O to sign sediment retrieval form. • **9/11/2018-** Land agent met with the L/O to explain the sediment retrieval process and the L/O agreed to sign the sediment retrieval form. • **9/20/2018**- Pending update. • **9/22/2018-** Pending.

APPENDIX E

VARIANCE CONDITIONS

None.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 47

February 21, 2023

Preserve Giles County
PO Box 302
Newport, VA 24128

POWHR
Protect Our Water, Heritage, Rights
PO Box 809
102 Progress St.
Pembroke, VA 24136

January 28, 2021

Federal Energy Regulatory Commission
c/o Ms. Kimberly D. Bose, Secretary
888 First Street, N.E.
Washington, DC 20426

Virginia State Water Control Board
Department of Environmental Quality
1111 East Main Street, Suite 1400
P.O. Box 1105
Richmond, Virginia 23218

Re: Mountain Valley Pipeline, LLC Docket No. CP16-10-000

Members of the Commission and the Virginia State Water Control Board,

Preserve Giles County and Protect Our Water, Heritage, Rights (POWHR) submit the attached Notice of Alert regarding the U.S. Forest Service's Plan of Development for Mountain Valley Pipeline's work within Spread G in Giles County.

The revised Plan of Development[1] made a drastic change in the way Mountain Valley could gain access to the crossing of the Appalachian Trail at the top of Peter's Mountain. Rather than using the Forest Service Road known as Pocahontas Road, the change requires Mountain Valley to utilize State and private roads and lands to gain access to its Right of Way (ROW) up the side of Peter's Mountain.

The new access route is rife with hazards to human life, destruction of landowner property, public access to homes and businesses, and certain sedimentation in Kimballton Branch, a headwater to Stoney Creek, home to the endangered Candy Darter.

We call on FERC and VDEQ to greatly enhance their monitoring resources to provide constant **daily** surveillance of MVP's work in order to prevent and control both the safety hazards and the devastating sedimentation impacts to Kimballton Branch and Stoney Creek. By shifting this access route from Forest Service to public and private land, MVP's Plan of Development creates a more hazardous situation which should receive enhanced scrutiny before any work is approved.

Thank you for your prompt and serious attention to this critical situation.

Respectfully,

Donna S. Pitt
Preserve Giles County

Russell Chisholm
Protect Our Water, Heritage, Rights

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[1] U.S. Forest Service Record of Decision, Region 8, Jefferson National Forest, R8 MB-159, January 2021, Mountain Valley Pipeline and Equitrans Expansion Project, Giles and Montgomery Counties, Virginia, Monroe County, West Virginia.

NOTICE of ALERT to FERC and VADEQ
for
Mountain Valley Pipeline Spread G in Giles County on Peters Mountain

Changed Use of the MVP Right-of-Way Approaching Jefferson National Forest Boundary Requires Heightened Oversight by FERC and VADEQ Environmental Inspectors

On January 11, 2021, the U.S. Forest Service issued a Record of Decision that approves a new Plan of Development for the Mountain Valley Pipeline Project in the Jefferson National Forest (JNF). One major change has been the abandonment of the Forest Service's Pocahontas Road as an Access Road to the MVP Right-of-Way (ROW) on the national forest land.

All MVP personnel, vehicles, construction equipment and materials will now be transported to the JNF and its construction ROW up to the bore pit near the top of Peters Mountain using the MVP ROW through private property immediately downslope of the JNF boundary and Mystery Ridge. The affected ROW is from approx. MP 197.9 to 198.9. Access to the ROW will be via Rogers Road (a one-lane dirt and gravel road) and across an Access Road easement.

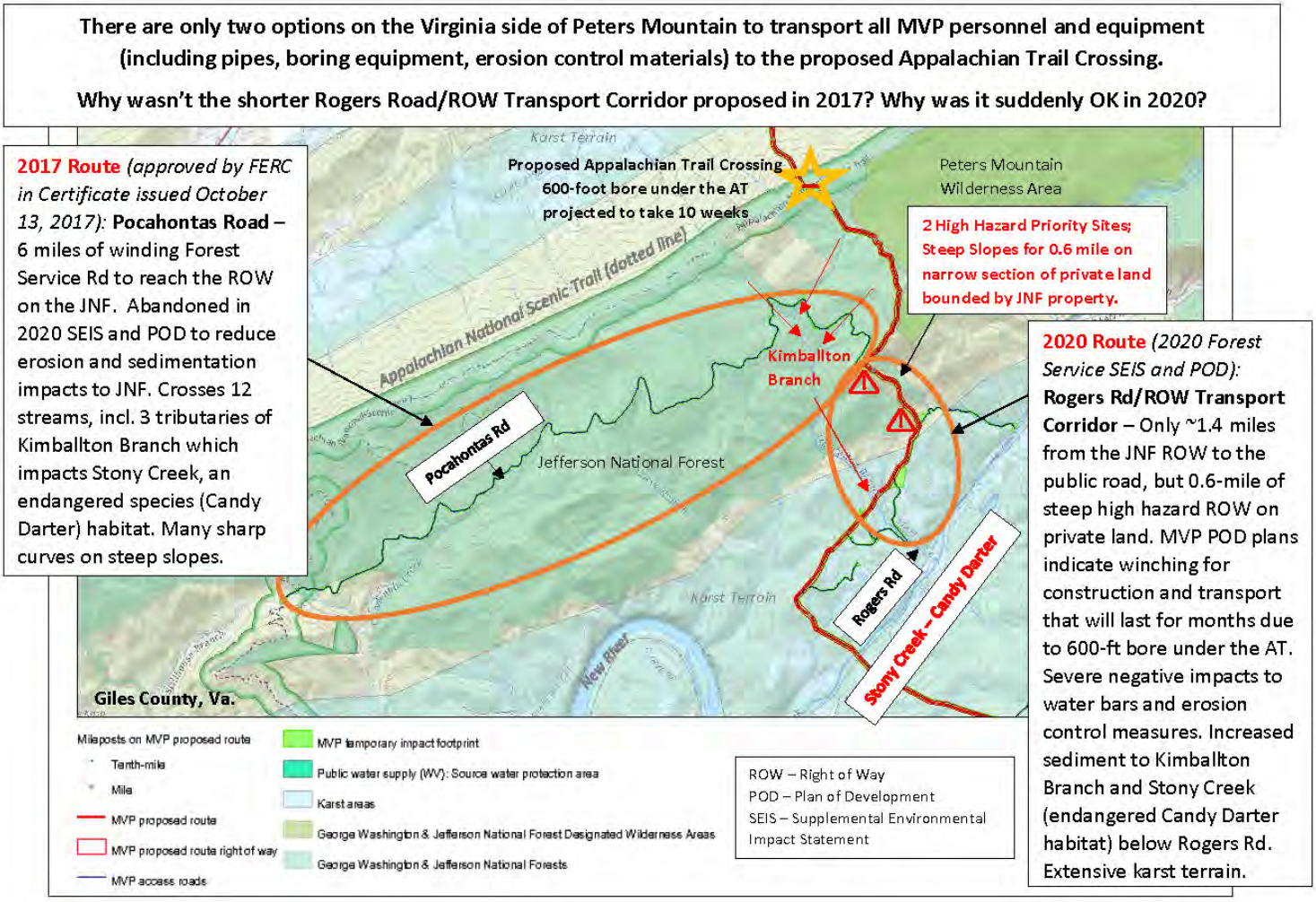
It is imperative that FERC and VADEQ environmental inspectors focus significant *daily* resources on this area to prevent serious environmental violations and safety hazards on and approaching the MVP ROW via Rogers Road in the Kimballton/Goldbond area near Pembroke, Va. This use change will create potentially devastating sedimentation impacts to Kimballton Branch and the stream it flows into, Stony Creek, which has been identified as one of the few and best remaining habitats of the endangered Candy Darter. Much of Kimballton Branch and all of Stony Creek in this area are located in karst terrain.

MVP's "solution" for the Forest Service has not eliminated severe sedimentation impacts – it has simply shifted them to private lands outside the JNF boundary and increased their negative impacts on Stony Creek and the endangered aquatic resources it supports.

One question looms large: Why didn't MVP choose the shorter, more direct Rogers Road alternative in 2017? When you compare the only two options for access and transport to the top of Peters Mountain in Virginia (see Figure 1): Why did MVP prefer to undertake the permit hassles of using the 6-mile Pocahontas Road on Forest Service land? Clearly, MVP must have seen significant problems with the route they are now planning to use.

MVP's 2020 Forest Service Plan of Development (POD) has changed the access/transport route on Peters Mountain with no evidence that negative impacts outside the JNF boundary were evaluated or considered. We believe that this change endangers both lives and the environment. We further believe that if both of these routes had been *adequately* evaluated in 2017, MVP's proposed route over Peters Mountain at this location would not have been approved.

Figure 1. Comparison of MVP's Virginia Access/Transport Options to the Appalachian Trail Crossing.



Preserve Giles County and the POWHR coalition urgently call on the FERC and VADEQ to ensure that both agencies will commit the resources required to hold MVP to full compliance with its permit requirements to control erosion *and* to hold MVP accountable for its violations when those safeguards fail. As described more fully in our Conclusion and Requests, this includes:

- Requiring MVP to submit revised construction and erosion control plans that reflect the radically changed use of a designated high hazard area;
- Restricting MVP's contractors to proceed no further or faster than adequate erosion controls can be installed each day; and
- Committing to daily FERC/DEQ inspections in response to the higher amount and duration of construction traffic that this ROW access/transport corridor will be required to sustain.

Following is a summary of several identified issues, most of which were reported to the Forest Service in the November 9, 2020 comment by The Wilderness Society et al. on the Draft SEIS.[1]

Note: Several maps that accompanied The Wilderness Society (TWS) comment as Exhibits are included in full as Attachment 1: See TWS VII.A.2 Exhibit 1 for a close-up of the Rogers Road/ROW area. Attachment 2 includes aerial photos of the Access and ROW area taken by Mountain Valley Watch, showing the current status of the ROW in this area with trees felled but not cleared.

FACTS AND ISSUES

1. **As an Access/Transport corridor, the non-JNF ROW between MP 197.9 and MP 198.9 will bear a dramatically increased traffic load.** The new access/transport ROW corridor must now be used to transport all construction vehicles, pipes, and personnel to and from the construction corridor on the JNF, including the equipment needed for a 600-foot conventional bore under the AT on the Peters Mountain ridge, as proposed in MVP's plans.

2. **The non-JNF Access/Transport ROW corridor will need to remain open to traffic for months, potentially during late winter and early spring months typically marked by frequent and extreme precipitation events.** According to the MVP Historic Property Treatment Plan recently filed with FERC, "The work required to bore under the ANST Historic District (and associated noise and dust) is expected to last approximately 10 weeks."[2] Coupled with the increased daily load, the length of time the ROW will have to remain exposed with temporary ESCs will severely increase the amount of sediment-laden run-off in an area already identified as susceptible due to extreme steep slopes.

3. **Steep slopes and "high hazard" features create the conditions for a safety and environmental nightmare.** Immediately below the JNF boundary, MVP plans to use winching construction techniques for more than half a mile of steep slopes where they will now need to repeatedly transport personnel, pipes, and equipment. Slopes range up to 74% as shown in Attachment 1, TWS VII.A.2 Exhibit 2.[3] This area is further challenged by two "high hazard sites" that were identified by Forest Service staff in October 2016.[4] The locations were among six representative sites selected because "they appear to present a high risk for slope failure, slippage, and erosion/sedimentation." A third high hazard site is at the bore pit at the top of Peters Mountain. *(See Attachment 1, TWS Comment Section VII.A Exhibits: 3.a MVP Priority (High Hazard) Site Overview map; 3.b, Slope Map of Priority Site #1 at the base of the steep segment;*

[1] The Wilderness Society (TWS) et al. comment to USFS on DSEIS, Section VII.A.2, pp. 50-61. USFS Reference #50036-2783-3207. FERC Accession No. 20201112-5199.
[2] MVP Historic Property Treatment Plan, Appalachian National Scenic Trail Historic District (021-5012), p. 8. Accession No. 20201210-5005.
[3] MVP 2020 Plan of Development (POD), Appendix B, pp. B-1, B-3. [See Attachment 1: TWS VII.A.2, Exhibit 2]
[4] USFS, "Request for Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Route of the proposed Mountain Valley Pipeline Project in the Jefferson National Forest. File Code 1900;2720, October 24, 2016.

and 3.c, Slope Map of Priority Site #4 at the top of the steep segment where the ROW turns and enters the JNF.)[5]

4. **MVP's proposed mitigation measures for the two high hazard areas – which include reducing time of exposure and installing more frequent trench breakers – will be undermined by the ROW's changed use to serve as the sole access/transport route to the JNF on Peters Mountain.** MVP's measures as described in the proposed plans for High Hazard sites include: "constructing in a timely fashion to reduce the amount of time the LOD is exposed to the elements and not under final grade; and installing additional trench breakers (minimum 25-ft spacing) in areas steeper than 65 percent slope and armoring the ground surface in steep areas with larger rocks from trench excavation."[6]

5. **Removing and restoring water bars (trench breakers) every day during the time required for ROW construction and boring under the Appalachian Trail will reduce the efficacy of the most important BMPs for controlling stormwater runoff on steep slopes.** The repeated shifting of water bars and tracking back and forth by heavy equipment will also dramatically increase soil disruption and compaction, creating worse conditions for later revegetation and restoration.

6. **Increased sedimentation impacts to Kimballton Branch after every rain will carry sediment-laden water across karst and directly to Stony Creek, less than 400 yards downstream from where MVP's Access Roads start from Rogers Road.** It is sadly ironic that the addition of the Candy Darter to the endangered species list in 2018 is the most notable environmental change between 2017 and 2020, together with the increasing trend of unpredictable high-intensity precipitation events. Both of these factors should argue even more forcefully against using the Rogers Road / MVP ROW combination as an access/transport corridor to the JNF.

   As shown in Figure 1, Kimballton Branch will bear the brunt of MVP's failed ESCs, from its headwater tributaries close to MVP's bore pit atop Peters Mountain at MP 196.4, to its crossing by the ROW at MP 199.5, to its run next to and under Rogers Road before entering Stony Creek. Much of this will be in karst terrain, including where Stony Creek itself will be crossed by the MVP at MP 200.4.

7. **Karst features have already been documented in Stony Creek near the entry point of Kimballton Branch about 200 yards above the Gravely Hill Road bridge.** FERC's Compliance Monitor report for 12/28/20 states: "In Spring 2019 numerous non-Project related sinkholes developed within the banks of Stony Creek in this general location. Both sandbag locations are above the Gravely Hill Road bridge. This is the same location as the uppermost sinkhole documented in 2019. … [T]wo recent sandbagged locations are hydraulically connected by a small channel off the left bank. Sinking waters at the upstream sandbagged location caused bank failure."[7]

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[5] MVP 2020 POD, Appendix G, Figures 1, 2, 17. [See Attachment 1: TWS VII.A.3 Exhibits 3a., 3b., 3c.]

[6] MVP 2020 POD, Appendix G, "Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions …," pp. G-10, G-30.

[7] Environmental Compliance Monitoring Program, December 27, 2020 - January 2, 2021 Summary Report, p. 3, Accession No. 20210115-4000.

8. **VADEQ expressed specific concerns about karst and sedimentation in its comments on the Forest Service's Draft SEIS.**[8] (It is not clear that DEQ personnel were fully aware of the changed use of the ROW into an access route in this section below the JNF boundary. One VADEQ comment mentioned karst in relation to the Pocahontas access road in the JNF.)

    a. Correcting a DSEIS statement that no geologic formations associated with karst are present in the affected areas of the JNF, the DEQ commenter said: "[T]here are limestone units underlying sections of the NFS land on Peters Mountain where trees have reportedly been felled but no other land disturbing activities have yet to occur." The comment goes on to point out the "**chance of subsurface routing of overland flow and [that] enhanced erosion controls devices should be utilized in this section."** [emphasis added here and below]

    b. "Additionally, although the NFS land does not quite extend downslope on Peter's Mountain to the main karst forming Knox Group carbonate units (although the JNF boundary does at approximately 199.5), **any storm flow and sediment generated from NFS land that overwhelms erosion control devices in this region will likely flow downhill onto and into these karst units known to have substantial and rapid subsurface flow paths in Giles County."**

    c. Under "Recommendations", the DEQ commenter noted: **"MVP is highly encouraged to err on the side of overbuilding erosion control devices in this steep region** … to prevent short term surface water and ground water impacts that could be caused by the type of intense storms that plagued its earlier work and resulted in impacts to groundwater."

CONCLUSION AND REQUESTS

Preserve Giles County and the POWHR coalition urgently call on the FERC and VADEQ to ensure that both agencies will commit the resources required to hold MVP to full compliance with its permit requirements to control erosion *and* to hold MVP accountable for its violations when those safeguards fail.

We urge you to put into place the following reasonable and minimum requirements:

1. **FERC and VADEQ preparations for inspection and oversight must begin BEFORE construction is allowed to proceed.** Given MVP's history of rushed slipshod construction followed by repeated requests for variances and modifications to try to remediate ESC failures, once construction starts it will be too late.

2. **MVP must submit site-specific construction and erosion control plans for MPs 197.9 to 198.9 based on the radically changed use of this segment and the extended duration that this transport corridor will remain exposed.** As the DEQ commenter recommended – and as every citizen monitor and MVP, FERC, and DEQ/DEP environmental inspector can attest – "err on the

[8] From the USFS MVP Final SEIS, December 2020, Appendix D-Agency Correspondence, pp. 275-276.

side of overbuilding erosion control devices in this steep region." It should not be taken for granted that MVP will do this of its own accord. Has MVP provided DEQ with erosion control and karst mitigation plans for this area based on the proposed usage? Were any special plans developed for the access road that runs close to at least one year-round residence situated on karst above Rogers Road? Revised plans that have been reviewed and approved by both FERC and VADEQ must be in place before the first tree is cleared or stump is pulled.

3. **Clearing and construction must not be allowed to outpace the installation of adequate erosion control measures. Contractors must not clear or disturb more ROW than can be stabilized and controlled in the same day**. MVP needs to make this clear to their contractor crews. Time and money saved in speed will be far more costly in the long run – to the environment and to MVP.

4. **FERC and VADEQ inspectors must inspect construction and enforce installation of erosion controls at the earliest stages of clearing**. As was learned the hard way in the first months of non-JNF construction in spring 2018, some of the worst runoff and sedimentation discharge will occur in the early stages of tree-clearing and ROW preparation before adequate control measures are in place.

5. **Inspectors must be present daily to ensure that control devices are installed and maintained properly.** This includes reinstalling all water bars at the end of each day after construction workers have left the upslope work areas; that is, all personnel working on the Virginia side to the top of Peters Mountain. MVP's 2020 Plan of Development that asserts that: "Construction and operations traffic will not be permitted to use FR# 972 Pocahontas Road, FR#11080 Mystery Ridge Road, or FR#188 Brush Mountain Road. Mountain Valley construction and operation personnel and equipment will be required to access the ROW via crossings from public roads."[9]

6. **Serious attention must also be given to MVP's access route and workspaces close to the ROW, as well as the approach to Rogers Road from Big Stoney Creek Road (Rte 635).** This involves sharp turns on narrow roads (Norcross Road and Gravely Hill Road), crossing Stony Creek on a one-lane bridge before reaching Rogers Road and another 90-degree turn. All will experience frequent heavy construction traffic and local traffic delays.

The access/transport alternative that MVP proposed and the Forest Service and Bureau of Land Management approved is dangerous – dangerous for surface and ground water resources and the aquatic life they support, for construction and operations personnel, and ultimately for the installed pipeline's integrity and the safety of neighboring residents and the community.

Members of Preserve Giles and other POWHR coalition organizations have argued from the start that the MVP route could not be safely constructed due to the cumulative hazards of this Valley and Ridge Province region – the steep terrain, slip-prone soils, extensive karst, and active seismic zone conditions that led karst expert Dr. Ernst Kastning to label it a "no-build" zone for pipelines of this

[9] MVP 2020 POD, p. 6-26.

size.[10] Now the Forest Service is guilty of sacrificing its shared watershed partners (impacting both private and public water resources) to accommodate an increasingly unnecessary 42-inch methane-gas pipeline project.

It is sometimes easy to do the right thing. It is just common sense for the FERC and the VADEQ to require that this unsafe, unexamined transportation alternative be built with the highest level of caution and oversight.

ATTACHMENTS:

1. Exhibits from The Wilderness Society Comment of November 9, 2020 to the U.S. Forest Service regarding the Draft Supplemental Impact Statement for the Mountain Valley Pipeline Project.

2. Aerial photos of the MVP Right of Way taken November 21, 2020, Mountain Valley Watch

[10] Kastning Report, 2016, Executive Summary, p. 1. Accession No. 20160713-5029.

ATTACHMENT 1

Exhibit 1: Multiple hazards on MVP's proposed ROW Access/Transport Route to JNF on Peters Mountain

TWS EXHIBIT Section VII.A.2, Page 53, appearing in text as
"Exhibit 1, an annotated map of the area . . . ."
(USFS Reference #50036-2783-3249)

Exhibit 2: FROM MVP-POD Appendix B—Detail Figures for Construction Techniques and Average Slopes

TWS EXHIBIT Section VII.A.2, Page 53, appearing in text as
"Exhibit 2"
(USFS Reference #50036-2783-3251)

Exhibits 3.a, 3.b, 3.c: High Hazard Site Map and Slope Maps

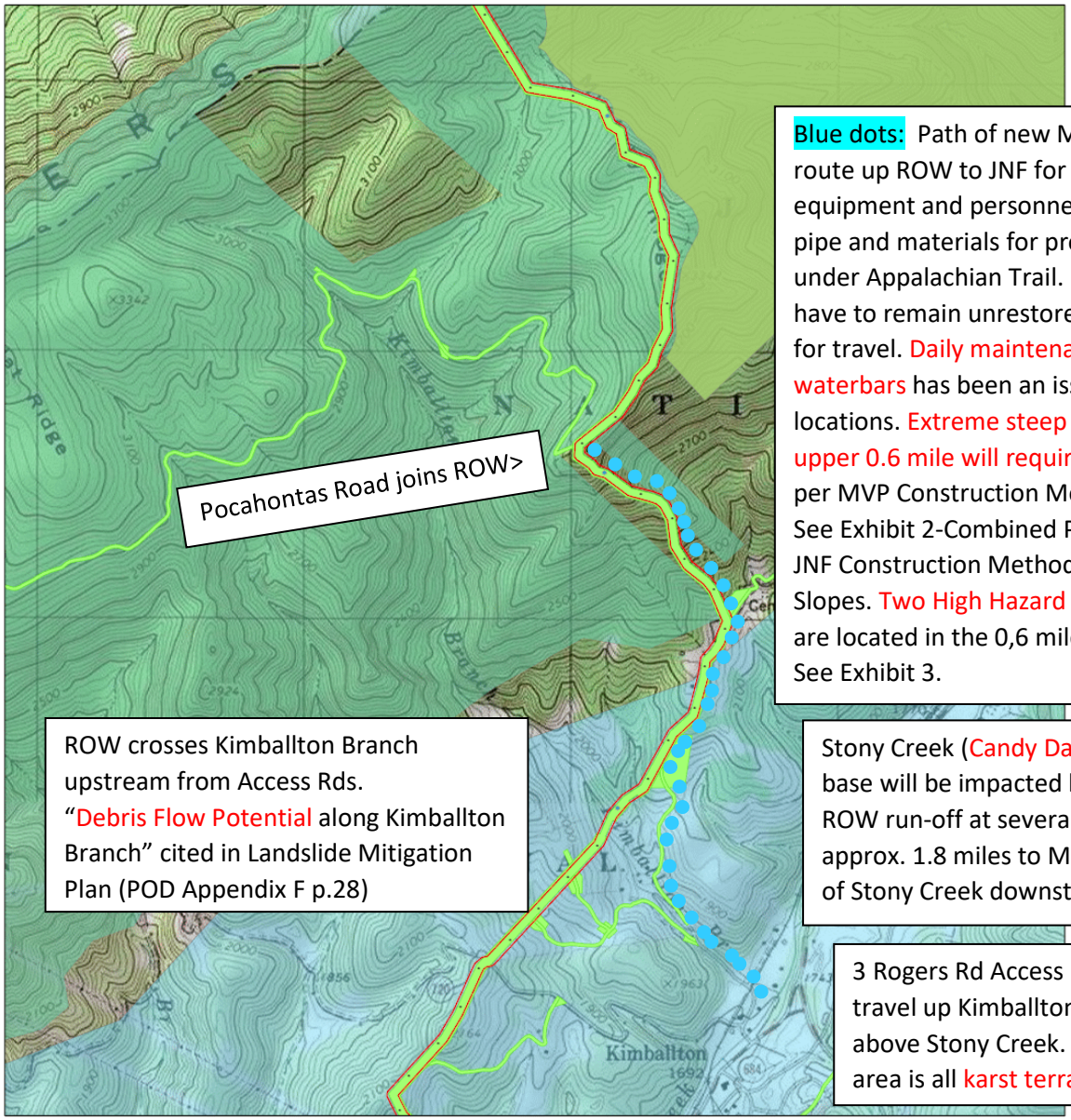
TWS EXHIBIT Section VII.A.3, Page 55, appearing in text as
"Exhibit for site map and slope figures . . . ."
(USFS Reference #50036-2783-3254)

SOURCE: Exhibits from The Wilderness Society et al.,
"Comment on the Mountain Valley Pipeline and Equitrans Expansion Project
Draft Supplemental Environmental Impact Statement (#50036)"
submitted to the US Forest Service, November 9, 2020
(USFS Reference #50036-2783-3207)

EXHIBIT 1

Multiple hazards on MVP's proposed ROW Access/Transport Route to JNF on Peters Mtn

MVP ROW Access Below Pocahontas Rd



Blue dots: Path of new MVP access route up ROW to JNF for all equipment and personnel, including pipe and materials for proposed bore under Appalachian Trail. ROW will have to remain unrestored and open for travel. Daily maintenance of waterbars has been an issue at other locations. Extreme steep slopes for upper 0.6 mile will require winching per MVP Construction Method plans. See Exhibit 2-Combined Peters Mtn JNF Construction Methods / Avg Slopes. Two High Hazard Priority Sites are located in the 0,6 mile segment. See Exhibit 3.

ROW crosses Kimballton Branch upstream from Access Rds. "Debris Flow Potential along Kimballton Branch" cited in Landslide Mitigation Plan (POD Appendix F p.28)

Stony Creek (Candy Darter) along base will be impacted by MVP ROW run-off at several points for approx. 1.8 miles to MVP crossing of Stony Creek downstream.

3 Rogers Rd Access Rds to ROW travel up Kimballton Branch just above Stony Creek. Blue shaded area is all karst terrain.

10/29/2020, 3:24:51 PM

1:18,056

0 0.15 0.3 0.6 mi

0 0.25 0.5 1 km

Mileposts on MVP proposed route

- Tenth-mile
- Mile
- MVP proposed route right of way
- MVP temporary impact footprint
- Karst areas
- George Washington & Jefferson National Forest Designated Wilderness Areas
- George Washington & Jefferson National Forests

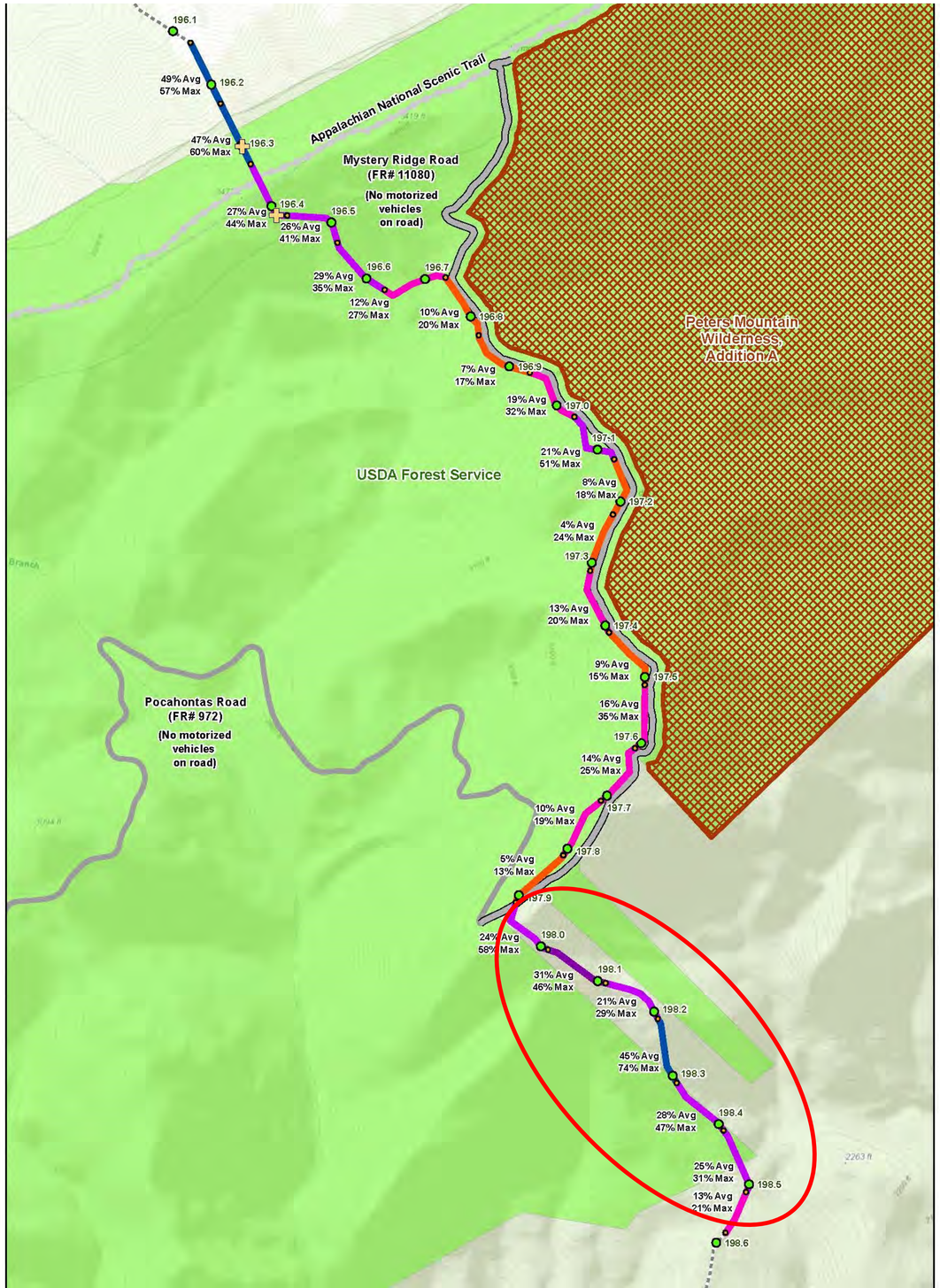
EXHIBIT 2

FROM MVP-POD Appendix B—Detail Figures for Construction Techniques and Average Slopes

MVP proposes to move all Construction Equipment onto the JNF using Access Points below MP 198.6.

Focusing on the more than half-mile ROW in the red ovals below, mostly outside the JNF but impacted by the FS decision:

1. Construction Method is “Down Slope with Winch”, meaning all pipes, equipment and crews will be winched up.
2. Slopes between MP 197.9 and MP 198.6 average more than 20% in each segment and range up to 74%.



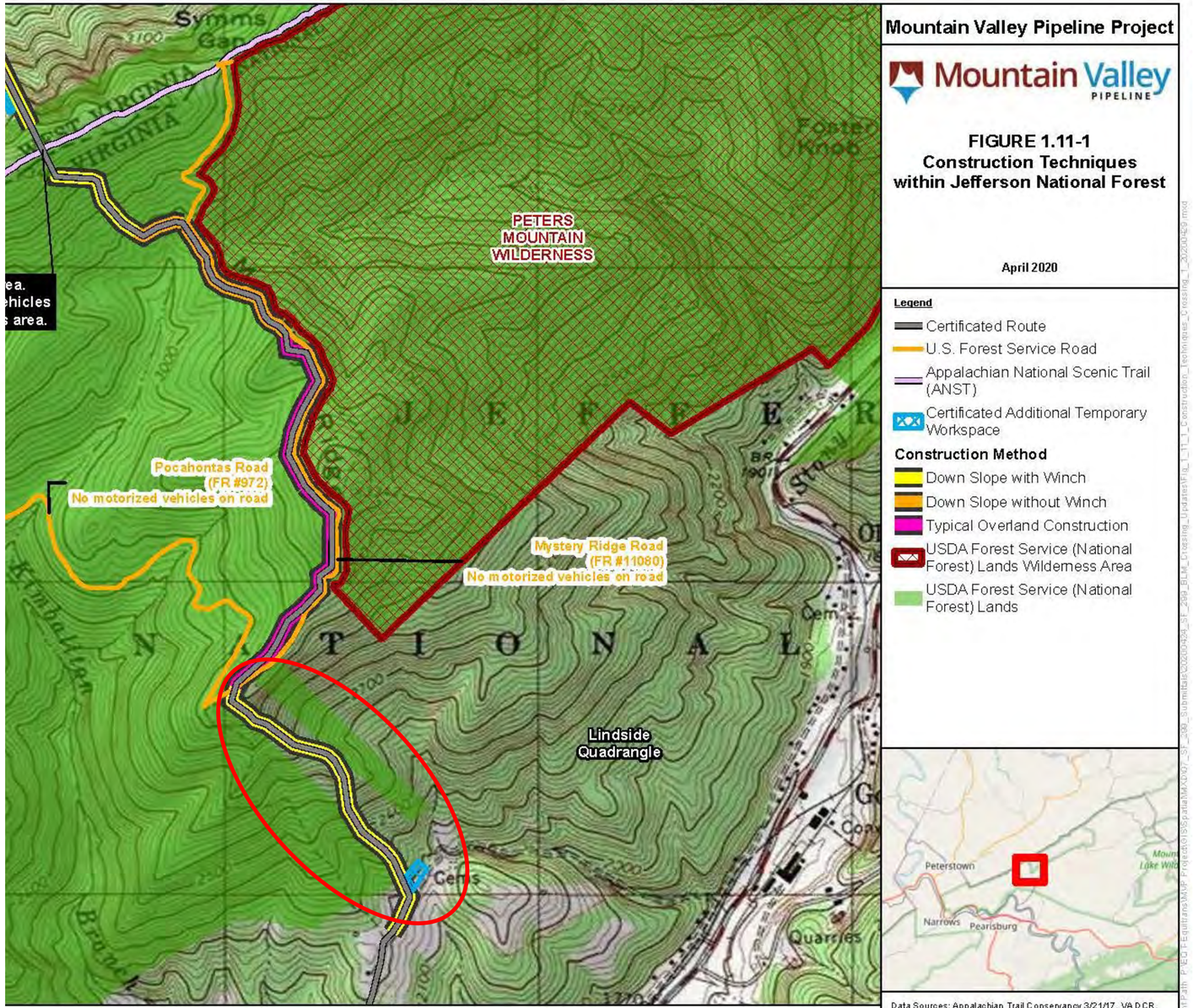


EXHIBIT 3.a

Priority ("High Hazard") Site Map – Excerpt of Peters Mountain Section

Sites #1 and #4 are located along the transport segment highlighted in Exhibit 2.
See Slope Maps for Sites #1 and #4 on the following pages.

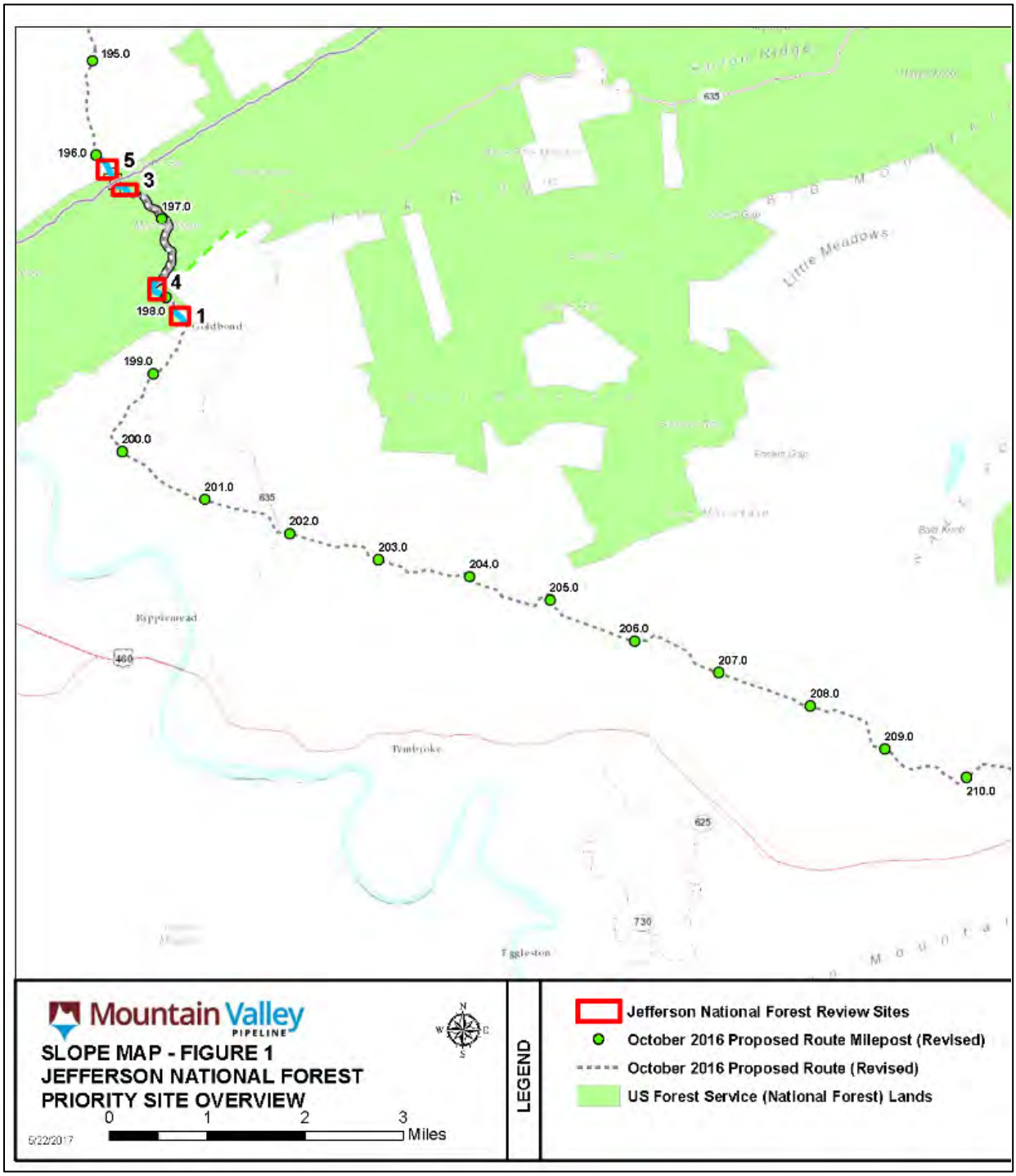


EXHIBIT 3.b

Priority Site #1 – Slope Map

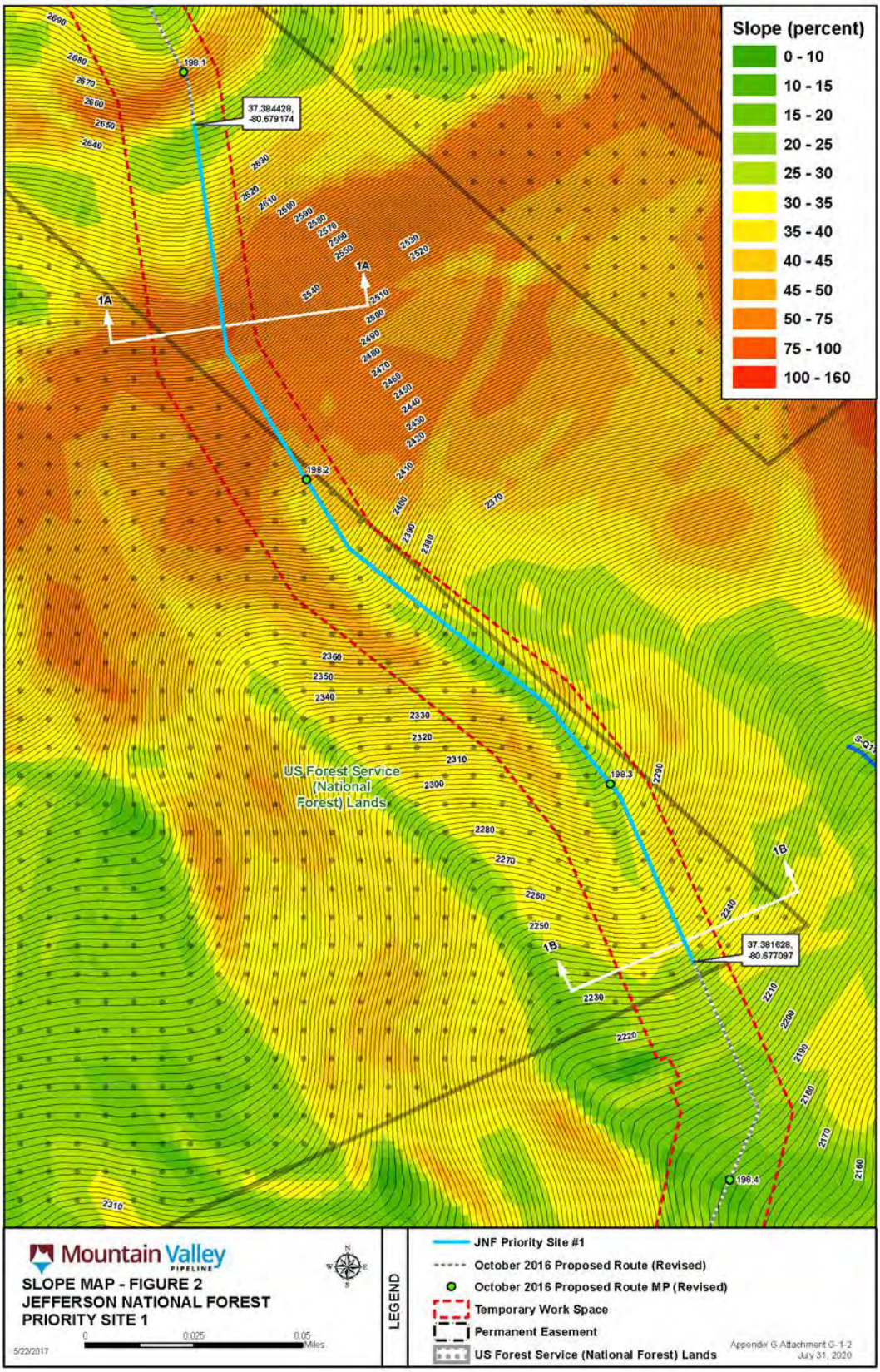
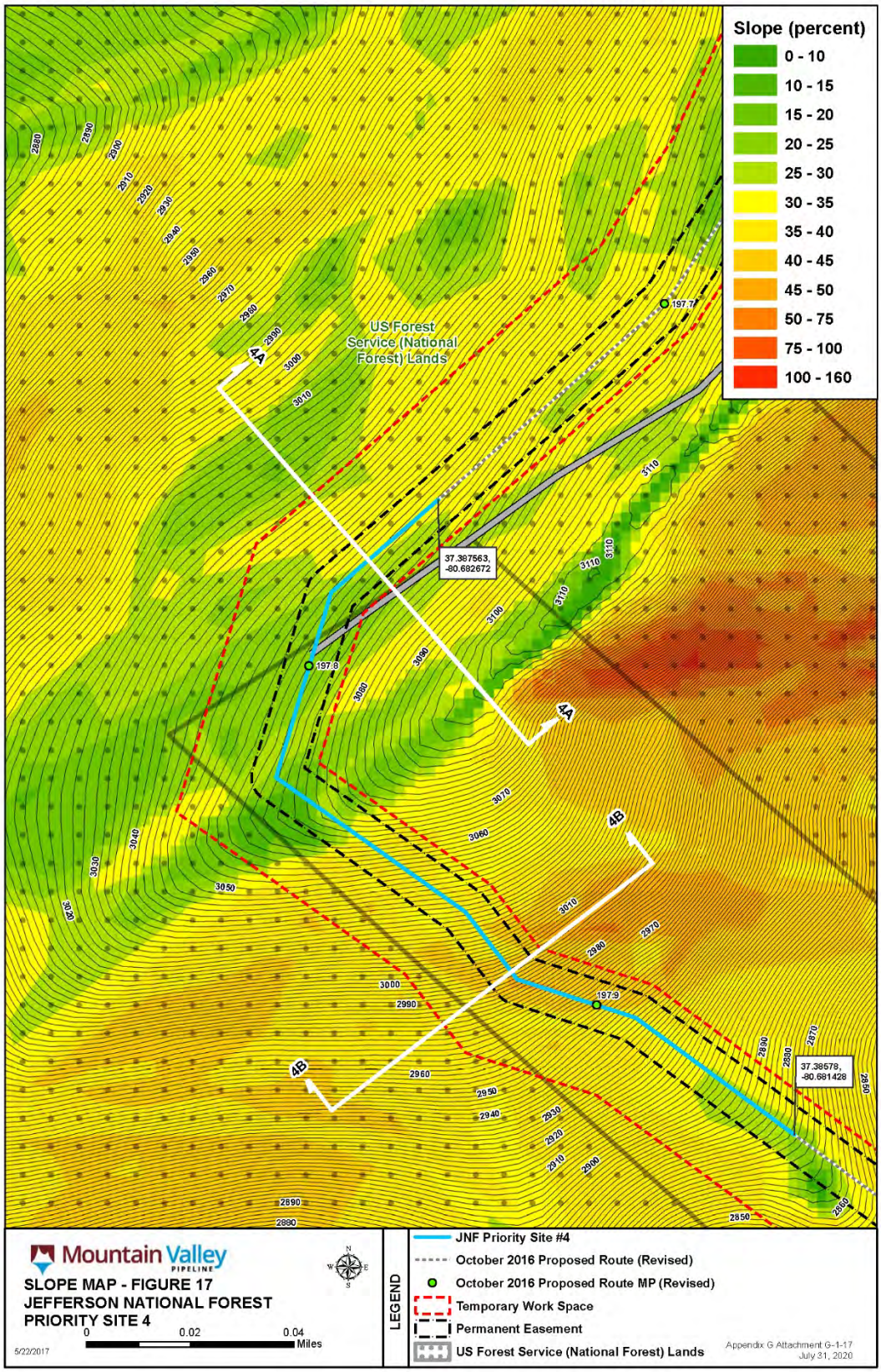


EXHIBIT 3.c

Priority Site #1 – Slope Map



ATTACHMENT 2

Aerial Photos of MVP's Rogers Road/ROW Transport Route
to JNF Right of Way
(Mountain Valley Watch photos, 11/21/2020)

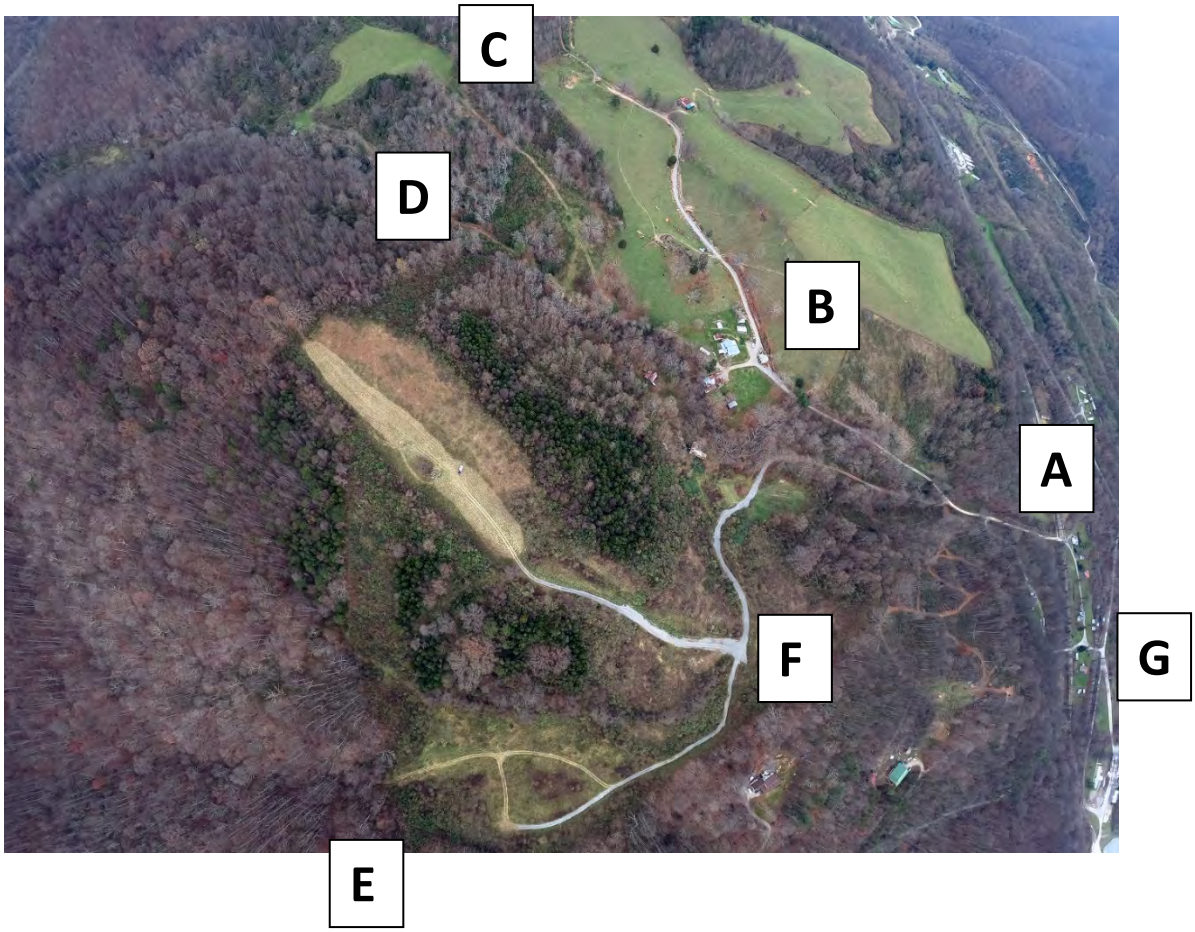
Aerial Photos of MVP's Rogers Road/ROW Transport Route to JNF Right of Way

(Mountain Valley Watch photos, 11/21/2020)

Use Links to view high-resolution photos.

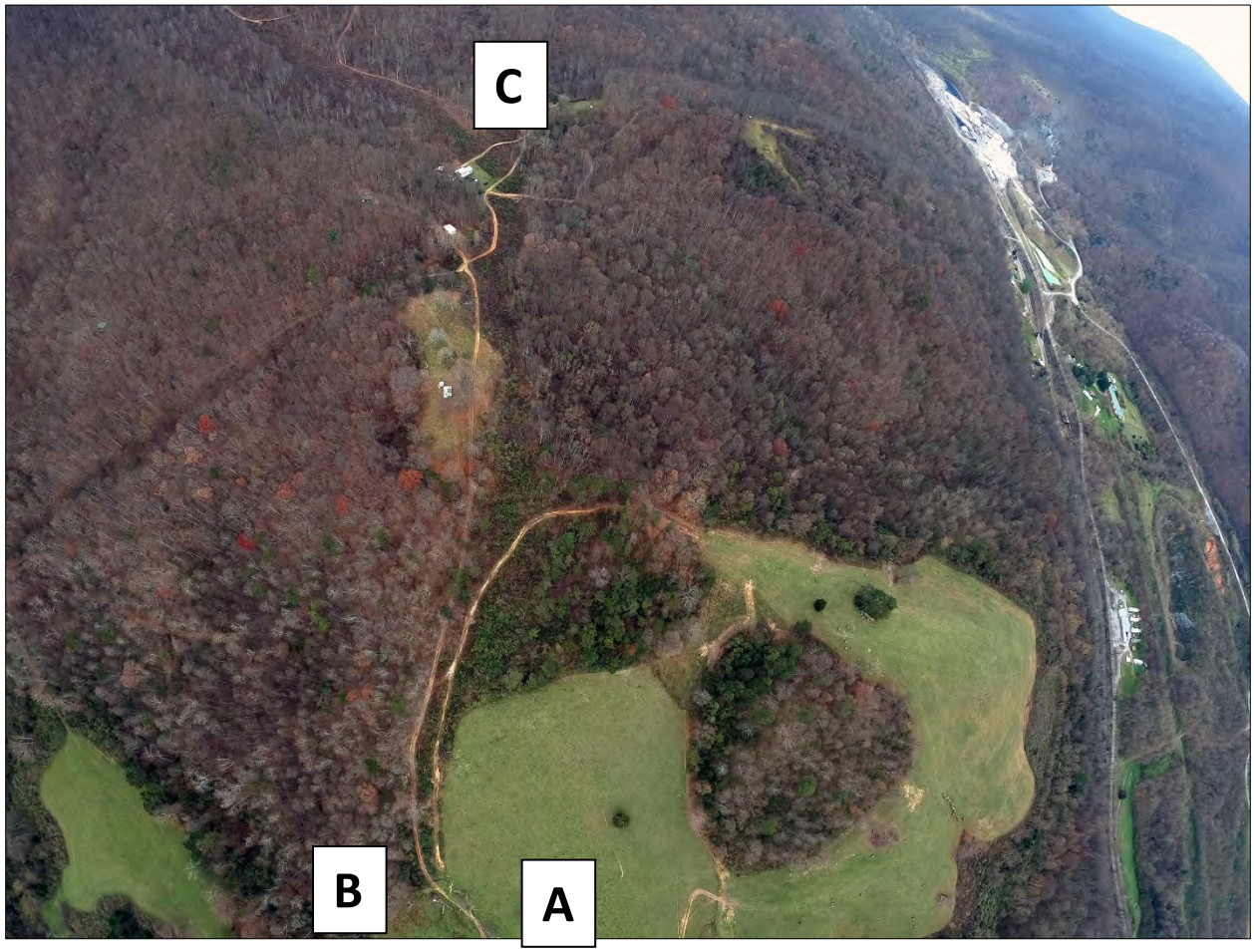
1. **Overview of area from Rogers Rd to MVP ROW entry on private lands. Entire area within a band of karst.**
   http://newrivergeographics.com/mvw/MVW20201121/G0023915.JPG

   A – Rogers Road.
   B – Access Road on private property runs very close to home.
   C -- Access Road enters the ROW at end of winding road in field to head toward JNF. Large workspace area planned in field to right of the ROW between MP 198.9 and 198.8.
   D – Kimballton Branch is crossed by ROW; Kimballton enters Stony Creek close to **A.**
   From C to E -- MVP ROW can be seen faintly as band of cut trees.
   F – Two more Access Roads MVP will use to get to the ROW below Kimballton Crossing.
   G – Gravely Hill Road Bridge over Stony Creek.



2. View from Access Road entry to ROW's turn uphill near High Hazard Site #1.
http://newrivergeographics.com/mvw/MVW20201121/G0023924.JPG

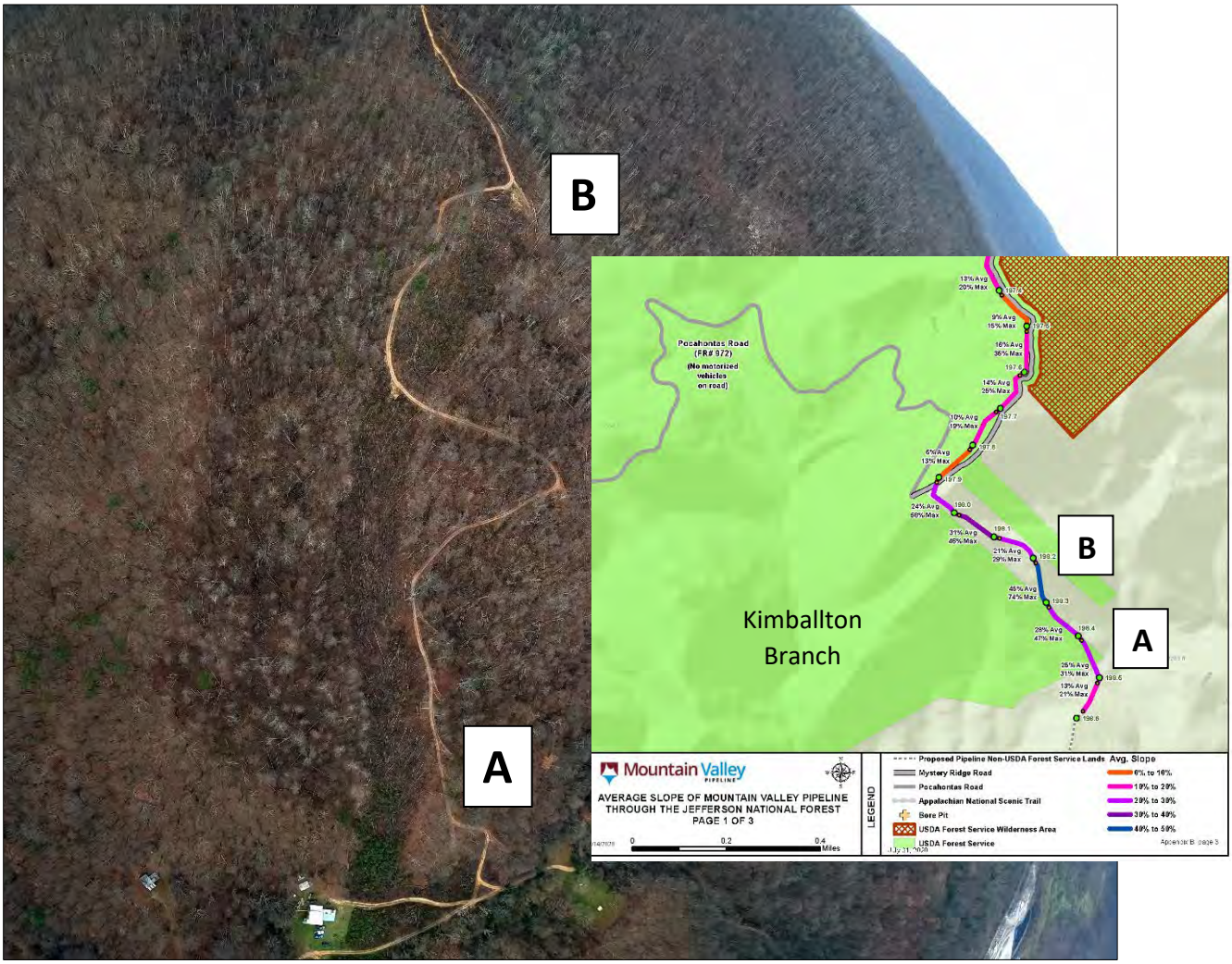
A – Large workspace area will be in field.
B to C – From the workspace entry the ROW runs close to cabins along an existing dirt trail before turning uphill beyond last white structure.
C – High Hazard Site #1 is in this vicinity near the bottom of the slope.



3. **High Hazard Priority Site #1 at base of 0.6-mile steep slope segment to JNF boundary**
http://newrivergeographics.com/mvw/MVW20201121/G0023931.JPG

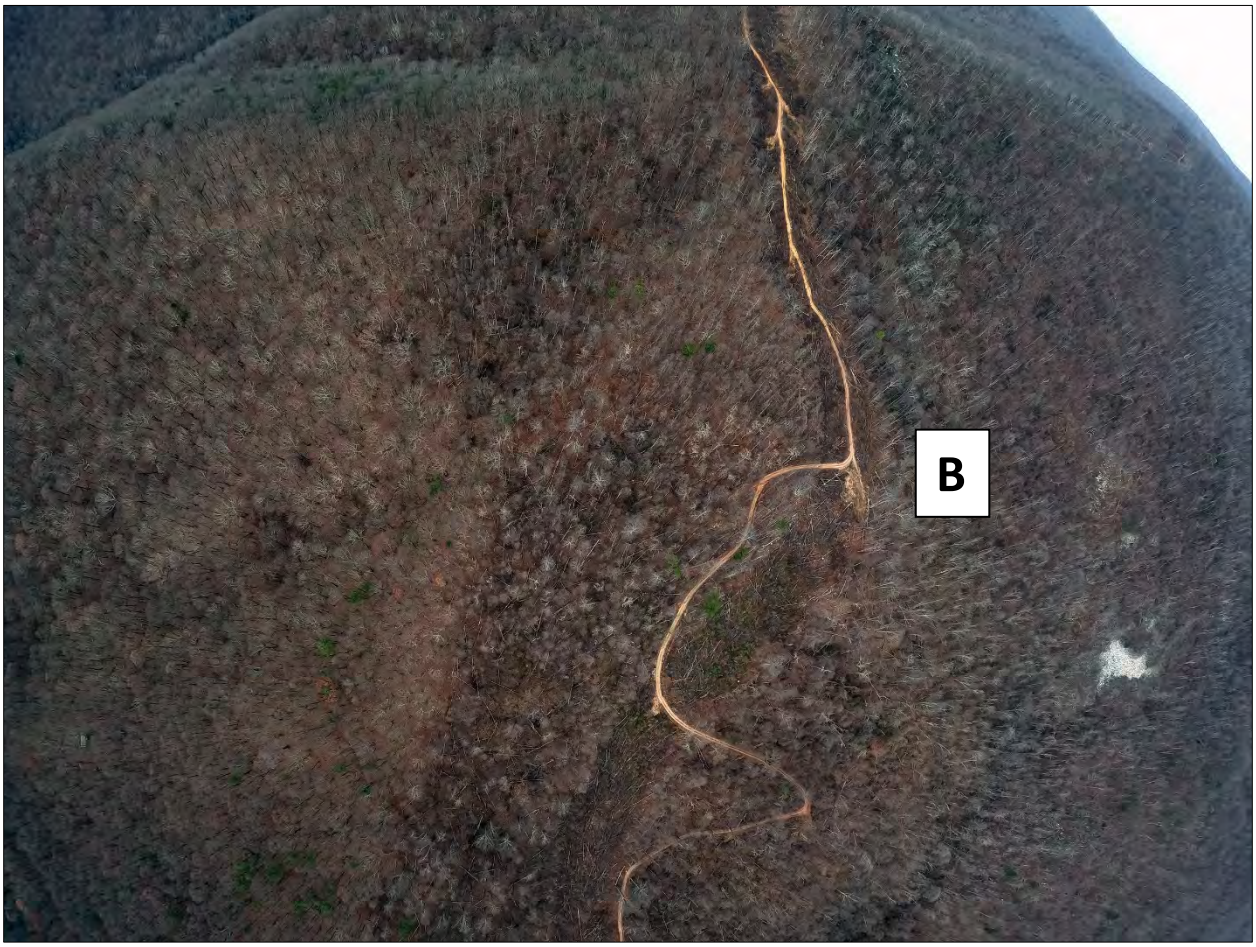
Inset detail from MVP's "Average Slope of MVP Through JNF" map shows approximate locations on photo (MVP 2020 Plan of Development Appendix B, p. 3). Kimballton Branch label is added to the MVP map. MVP's construction plans indicate winching for construction in the entire 0.6-mile segment (Appendix B, p. X).

A – Approximate location of High Hazard Site #1.
The ROW runs through a narrow parcel of private land with JNF on both sides. The ROW crosses back across a corner of JNF land near the bottom of the slope.
B – The steepest segment is at and below this bend in the ROW. For 0.1-mile, average slopes are 45%, going up to 74%. Erosion run-off can be seen from private ATV use in the ROW here and elsewhere.



4. Continued ROW between High Hazard sites.
http://newrivergeographics.com/mvw/MVW20201121/G0023933.JPG

B – Marks same location indicated in Photo 3 at top of steepest segment.

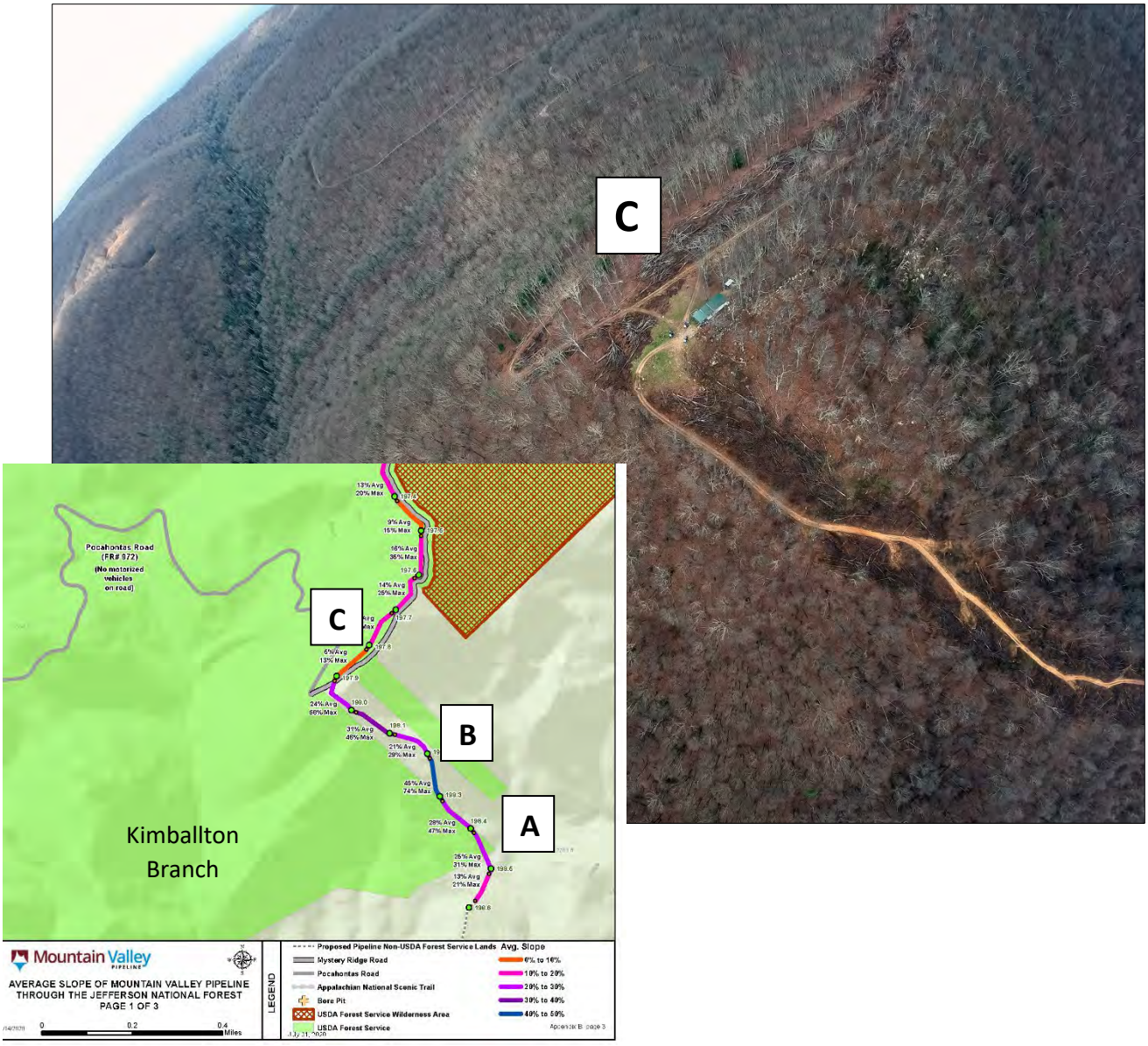


5. **High Hazard Priority Site #4, where ROW enters Jefferson National Forest.**
http://newrivergeographics.com/mvw/MVW20201121/G0023938.JPG

Inset detail from MVP's "Average Slope of MVP Through JNF" map repeated to show locations on photo.

C – Approximate location of High Hazard Site #4, where the ROW bears right continuing in the JNF. Pocahontas Road is seen approaching the same point from the opposite direction.

Structure on private land can be seen as extremely close to the ROW at this location, accessed by ATV trails.



The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 48

February 21, 2023

2200 Energy Drive | Canonsburg, PA 15317
844-MVP-TALK | mail@mountainvalleypipeline.info
www.mountainvalleypipeline.info

December 9, 2020

Mr. Andrew Downs
Regional Director
Appalachian Trail Conservancy Central and Southwest Virginia
5162 Valleypointe Parkway
Roanoke, VA 24019

Subject: **Mountain Valley Pipeline Project**
Historic Property Treatment Plan for the Appalachian National Scenic Trail Historic District (021-5012)
FERC DOCKET NO. CP16-10, WVDCH FILE# 15-67-MULTI, DHR FILE #2014 1194

Dear Mr. Downs,

On behalf of Mountain Valley Pipeline, LLC (Mountain Valley), a joint venture among EQM Midstream Partners, LP; NextEra Capital Holdings, Inc.; Con Edison Gas Midstream LLC; WGL Midstream; and RGC Midstream, LLC, you will find enclosed for your comment *Mountain Valley Pipeline Project*, *Historic Property Treatment Plan, Appalachian National Scenic Trail Historic District (021-5012)* dated November 2020.

As you know, as the lead federal agency for compliance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act (NHPA) for this undertaking, the Federal Energy Regulatory Commission (FERC) entered into a Programmatic Agreement (PA) with the Bureau of Land Management, National Park Service, U.S. Forest Service, U.S. Army Corps of Engineers, the Advisory Council on Historic Preservation, and the West Virginia and Virginia State Historic Preservation Offices—the West Virginia Division of Culture and History and Virginia Department of Historic Resources, respectively. Concurring parties to the PA relevant to the Appalachian National Scenic Trail (ANST) Historic District include the Giles County Board of Supervisors, the Appalachian Trail Conservancy, and Mountain Valley. Pursuant to Stipulations III.B.3 and III.B.4 of the executed PA, consultation regarding the determination and mitigation of effects for the Project for the ANST Historic District is ongoing.

The enclosed Treatment Plan documents Mountain Valley's efforts (to date) and provides a timeline and process for future efforts to coordinate with consulting parties to identify minimization and mitigation measures appropriate to address the Project's potential adverse effects to the ANST Historic District. The Treatment Plan also details minimization and mitigation measures, identified as a result of consultation conducted to date, designed to mitigate the adverse effects of the Project.

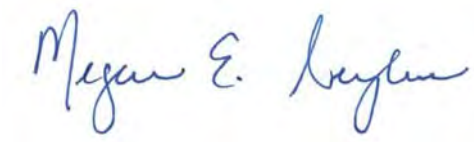
Please review the enclosed Treatment Plan under Stipulation III.B.3. in the executed Programmatic Agreement for the project. This Treatment Plan will also be filed with the FERC, the lead federal agency for the project. Per Stipulation IV.E., comments should be submitted to Paul Friedman at the FERC. He can be reached at:

Mr. Paul Friedman
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, D.C. 20426
(202)502-8059
Paul Friedman @ferc.gov

If you have any technical questions during your review, you may contact Evelyn Tidlow by telephone at (612) 812-5478 or by email at E.Tidlow@gaiconsultants.com, or Megan Neylon, Equitrans Midstream, by telephone at (724) 873-3645 or by email at MNeylon@Equitransmidstream.com.

Thank you for your attention.

Sincerely,



Megan Neylon
Environmental Manager

Enclosures: Historic Property Treatment Plan: Appalachian National Scenic Trail Historic District (021-5012)

cc:
Ms. Wendy Janssen, NPS
Mr. Joby Timm, USFS
Mr. Chris McKlarney, Giles County Board of Supervisors
Mr. Roger Kirchen, DHR
Ms. Susan Pierce, WVDCH
Mr. John Eddins, ACHP

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December 9, 2020

Mr. John Eddins
Advisory Council on Historic Preservation
1100 Pennsylvania Avenue NW, Suite 803
Washington, DC 20004

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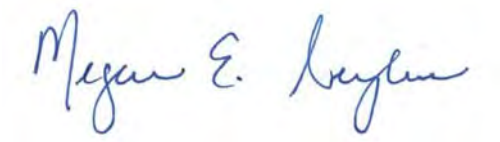

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Mr. Chris McKlarney, Giles County Board of Supervisors
Mr. Roger Kirchen, VDHR
Ms. Susan Pierce, WVDCH

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December 9, 2020

Ms. Wendy Janssen
Superintendent, National Park Service
Appalachian Trail Office
P.O. Box 50
Harpers Ferry, WV 25425

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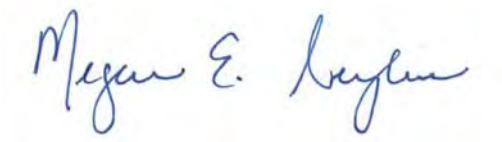

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December 9, 2020

Mr. Roger Kirchen
Virginia Department of Historic Resources
Division of Review and Compliance
2801 Kensington Avenue
Richmond, Virginia 23221

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FERC DOCKET NO. CP16-10, WVDCH FILE# 15-67-MULTI, DHR FILE #2014 1194

Dear Mr. Kirchen,

On behalf of Mountain Valley Pipeline, LLC (Mountain Valley), a joint venture among EQM Midstream Partners, LP; NextEra Capital Holdings, Inc.; Con Edison Gas Midstream LLC; WGL Midstream; and RGC Midstream, LLC, you will find enclosed for your comment *Mountain Valley Pipeline Project*, *Historic Property Treatment Plan, Appalachian National Scenic Trail Historic District (021-5012)* dated November 2020.

As you know, as the lead federal agency for compliance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act (NHPA) for this undertaking, the Federal Energy Regulatory Commission (FERC) entered into a Programmatic Agreement (PA) with the Bureau of Land Management, National Park Service, U.S. Forest Service, U.S. Army Corps of Engineers, the Advisory Council on Historic Preservation, and the West Virginia and Virginia State Historic Preservation Offices—the West Virginia Division of Culture and History and Virginia Department of Historic Resources, respectively. Concurring parties to the PA relevant to the Appalachian National Scenic Trail (ANST) Historic District include the Giles County Board of Supervisors, the Appalachian Trail Conservancy, and Mountain Valley. Pursuant to Stipulations III.B.3 and III.B.4 of the executed PA, consultation regarding the determination and mitigation of effects for the Project for the ANST Historic District is ongoing.

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Mr. Paul Friedman
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, D.C. 20426
(202)502-8059
Paul Friedman @ferc.gov

If you have any technical questions during your review, you may contact Evelyn Tidlow by telephone at (612) 812-5478 or by email at E.Tidlow@gaiconsultants.com, or Megan Neylon, Equitrans Midstream, by telephone at (724) 873-3645 or by email at MNeylon@Equitransmidstream.com.

Thank you for your attention.

Sincerely,

Megan Neylon
Environmental Manager

Enclosures: Historic Property Treatment Plan: Appalachian National Scenic Trail Historic District (021-5012)

cc:

Ms. Wendy Janssen, NPS
Mr. Joby Timm, USFS
Mr. Andrew Downs, ATC
Mr. Chris McKlarney, Giles County Board of Supervisors
Ms. Susan Pierce, WVDCH
Mr. John Eddins, ACHP

2200 Energy Drive | Canonsburg, PA 15317
844-MVP-TALK | mail@mountainvalleypipeline.info
www.mountainvalleypipeline.info

December 9, 2020

Mr. Chris McKlarney
County Administrator
Giles County Board of Supervisors
315 North Main Street
Pearisburg, VA 24134

Subject: **Mountain Valley Pipeline Project**
Historic Property Treatment Plan for the Appalachian National Scenic Trail Historic District (021-5012)
FERC DOCKET NO. CP16-10, WVDCH FILE# 15-67-MULTI, DHR FILE #2014 1194

Dear Mr. McKlarney,

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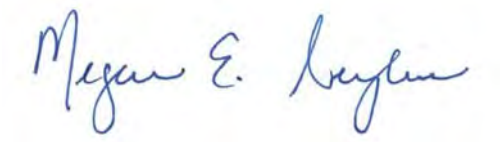

Megan Neylon
Environmental Manager

Enclosures: Historic Property Treatment Plan: Appalachian National Scenic Trail Historic District (021-5012)

cc:
Ms. Wendy Janssen, NPS
Mr. Joby Timm, USFS
Mr. Andrew Downs, ATC
Mr. Roger Kirchen, DHR
Ms. Susan Pierce, WVDCH
Mr. John Eddins, ACHP

2200 Energy Drive | Canonsburg, PA 15317
844-MVP-TALK | mail@mountainvalleypipeline.info
www.mountainvalleypipeline.info

December 9, 2020

Ms. Susan Pierce
Deputy State Historic Preservation Officer
West Virginia Division of Culture and History
1900 Kanawha Boulevard
East Charleston, West Virginia 25305-0300

Subject: **Mountain Valley Pipeline Project**
Historic Property Treatment Plan for the Appalachian National Scenic Trail Historic District (021-5012)
FERC DOCKET NO. CP16-10, WVDCH FILE# 15-67-MULTI, DHR FILE #2014 1194

Dear Ms. Pierce,

On behalf of Mountain Valley Pipeline, LLC (Mountain Valley), a joint venture among EQM Midstream Partners, LP; NextEra Capital Holdings, Inc.; Con Edison Gas Midstream LLC; WGL Midstream; and RGC Midstream, LLC, you will find enclosed for your comment *Mountain Valley Pipeline Project*, *Historic Property Treatment Plan, Appalachian National Scenic Trail Historic District (021-5012)* dated November 2020.

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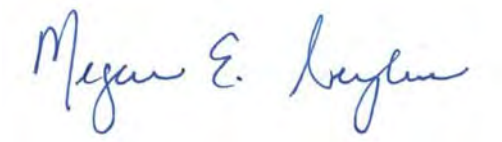

Megan Neylon
Environmental Manager

Enclosures: Historic Property Treatment Plan: Appalachian National Scenic Trail Historic District (021-5012)

cc:
Ms. Wendy Janssen, NPS
Mr. Joby Timm, USFS
Mr. Andrew Downs, ATC
Mr. Chris McKlarney, Giles County Board of Supervisors
Mr. Roger Kirchen, VDHR
Mr. John Eddins, ACHP

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www.mountainvalleypipeline.info

December 9, 2020

Mr. Joby Timm
Forest Supervisor
George Washington and Jefferson National Forests
5162 Valleypointe Parkway
Roanoke, VA 24019

Subject: **Mountain Valley Pipeline Project**
Historic Property Treatment Plan for the Appalachian National Scenic Trail Historic District (021-5012)
FERC DOCKET NO. CP16-10, WVDCH FILE# 15-67-MULTI, DHR FILE #2014 1194

Dear Mr. Timm,

On behalf of Mountain Valley Pipeline, LLC (Mountain Valley), a joint venture among EQM Midstream Partners, LP; NextEra Capital Holdings, Inc.; Con Edison Gas Midstream LLC; WGL Midstream; and RGC Midstream, LLC, you will find enclosed for your comment *Mountain Valley Pipeline Project*, *Historic Property Treatment Plan, Appalachian National Scenic Trail Historic District (021-5012)* dated November 2020.

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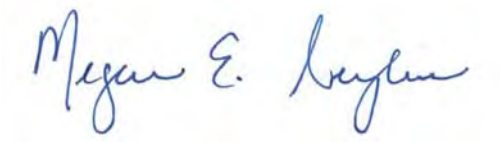

Megan Neylon
Environmental Manager

Enclosures: Historic Property Treatment Plan: Appalachian National Scenic Trail Historic District (021-5012)

cc:
Ms. Wendy Janssen, NPS
Mr. Andrew Downs, ATC
Mr. Chris McKlarney, Giles County Board of Supervisors
Mr. Roger Kirchen, DHR
Ms. Susan Pierce, WVDCH
Mr. John Eddins, ACHP

MOUNTAIN VALLEY PIPELINE PROJECT

HISTORIC PROPERTY TREATMENT PLAN
Appalachian National Scenic Trail Historic District (021-5012)

Monroe County, West Virginia and Giles County, West Virginia

DOCKET NO. CP16-10
WVDCH FILE #15-67-MULTI
DHR FILE #2014 1194

Prepared for

Mountain Valley PIPELINE LLC

2200 Energy Drive
Canonsburg, PA 15317

Prepared by

TETRA TECH

661 Andersen Drive, Suite 200
Pittsburgh, PA 15220

December 2020

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FIGURES

ATTACHMENTS

1.0 INTRODUCTION

1.1 Project Overview

Mountain Valley Pipeline, LLC (Mountain Valley) was issued a Certificate of Public Convenience and Necessity (Certificate) from the Federal Energy Regulatory Commission (FERC) on October 13, 2017, pursuant to Section 7(c) of the Natural Gas Act authorizing it to construct and operate the Mountain Valley Pipeline Project (Project) located in 17 counties in West Virginia and Virginia. The Project is an approximately 304-mile-long, 42-inch-diameter natural gas pipeline. Construction of the Project began in early 2017. After being suspended following a July 2018 order by the U.S. Court of Appeals for the Fourth Circuit vacating and remanding the Right-of-Way Grant issued for the crossing of federal lands and a Stop Work Order issued by the FERC, construction subsequently resumed in most areas outside of the Jefferson National Forest (JNF).

The FERC is the lead federal agency for compliance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act (NHPA) for this undertaking and entered into a Programmatic Agreement (PA) in December 2017 with the Bureau of Land Management, National Park Service (NPS), U.S. Forest Service (USFS), U.S. Army Corps of Engineers, the Advisory Council on Historic Preservation, and the West Virginia and Virginia State Historic Preservation Offices (SHPOs)—the West Virginia Division of Culture and History (WVDCH) and Virginia Department of Historic Resources (DHR), respectively. Concurring parties to the PA relevant to the Appalachian National Scenic Trail (ANST) Historic District include the Giles County Board of Supervisors, the Appalachian Trail Conservancy (ATC), and Mountain Valley. Pursuant to Stipulations III.B.3 and III.B.4 of the executed PA, consultation regarding the determination of effects for the Project for the ANST Historic District (DHR Site 021-5012) is ongoing.

This Treatment Plan documents Mountain Valley's efforts (to date) and provides a timeline and process for future efforts to coordinate with the relevant consulting parties to identify minimization measures appropriate to address the Project's potential adverse effects to the ANST Historic District.[1] If additional specific minimization measures are identified as a result of continued consultations, a timeline for implementing these measures will be developed through the consultation process. This Treatment Plan also specifies that mitigation measures, should they be required after minimization measures are implemented, will be developed through the consultation process.

Mountain Valley developed the direct and indirect Areas of Potential Effect (APE) through consultation with the WVDCH and DHR.[2] In West Virginia, the indirect APE was defined as 0.4 kilometers (0.25 miles) on either side of the proposed pipe centerline and a 0.8-kilometer (0.5-mile) radius around the limits of ground disturbance for each compressor station. The direct APE comprised a 91.46-meter (300-foot) corridor centered on the proposed pipeline (or 45.7 meters

[1] Initially the Project included use of Pocahontas Road as an access road; this access road has been removed from the Project.

[2] Direct and indirect APE terminology is consistent with the PA, FERC 2017 guidance, and previous Section 106 documents prepared for the Project including FERC's EIS.

[150 feet] on either side of the pipe centerline). The direct APE also included the limits of ground disturbance for any ancillary facilities necessary to construct, operate, and maintain the pipeline. Ancillary facilities include compressor stations, access roads, construction staging areas, and temporary workspaces. For access roads, the direct APE was defined as a 30.5-meter (100-foot) corridor centered on the proposed access road (or 15.2 meters [50 feet] on either side of the proposed road centerline).[3]

In Virginia, the indirect APE for historic architectural resources comprised, at a minimum, a corridor centered on the pipeline or 137.2 meters (450 feet) on either side of the pipeline centerline. In some areas, the indirect APE was expanded up to one mile on either side of the pipeline in areas of higher elevation due to the possibility of distant views. The direct APE for the Project was defined at the outset of the Project as a 91.4-meter (300-foot) corridor that accommodated the actual construction right-of-way as well as workspace identified as project engineering and field surveys were completed.[4]

Mountain Valley's cultural resources consultants identified the National Register of Historic Places-eligible (NRHP) ANST Historic District in Giles County, Virginia, during the Phase I historic architecture survey conducted between May and November 2015.[5] Due to its NRHP eligibility, the ANST Historic District qualifies as a historic property as defined in Section 106 of the NHPA.

1.1 ANST – Resource Management

The National Trails System Act, which formally designated the ANST, stipulated that it "shall be administered primarily as a footpath" by the Secretary of the Interior in consultation with the Secretary of Agriculture (USFS). It authorizes "written cooperative agreements with the states or the political subdivisions, landowners, private organizations, or individuals to operate, develop, and maintain any portion of a national scenic or national historic trail either within or outside a federally administered area."[6] The ATC serves as resource managers in partnership with the NPS and the USFS.

1.2 Project Effect

In accordance with Section 106 of the NHPA of 1966 and the PA for the Project, consultation continues among the FERC, Mountain Valley, ATC, NPS, USFS, WVDCH, DHR, and Giles County to determine the Project's effects to the ANST Historic District, implement measures that would minimize or reduce to the extent possible impacts on the historic property, as well as identify and implement mitigation measures that would offset impacts on the property that cannot be avoided.

[3] In a May 8, 2015, letter, WVDCH concurred that the indirect APE was appropriately defined.
[4] In a May 20, 2015, letter, DHR concurred that the indirect APE was appropriately defined and accurately reflected previous consultation.
[5] Phase I Reconnaissance Architectural Survey for the Mountain Valley Pipeline, Craig and Giles Counties, Virginia (March 2016, DHR concurrence May 25, 2016)
[6] 16 U.S.C. § 1241

The Visual Impact Assessment (VIA) prepared for FERC's Final Environmental Impact Statement (EIS), to be supplemented by ongoing consultation with consulting parties (see section 4.2 below), identifies areas of vegetation removal that may alter vistas that contribute to the district's significance, thereby, affecting the integrity of the historic property's feeling and setting. Mountain Valley has proposed to minimize that effect as detailed in this Treatment Plan. Because consultation with consulting parties continues regarding the identification of adverse effects, minimization measures proposed in this document will be supplemented as necessary as a result of future consultations. Mitigation measures, if needed to address adverse effects following implementation of the minimization measures, will be developed through the ongoing consultation process.

2.0 DISTRICT FEELING AND SETTING

2.1 Appalachian National Scenic Trail Historic District

The ANST developed between 1928 and 1942 as a marked hiking trail and recreational corridor on the East Coast. The trail stretches approximately 2,200 miles from Georgia to Maine. In the 1930s, the Civilian Conservation Corps constructed the original trail, side trails, cabins, shelters, and planted vegetation. The ANST is eligible for the NRHP as a historic district according to Criterion A in the areas of recreation and conservation and Criterion Consideration G as a property that has achieved exceptional significance in the last 50 years. Resources contributing to the district's significance include the footpath, side trails, bridges (constructed for the ANST), vistas and viewpoints, and overnight use areas.[7] According to a November 17, 2017, letter from the NPS to the FERC, "the feeling of the Appalachian Trail Segment is expressed through the combination of its physical features, primarily the Trail's intentionally primitive design as it blends into the wild, natural, or cultural setting. The feeling of being on the Trail is also found in the grandeurs of its views and vistas; quiet and solitude…" (Attachment 3).

Mountain Valley's cultural resources consultant identified the NRHP-eligible ANST Historic District in Giles County, Virginia, during the Phase I historic architecture survey conducted between May and November 2015 (Figure 2.1). As per DHR guidance, previously recorded historic districts were not re-inventoried; a windshield survey was conducted to determine if existing historic districts had undergone any significant character changes that would render all or parts of the districts no longer eligible for listing in the NRHP. Mountain Valley's cultural resources consultants found that no such changes had occurred to the ANST Historic District and, therefore, recommended no changes to the NRHP-eligible status of the

[7] Post-1942 changes and additions to the ANST's route also contribute to the district.

Figure 2.1 Certificated Route Crossing the ANST Historic District

district. The NPS began the process of completing a Multiple Property Documentation for the West Virginia-Virginia segment of the ANST in 2019 that confirms the NRHP eligibility of the district.

3.0 DESCRIPTION OF MOUNTAIN VALLEY AS IT AFFECTS PROPERTY FEELING AND SETTING

The Project crosses the ANST Historic District along the West Virginia-Virginia state line at approximate Milepost (MP) 196.3 at a location where the trail runs along Peters Mountain between Flat Ridge and Mystery Ridge. The crossing is on national forest land. Per the recent U.S. Supreme Court decision in *U.S. Forest Service* v. *Cowpasture River Preservation Association,* the NPS holds a limited and specific use-right in the nature of an easement for the ANST footpath at the location where Mountain Valley crosses the ANST but does not have land management jurisdiction over the trail or adjacent areas of federal land.[8]

In accordance with management standards in the JNF Land and Resource Management Plan, Mountain Valley proposes to cross underneath the ANST Historic District on JNF-managed lands using trenchless (or bore) installation technology. This will allow the pipeline to cross under the ANST while avoiding direct impacts on its footpath. Significant buffer areas will be maintained on each side of the footpath to protect the resource. The proposed crossing is approximately 183 meters (600 feet) in length, and approximately 27.4 meters (90 feet) below the ANST Historic District. The bore profile, submitted by Mountain Valley to the USFS as part of the Plan of Development (POD) dated July 31, 2020, is included in this Treatment Plan as Attachment 1. As proposed, the crossing allows for an approximate buffer area with no construction disturbance (including no removal of vegetation) of 93.6 meters (307 feet) on the south side of the trail and 83.2 meters (273 feet) on the north side of the trail. The buffer areas of no disturbance will be maintained by the placement of safety fence that will be installed between the bore pits and the ANST. These barriers will be set up approximately three meters (ten feet) in front of each bore pit to provide for the safety of workers and visitors to the ANST during construction activities. Thus, there is approximately 176.8 meters (580 feet) between the bore pits.

Mountain Valley completed a geologic analysis that determined the bore path will encounter primarily solid rock. Mountain Valley's trenchless technology consultant expects with a high degree of confidence that the pipeline can be successfully installed using boring technology. However, in the unlikely event that this method fails, Mountain Valley identified a set of alternative means to achieve the goal of constructing the pipeline without trenching or other disturbance to the ANST Historic District footpath and adjacent woodlands. If insurmountable issues are encountered during the boring process, Mountain Valley, in consultation with its trenchless technology consultant and the USFS, intends to perform corrective actions, such as selecting a new drill path, within the approved corridor or may implement an alternate trenchless crossing method as outlined in the *Contingency Plan for the Proposed Crossing of the Appalachian National Scenic Trail* (Attachment 2) from Mountain Valley's POD. No matter the trenchless construction method used, no open trenching will occur, and no motor vehicle traffic will be

[8] *U.S. Forest Service* v. *Cowpasture River Preservation Association,* 590 U.S. ___, 140 S. Ct. 1837 (2020*).*

permitted between the bore pits. Mountain Valley will notify and seek approval from the FERC and USFS representatives prior to implementing this contingency plan or making any adjustments to the boring plans and procedures. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting, regulatory, and land-managing agencies, and required approvals will be obtained prior to implementing any alternative crossing measures.

By using a bore and maintaining the buffer area to each side of the footpath, the Project will not directly impact the ANST Historic District. As stated in FERC's EIS, use of the bore would minimize effects to recreational users on the trail.[9] The footpath associated with the ANST Historic District would remain open during construction and would not require rerouting of trail traffic. Visual effects related to the bore would be minor due to the forested buffer and vegetative screening of the bore pits since the bore pits will not be visible from the trail. While trail users may be affected by the noise and dust of the construction activities, impacts would be minor because they would be occurring 83.2 meters (273 feet) from the users and effects would be temporary. Installation of the pipeline via a bore beneath the ANST Historic District would result in noise that may be audible to hikers, but these effects would vary based on the presence of hikers at the time of construction. In addition, the undisturbed forest on either side of the trail and location of the bore pits 21 to 27 meters (70 to 90 feet) in elevation below the trail would minimize noise effects. These construction impacts would be minor and temporary in nature. The work required to bore under the ANST Historic District (and associated noise and dust) is expected to last approximately 10 weeks. There will be no permanent noise impacts associated with operation of the pipeline.

As mentioned above and detailed in section 4.2 below, consultation with consulting parties to ensure visual indirect effects have been identified and minimized and mitigated as necessary will continue, but the VIA conducted for the USFS identified a number of areas where indirect visual impacts on the ANST Historic District could occur. In the VIA, Mountain Valley identified short-term, long-term, and permanent impacts on vegetation cover types resulting from construction of the Project – these impacts would indirectly impact the setting associated with the historic property. The analysis in the VIA was conducted to ensure compliance with Scenic Integrity Objectives (SIOs) on the JNF (including Mountain Valley's crossing of the ANST Historic District). Mountain Valley has/will implement the following measures and Best Management Practices, developed in consultation with USFS, to minimize visual impacts from the Project identified as part of the VIA.[10]

Mountain Valley sited the alignment to conform to the natural lines in the landscape and follow existing rights-of-way, where feasible. To make the vegetative openings appear more natural and conform to the natural form, line, color, and texture of the existing landscape, undulating edges have been or will be created during clearing activities to achieve the effect shown in Figure 3-1.

[9] FERC Final Environmental Impact Statement for Mountain Valley Pipeline issued June 23, 2017 (FERC Docket CP16-10-000, Accession No. 20170623-4000) 3-52.

[10] The USFS Scenery Management System includes landscape character descriptions and scenic integrity objectives for USFS landscapes that can be used to help assess the compatibility of a proposed project with the surrounding landscape.

These areas have a High or Moderate SIO and were identified in the FERC EIS as being affected by the Project.

- Top of Peters Mountain – MP 196.2 to the bore pit on north side of mountain.
- Top of Peters Mountain – from the bore pit on the south side of the mountain to MP 197.8 on Mystery Ridge.
- Crest of Sinking Creek Mountain – MPs 218.5 to 218.8 to reduce visibility of the "notch" in the trees at the top of the mountain.

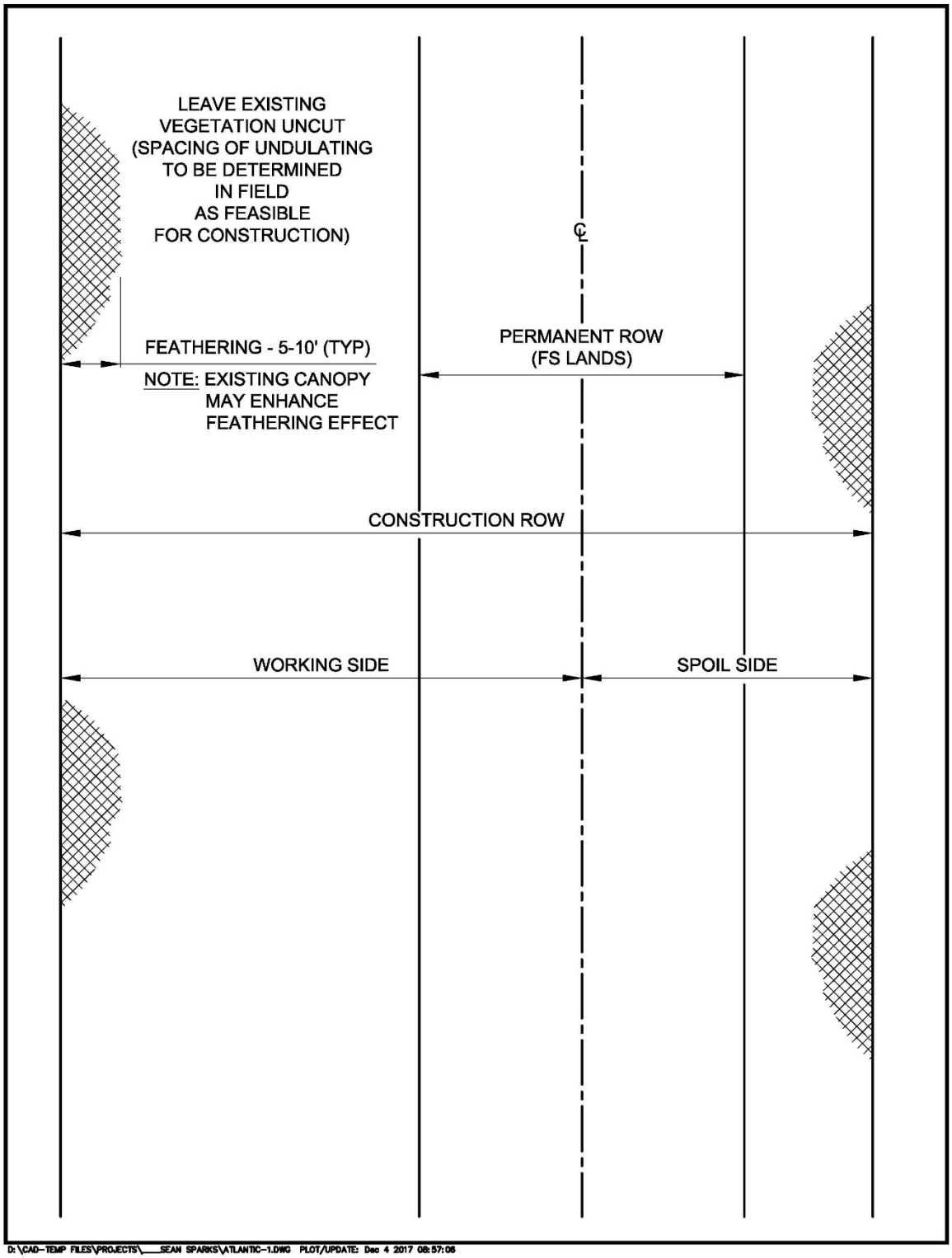


Figure 3-1. Typical Right-of-Way Clearing Pattern for Vegetation Feathering Technique

- The north side of Brush Mountain – MPs 219.8 to 220.8.

Additional minimization measures for temporary workspaces within forested areas would include replanting of some amount of shrub plantings or shrub seed mixes to soften the hard edge formed between the existing/undisturbed forest and the maintained permanent right-of-way. Mountain Valley intends to include woody seed mixes within temporary areas where forest regeneration is desired.

For these areas identified in the VIA, the construction and permanent operational right-of-way will be revegetated as shown in the concept diagram provided in Figure 3-2. This entails maintaining an herbaceous strip 10-foot-wide centered over the pipeline and only performing trimming or selective cutting of trees over 15-foot-tall within a 30-foot-wide strip centered over pipeline. Outside the 10-foot-wide strip, the remainder of the construction and permanent right-of-way would be revegetated using acceptable seed mixes, pollinator plants, shrubs and trees in accordance with the FERC Plan and Procedures (FERC Plan) and approved state plans.[11] Particularly along the edge of this herbaceous linear opening, a variety of sizes and species of vegetation would be planted in a manner that breaks up the straight, parallel edges of the corridor and reduces the hard shadow line that can draw the viewer's attention.

While clearing and/or grading has occurred in those locations identified above, Mountain Valley had a landscape architect on-site to monitor for activities pertaining to scenery including but not limited to undulating the construction right-of-way edges. Following construction, the landscape architect will also participate in the monitoring of right-of-way revegetation from a variety of viewpoints to ensure compliance with the SIOs is met within five years.

For the portion of the Project located within the JNF, direct impacts on the ANST Historic District have been avoided and vegetation removal has been minimized to the greatest practicable extent using the measures detailed above. However, the VIA prepared for FERC's EIS and ongoing consultation with consulting parties (section 4.2) identifies areas of vegetation removal within the viewshed of the ANST Historic District, beyond the JNF, that may affect the integrity of the property's feeling and setting and, as a result, require treatment.

[11] The FERC Plan and Procedures comprise construction best management practice standards that the FERC first introduced in 1994. The FERC has encouraged natural gas pipeline companies to adopt these documents into their applications to the FERC and commit to these standards in construction for new pipelines and maintenance on existing pipelines.

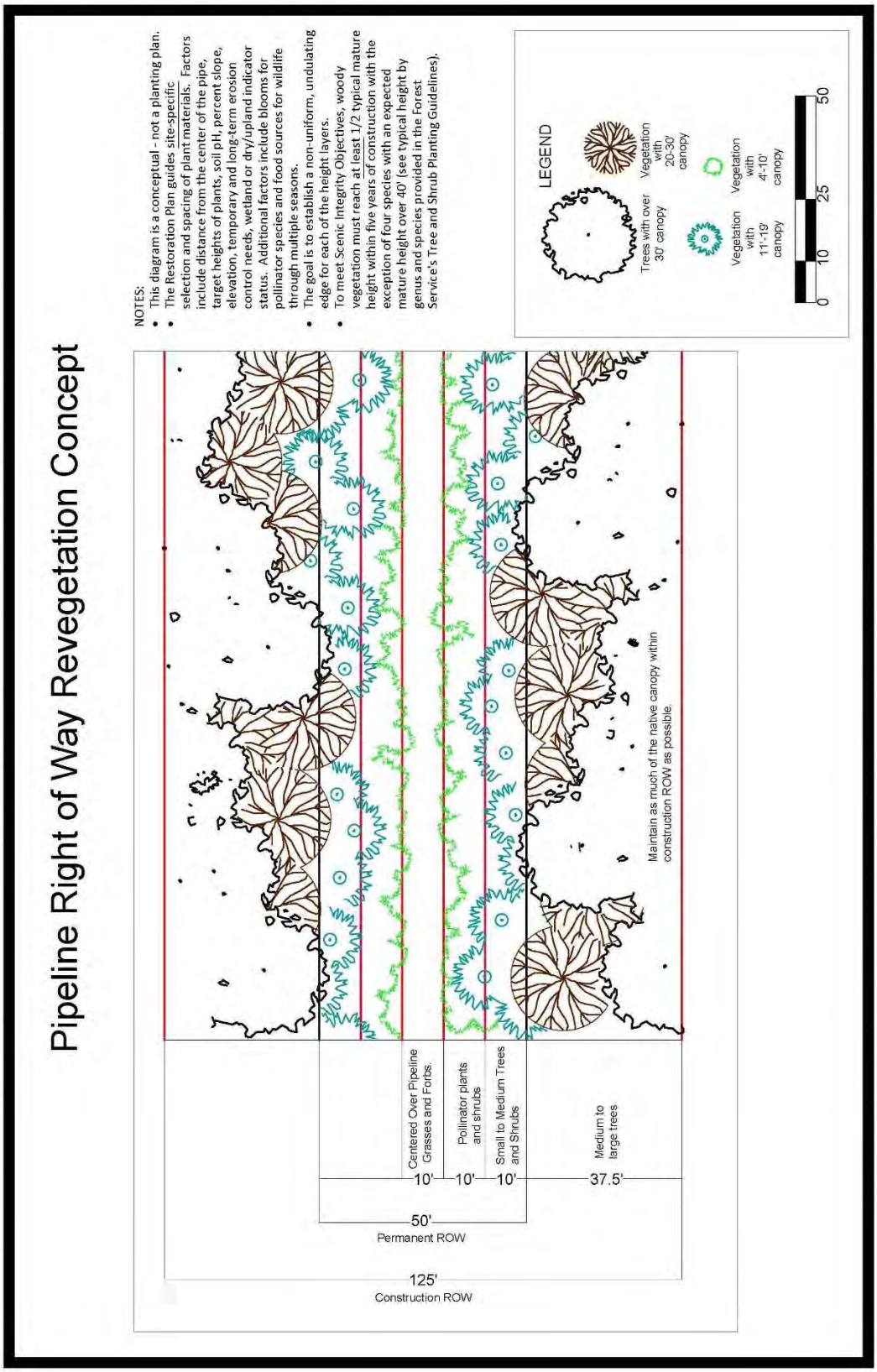


Figure 3-2. Concept for Revegetation of the Right-of-Way

4.0 MINIMIZATION AND MITIGATION OF ADVERSE EFFECTS IDENTIFIED

4.1 Approach to the Development of Minimization and Mitigation

Through the VIA and consultation to date with the ATC and other consulting parties, six areas beyond the JNF have been identified where significant views from the ANST may be impacted and enhanced revegetation may be appropriate.[12] Additional changes to Project restoration practices will minimize the adverse effect to the feeling and setting as it relates to viewpoints and vistas that contribute to the district's significance. As a result, Mountain Valley has identified minimization measures—enhanced treatment of the permanent right-of-way within the visual indirect APE for the district—that will directly address the potential adverse effect for these six areas.

Appropriate mitigation should have a nexus to the identified adverse effect of the proposed action and will take into consideration the input of consulting parties. If an adverse effect remains after minimization measures are implemented, it is likely the adverse effect would be changes to the district's feeling and setting as a result of vegetation removal within its viewshed. Specific mitigation measures should be proportional to the long-term physical adverse effect to the district and responsive to consulting party concerns. Mitigation measures, if needed, will be developed through the ongoing consultation process.

4.2 Consultation with Consulting Parties

4.2.1 Consultation Conducted from 2017 through 2020

Under the PA, FERC and the other consulting parties are required to determine whether similar treatment measures (i.e., enhanced revegetation) would be appropriate for segments of the Project's permanent right-of-way located outside the JNF to minimize impacts on views from the ANST Historic District. For the meetings and calls discussed below, if minutes or notes were prepared to document the discussions, those minutes are included in Attachment 3.

The NPS organized and led a consultation meeting on June 15, 2017, to discuss identification of potential impacts on the trail. Representatives from the NPS, USFS, ATC, BLM, U.S. Department of the Interior (USDOI) Solicitor's Office, Roanoke Appalachian Trail Club (RATC), and Mountain Valley attended the meeting. In early 2018, two conference calls were convened to continue the discussions related to potential impacts. In attendance to the January 10, 2018, call were individuals representing the FERC, ATC, USFS, NPS, USDOI, DHR, Giles County, and Mountain Valley. The April 4, 2018, call included representatives from the FERC, USFS, NPS, DHR, USDOI, ACHP, Giles County, RATC, and Mountain Valley. Both calls focused on identification of potential impacts on the ANST Historic District and minimization and mitigation of these impacts if identified. The second call resulted in the agreement that a field visit would greatly assist in identifying specific locations where the pipeline right-of-way could be seen from significant locations along the trail.

[12] Two of these areas will need be field-verified post-construction following restoration.

The USFS and NPS organized this field visit to the ANST Historic District in June 2018. Participants in the field visit included representatives from the NPS, USFS, Giles County, ATC, RATC, and Mountain Valley. The field visit involved hiking to three different locations on the trail over the course of three days, June 6-8, 2018. The locations, Angel's Rest, Symms Gap, and Kelly Knob, were chosen by the agencies, ATC, and RATC based on the VIA prepared in connection with the FERC's EIS for the Project and anecdotal information presented by ATC. Both indicated that segments of the Project's permanent right-of-way outside the JNF might be visible from those locations following clearing of the right-of-way for pipeline construction and prior to restoration and revegetation.

Further substantive discussions among the PA signatories and concurring parties regarding treatment measures on pipeline segments outside the JNF to address potential adverse impacts on views from the ANST Historic District did not occur between June 2018 and mid-2020. Mountain Valley reinitiated discussions with the ATC January 2020 to identify the specific locations along the pipeline corridor outside the JNF where it would be appropriate to apply enhanced revegetation measures to minimize the potential for adverse impacts on views from the ANST Historic District following completion of pipeline construction. Also discussed were areas that may be appropriate for enhanced revegetation but will require field verification following completion of pipeline construction and site restoration. Mountain Valley and the ATC agreed to conduct this field verification one year after the pipeline is placed in-service to ascertain whether additional minimization by reducing the permanent right-of-way and/or replanting portions of the right-of-way are necessary in these areas.

As detailed in the POD submitted to the USFS by Mountain Valley and in section 3 of this Treatment Plan, the USFS requires Mountain Valley to apply measures generally described as "enhanced revegetation" to the full extent of the Project corridor inside the JNF to minimize potential adverse impacts on views from the ANST Historic District. The Draft Supplemental EIS dated September 2020, prepared by the USFS for the Project, indicates that minor temporary adverse effects to trail users would occur from noise and dust, from the bore under the ANST Historic District, but the long-term effects would be minor as a result of the buffers on each side of the trail that would provide vegetative screening.[13] In a letter dated July 26, 2017, from the JNF to the DHR, the USFS indicated that boring the trail and implementing the revegetation plans agreed upon in the POD would result in no adverse effect to the ANST Historic District as it relates to the portion of the Project located on national forest lands (Attachment 3).

In 2019, Mountain Valley initiated outreach to the ATC seeking assistance to identify and develop sustainability and mitigation efforts that would complement the Project. In August 2020, Mountain Valley, ATC, and The Conservation Fund (TCF) announced a voluntary conservation agreement under which Mountain Valley will provide up to $19.5 million to the ATC for land acquisition and community investment intended to benefit the ANST, trail users, and local trail-dependent

[13] *Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement #50036* (September 2020). The USFS prepared this draft supplemental analysis to address the Fourth Circuit Court's ruling, new information, and changed circumstances such as new federally listed threatened and endangered species and critical habitat designations.

businesses. The agreement also included commitments for cooperation between Mountain Valley and ATC on a range of topics related to MVP permitting. The three-party agreement was not negotiated under the PA and is not formally a component of this Treatment Plan. However, the discussions among Mountain Valley, ATC, and TCF were informed by the consultations under the PA involving Mountain Valley and ATC prior to mid-2018. The funding provided by the three-party agreement will support actions that reinforce and complement the benefits of the measures described in this plan by, among other things, providing significant compensatory mitigation for potential adverse impacts on the ANST Historic District and other public resources and values.

This Treatment Plan has been provided to consulting parties identified by the FERC in 2018 as having an interest in the ANST Historic District. These consulting parties have an opportunity to comment on the plan as part of the consultation process to identify any additional potential effects and to discuss proposed minimization and mitigation measures. Once these comments are received following the requirements in section III.B.3 of the executed PA, the FERC will take timely comments into consideration before approving the final Treatment Plan.

4.2.2 Future Consultation

Additional Areas: Following FERC approval of the Treatment Plan, at the direction of the FERC, Mountain Valley will re-initiate consultations with the appropriate consulting parties using the results of discussions with the ATC (documented in the figures included below) to determine if additional areas may require consideration for minimization. This consultation process will be completed within six months of Mountain Valley receiving FERC approval for implementing the Treatment Plan. Mountain Valley will document these consultations by filing minutes on the docket and circulating copies to consulting parties. For the four areas outside the JNF that have been designated as requiring enhanced revegetation (per the VIA), Mountain Valley, the ATC, and other consulting parties will conduct a field review of these to assess the success of the revegetation to minimize adverse visual impacts on the ANST Historic District (Figures 4.3.1-3 through 4.3.1-5). At the same time, this group will field verify the two possible areas identified in 2020 ATC and Mountain Valley discussions (Figures 4.3.1-6 through 4.3.1-7) to determine if these areas will be subject to enhanced revegetation to reduce adverse visual effects. Timing on revegetating these areas, if needed, will be scheduled for when the appropriate growing season occurs following the field verification. If additional areas for requiring field verification are identified during upcoming consultations, these areas will be addressed in the same manner. As noted above, this field review and verification will occur one year after the pipeline is placed in-service.

Continuing Post-In-Service Field Review/Monitoring: Section 4.3.1 below describes the field review/monitoring process that will be followed to ensure that impacts are minimized successfully both in and outside the JNF and that the enhanced revegetated measures restore views to meet SIOs to the greatest extent practicable within five years (following the requirements of the VIA). This monitoring process will also address the areas identified during the field verification process and any other areas identified through implementation of this Treatment Plan. The VIA specifies that monitoring activities will be conducted by Mountain Valley's landscape architect consultant. Consulting parties will also participate in the monitoring process in order to define where adverse

visual effects remain after the minimization measures have been implemented. Throughout the monitoring process, Mountain Valley will continue to file documentation on the docket and inform consulting parties as required by the PA. Consultations with consulting parties related to minimization measures will be completed when Mountain Valley files documentation of successfully meeting the SIOs after the Project is placed in-service. If any revegetation areas do not meet the SIOs after five years, Mountain Valley's landscape architect will identify additional revegetation activities for those specific areas and Mountain Valley will implement the resulting recommendations.

Consultation for the Development of Mitigation Measures (if needed): Following the field review and verification conducted one year after the pipeline is placed in-service, Mountain Valley will conduct consultations to determine if adverse effects remain where minimization measures were implemented and document the results of the consultations on the docket. If such areas are identified, Mountain Valley will work with consulting parties to identify appropriate mitigation measures and implement them within two years after the pipeline is placed in-service. Because the need for mitigation is not yet established, it is noted that this process and timeline may need to be adjusted through the consultation process under this Treatment Plan. As noted above, specific mitigation measures should be proportional to the long-term physical adverse effect to the district and responsive to consulting party concerns.

4.3 Proposed Minimization and Mitigation Plan

4.3.1 Enhanced Right-of-Way Treatment to Minimize Visibility of Permanently Maintained Corridor

Mountain Valley's proposed minimization plan to address potential adverse effects focuses on reducing the visibility of the maintained permanent right-of-way from locations along the ANST Historic District. The VIA prepared for the FERC's EIS, augmented by the observations made during the June 2018 field visit and subsequent discussions with ATC, indicate that enhanced revegetation will be appropriate in four locations and may be appropriate in two additional areas (pending field verification) outside the JNF (Figure 4.3.1-1). Because the entire pipeline corridor

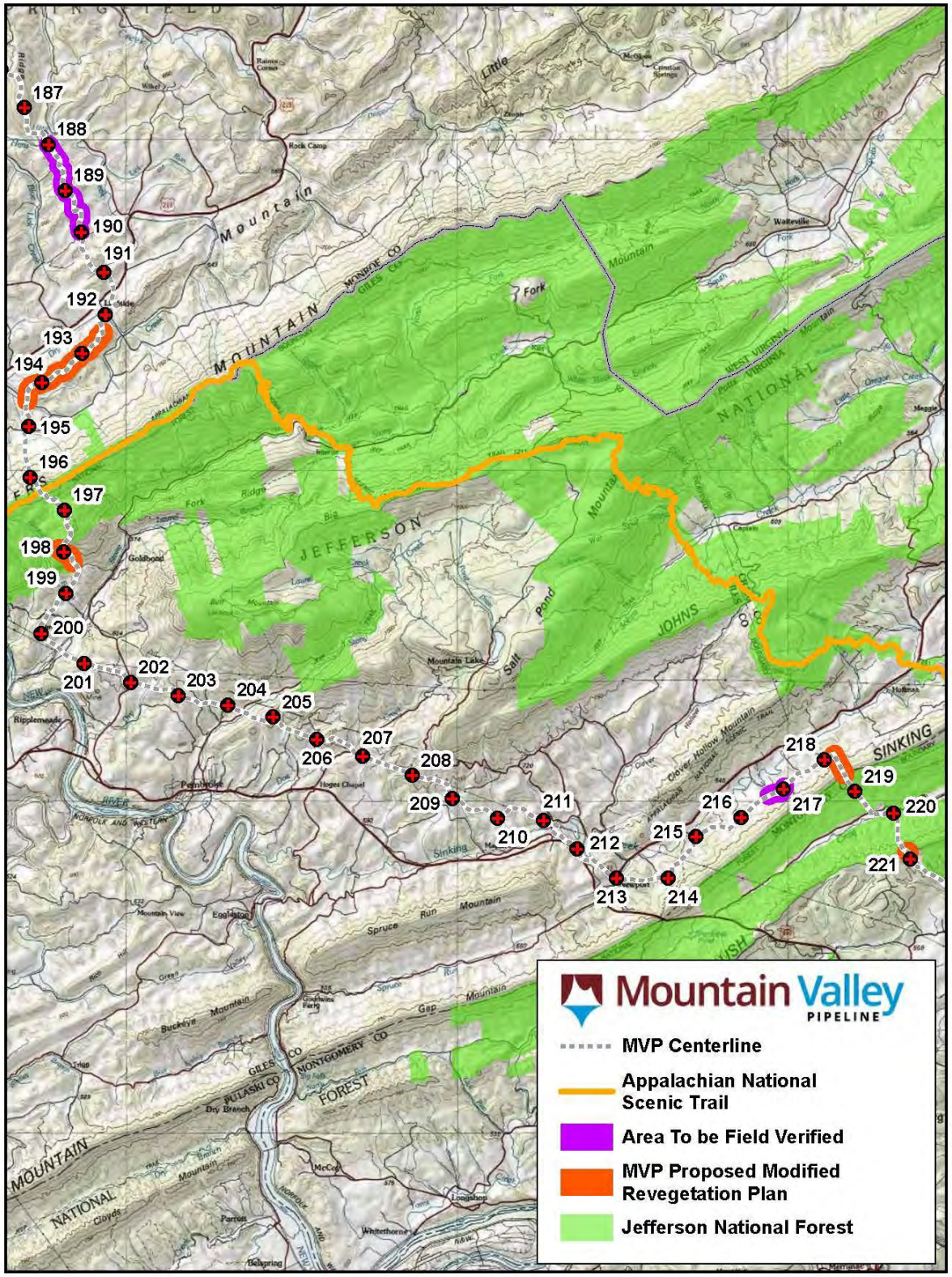


Figure 4.3.1-1 Overview of Proposed Enhanced Right-of-Way Treatment and Field Verification Areas Associated with the ANST Historic District Outside the JNF

within the JNF will be subject to the enhanced vegetation planting, specific areas related to the ANST Historic District on the forest are not identified in this Treatment Plan.

Mountain Valley will implement the following minimization measures to lower potential visual impacts from the Project identified through consultation to date. Within the following route segments, depicted in Figures 4.3.1-2 through 4.3.1-5, Mountain Valley will revegetate the right-of-way to ensure that vegetative openings appear more natural and conform to the natural form, line, color, and texture of the existing landscape.

ANST Historic District Enhanced Revegetation Areas (See Figures 4.3.1-2 through 4.3.1-5)

Segment	Milepost Range	Length (feet)	Mileage
1	192.2 - 194.4	9,525	1.80
2	197.3 - 198.9	2,115	0.40
3	218.2 - 218.6	2,232	0.40
4	220.83 - 220.86	148	0.03
	Total		

Mountain Valley will revegetate the construction and permanent operational right-of-way as shown in the concept diagram provided in Figure 3-2. This entails maintaining an herbaceous strip 10-foot-wide centered over the pipeline (reduced from the typical 50-foot width) and performing trimming or selective cutting of trees over 15 feet in height within a 30-foot-wide strip centered over pipeline. Outside the 10-foot-wide strip, the remainder of the construction and permanent right-of-way will be revegetated using acceptable seed mixes, pollinator plants, shrubs and trees in accordance with the FERC Plan and consistent with Virginia Department of Environmental Quality's approval. Particularly along the edge of this herbaceous linear opening, a variety of sizes and species of vegetation will be planted in a manner that breaks up the straight, parallel edges of the corridor and reduces the hard shadow line that can draw the viewer's attention. Species of vegetation will be determined based on the established surrounding vegetation. This would reduce the visual contrast and the potential indirect visual effects to the ANST Historic District.

In addition, the following route segments based on consultations with the ATC and depicted in Figures 4.3.1-6 and 4.3.1-7 may be appropriate for enhanced revegetation but will require field verification following completion of pipeline construction and site restoration. If these require enhanced revegetation and/or future consultations identify additional areas for enhanced vegetation plantings, they will be managed following the same specifications described in section 4.2.2.

ANST Historic District Field Verification Areas (See Figures 4.3.1-6 through 4.3.1-7)

Segment	Milepost Range	Length (feet)	Mileage
1	188 - 190	10,557	2.0
2	216.6 - 217.1	2,062	0.39
	Total		

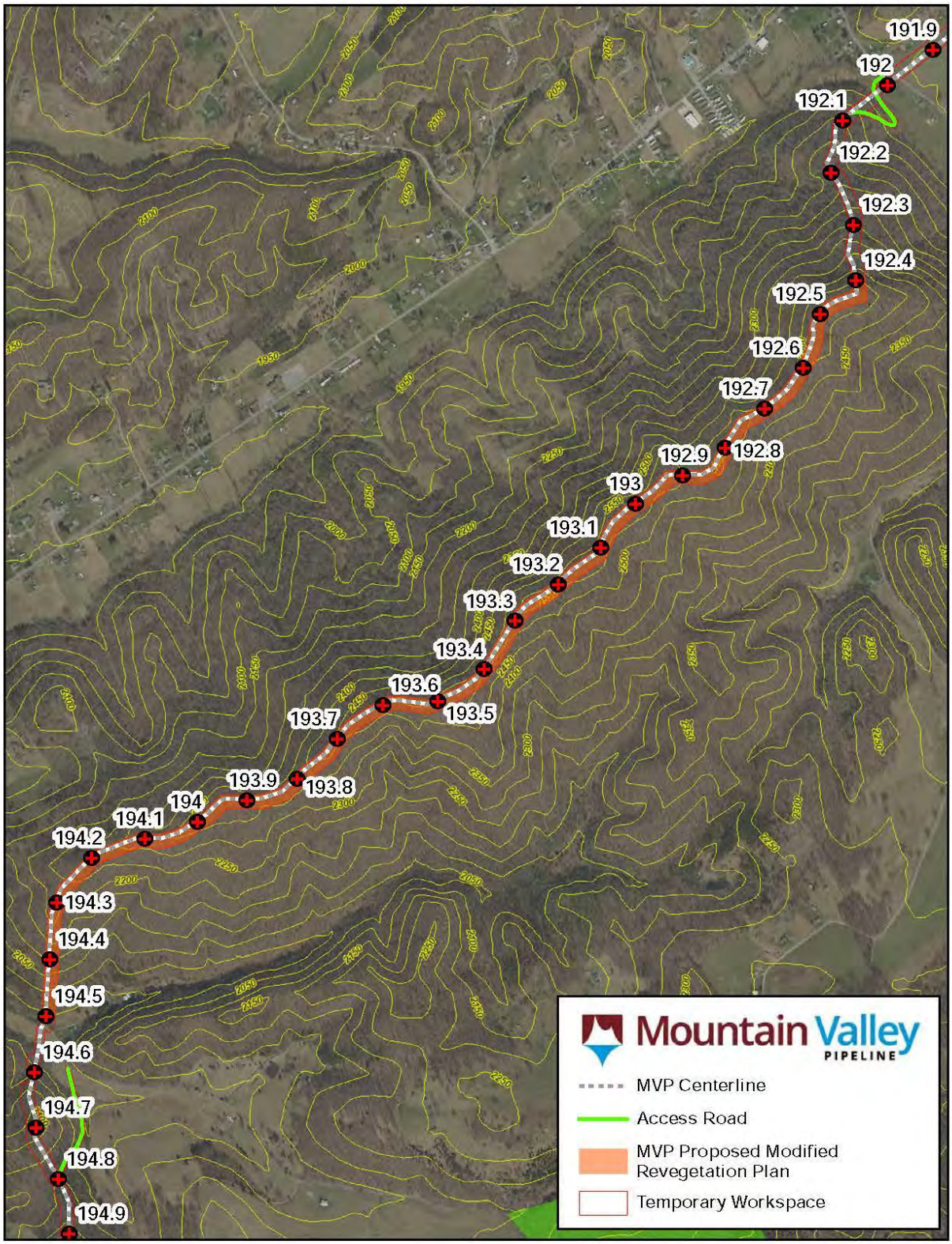


Figure 4.3.1-2 Overview of Proposed Enhanced Right-of-Way Treatment Associated with the ANST Historic District (Mileposts 192.2 - 194.4) Outside the JNF

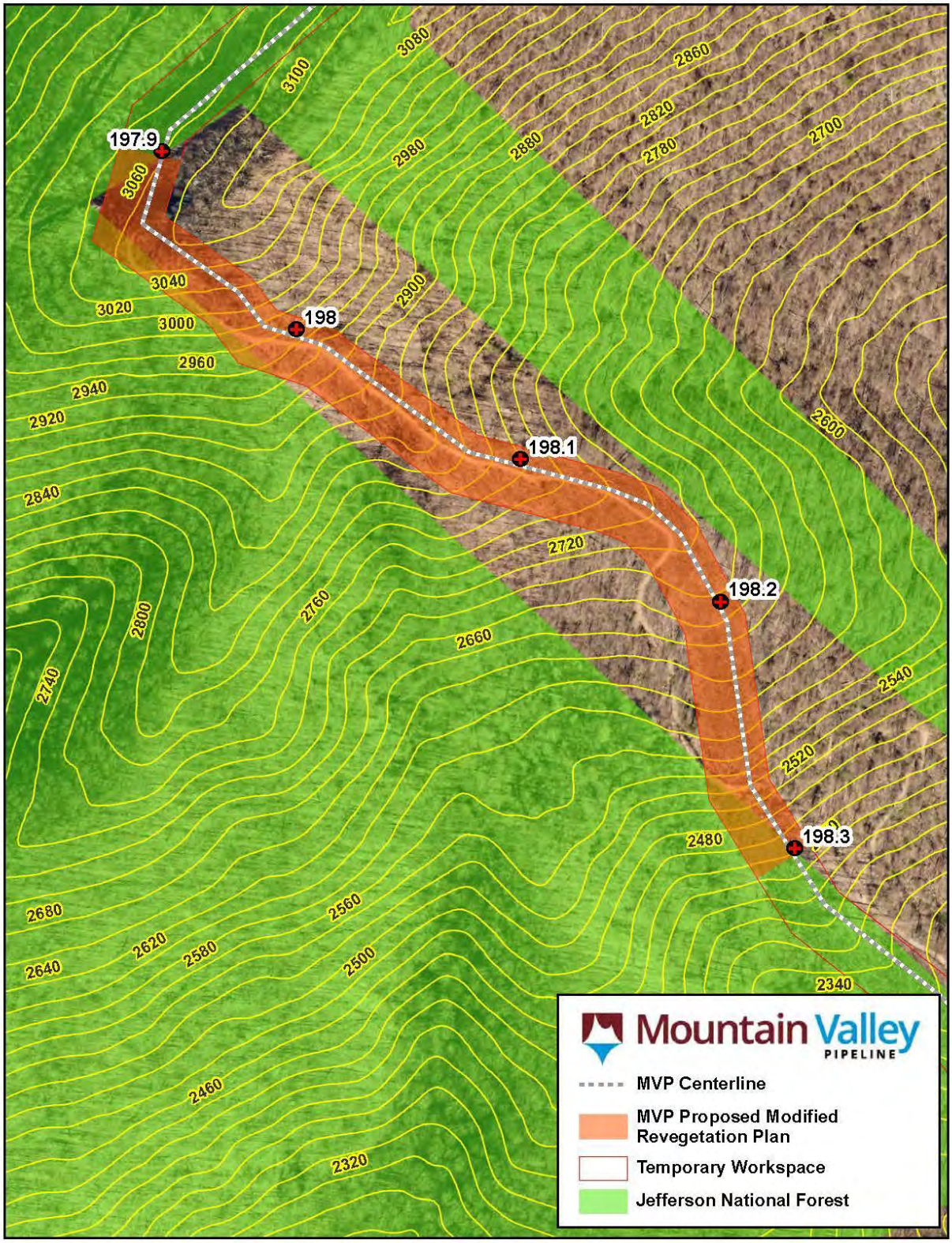


Figure 4.3.1-3 Overview of Proposed Enhanced Right-of-Way Treatment Associated with the ANST Historic District (Mileposts 197.3 - 198.9) Outside the JNF

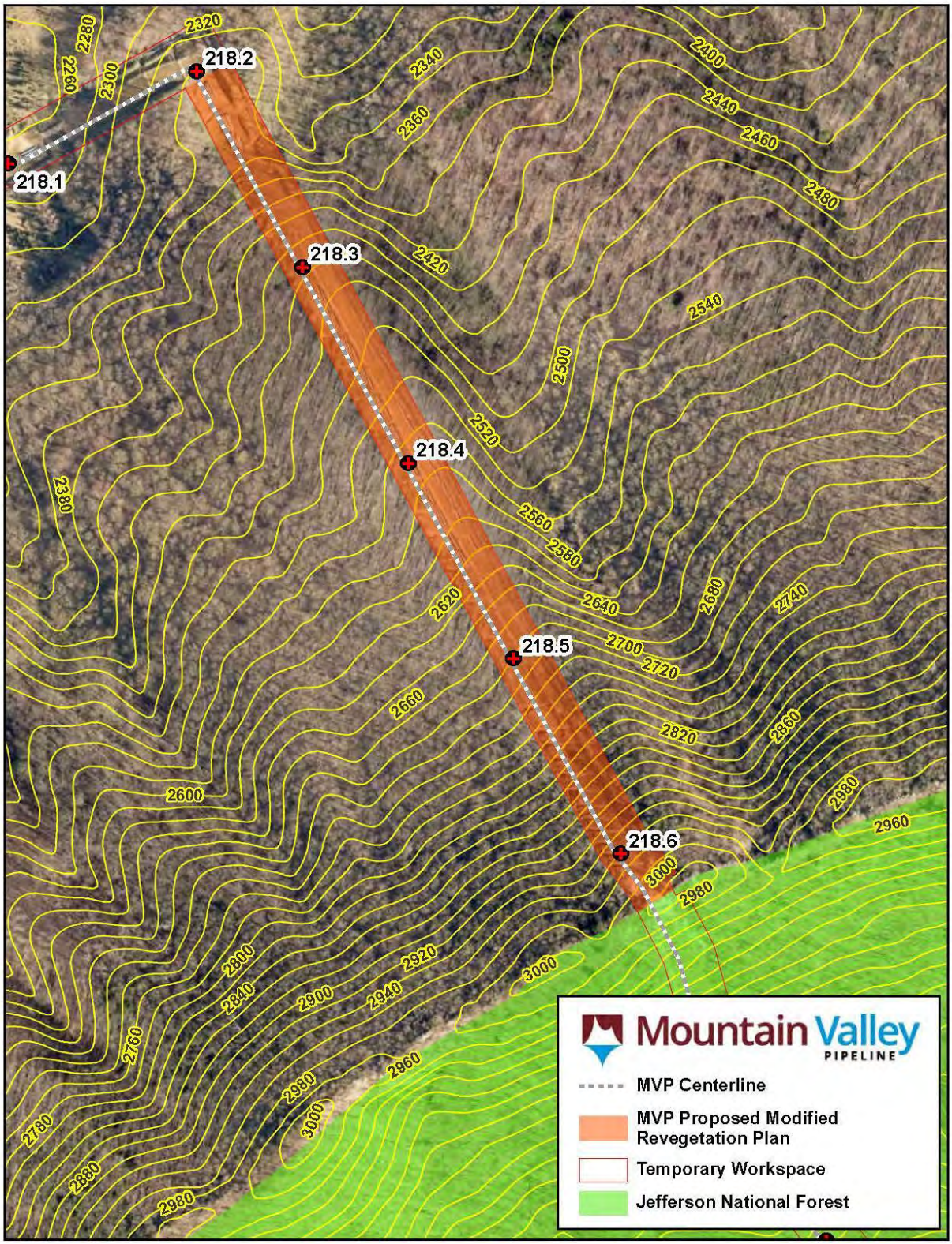


Figure 4.3.1-4 Overview of Proposed Enhanced Right-of-Way Treatment Associated with the ANST Historic District (Mileposts 218.2 - 218.6) Outside the JNF

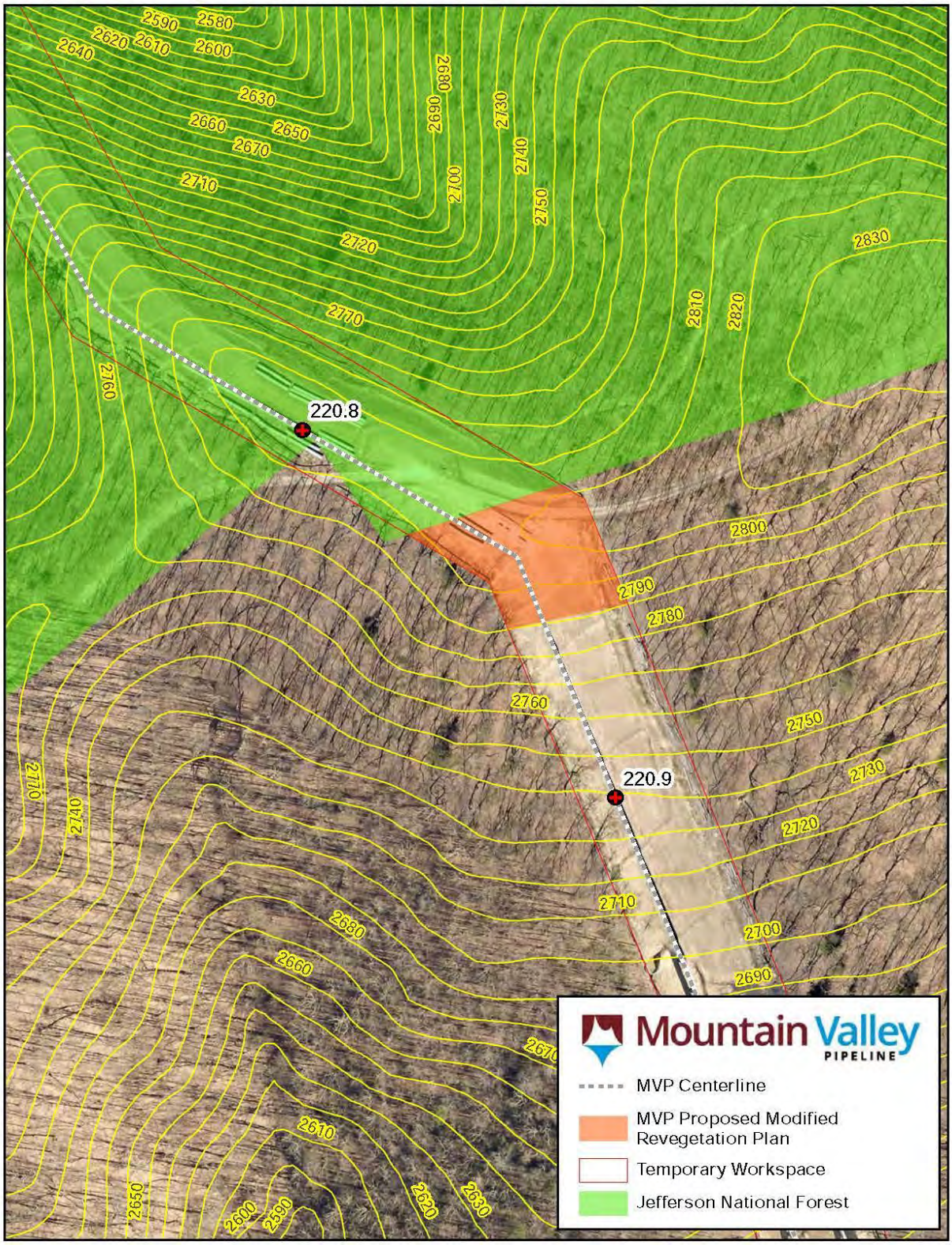


Figure 4.3.1-5 Overview of Proposed Enhanced Right-of-Way Treatment Associated with the ANST Historic District (Mileposts 220.83 - 220.86) Outside the JNF

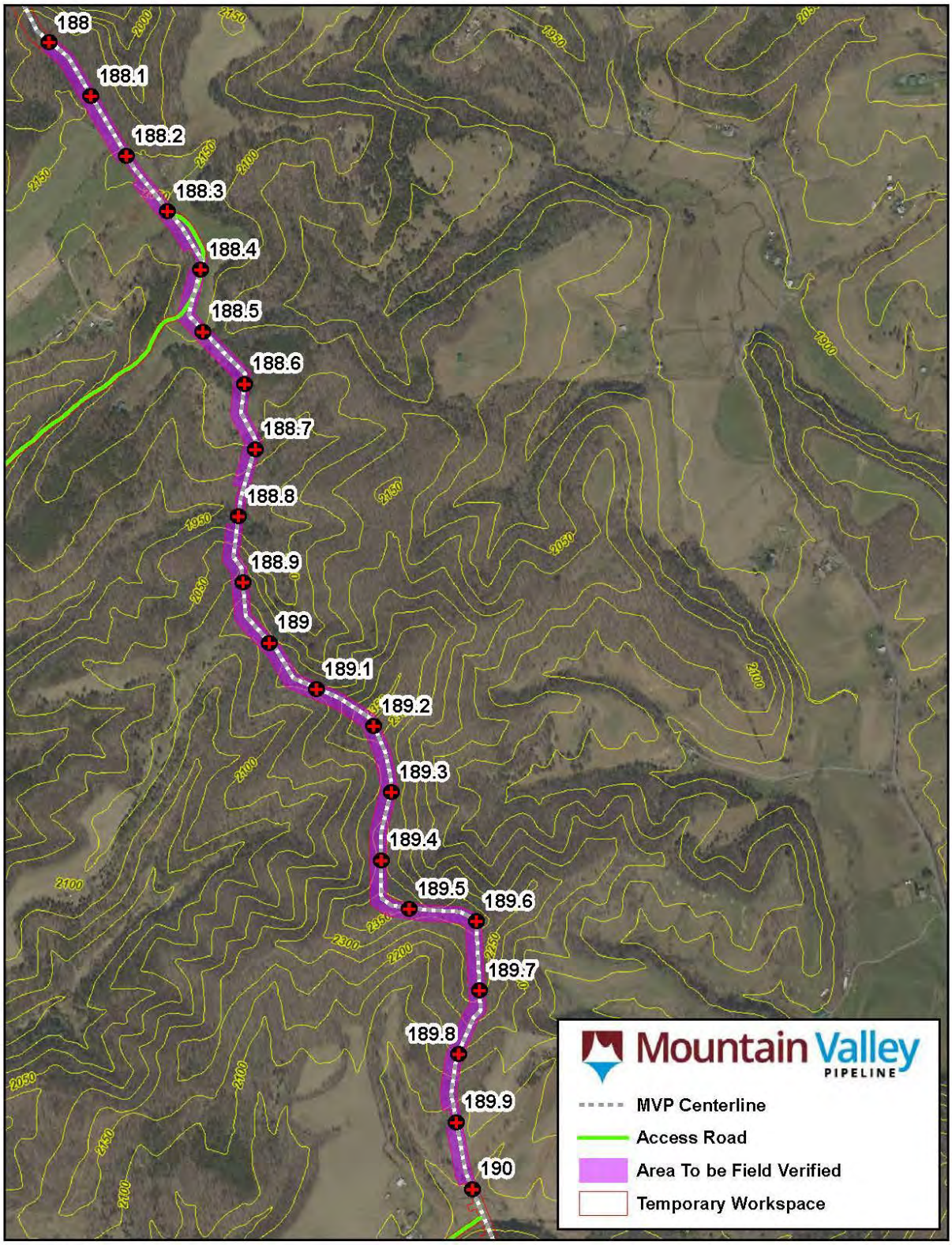


Figure 4.3.1-6 Proposed Field Verification Areas Associated with the ANST Historic District (Mileposts 188 - 190) Outside the JNF

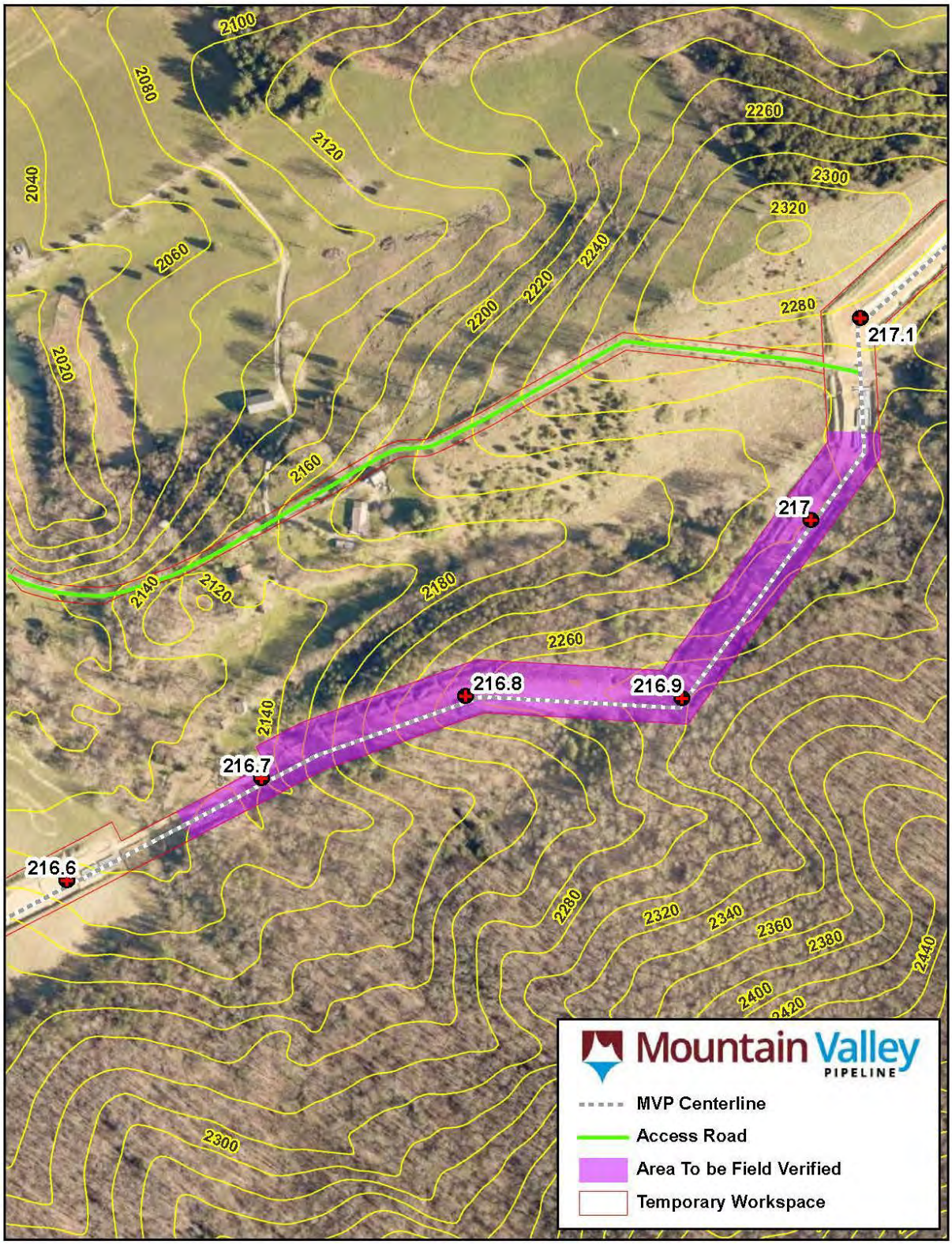


Figure 4.3.1-7 Proposed Field Verification Areas Associated with the ANST Historic District (Mileposts 216.6 - 217.1) Outside the JNF

To ensure the enhanced right-of-way treatment in and outside of the JNF effectively minimizes impacts on the ANST Historic District and restores views to meet SIOs to the greatest extent practicable within five years, the post-construction revegetation will be monitored by Mountain Valley's landscape architecture consultant and consulting parties. Monitoring will be conducted on an annual basis and the results reported to the FERC and consulting parties. If the annual monitoring review indicates that revegetation is not occurring as necessary to meet the five-year goal, remedial actions will be recommended by the landscape architect and Mountain Valley will implement the recommendations. The timing for implementing the recommendations will be based on what actions are required.

By following this Treatment Plan for identifying and implementing enhanced revegetation where needed, effects to the ANST Historic District would be minimized to the greatest extent practicable. If adverse effects remain as determined by field reviews/monitoring conducted by the Mountain Valley and the consulting parties, suitable mitigation measures will be developed as part of the consultation process and implemented prior to completion of the five-year monitoring program.

5.0 SCHEDULE

This Treatment Plan will be reviewed in a manner consistent with Stipulation III.B.3 of the PA. Mountain Valley will provide copies of the Treatment Plan to the FERC, ATC, NPS, USFS, WVDCH, and DHR, and Giles County Board of Supervisors for a 30-calendar-day review period. Mountain Valley will file all correspondence relating to the transmittal of, and any comments received from the consulting parties pertaining to the Treatment Plan, on the FERC docket. FERC staff will take timely comments into consideration before accepting the Treatment Plan as final.

Mountain Valley will implement this Treatment Plan concurrent with construction and restoration activities. Following FERC approval of the Treatment Plan, at the direction of the FERC, Mountain Valley will complete the consultation process described in section 4.2.2 within six months of Mountain Valley receiving FERC approval for implementing the Treatment Plan. Once this consultation has identified any new potential visual impact areas, the field review and verification will occur as described above. If adverse effects remain following the implementation of the minimization measures, including any remedial actions after five years if required, mitigation measures will be developed in consultation with the consulting parties and implemented by Mountain Valley.

ATTACHMENT 1

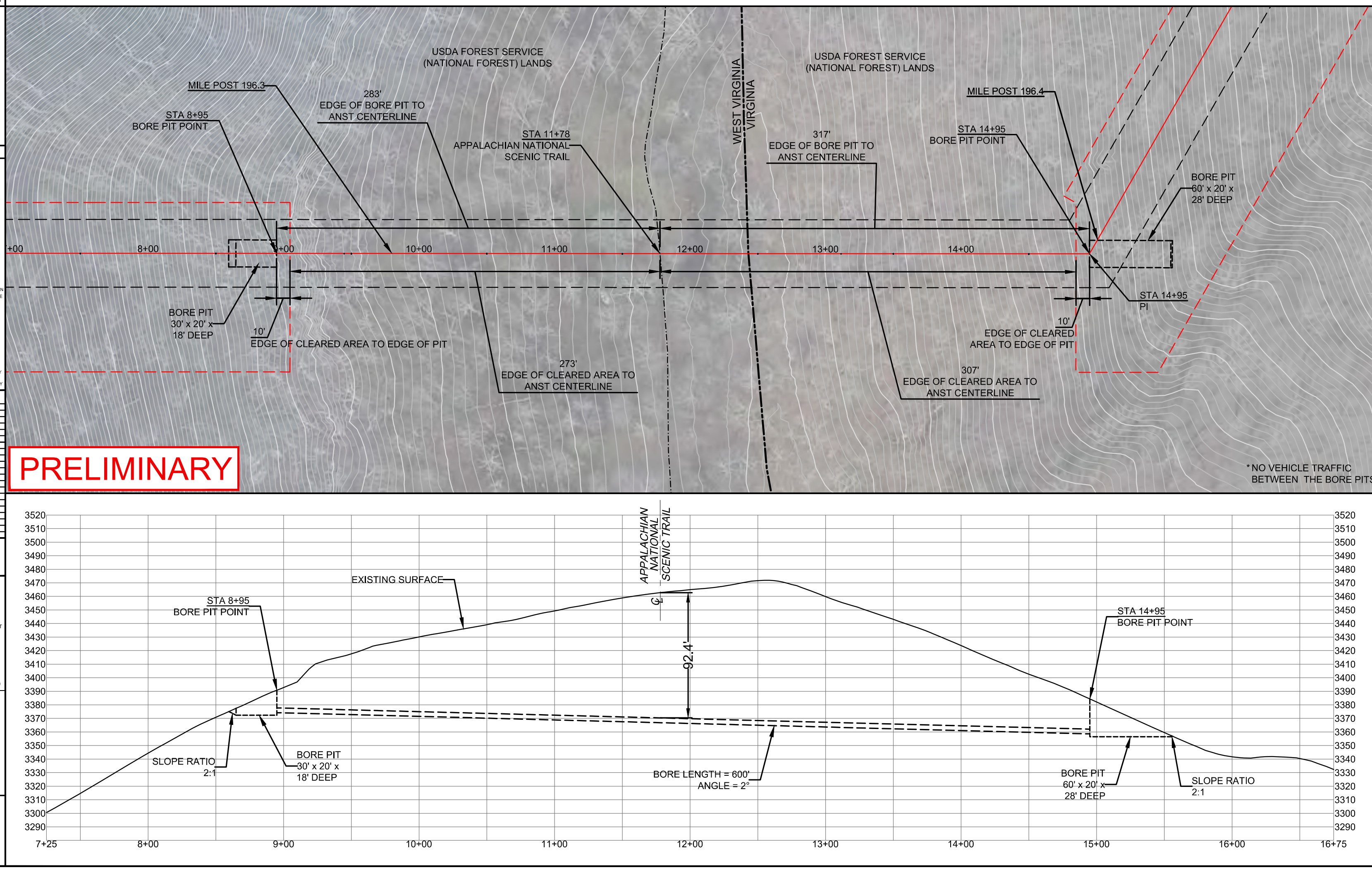
BORE PROFILE FOR APPALACHIAN NATIONAL SCENIC TRAIL

RIGHT-OF-WAY
OWNERSHIP DATA

DESIGN: PIPE / COATING; SLOPE DISTANCE; CLASS LOCATION / HCA

ENVIRONMENTAL: CONSTRUCTION EXCLUSION; WETLAND / STREAM; SEDIMENT BARRIER LEFT; SEDIMENT BARRIER RIGHT

APPALACHIAN NATIONAL SCENIC TRAIL - BORE (OPTION "A")



PLAN VIEW

LEGEND: PROPOSED 42" PIPELINE; NON-SURVEYED C/L; 500' TICK MARK; EXISTING PIPELINE; PERMANENT EASEMENT; WORK SPACE LIMITS; PERMANENT ACCESS RD; TEMPORARY ACCESS RD; ANCILLARY SITE; PROPERTY LINE; ROAD RIGHT-OF-WAY; FENCE LINE; OVERHEAD POWER; OVERHEAD TELEPHONE; C/L ROAD; C/L RAILROAD; DELINEATED STREAM; DELINEATED WETLAND; PI SYMBOL; PROPOSED TEST STATION; MAILBOX; LINE MARKER - VENT PIPE; POWER/TELE POLE; SIGN; TOWER LEG; TREE; GUY ANCHOR; TANK; GAS VALVE; WELL - GAS/OIL/WATER/MONITORING; POST - GATE/FENCE; ELEC/GAS/WTR METER; PEDESTAL - UTILITY; MH - SANITARY/WATER; CATCH BASIN - CULVERT; ADDITIONAL TEMPORARY WORK SPACE(ATWS); ABOVE GROUND FACILITY

REFERENCE DRAWINGS

DRAWING NO.	DESCRIPTION

WORK SPACE: PROPOSED PIPELINE; EXISTING PIPELINE; WORK SPACE LIMITS; PERMANENT EASEMENT; TEMPORARY WORK SPACE(TWS); ADD. TEMPORARY WORK SPACE(ATWS)

CONSTRUCTION METHOD
CONSTRUCTION METHOD KEY
1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16 -

PROFILE

REVISIONS

REV	BY	DATE	DESCRIPTION
1	BK K	08/18/17	PER U.S. FOREST SERVICE COMMENTS

MATERIAL SUMMARY

MK. NO.	QTY	DESCRIPTION

APPROVED FOR CONSTRUCTION | APPROVED FOR BIDDING | APPROVED FOR FERC (REV / BY / DATE)

Mountain Valley PIPELINE

PIPELINE ALIGNMENT
MOUNTAIN VALLEY PROJECT - H600 LINE
RED SULPHUR DIST., MONROE CO., W.V.
PEMBROKE PRECINCT., GILES CO., VA.

July 31, 2020

Appendix A-2-2

ATTACHMENT 2

CONTINGENCY PLAN FOR THE PROPOSED CROSSING OF THE APPALACHIAN NATIONAL SCENIC TRAIL

Document Accession #: 20201210-5005 Filed Date: 12/10/2020

Mountain Valley Pipeline Project

Docket No. CP16-10-000

Contingency Plan for the Proposed Crossing of the Appalachian National Scenic Trail

July 31, 2020

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENT

ACRONYMS AND ABBREVIATIONS

ANST	Appalachian National Scenic Trail
FERC	Federal Energy Regulatory Commission
FS	U.S. Forest Service of the U.S. Department of Agriculture
HDD	horizontal directional drilling
JNF	Jefferson National Forest[1]
Mountain Valley	Mountain Valley Pipeline, LLC
MP	milepost
MT	Microtunneling
MTBM	microtunnel boring machine
MVP	Mountain Valley Pipeline, LLC
POD	Plan of Development
Project	Mountain Valley Pipeline Project
ROW	right-of-way
TBM	tunnel boring machine
Transco	Transcontinental Gas Pipe Line Company, LLC

[1] Jefferson National Forest refers to the southern portion of the current George Washington & Jefferson National Forests throughout this document. Originally two separate national forests, the JNF and the George Washington National Forest were administratively combined in 1995 and are administered as a single national forest unit.

1.0 INTRODUCTION

Mountain Valley Pipeline, LLC (Mountain Valley), a joint venture between EQM Midstream Partners, LP; NextEra Capital Holdings, Inc.; WGL Midstream; RGC Midstream, LLC; and Con Edison Midstream, LLC, is the owner of the Mountain Valley Pipeline Project (Project or MVP), an approximately 303-mile, 42-inch-diameter natural gas pipeline traversing 17 counties in West Virginia and Virginia. The Project extends from the existing Equitrans transmission system and other natural gas facilities in Wetzel County, West Virginia to Transcontinental Gas Pipe Line Company, LLC's (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. In addition to the pipeline, the Project includes approximately 171,600 horsepower (hp) of compression at three compressor stations along the route, as well as measurement, regulation, and other ancillary facilities required for the safe and reliable operation of the pipeline. The pipeline is designed to transport up to 2.0 million dekatherms per day of natural gas.

2.0 PURPOSE

Mountain Valley has proposed to cross underneath the Appalachian National Scenic Trail (ANST), located on U.S. Forest Service (FS) lands, using trenchless (or bore) installation technology. The ANST is a significant recreational resource. Trenchless technology would allow the Project to cross under the ANST while protecting the ground surface used for the ANST footpath and significant buffer areas on each side of the trail from disturbance.

The proposed crossing is 600 feet in length, and approximately 90 feet below the ANST. Mountain Valley has completed a geologic analysis, described in the following section, that has determined the bore path will encounter primarily solid rock. Mountain Valley's trenchless technology consultant, RK&K Engineering, expects with a high degree of confidence that the pipeline can be successfully installed using Manned Tunnel Boring technology. However, in the unlikely event that this method fails, Mountain Valley has identified a set of alternative means to achieve the goal of constructing the pipeline without trenching or other disturbance to the ANST footpath and adjacent woodlands. The following sections of this document describe the contingency measures Mountain Valley has identified. No matter the construction method used, no trenching will occur, and no motor vehicle traffic will be permitted between the bore pits.

3.0 SITE GEOLOGY

The ANST bore crossing is located in the folded and thrust-faulted Valley and Ridge geologic province, on the crest of Peters Mountain at the border between West Virginia and Virginia. The geologic formations that underlie the Peters Mountain ridgeline are the Ordovician-age Juniata Formation and the Silurian-age Tuscarora and Rose Hill Formations that dip moderately (30 degrees) to the southeast (note that the latter two formations generally correspond to the White Medina Formation and Red Medina Formation in West Virginia). A professional geologist visited the site to confirm the mapping and geological conditions in the area, as described in the attached May 12, 2020 memo from Draper Aden Associates.

The Juniata Formation is composed mainly of fine-grained gray-red commonly crossbedded sandstone, with minor red shale interbeds in the lower part of the unit and minor gray-red fissile siltstone and silty shale in the upper part. It generally occupies steep outcrop slopes below ridgelines commonly formed by the overlying Tuscarora sandstone.

The Tuscarora and Rose Hill Formations are found throughout the Valley and Ridge province, as thrust faulting has resulted in repeated geologic sections throughout. The Tuscarora is the dominant ridge-former

in the vicinity of this bore, with the Rose Hill being somewhat less weather resistant than the Tuscarora, but nonetheless also a ridge-former as they are both hard, competent rocks. The following descriptions of these formations were taken from various sources at different locations within the Valley and Ridge province, in order to provide a comprehensive geologic description. The boring would proceed at the prescribed 2-degree angle along the bedrock formations that dip at 30 degrees and therefore would penetrate several units of the Tuscarora and Rose Hill formations.

The Tuscarora Formation sandstone and conglomerate units consist of thin to very thick-bedded, white to light-gray, medium to coarse-grained sandstone and strongly welded quartzite. The Tuscarora quartzite is typically the most weather-resistant (i.e., hardest) rock-type in this province. The Tuscarora sandstone and conglomerate units can be quite hard, particularly where it demonstrates low-grade metamorphism to a welded quartzite.

The Rose Hill Formation is composed of deep-red hematitic sandstones, brown to tan medium-grained sandstones with clay galls, and red and green sandy and micaceous shales. The shales and hematitic sandstones are distinctive and permit ready identification of the unit. The hematitic sandstone is bounded above and below by greenish-gray to red shale with thin gray sandstone interbeds, some of which have abundant brachiopod fossils. Ripple marks are common on the sandstone beds. The Juniata Formation and the Rose Hill Formation are generally observed to be less weather-resistant (i.e., less hard) than the Tuscarora, with more frequent occurrences of shale and siltstone units. The hematite-cemented sandstone units of the Rose Hill are relatively hard compared to the Formation shale and siltstone units, but are generally less indurated than the Tuscarora Formation. Therefore, the Tuscarora quartzite is the dominant ridge-forming unit in the region surrounding the bore.

Mountain Valley has identified four different boring techniques capable of tunneling under the ANST: (1) manned tunnel boring, (2) microtunneling, (3) direct pipe, and (4) guided pilot conventional boring. The following section briefly describes the alternative construction techniques appropriate to the geology of the proposed bore location and highlights the relative merits of the different techniques. After outlining the different techniques, this document describes how Mountain Valley intends to respond to contingencies that may arise during the boring operations.

4.0 MANNED TUNNEL BORING: OPTION 1

Manned tunnel boring uses a machine that is propelled forward by jacked pipe or by thrusting itself forward off fixed conventional tunnel supports installed within the tail can of the tunnel boring machine (TBM). It can be referred to as “Analog Age Tunneling” because in all cases the operator rides underground within the TBM and uses his or her hands to operate machine controls and visually follows a laser beam to control the direction of TBM. TBMs are manned and have complete face access allowing for accurate line and grade tolerances as well as adaptability to changing conditions.

Manned tunnel boring’s major advantage over other boring technologies is that the cutting face to the bore path is always accessible, facilitating removal of obstructions, modifications, and mechanical repairs without significant interference with bore progress. The product pipe is installed as the boring is advanced, leaving no unsupported hole that could potentially collapse. Manned tunnel boring requires construction of launching and receiving pits on either side of the bore, but has a smaller footprint than other typical trenchless technologies. The TBM does not use a slurry to move material, thus significantly reducing the risk of inadvertent returns. This method is guided and steered as it progresses in a single step process.

Cutting heads and teeth are changeable throughout the bore. This method utilizes less equipment than slurry microtunneling or direct pipe.

It is estimated that the manned tunnel bore under the ANST will take approximately 10 weeks to complete. However, there are many factors (such as weather and equipment malfunctions) that may extend this duration. Mountain Valley intends to complete the bore as quickly as possible. Cuttings (spoil) generated by boring operations may be stockpiled temporarily at the site but will ultimately be reused as backfill in the pipeline right of way or transported offsite to an appropriate disposal site.

The manned tunnel bore method (utilizing the appropriate cutting head based on site conditions) described above is an appropriate method for penetrating the geologic formations previously described.

5.0 ALTERNATE TRENCHLESS CROSSING METHODS

5.1 Microtunneling: Option 2

Microtunneling (MT) is a pipeline installation method that consists of jacking a pipe behind a remotely-controlled, steerable, guided, articulated microtunnel boring machine (MTBM). MT projects can range in diameter from 10 to 136 inches. Drive lengths for MT installations can range from 200 to 1,500 feet in length. A wide range of soil types are suitable for installation by MT, including boulders and rock. Boulders and cobbles up to one-third the diameter of the installed pipe can be accommodated by the MTBM. MT activities will only be conducted during daylight hours and will require only one bore pass.

Although unmanned, the MT method, due to its advanced control and guidance system, is capable of installing pipelines to accurate line and grade tolerances. Also, the borehole or tunnel is continuously supported by the installed pipe. Finally, the bentonite slurry (clay and water) collection/recycling system and pressure control features at the excavation face minimize the potential for drilling fluid loss.

Primary disadvantages of the MT method are the necessary use of a slurry and the extended lengths of pipe segments causing more workspace area to be utilized. These factors were the reason why Mountain Valley selected the manned tunnel bore method as the primary ANST crossing method and identified the MT method as an alternate installation choice.

5.2 Direct Pipe: Option 3

Direct Pipe is a trenchless installation method that combines features of Horizontal Directional Drilling (HDD) and MT. Direct Pipe was developed by the HerrenKnecht Company in Germany to provide a one-step pipe jacking method that offered the advantages of both HDD and MT. Direct Pipe utilizes an MTBM connected to the leading edge of an assembled length of pipe and a pipe thruster to jack the pipeline into place, similar to, but in the opposite direction of HDD pullback operations.

Direct Pipe projects can range in diameter for 30 to 60 inches. Drilling lengths for Direct Pipe projects can reach up to 4,900 feet. A wide range of soil types are suitable for installation by Direct Pipe, including boulders and rock. Boulders and cobbles up to one-third the diameter of the installed pipe can be accommodated by the MTBM at the front end of the pipeline.

During Direct Pipe operations, the tunnel face is excavated by an MTBM similar to the MT and pipe-jacking method. The tunnel face is slurry-supported using a bentonite (clay) suspension. The excavated material is removed via a slurry circuit with separation plant in order to separate the spoil from the slurry liquid before feed pumps transport the liquid back to the tunnel face. The MTBM is controlled from the operating container located on the surface adjacent to the pipe thruster. A gyro compass is used for steering

control of the MTBM, allowing a drill radius similar to HDD to be completed. If used, Direct Pipe activities would only be conducted during daylight hours and would require only one bore pass.

An advantage of Direct Pipe system is one-step jacking method, which allows the pipe to be installed in one pass. Also, the installation of the pipe directly behind the MTBM provides constant support to the bore hole. The receiving-side footprint for Direct Pipe is small compared to other methods since all materials and equipment are located on the launch side. The advance control and guidance system provides high-precision target control. Finally, as with MT, the slurry collection/recycling system and pressure-control features at the excavation face minimize the potential for drilling fluid loss.

One disadvantage of Direct Pipe is that the technique requires a large work area on the launch side of a proposed crossing to accommodate the Pipe Thruster, supporting equipment, and long lengths of welded product pipe. Also, this is a relatively new technology to the industry. For these reasons, Mountain Valley did not select Direct Pipe as the ANST primary crossing technique.

5.3 Guided Pilot Conventional Boring: Option 4

Pilot guided conventional boring, or auger boring, is one of the most popular trenchless methods and has been used for more than 50 years. It consists of a jacking pipe that is advanced ("jacked") and a rotating cutting head that is attached to the leading edge of the auger string. The spoil is transported back by the rotation of auger flights within the steel jacking pipe. Auger boring can be used to install pipes ranging from 4 to 60 inches in diameter. Drive lengths for typical auger boring projects range from about 40 to 600 feet. Auger bores can be successfully completed in a range of soil types from dry sand to firm clay to hard rock. Boulders and cobbles up to one third of the diameter of the installed pipe can be accommodated. If used, conventional bore activities will only be conducted during daylight hours. A conventional bore would require a pilot pass followed by the main bore pass. Figure 1 illustrates the process of completing a conventional bore.

Auger boring's major advantage over some other boring technologies is that the pipe is installed as the boring is advanced, leaving no unsupported hole that could potentially collapse. Auger boring requires construction of launching and receiving pits on either side of the bore, but has the least amount of areal footprint required of the trenchless technologies. The launch pit, where the jacking machine is located, would be on the Virginia side of the bore and would be 20 feet wide by 60 feet long. The receiving pit, on the West Virginia side of the bore, would be 20 feet wide by 30 feet long, in plan (see Figure 2). A summary table of the bore pit lengths and widths is included at Table 1. It is estimated that the conventional bore under the ANST would take approximately 10 weeks to complete. However, there are many factors (such as weather and equipment malfunctions) that may extend this duration. Mountain Valley would complete the bore as quickly as possible. Cuttings (spoil) generated by boring operations may be stockpiled temporarily at the site but would ultimately be reused as backfill in the pipeline right-of-way or transported offsite to an appropriate disposal site.

The horizontal auger bore method (utilizing the appropriate cutting head) described above is an appropriate method for penetrating the geologic formations previously described. If the conventional auger bore encounters excessively hard rock, an air driven rock hammer drill can be deployed at the bore face, substituting for the auger as needed.

The conventional auger bore method is the least favorable because the length of the bore under the ANST is at the outer limits of this method's typical application.

6.0 CONTINGENCY PLAN

If insurmountable issues are encountered during the manned tunnel boring process, Mountain Valley, in consultation with RK&K and the FS, intends to perform corrective actions, such as selecting a new drill path, within the approved corridor or may implement an alternate trenchless crossing method as outlined in this plan. The following list, which is illustrative, not exhaustive, provides examples of issues that could require the implementation of this contingency plan:

- Mechanical failures of MTB Equipment - If a catastrophic failure of the TBM equipment occurs and it is not possible to repair or rebuild, a substitute boring unit will be installed.
- Deviation from planned bore path - If the deviation from the bore path is significant enough that the field engineer determines it cannot be corrected or made up in the remaining bore length, the bore will be considered a failure. The amount of acceptable deviation is dependent upon the angle of deflection and the remaining distance to be drilled.
- Unanticipated geological or hydrological conditions in which ground or surface water affects construction or the geologic materials become unstable or collapse.
- Unexpected soil contaminants or conditions posing a safety hazard to the MTB methodology.

Mountain Valley will not use open-cut methods to install the pipeline under the ANST. Mountain Valley will notify and seek approval from Federal Energy Regulatory Commission (FERC) inspectors and FS representatives prior to implementing this contingency plan or making any adjustments to the boring plans and procedures. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting, regulatory, and land-managing agencies, and required approvals will be obtained prior to implementing any alternative crossing measures.

While all FS-approved contingency options are viable at the ANST crossing, manned tunnel boring is the most effective method. Microtunneling and Direct Pipe are a more complex process and will require larger entry and exit workspaces, and the length of a conventional auger bore underneath the ANST would be at the outer limits of this method's typical application. Either of the three contingency methods are estimated to take approximately 10 weeks to complete. However, there are many factors (such as weather and equipment malfunctions) that may extend this duration. Mountain Valley intends to complete the bore as quickly as possible.

6.1 Initial Contingency Plan – Reattempt Bore

In the event that the bore is determined to be unsuccessful based on encountering one or more issues identified above, or other obstacles, Mountain Valley will notify and seek approval from FERC inspectors and FS representatives prior to shifting the bore entry to the east or west of the original bore entry and attempting another bore. Should a bore failure involve stuck pipe following known engineered recovery techniques, any pipe from a failed bore will be abandoned in place and backfilled with grout. Should Mountain Valley and technical consultants determine that the manned tunnel bore is not appropriate based on the initial attempts, Mountain Valley will propose to use a different trenchless crossing method. Three alternatives are discussed below, with microtunneling being the most feasible and Mountain Valley's preferred contingency method.

6.2 Microtunneling Installation

In the event that the conventional bore reattempt is determined to be unsuccessful based on encountering one or more issues identified above, Mountain Valley will notify and seek approval from FERC inspectors

and FS representatives prior to making any adjustments, abandoning the process, and moving to the MT method. The MT bore will be attempted in the same location as the conventional bore, and similarly offset to the east and west in the event that the first MT attempt is not successful.

As stated above, MT is a pipeline installation method that consists of jacking a pipe behind a remotely-controlled, steerable, guided, articulated MTBM. The MT method most common in the United States is the slurry method. Mountain Valley recognizes that drilling fluids may not be spread onsite as a means of disposal; they will be hauled offsite to an appropriate disposal site. Cuttings (spoil) separated from the drilling fluid may be stockpiled temporarily at the site but will ultimately be transported offsite to an appropriate disposal site. Assuming a swell factor of 34% for sandstone, boring operations will generate approximately 329 cubic yards of cuttings.

The equipment needed for a successful microtunnel, in addition to the MTBM and jacking machine, includes the lubricant/recycling tank and pumps, control container, and supply and storage trailers. In addition, a crane or large side boom will be needed for pipe handling and to lower the MTBM in place as well as the pipe sections. Figure 3 illustrates the process of completing MT.

In the event that the MTBM gets stuck and cannot move forward, it will be pulled out of the bored hole using track-mounted equipment. No additional excavation is anticipated.

The typical workspace footprint of microtunnel setup for this Project is anticipated to be a minimum of approximately 125 feet wide by 250 feet long on the launch side, with a bore pit 20 feet wide by 55 feet long (see Figure 4). Control containers and support equipment are placed adjacent to the launch pit. The exit side workspace required for this method is approximately 125 feet in width by 125 feet in length, with a bore pit 20 feet wide by 30 feet long. A summary table of the bore pit lengths and widths is included in Table 1.

Table 1.

Bore Pit Dimensions for the Proposed and Alternative ANST Bore Methods

Method	Bore Pit Dimensions (Entry/Exit)	Workspace Dimensions (Entry/Exit)
Manned Tunnel Bore	20’ wide x 60’ long / 20’ wide x 30’ long	125’ wide x 125’ long / 125’ wide x 125’ long
Microtunneling	20’ wide x 60’ long / 20’ wide x 30’ long	125’ wide x 125’ long / 125’ wide x 125’ long
Direct Pipe	20’ wide x 60’ long / 20’ wide x 30’ long	125’ wide x 250’ long / 125’ wide x 125’ long
Conventional Bore	20’ wide x 80’ long / 20’ wide x 30’ long	125’ wide x 600’ long / 125’ wide x 125 long’

6.3 Direct Pipe Installation

In the event that the manned tunnel bore and microtunnel bores are determined to be unsuccessful in the designed location based on encountering one or more issues identified above, Mountain Valley will notify and seek approval from FERC inspection and FS representatives prior to making any adjustments abandoning the process and moving to the Direct Pipe method. The Direct Pipe bore will be attempted in the same location as the manned tunnel bore, and similarly offset to the east and west in the event that the first Direct Pipe attempt is not successful.

During Direct Pipe operations, the tunnel face is excavated by an MTBM similar to the MT method. The excavated material is removed via a slurry circuit with separation plant in order to separate the spoil from the slurry liquid before feed pumps transport the liquid back to the tunnel face. The MTBM is controlled from the operating container located on the surface adjacent to the Pipe Thruster. A gyro compass is used for steering control of the MTBM allowing drill radii similar to HDD. Mountain Valley recognizes that drilling fluids may not be spread onsite as a means of disposal; they will be hauled offsite to an appropriate disposal site. Cuttings (spoil) separated from the drilling fluid may be stockpiled temporarily at the site but will ultimately be transported offsite to an appropriate disposal site. Assuming a swell factor of 34% for sandstone, boring operations will generate approximately 329 cubic yards of cuttings. Figure 5 illustrates the process of completing a Direct Pipe bore.

In the event that the MTBM used in Direct Pipe operations gets stuck and cannot move forward, it will be pulled out of the bored hole using track-mounted equipment. No additional excavation is anticipated.

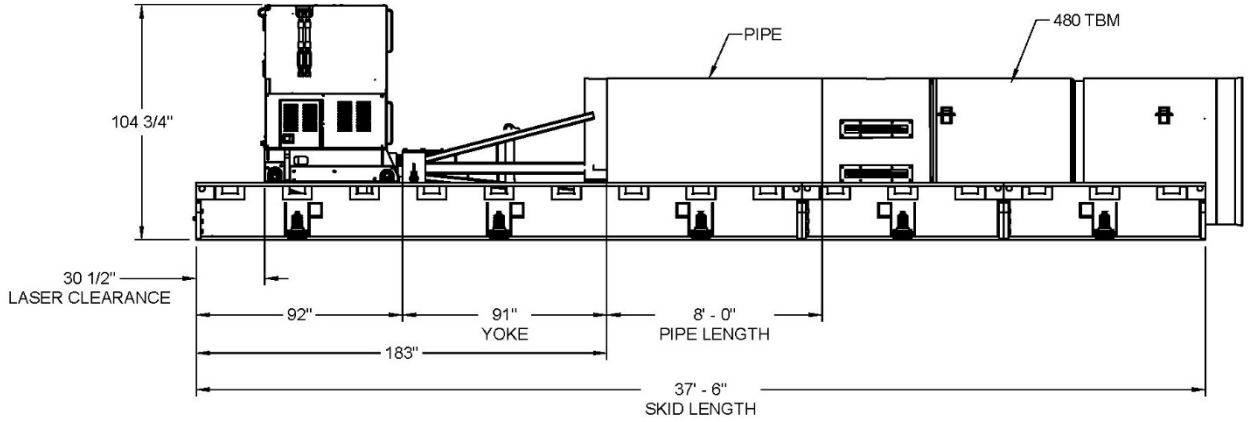
Direct Pipe typically requires a large area on the launch side. The recommended minimum work area for a Direct Pipe installation of this magnitude is approximately 125 feet wide and at least the length of the crossing on the launch side (over 600 feet at this site) due to need to string assembled pipe. The exit side workspace required for this method is approximately 125 feet in width by 125 feet in length. The entry and exit bore pits are approximately 20 feet by 80 feet and 20 feet by 30 feet, respectively (See Figure 6). A summary table of the bore pit lengths and widths is included in Table 1. The equipment needed for a successful direct-pipe installation is similar to MT: MTBM and thruster, lubricant/recycling tank and pumps, control container, and supply.

6.4 Guided Pilot Conventional Bore

In the event that the manned tunnel bore, microtunneling, and direct pipe attempts are determined to be unsuccessful in the designed location based on encountering one or more issues identified above, Mountain Valley will notify and seek approval from FERC inspection and FS representatives prior to making any adjustments abandoning the process and moving to the guided pilot conventional bore method. The guided pilot conventional bore will be attempted in the same location as the other methods, and similarly offset to the east and west in the event that the first guided pilot conventional bore attempt is not successful.

This option is the least favorable due to the overall length of the bore, which is near the outer limits of the distance typically bored in this manner.

FIGURES



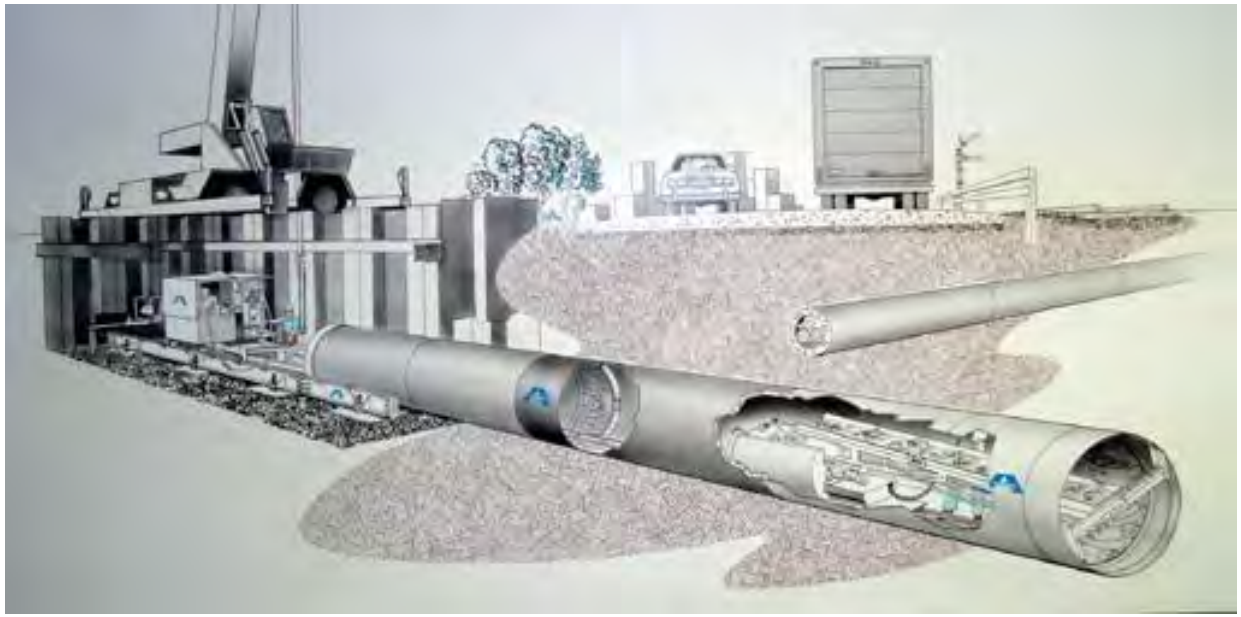


Figure 1. Appalachian National Scenic Trail Crossing – Manned Tunnel Bore Typical Drawings

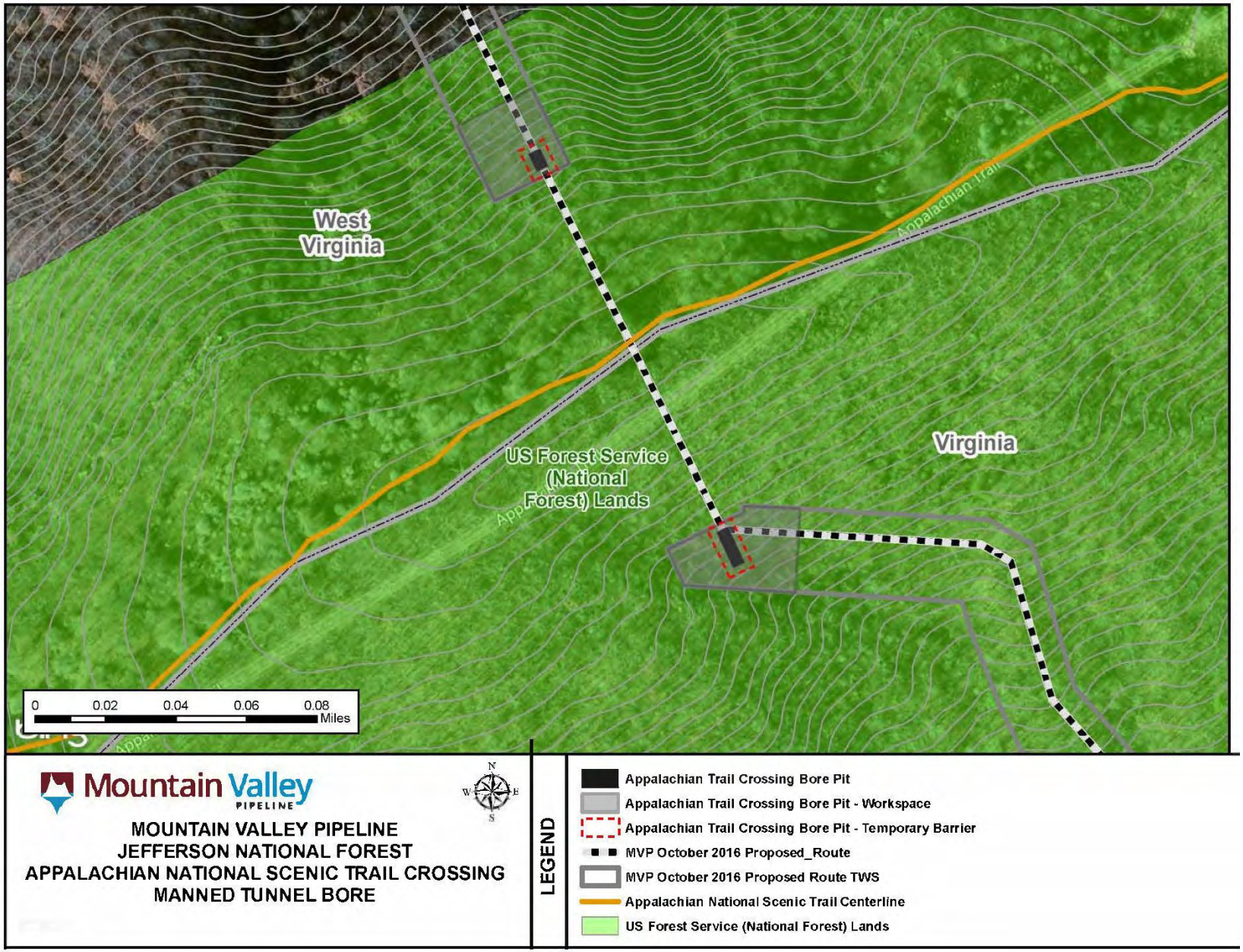


Figure 2. Appalachian National Scenic Trail Crossing – Manned Tunnel Bore

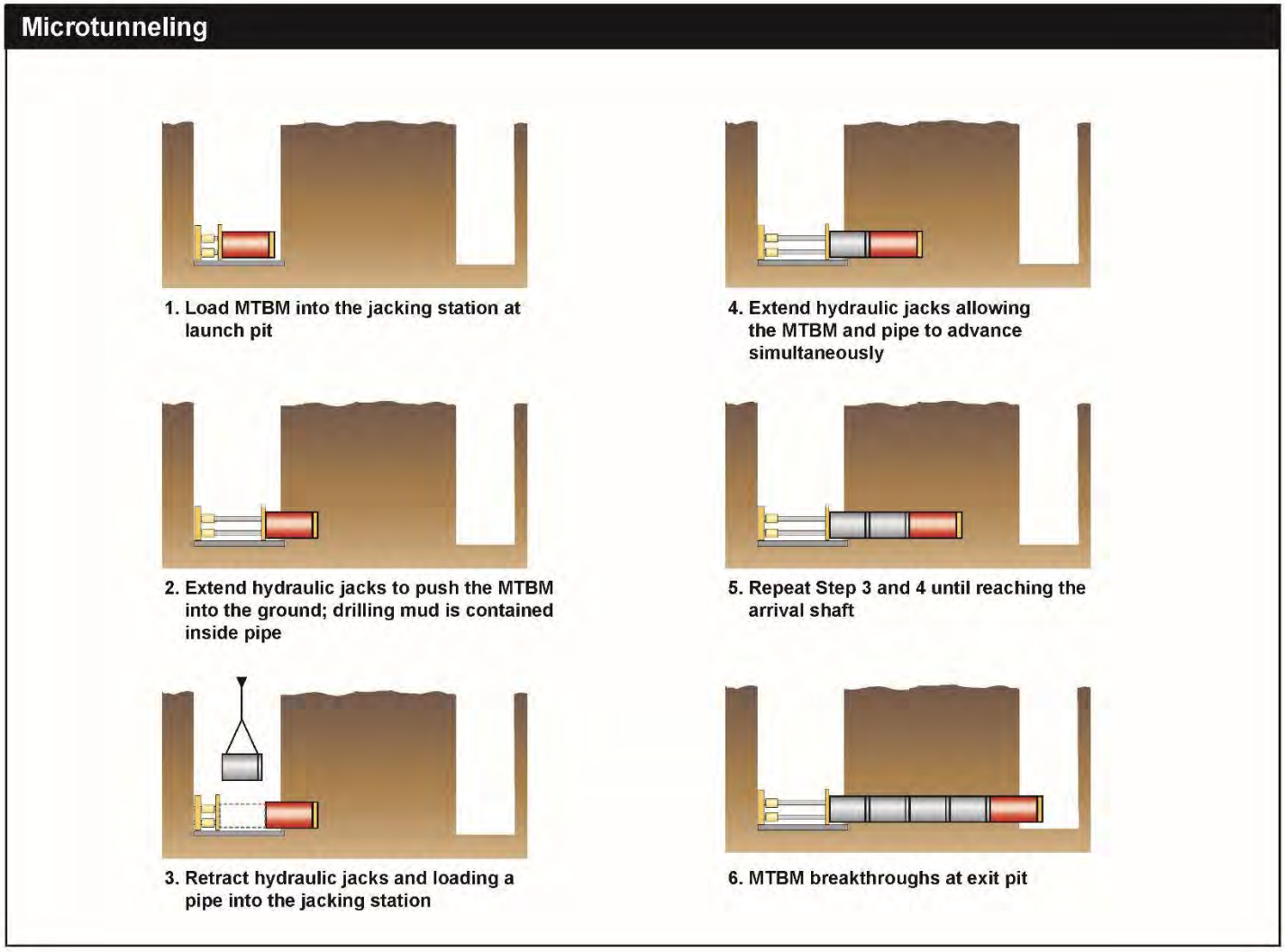


Figure 3. Appalachian National Scenic Trail Crossing – Microtunneling Process Drawing

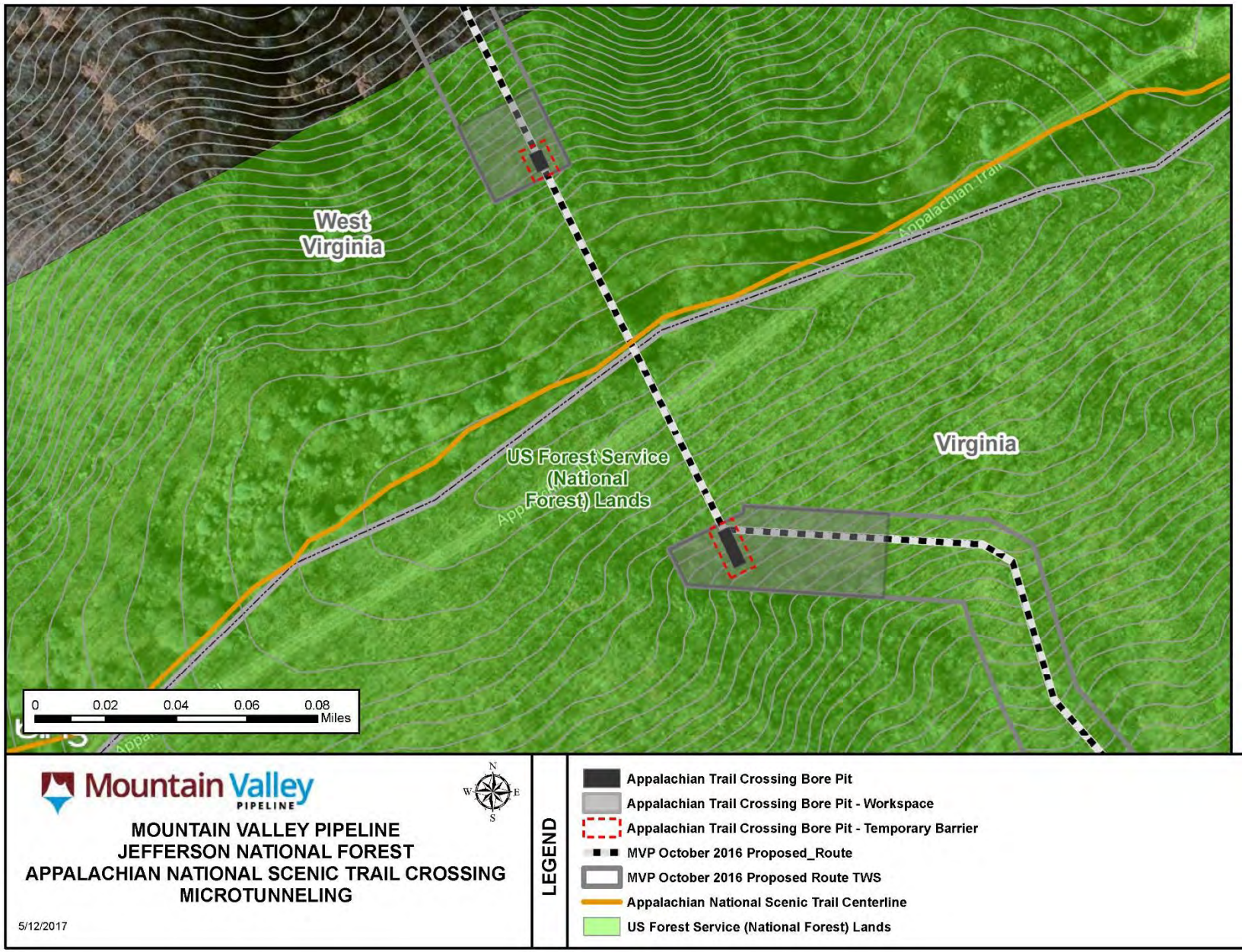


Figure 4. Appalachian National Scenic Trail Crossing – Microtunneling

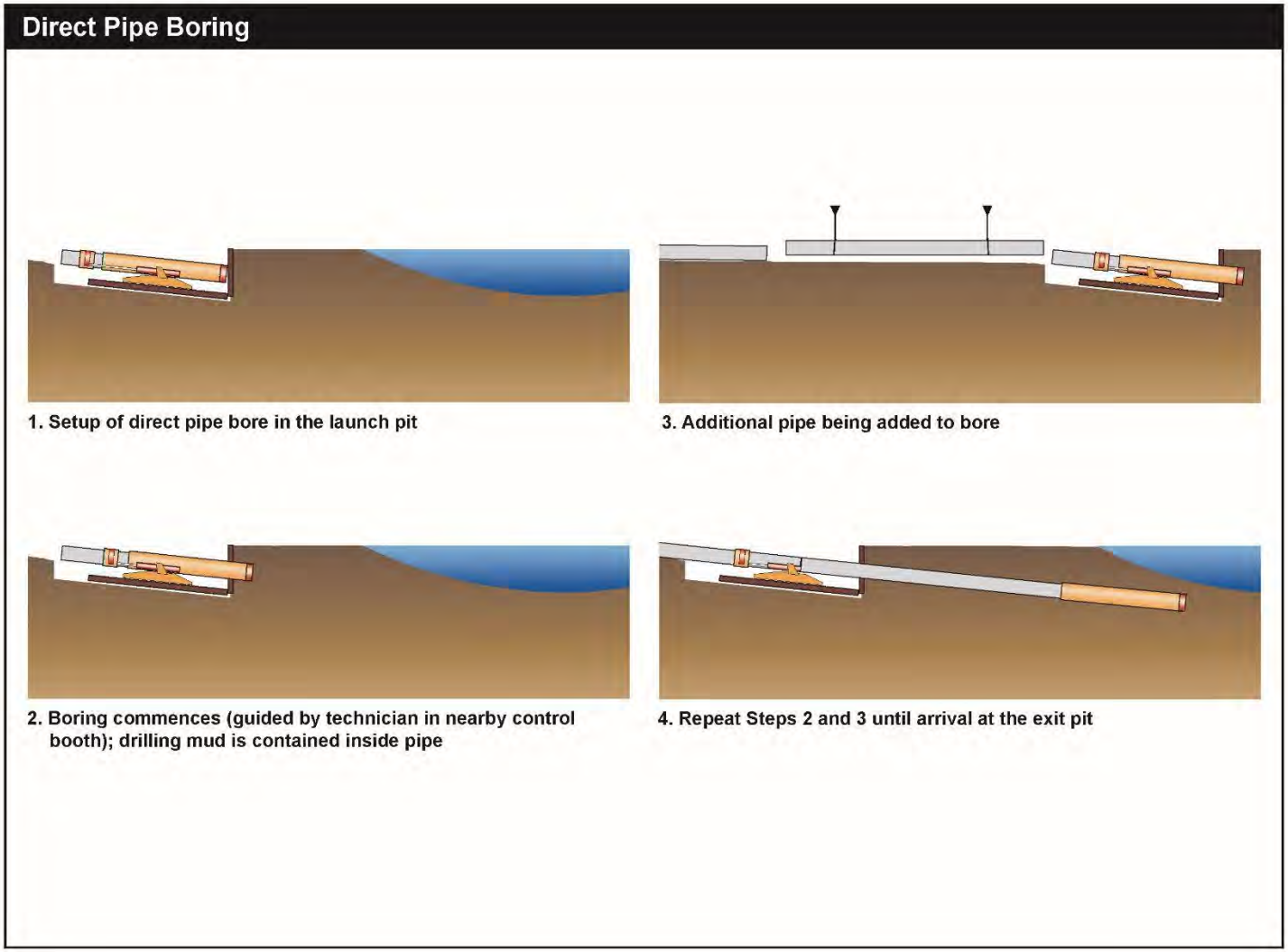


Figure 5. Appalachian National Scenic Trail Crossing – Direct Pipe Process Drawing

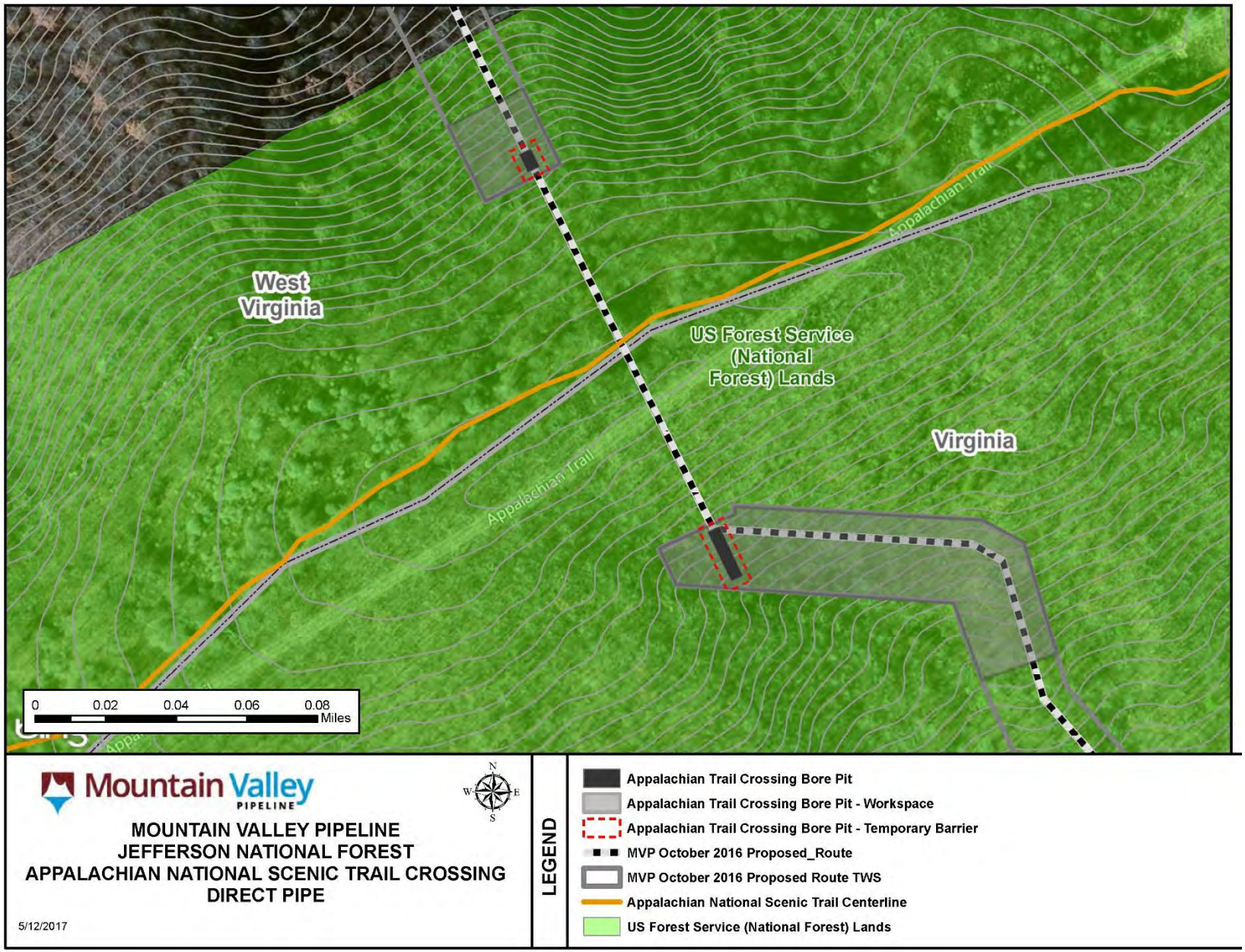


Figure 6. Appalachian National Scenic Trail Crossing – Direct Pipe

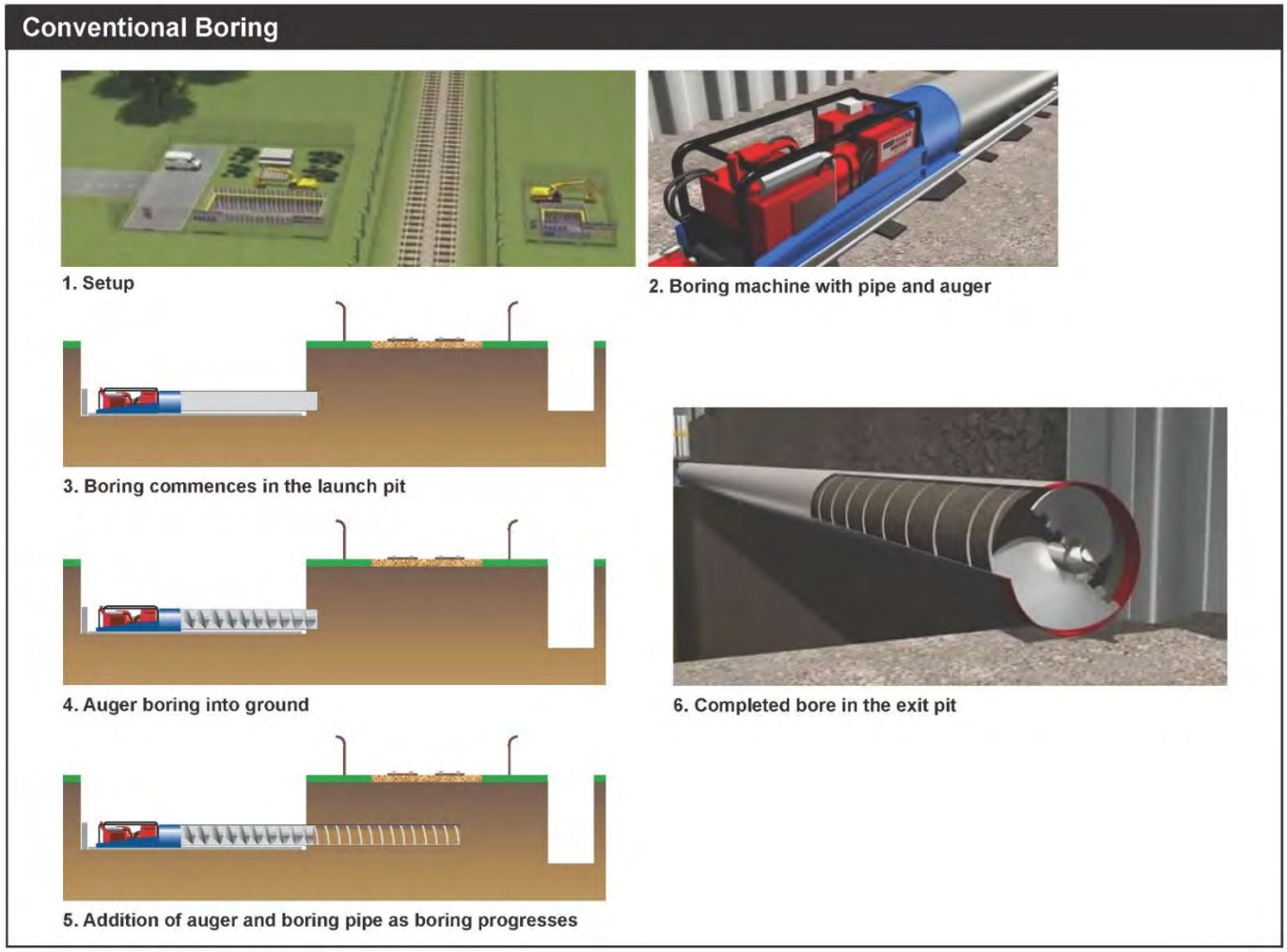


Figure 7. Appalachian National Scenic Trail Crossing – Conventional Bore Process Drawing

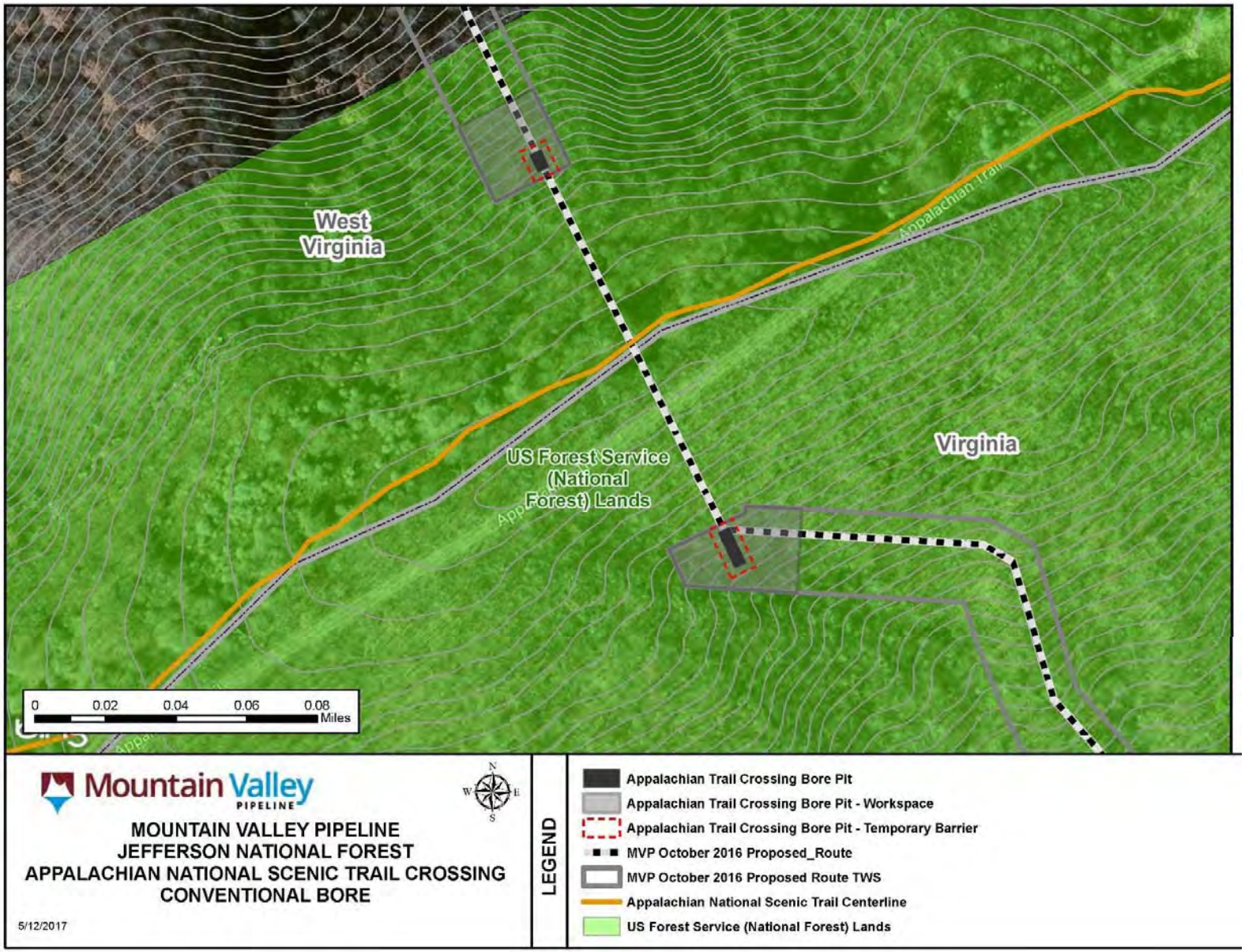


Figure 8. Appalachian National Scenic Trail Crossing – Conventional Bore

ATTACHMENT E-1
MEMORANDUM ON GEOLOGIC FORMATION DESCRIPTIONS AT MVP ANST CROSSING SITE

Memorandum

To:	Megan Neylon, Equitrans Midstream
From:	William D. Newcomb, P.G., Program Manager
Date:	05/12/2020
Project Name:	Mountain Valley Pipeline Project
Project Number:	B14188B-01 / 21[G]
Subject:	Geologic formation descriptions at ANST crossing site

The following discussion summarizes geologic formations observed in outcrops at one portion of the Mountain Valley Pipeline (MVP) that will entail a manned tunnel boring under one scenic trail, the Appalachian National Scenic Trail (ANST) between Monroe County West Virginia and Giles County, Virginia (starting at MVP Milepost 196.3).

The purpose for completing the manned tunnel boring at this location is to preserve the viewshed at the scenic feature. The purpose for presenting the information included herein is to provide descriptive details of the rock type observed in outcrops at the bore site, in order to assist Mountain Valley in design specifications of the bore.

William D. Newcomb, P.G., a registered professional geologist in Virginia (number 2801000924; expires August 31, 2021) with 30 years of experience in geology, geotechnical assessments and hydrogeology, visited the ANST site on December 7, 2016, to observe bedrock characteristics in outcrops at the ground surface. No subsurface invasive sampling was permitted at this location by the U.S. Forest Service (ANST site).

Appalachian National Scenic Trail (ANST), Monroe County, West Virginia and Giles County, Virginia.

Mountain Valley seeks a permit from the U.S. Forest Service (FS), which maintains the right-of-way for the ANST, in order to complete a manned tunnel boring under the ANST at approximately Milepost 196.3 of the MVP (Figure 1).

The ANST bore crossing is located in the folded and thrust-faulted Valley and Ridge geologic province, on the crest of Peters Mountain at the border between West Virginia and Virginia. The geologic formations that underlie the Peters Mountain ridgeline are the Silurian age Tuscarora and Rose Hill Formations that dip moderately (30-degrees) to the southeast (the Juniata Formation conformably underlies the Tuscarora Formation in this area).

The proposed boring would proceed at a 2-degree upward angle from southeast to northwest (i.e., from Virginia into West Virginia). The bore would likely begin in the Rose Hill Formation on the southeast flank of Peters Mountain, penetrate the Tuscarora and then enter the Juniata Formation with the receiving pit likely encountering the Juniata Formation on the northwest slope of Peters Mountain (see Figure 2 for site-photographs of the bedrock formations near the ANST bore site at the ridgeline of Peters Mountain; downslope exposures of bedrock are covered by colluvial deposits). The boring would proceed at the prescribed 2-degree angle along the bedrock formations that dip at 30-degrees. The proposed bore is slated to be approximately 600 feet in length between the bore pit and receiving pit, with a maximum depth of approximately 92 feet below ground at the ridgeline.

The Tuscarora, Rose Hill and Juniata Formations are found throughout the Valley and Ridge province, as thrust faulting has resulted in repeated geologic sections throughout. The Tuscarora and Rose Hill Formations are ridge forming units on Peters Mountain. The following general descriptions of these formations provide a fairly comprehensive geologic description of the bedrock units likely to be encountered by the proposed boring.

The Juniata Formation is composed mainly of fine-grained gray-red commonly crossbedded sandstone, with minor red shale interbeds in the lower part of the unit and minor gray-red fissile siltstone and silty shale in the upper part. It generally occupies steep outcrop slopes below ridgelines commonly formed by the comformably overlying Tuscarora sandstone.

The Tuscarora Formation sandstone and conglomerate units consist of thin- to thick-bedded, white to light-gray, medium to coarse-grained sandstone (some areas strongly welded quartzite are observed). Thin beds of quartz-pebble conglomerate occur in the lower half of the formation. The Tuscarora displays cross-bedding and clay rip-ups. The Tuscarora quartzite is typically the most weather-resistant (aka, hardest) rock-type in the Valley and Ridge province of southern West Virginia and southwestern Virginia. As a result, it plays a prominent role in the shaping of the local topography and is well exposed in numerous mountain outcrops.

The Tuscarora is comformably overlain by the Rose Hill Formation (and Keefer sandstone unit) at the top of the last quartz arenite of the Tuscarora. The Rose Hill Formation is composed of deep-red hematitic sandstones, brown to tan medium-grained sandstones with clay galls, and red and green sandy and micaceous shales. The shales and hematitic sandstones are distinctive and permit ready identification of the unit. The hematitic sandstone is bounded above and below by greenish-gray to

red shale with thin gray sandstone interbeds, some of which have abundant brachiopod fossils. Ripple marks are common on the sandstone beds.

The Tuscarora sandstone and conglomerate units can be quite hard, particularly where it demonstrates low-grade metamorphism to a welded quartzite. Figure 3 provides a link to several photographs of a rock core through the Tuscarora Formation in West Virginia (depth ranges from 6,775 to 6,819 feet below ground). Figure 4 shows specific close-up photographs of the sandstone and conglomerate units of the Tuscarora. Figure 5 is a descriptive log of the Tuscarora core that is presented at the link provided in Figure 3.

Review of the Tuscarora Formation core (Figure 3) shows intervals of white and gray well- cemented sandstone and conglomerate layers, which form the most weather-resistant (i.e., ridge forming) units in the formation in the Appalachian basin, including the vicinity of the MVP bore at MP 196.3. However, silt and shale partings, joints and fractures are also common to the Tuscarora, which would reduce the overall resistance to boring through the Formation. The photographs of the core sandstone and conglomerate units show a tightly cemented fine to medium-grained sandstone and conglomerate (Figure 4). The data log (Figure 5) does not provide specific information on hardness, but gives a good overall description of the Tuscarora Formation, which is consistent with what is observed in southwestern Virginia, near the bore pits at Peters Mountain.

The Rose Hill and Juniata Formations are generally observed to be less weather-resistant (i.e., less hard) than the Tuscarora, with more frequent occurrences of shale and siltstone units. The hematite-cemented sandstone units of the Rose Hill are relatively hard compared to the shale and siltstone units, but are generally less indurated than the Tuscarora Formation.

In summary, the primary risk for the bore site is penetrating the Tuscarora quartzite, in terms of hardness of the formation. There is also a complication given the 30-degree southeast dip of the formation underlying Peters Mountain, in terms of bore deflection. The length of the bore (approximately 600 feet) also presents a risk to completing the bore at the prescribed receiving pit.

References:

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Schultz, A. P. and Stanley, C. B. (2001). Geologic map of the Virginia portion of the Lindside Quadrangle, Virginia. Publication 160 Virginia Division of Mineral Resources; Cooperative Geological Mapping Program, U.S. Geological Survey.

Figure 1 – MVP bore under ANST at Approximate Milepost 196.3
(geologic basemap from Schultz and Stanley, 2001)

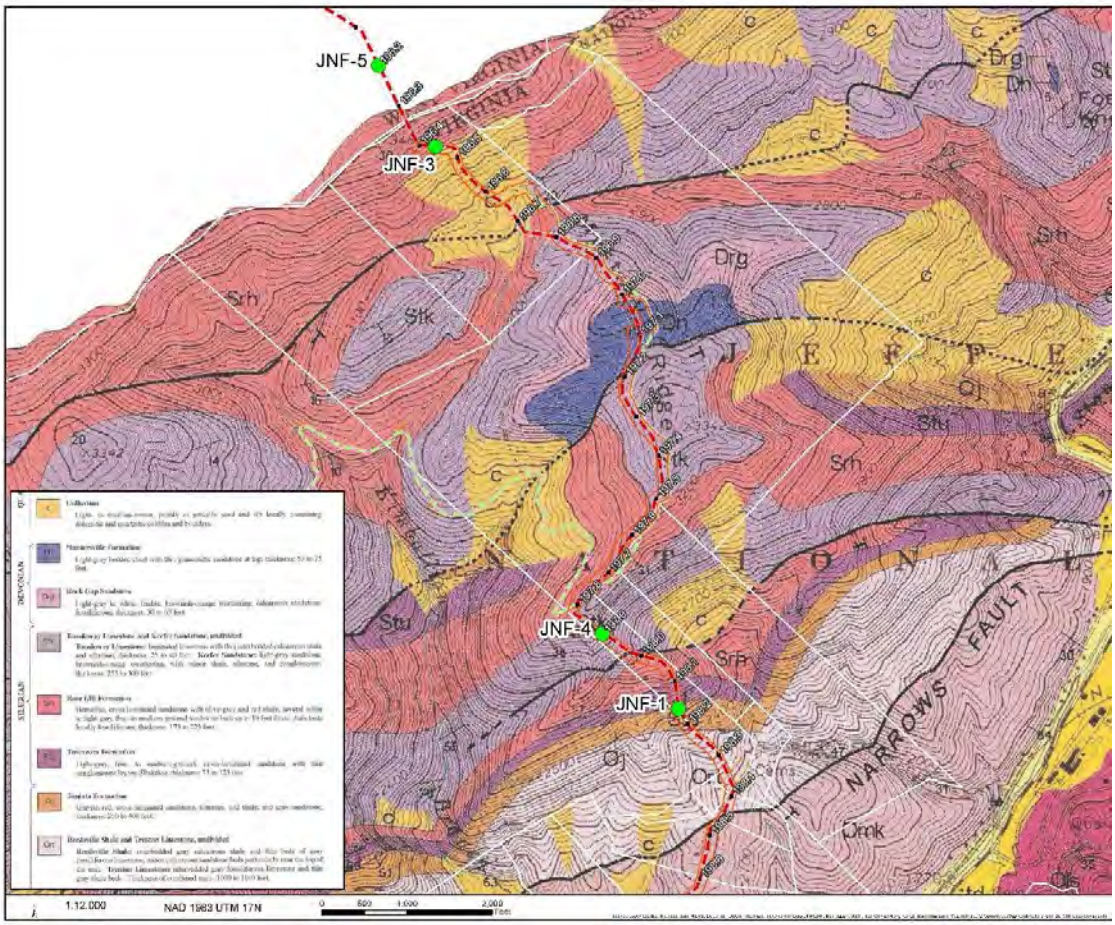

Figure 2 – Representative Site Photographs of Peters Mountain where Rose Hill Formation outcrops at the ridge line and Tuscarora Formation outcrops to the northwest and downslope from the ridge line in the vicinity of the ANST bore (the Juniata Formation underlies the Tuscarora). The bore would likely begin in the Rose Hill Formation on the southeast flank, penetrate the Tuscarora and then enter the Juniata with the receiving pit likely encountering the Juniata Formation on the northwest slope of Peters Mountain.

Figure 3 – This link provides photographs of Tuscarora Formation core from tight-gas exploration in West Virginia (core depth ranges from 6,775 to 6,819 feet below ground.
http://www.wvgs.wvnet.edu/atg/CoreViewer.aspx?RO=4&PN=1&api=4703902751

Figure 4 – Photographs of Tuscarora sandstone and conglomerate units from core provided at the link presented in Figure 3

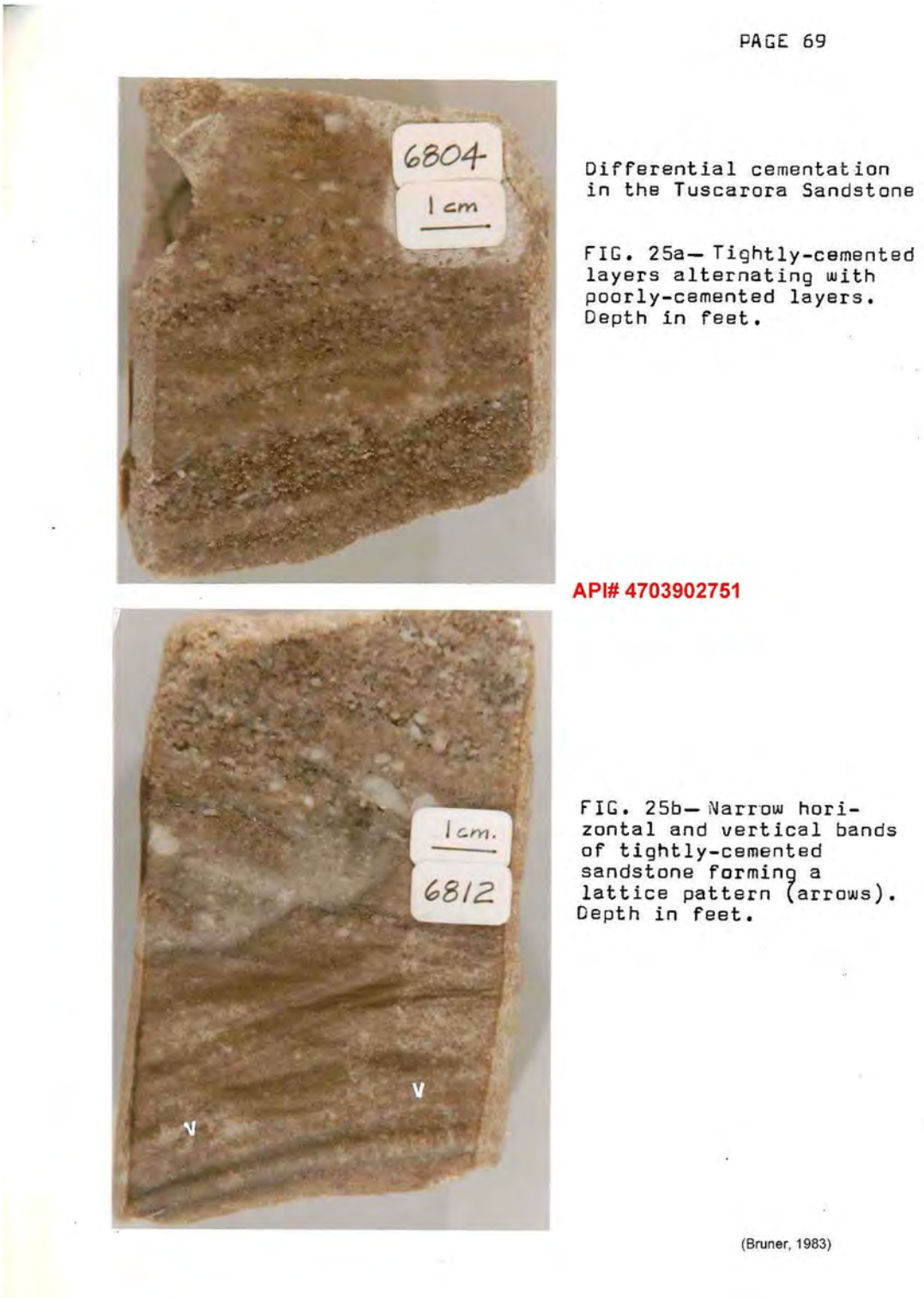

Figure 4 – Continued

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FIG. 25c— Irregular lower digitate boundary, similar to the lower boundaries in poorly cemented disk-shaped lenses found in outcrop. Depth in feet.

API# 4703902751

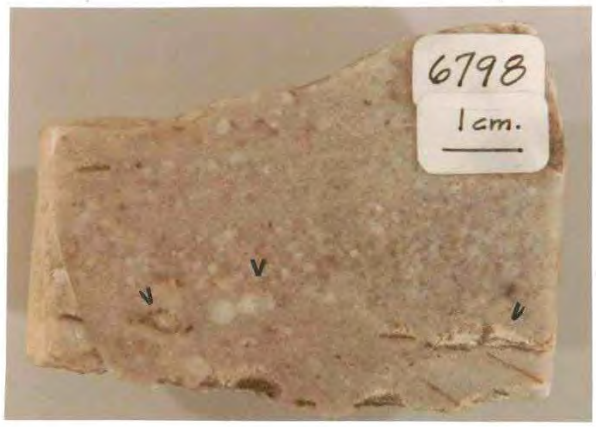
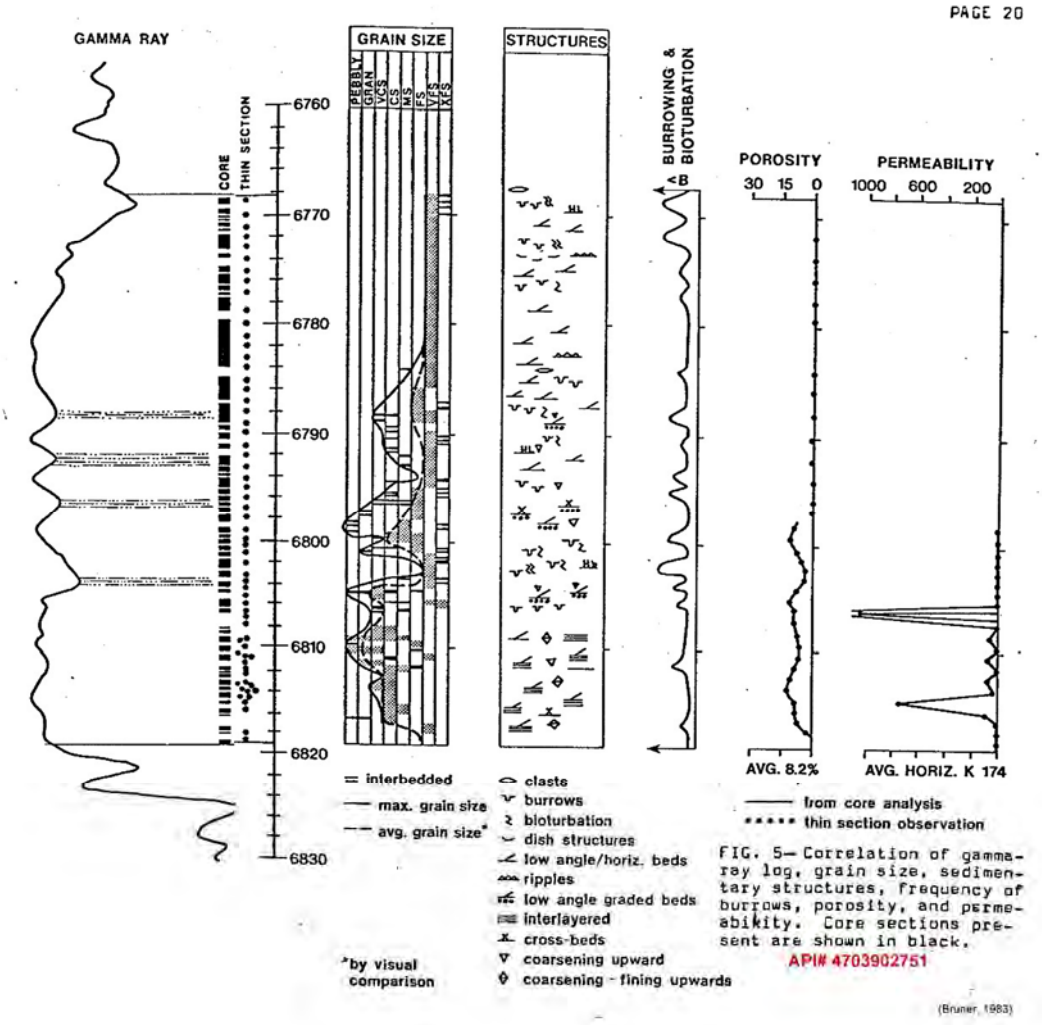


FIG. 25d— Poorly-cemented patches over pebbles and clay clasts (arrows). Depth in feet.

(Bruner, 1983)

Figure 5 – Descriptive data on the Tuscarora core provided in Figure 3



ATTACHMENT 3

CORRESPONDENCE AND MEETING NOTES

Document Accession #: 20201210-5005 Filed Date: 12/10/2020

USDA United States Department of Agriculture | Forest Service | George Washington and Jefferson National Forests | 5162 Valleypointe Parkway Roanoke, VA 24019 540-265-5100

File Code: 2360
Date: July 26, 2017

Roger Kirchen
Director Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Dear Mr. Kirchen,

Please find enclosed a hard copy and disc copy of the ***Mountain Valley Pipeline Project Cultural Resource Survey and Evaluation, Jefferson National Forest, Giles and Montgomery Counties, ARPA Permit BBW 43304T, Phase II Cultural Resource Investigations, Sites 44GS0238, 44GS0240, 44GS0241, 44GS0242, 44GS0243, 44GS0244, 44GS0247, 44GS0251, 44MY0577, 035-5129 and 035 -5134. Docket No. CP16-10, FR# 15 – 76 – MULTI, June 22, 2017.*** This project is located on the Eastern Divide Ranger District within the confines of the George Washington and Jefferson National Forests.

The results of short interval Phase II survey of the proposed pipeline corridor in Giles County have resulted in the findings that sites *44GS0238, 44GS0241, 44GS0247 and 44GS0251* are now considered a single archaeological site (**44GS0241**)consisting of a prehistoric Native American site with multiple historic components covering approximately 5.8 acres. After close review of the presented data it has been determined that this site meets the Secretary of the Interior's criteria for National Register of Historic Places (NRHP) eligibility under Criterion D and should be considered eligible for listing under the National Historic Preservation Act. The proposed project as planned will have an adverse effect upon this historic property. Therefore, consultation with you and other consulting parties per 36CFR800.6 is needed to resolve this adverse effect. Unless the site can be completely avoided, it is our recommendation that the most appropriate mitigation is Phase III data recovery. As the George Washington and Jefferson National Forests is required to manage and protect this historic property, we will request to be a signatory to the Memorandum of Agreement (MOA) and a participant in designing the Phase III data recovery strategy.

The other identified archaeological sites, all located within Giles County; *44GS0240, 44GS0242, 44GS0243, 44GS0244* are recommended not eligible for NRHP listing due to the absence of features, absence of stratification or depth of deposit and do not meet the Department of Interiors Criteria for NRHP eligibility. *44MY0577*, located in Montgomery County, Virginia is outside of the project boundaries and will remain unaffected by the proposed project. Architectural resources *035-5129 and 035- 5134* were determined to not be eligible for listing due to a lack of qualifying factors. *035- 5129* is a late twentieth century cabin structure and *035 – 5134* was misidentified as a potential gravesite.

No archaeological resources were identified associated with the Appalachian National Scenic Trail (ANST). However the trail in itself is eligible for NRHP listing. Furthermore, the National Park Service is currently in the process of nominating the entire ANST to the NRHP as a historic district. However, we contend that employing the mitigation measures outlined for the ANST in the FEIS, which includes boring under the ANST, coupled with revegetation plans, will result in no adverse effect to the proposed ANST historic district on national forest lands. The FEIS is available for viewing here:
https://www.fs.usda.gov/detail/gwj/landmanagement/projects/?cid=stelprd3827827

This report is consistent with the Secretary of the Interior's Standards for Identification (48 FR 44720-44723), Section 106 of the National Historic Preservation Act of 1966, as amended, and with the guidelines established by the Department of Historic Resources. Your concurrence with our findings and recommendations are requested. If you have any questions regarding this undertaking please don't hesitate to contact, Mike Madden, USFS Forest Archaeologist at 540-265-5211 or mjmadden@fs.fed.us

Sincerely,

JOBY P. TIMM
Forest Supervisor

United States Department of the Interior

NATIONAL PARK SERVICE
Northeast Region
United States Custom House
200 Chestnut Street
Philadelphia, PA 19106

IN REPLY REFER TO:

A.1.2. (NER-RSS)

November 17, 2017
Paul Friedman, Project Manager
Federal Energy Regulatory Commission
888 First Street NE
Washington, D.C. 20426

RE: Mountain Valley Pipeline Section 106 Consultation

Dear Mr. Friedman:

The National Park Service (NPS) submits the following comments on FERC's Mountain Valley Pipeline (MVP) Section 106 submission to the Advisory Council on Historic Preservation (ACHP), including FERC's assessment of adverse effect and internal working draft programmatic agreement (PA). Our comments address the Appalachian National Scenic Trail (Appalachian Trail) and the Blue Ridge Parkway (Blue Ridge), both units of the National Park System.

The NPS understands FERC wishes to expedite completion of the MVP Section 106 process, and we are supportive of that goal. We believe that considering the NPS comments provided below will address our concerns and allow FERC to execute the PA quickly.

In summary, NPS believes that applying the agreed upon US Forest Service (USFS) revegetation management protocols at key points along the Trail where the ROW is visible could address our key viewshed concerns. We also wish to work with FERC and MVP regarding avoiding and minimizing cumulative and long-term potential visual effects to the Trail, particularly on non-USFS lands where the ROW runs parallel to the Trail, which we believe should be attainable through similar revegetation protocols.

About the Appalachian National Scenic Trail

The NPS has a "demonstrated interest" (36 CFR Part 800.2) in the effects of the undertaking on the Appalachian Trail, and therefore the NPS requests an opportunity to consult on the assessment of effects on the Trail and on proposed measures to resolve any direct and indirect adverse effects. Utilizing the National Register of Historic Places Multiple Property Documentation Form (MPDF) being prepared by the NPS for nominating the Appalachian Trail to the National Register of Historic Places (NRHP) and

considering the criteria of adverse effects at 36 CFR §800.5, the NPS believes the undertaking as proposed in the FEIS could have an adverse effect on the Trail.

As outlined in the MPDF, the Appalachian Trail is significant at the national level under Criterion A in the areas of Recreation and Conservation and meets Criteria Consideration G for properties that have achieved exceptional significance within the past 50 years. Resources eligible for nomination under the MPDF are those that were constructed as part of the effort to develop the trail or predecessor trails that were incorporated into and became part of the Appalachian Trail. Those resources consist of the Appalachian Trail footpath, side trails, bridges (built for the trail), vistas and viewpoints, and overnight use areas.

The Appalachian Trail's essential function is to provide a pathway to reach, travel through, and experience the remote natural, wild, scenic, and cultural lands along the Appalachian Mountain range. Views, vistas, and viewpoints are directly associated with the Appalachian Trail's significance as a recreational resource, reflecting both its original design intent as a skyline trail and contributing to the visitor experience by providing some of the most satisfying and exhilarating moments of a hike. The many notable viewing locations along the Appalachian Trail afford wide-angle panoramas that produce a sense of perspective and awe at the enormity of a given scenic tableau. They are among the chief interests of the hike, providing an opportunity to see forward to what lies ahead, study the features of the surrounding landscape, and marvel at the great distance walked to reach the viewing location.

The Appalachian Trail historic district is broken down into state Segments. The setting surrounding the Trail corridor is vital to each Segment's ability to convey its historical associations under Criterion A in the areas of Recreation and Conservation. The feeling of an Appalachian Trail Segment is expressed through the combination of its physical features, primarily the Trail's intentionally primitive design as it blends into the wild, natural, or cultural setting. The feeling of being on the Trail is also found in the grandeurs of its views and vistas; quiet and solitude that offers the chance for contemplation and respite from urban life; and the community of thru-hikers and day hikers that choose to walk the Trail because of its location, setting, and reputation as the most famous of all American recreational hiking trails.

Comments on Appalachian Trail

The undertaking will affect the viewshed of the Appalachian Trail and the recreational visitor experience described above. The proposed MVP pipeline route cleared ROW would cross and parallel large sections of the Appalachian Trail through forested and steep mountainous terrain and across public and private lands. However, it is our understanding that FERC and MVP have consulted with the USFS to identify effects to USFS land and have developed methods to minimize and mitigate those effects.

The measures proposed by the USFS are explained in Appendix H, but unfortunately, would only apply on USFS land. Of the 43 miles of MVP that could be viewed from the Trail, 3.4 miles are on the Jefferson National Forest. A substantial portion of the MVP pipeline route will parallel the Appalachian Trail on non-USFS land and potentially be visible from the Trail. To reduce effects to the visitor experience, the NPS requests consultation to identify specific areas where similar measures could be applied to the ROW on private land in order to reduce impacts to Trail users from key viewsheds.

The USFS is proposing to amend the Jefferson National Forest Plan to allow the High Scenic Integrity Objectives for the Trail on USFS land to not be met for up to five years after construction of MVP, which is an unprecedented action. The NPS reviewed the visual impact assessment (VIA) in the final EIS and feels that further consultation is needed to assess long term effects to the Trail's viewshed, particularly from several key viewing points such as Kelly's Knob and Angel's Rest. We wish to consult with FERC and MVP in the manner FERC has done with the USFS and as required by Section 106.

Two areas in particular are of concern: Kelly's Knob and Angel's Rest.

- **Kelly's Knob:** At an elevation of approximately 3,600 feet, Kelly's Knob offers multiple locations for viewing the surrounding landscape, including elevated perches on rock outcroppings where visitors climb to take in panoramic views. Portions of the proposed pipeline route are approximately two miles from Kelly's Knob. Approximately six miles of the cleared ROW may be seen by Trail hikers from this location. The view from Kelley's Knob includes portions of the pipeline route on Sinking Creek Mountain and in the valley that are not on USFS land and thus not subject to any proposed USFS revegetation management protocols. The forested areas present greater potential for altering the view visitors expect to see because of tree clearing than non-forested areas present. Strategic revegetation along parts of the ROW in this area could lessen impacts.
- **Angel's Rest:** At an elevation of approximately 3,600 feet, Angel's Rest overlook on Pearis Mountain offers panoramic views out across Pearisburg, Virginia, the New River and surrounding mountains and valleys. The proposed pipeline route is approximately six miles from Angel's Rest. Approximately eight miles of the cleared ROW may be seen by Trail hikers from this location. The majority of the visible area of the pipeline route from Angel's Rest is on private forested land and also not subject to any proposed USFS revegetation management protocols.

The NPS is also concerned about cumulative impacts on the Trail. Based on a bare-earth viewshed analysis NPS and Appalachian Trail Conservancy conducted, the ROW may be intermittently visible along 100 miles of the Appalachian Trail and from up to 16 trail vistas and viewpoints. Twenty-six percent of the Appalachian Trail length on National Forest land in Virginia is within the MVP and proposed Atlantic Coast Pipeline impact areas. The cumulative impacts of these and other existing gas and utility corridors on the integrity of the Appalachian Trail in Virginia should be evaluated. Consultation conducted as a result of the PA would allow identification of areas where viewsheds and the visitor experience would be most impacted, and develop measures to minimize and mitigate potential impacts.

Finally, there are several references made in the final EIS to avoiding impacts to the Appalachian Trail by boring under it. Boring under the Trail should avoid directly disturbing the Trail footpath at the proposed crossing on top of Peter's Mountain. However, construction impacts may still occur at the Trail crossing and certainly will occur on the pipeline construction access road (Pocahontas Road) that is co-aligned with the Trail.

Comments on Blue Ridge Parkway

The Blue Ridge Parkway is consulting with the Virginia Department of Historic Resources, State Historic Preservation Office (VADHR), on our Section 106 responsibilities for the NPS right-of-way and construction permits related to MVP. While the permitting will not adversely affect the NRHP-eligible Blue Ridge Parkway historic district, VADHR has determined that activities permitted by Blue Ridge will adversely affect the NRHP-eligible Bent Mountain Rural Historic District. Since this action is directly related to the broader undertaking by FERC, the Blue Ridge will resolve adverse effects through the FERC MVP PA. The terms of the construction permit and MVP treatment plan each provide measures that resolve adverse effects related to the Parkway permitting necessary for the MVP project.

In addition to the treatment plan, the terms and conditions of the Blue Ridge construction permit for MVP will include the following conditions to minimize the adverse effect to Bent Mountain Rural Historic District.

- Permittee shall narrow clearing and the temporary construction right-of-way to a width of 75 feet for an approximate distance of 75 feet in length, to reduce visual impacts from tree clearing as viewed from the Parkway Motor Road, entrance ramp and area historic districts. Additional tree clearing may be required in the vicinity at the direction of the Parkway Resident Landscape Architect to feather the appearance of the Right-of-Way as viewed from the Parkway Motor Road and entrance ramp.

- Permittee must provide a list of trees to be removed to provide view of background scenery and for construction activities. The list shall include the individual species, diameter at breast height (dbh), and overall height, and must be provided at least 15 working days in advance of proposed removal. The NPS will review and provide approval in writing. A field meeting shall be conducted with NPS and Permittee staff to mark the approved trees for removal. Trees may only be cut between November 15 and March 15 to protect migratory birds and rare bats that are known to occur.

- Permittee shall implement the Historic Property Treatment Plan for the Bent Mountain Rural Historic District, and abide by the terms of the Programmatic Agreement for the Mountain Valley Project – FERC CP16-10-000.

The MVP Historic Property Treatment Plan for the Bent Mountain Rural Historic District further addresses mitigation for the adverse effect. Blue Ridge concurs with VADHR that preparation of a Preliminary Information Form, a precursor to the National Register nomination process, for the Bent Mountain Rural Historic District will help mitigate the adverse effect. By using the FERC PA to address adverse effects related to the Blue Ridge permitting, the Section 106 process is synchronized.

Comments on Draft Programmatic Agreement

The NPS provides the following specific comments on the revised draft PA (received via email, November 9, 2017).

We suggest the 10th WHEREAS clause be revised as follows and separated into three separate clauses:

Whereas clause #10

WHEREAS, the MVP pipeline route will cross the Blue Ridge Parkway (BRP) in Roanoke and Franklin Counties, Virginia, and the Blue Ridge Parkway Historic District is eligible for listing in the National Register of Historic Places (NRHP). The BRP is managed by the U.S. Department of the Interior National Park Service (NPS), and the NPS must issue a Right-of-Way Grant and construction permits allowing the MVP pipeline to cross the Blue Ridge Parkway lands, making the project an undertaking for which NPS must comply with Section 106. NPS agrees with FERC that the MVP will have no adverse effects on the Blue Ridge Parkway Historic District. The NPS is a consulting party under Section 106 of the NHPA, and is invited to be a signatory to this PA; and

Two additional WHEREAS clauses to be added:

WHEREAS, the BRP has consulted with VADHR on the permitting at Blue Ridge Parkway and reviewed MVP cultural resource surveys. The BRP worked with MVP to avoid archeological resources on BRP land but VADHR determined that there will be an adverse effect on the Bent Mountain Rural Historic District. The terms of the BRP construction permits and the MVP treatment plan for Bent Mountain Rural Historic District will resolve this adverse effect; and

WHEREAS, the MVP pipeline route also crosses a segment of the Appalachian Trail within the Jefferson National Forest, and the NPS is the lead federal agency for the administration of the entire Appalachian Trail under the National Trails System Act (16 USC § 1241 et seq.). *FERC is continuing consultations with the NPS, VADHR and USFS regarding the pipeline's direct crossing of the Appalachian Trail and the potential effects to Appalachian Trail's views and visitor experiences; and*

We suggest that the 16th WHEREAS clause be revised as follows:

WHEREAS, *for implementation of the PA stipulations, a PA "signatory" includes both "required" and "invited" signatories* and unless otherwise defined in this PA, all terms are used as defined at 36 CFR § 800.16; and

NPS recommends the following stipulations be added:

II. E. FERC recognizes that the NPS and VADHR have not yet concurred with FERC's "no adverse effect determination" for the pipeline's direct crossing of the Appalachian Trail within the Jefferson National Forest nor has there been consultation with the NPS to assess indirect effects to the Appalachian Trail's views where the pipeline will run parallel to the Trail. FERC will continue consultation with the NPS, VADHR, USFS and other appropriate consulting parties to assess potential effects and resolve any adverse effects.

III. A. 3. FERC will continue consultations with NPS, VADHR, USFS and other appropriate consulting parties to determine if any treatment measures are necessary to avoid, minimize or mitigate any direct effects resulting from the pipeline construction activities or the direct crossing of the Appalachian Trail.

III. B. 3. Upon completion of the assessment of effect (Stipulation II. E.) for any potential adverse effects to the Appalachian Trail's views and the visitor experience by the MVP, MVP shall develop site-specific Treatment Plans for the mitigation of effects, including effects where the viewshed and the visitor experience is part of the historic significance. MVP shall provide copies of the newly developed site-specific Treatment Plans to FERC staff, NPS and VADHR (and federal land managing agencies, interested Indian Tribes, and other consulting parties, as appropriate) for a fifteen (15) calendar day review period. FERC will take timely comments into consideration before approving any final Treatment Plans.

NPS recommends the following stipulations be revised:

VI. E. *If the PA becomes null and void (per stipulation VI. B.) or is terminated,* FERC shall request the ACHP to comment pursuant to 36 CFR § 800.7(c). After considering the comments of the ACHP, FERC shall notify the other signatories of actions it will pursue to resolve adverse effects at affected historic properties and meet its obligations under Section 106 of the NHPA.

VII. D. *FERC shall coordinate signatory review of the PA, its* terms and conditions, and activities conducted under the PA, within five (5) years of its execution. At that time, the signatories shall consult to determine if progress of activities under the PA is satisfactory, or a signatory may suggest an amendment or raise an objection, which shall be resolved according to Stipulations V.B. or VI.A.

FERC's responsibilities under Section 106 regulations 36 CFR Part 800.2(a)(5) require consultation with the NPS as we have a "demonstrated interest" in the effects of the undertaking in regards to both the Blue Ridge Parkway and the Appalachian Trail. FERC is aware that Blue Ridge staff have been consulting with the VADHR regarding effects to the Parkway and adjacent historic districts. Through our recommended consultation, we believe the effects to the Appalachian Trail can also be properly assessed in a timely manner. As FERC has done with the USFS, we believe the consultation can result in those effects being minimized or mitigated.

We appreciate your consideration of our comments and are committed to assisting your efforts to conclude your Section 106 requirements within your intended schedule. We look forward to further consultation regarding MVP's effects on the Appalachian Trail and the Blue Ridge Parkway. Please feel free to contact Appalachian National Scenic Trail Superintendent Wendy Janssen (304-535-6279), Blue Ridge Parkway Acting Chief of Staff Alexa Viets (828-348-3402) if you have any questions.

Sincerely,

John Anfinson
Associate Regional Director, Acting
Resource Stewardship and Science
Northeast Regional Office, NPS

Sarah Craighead
Deputy Regional Director, Acting
Southeast Regional Office, NPS

Office of Energy Projects – Division of Gas Environment and Engineering – Gas Branch 3	**Docket No.:** CP16-10-000 Mountain Valley Project

Conference Telephone Call Regarding the Appalachian National Scenic Trail

Date/Time of Meeting: Wednesday, January 10, 2018, 1:00 – 3:00 pm EST

Meeting Participants:

Name	Representing
Paul Friedman	Federal Energy Regulatory Commission (FERC)
Andrew Downs	Appalachian Trail Conservancy (ATC)
Laura Belleville	ATC
Joby Timm	U.S Department of Agriculture, Forest Service (FS)
Ginny Williams	FS
Troy Morris	FS
Mike Madden	FS
Grace Ellis	Galileo Project, LLC (contractor to the FS)
Wendy Janssen	U.S Department of the Interior (USDOI),. National Park Service (NPS)
Mary Krueger	NPS
Jonathan Meade	NPS
Denise Nelson	NPS
Mark Meyer	NPS
Jennifer McConaghie	NPS
David Uschold	NPS
John Henson	USDOI Counsel
Roger Kirchen	Virginia Department of Historic Resources (VADHR)
Libby Cook	VADHR
Ethel Eaton	VADHR
Richard Chidester	Giles County
John Ross	Giles County
John Centofanti	Mountain Valley Pipeline LLC (Mountain Valley)
Matt Eggerding	Mountain Valley
Thomas Jensen	Mountain Valley
Evelyn Tidlow	GAI Consultants (contractor to Mountain Valley)
Sean Sparks	Tetra Tech (contractor to Mountain Valley)
Chris Lawson	Tetra Tech (contractor to Mountain Valley)
Lavinia DiSanto	Cardno (contractor to FERC)
Douglas Mooneyhan	Cardno (contractor to FERC)

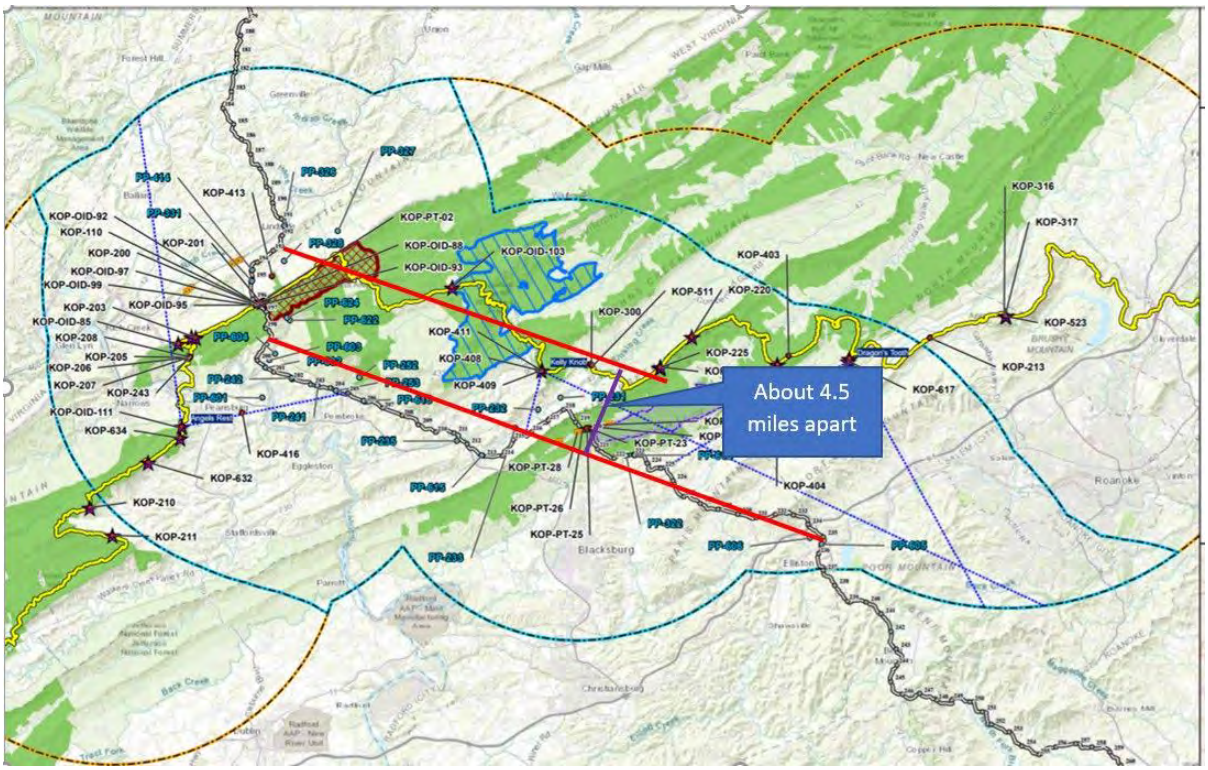
Memorandum – Notes of the Conference Call

Representatives from the FERC, ATC, FS, NPS, USDOI, VADHR, Giles County, and MVP had a conference telephone call on January 10, 2018 to discuss visual impacts on the Appalachian National Scenic Trail (ANST) from the Mountain Valley Pipeline Project (MVP). FERC staff stated that the purpose of the call was to initiate the consultation requirements of Stipulation

III.B.4. of the December 2017 Programmatic Agreement for the MVP. For use during the call, Mountain Valley prepared a summary of their *Visual Impact Analysis (VIA) for the Jefferson National Forest* which was filed on May 11, 2017 (summary attached to this Memo). Based on discussion on the call, parties requested a follow up in-person meeting to specifically identify and address certain critical locations where ANST views would be impacted, specifically Kelly Knob and Angel's Rest.

FERC staff took issue with a few statements from the NPS letter dated November 17, 2017, that read: "…43 miles of the MVP … could be viewed from the Trail" and "…A substantial portion of the MVP pipeline route will parallel the Appalachian Trial…." In fact, only a small portion of the MVP pipeline would parallel the ANST, and the pipeline route would cross the Trail in a perpendicular manner. MVP's VIA indicated that the "bare earth" analysis showed that about 40 miles of the pipeline corridor would be visible from the ANST if there were no trees along the Trail. However, about 39.3 miles of the Trail in this viewshed is forested, blocking views of the pipeline corridor.

These issues were clarified by ATC staff, noting that the pipeline generally parallels the trail about 4 miles apart for about 15 miles (see map below) and that small changes in methodology may be responsible for the similar results of visible pipeline from the A.T.: 43 miles as calculated by NPS and 39 miles as calculated by MVP.



NPS staff noted that the two-dimensional visual simulations may not fully represent actual conditions, vegetation screening isn't always permanent (due to disease or fire), and it is their goal to preserve the ANST visitor experience. The ANST is eligible for the NRHP partly due to its scenic qualities.

Participants agreed that the pipeline corridor would likely be visible from Dragons Tooth (near milepost [MP] MP 231.8), but that the view would be too far away to warrant additional mitigation. The VIA indicated that the pipeline corridor will be visible from Kelly Knob (near MP 218.1) and Angel's Rest (near MP 197.3). ATC representatives identified two additional ANST locations where there may be impacts to the experience of hikers: 1) Pocahontas Road (access road MVP-GI-232) and 2) Peter's Mountain from KOP-OID-85 (Rice Field section of the ANST) to KOP-201 (campsite on the Peters Mountain segment of the ANST looking southwest approximately 0.2 mile from the MVP pipeline).

The participants agreed that the MVP would have "no adverse effects" on the ANST, if certain measures are implemented by Mountain Valley. First, Mountain Valley would implement already agreed to measures, outlined in its Plan of Development submitted to the FS, for the portion of the pipeline route within Jefferson National Forest (JNF), including a) feathering/undulating of the edge of the right-of-way during tree clearing; b) plantings along the right-of-way during revegetation/restoration; and c) reduced mowing to a 10-foot-wide strip centered over the pipeline during maintenance/operation. While the FERC Plan requires revegetation monitoring for two seasons, Mountain Valley would extend that monitoring to five years under an agreement with the FS on the JNF. Second, outside the JNF, where portions of the pipeline corridor may be visible to ANST hikers, Mountain Valley would also conduct a program of plantings along the edge of the right-of-way during restoration/revegetation and monitoring to ensure success. Expanding upon the USFS contract to assess the impacts and effectiveness of the Plan of Development to include key ANST viewpoints was discussed, with follow-up conversations agreed upon by NPS, USFS, and ATC. The ATC will, in the near future, provide FERC with MPs for portions of the pipeline route it thinks would be visible from the ANST. However, Mountain Valley does not have to feather or undulate the edge of the right-of-way during tree clearing in those areas; and Mountain Valley does not have to delay tree clearing in those areas, and can use mechanical methods for tree clearing. Lastly, for safety and visitor experience reasons, Mountain Valley would work with the FS, NPS and ATC to permanently relocate the ANST at the crossing of Pocahontas Road. If this cannot be accomplished in time for project construction, Mountain Valley would institute a system of flagging and monitoring, and escort hikers through the construction zone along Pocahontas Road in the short term.

There was discussion about how to memorialize any decisions reached that would minimize impacts to the ANST. FERC recommended something akin to an avoidance plan or minimization plan. Once the details, such as specific areas for restoration and relocation of the ANST, have been agreed upon, a plan should be prepared for review.

ATC and NPS representatives also raised concerns about "cumulative" impacts on the ANST. While it was pointed out that Mountain Valley is committed to a mitigation program with the Commonwealth of Virginia to compensate for forest impacts, it was agreed that the discussion of cumulative impacts would be tabled for a future conference call or meeting among the interested parties.

It was decided that a memorandum summarizing today's call would be created and circulated to all participants for review. Mountain Valley agreed to provide an updated construction schedule,

with specifics for the area near the ANST. As noted above, the FS agreed to work with the NPS and ATC to investigate the steps involved in the ANST relocation near Pocahontas Road.

Document Content(s)

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 49

February 21, 2023

USDA United States Department of Agriculture | Forest Service | George Washington and Jefferson National Forests | 5162 Valleypointe Parkway Roanoke, VA 24019 540-265-5100

File Code: 1900; 2720
Date: October 24, 2016

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St., N.E., Room 1A
Washington, DC 20426

Dear Ms. Bose:

Subject: Request for Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Route of the proposed Mountain Valley Pipeline Project in the Jefferson National Forest
OEP/DG2E/Gas 3
Mountain Valley Pipeline, LLC
Docket No. CP16-10-000

The Forest Service submits an information request to Mountain Valley Pipeline, LLC to support the Forest Service's review of MVP's special use proposal for the proposed Mountain Valley Pipeline Project (MVP Project). The proposed project would affect 3.4 miles of National Forest System lands on the Jefferson National Forest.

In the attached document, we discuss the objectives of our request for the site-specific design of stabilization measures in selected high-hazard locations along the proposed MVP Project route. We also discuss the methods we followed and the criteria we used to select the representative sites.

For questions, please contact Jennifer Adams, Special Project Coordinator, at (540) 265-5114 or by email at jenniferpadams@fs.fed.us.

Sincerely,

JOBY P. TIMM
Forest Supervisor

cc: Mountain Valley Pipeline, LLC

U.S. Forest Service Request for Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Proposed Mountain Valley Pipeline Route

Introduction and Objectives

The route for the Mountain Valley Pipeline Project (MVP Project), proposed by Mountain Valley Pipeline, LLC (MVP) would cross some very challenging terrain in the central Appalachians. Potentially difficult situations include steep slopes, presence of headwater streams, geologic formations with high slippage potential, highly erodible soils, and the presence of high-value natural resources downslope of high hazard areas. These hazards are exacerbated by high annual rates of precipitation and the potential for extreme precipitation events.

Similar hazards on other smaller pipeline projects in the central Appalachians have led to slope failures, erosion and sedimentation incidents, and damage to aquatic resources. Therefore, the Forest Service (FS) is concerned that crossing such challenging terrain with a much larger pipeline could present a high risk of failures that lead to resource damage.

To address these hazards, MVP has proposed to implement slope stabilization and erosion/sedimentation control measures. MVP provided general descriptions and conceptual drawings of these methods in its resource reports and other filings. In comments on resource reports and in other communications, the FS has identified the need for more detailed information to document the effectiveness of the proposed techniques and measures.

The Jefferson National Forest contain Forest Plan standards that limit some activities on steep slopes. The FS is reviewing MVP's Special Use Permit application and expects MVP to submit an amended Special Use Permit application to address the FS's previous comments on the proposed MVP Project route. To facilitate the acceptance of MVP's amended Special Use Permit application for further processing, the Forest needs to be able to determine that the MVP project is consistent or can be made consistent with this Forest Plan direction.

To further clarify the likelihood that the MVP can be constructed through the Jefferson National Forest without undue risk of resource damage, the FS is requesting that MVP develop site-specific stabilization designs for selected areas of challenging terrain. FS specialists have selected several sites that appear to present a high risk for slope failure, slippage, and erosion/sedimentation. Note that these are merely representative sites that have been selected to demonstrate whether stability can be maintained for the purpose of making a preliminary determination of Forest Plan consistency. Should the MVP be permitted, multiple additional high hazard areas will need to be addressed on a site-specific basis.

MVP should present designs for the selected sites that clearly illustrate the following:

- Anticipated hazards at each site
- How the hazards will be minimized, to include specific techniques and materials tailored to the conditions of each site
- Plan and profiles (cross section(s) perpendicular to centerline, and a longitudinal cross section along the centerline) with dimensions (feet) showing 1) the original ground surface, 2) the maximum extent of the cut, fill and spoil during construction, 3) the post-construction reclaimed ground surface, showing reclamation backfill, reclaimed slopes, and the permanent right-of-way
- Short-term and long-term measures (i.e., construction vs. operation and maintenance periods)
- Provisions for ensuring that long-term stabilization features will remain in place and effective over the life of the project, without the need for continual maintenance
- Rationale and supporting documentation for the likelihood that the techniques and materials used at each site will be effective
- Potential resource impacts in the event of a failure, and how the potential for such impacts will be minimized

Methods Used to Select Representative Sites

- The Forest selected several locations along the right-of-way (ROW) where expert knowledge and resource data indicate a potential "worst case scenario" for 1) trying to maintain slope stability, 2) preventing potential significant indirect adverse effects to resources such as water quality, hydrology and aquatic ecosystems, and 3) ensure that long-term maintenance and stability can be accomplished if the project is implemented.
- JNF provided narratives to highlight representative site-specific Forest Service-administered areas of concern along the portion of the ROW that crosses this Forest in Virginia. The following data sources were used:
    - Topographic maps
    - surface ownership layer
    - ACP survey corridor and proposed centerline
    - Geologic formations and field survey data from the geohazard assessment

Selected Sites

JNF Priority site #1 of 6
From Station 10380+00 to 10390+00 on Drawing No. PA-GIVA-H600 -03 in Appendix A of MVP Plan of Development June 2016.
Lowest downslope NFS lands on south side of Peters Mountain.

JNF Priority site #2 of 6
The narrow ridge with steep slopes on north side of Brush Mountain from Station 11543+66 to the National Forest property line on crest of Brush Mountain on Drawing No. PA-MOVA-H600 -03 in Appendix A of MVP Plan of Development June 2016. MP 219.2-219.4. And the route variation to another ridge on north side of Brush Mountain presented by MVP to Forest Service at October 19, 2016 meeting in Roanoke VA.

JNF Priority site #3 of 6
The steepest slopes downslope from the bore pit (Station 10287+19) on south side of Peters Mountain to Station 10300+00 on Drawing No. PA-GIVA-H600 -01 in Appendix A of MVP Plan of Development June 2016. And the route variation for steepest slopes downslope from the bore pit on south side of Peters Mountain (Station 10287+19) presented by MVP to Forest Service at October 19, 2016 meeting in Roanoke VA.

JNF Priority site #4 of 6
From Station 10360+00 to 10367+47 on Drawing No. PA-GIVA-H600 -03 in Appendix A of MVP Plan of Development June 2016.
Steep slopes between MP 196.9 and MP 197 on south side of Peters Mountain.

JNF Priority site #5 of 6
MP 195.3-195.4
Steep slope north side of Peters Mountain

JNF Priority site #6 of 6
MP 217.2
Steep slope south side Sinking Creek Mountain

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 50

February 21, 2023

[FERC Accession No. 20210115-4000]

FEDERAL ENERGY REGULATORY COMMISSION
ENVIRONMENTAL COMPLIANCE MONITORING PROGRAM
WEEKLY SUMMARY REPORT

MOUNTAIN VALLEY PROJECT
DOCKET NO.: CP16-10-000
FOR THE PERIOD: DECEMBER 27, 2020 THROUGH JANUARY 2, 2021

On October 13, 2017, the FERC published an Order Issuing Certificates (Certificates) to Mountain Valley Pipeline, LLC (Mountain Valley) and Equitrans, L.P. (Equitrans) to construct and operate pipeline, compression, metering facilities, and related infrastructure as part of the Mountain Valley Project (Project) and Equitrans Expansion Project (EEP). The Project facilities consist of approximately 303.5 miles of new natural gas pipeline and multiple aboveground facilities located in West Virginia and Virginia. On July 27, 2018, the United States Court of Appeals for the Fourth Circuit issued an order vacating decisions by the Department of the Interior's Bureau of Land Management (BLM) and by the Department of Agriculture's Forest Service (Forest Service) authorizing the construction of the Mountain Valley Pipeline Project (Project) across federal lands. On August 29, 2018 and October 24, 2018, FERC announced that full construction activities could resume except for the Jefferson National Forest between MPs 196.0 and 221.0. On October 2, 2018, the U.S. Court of Appeals for the Fourth Circuit vacated the U.S. Army Corps of Engineers permit for the Huntington District. On October 5 and 19, 2018, the U.S. Army Corps of Engineers (Norfolk and Pittsburgh Districts, respectively) suspended their permits. Since May 17, 2019 the FERC approved select streams and wetland to be crossed by conventional bore. Communications between staff of the Federal Energy Regulatory Commission (FERC) and the U.S. Army Corps of Engineers confirmed that no permits are necessary under Section 404 of the Clean Water Act for conventional bore of wetlands or waterbodies for non-Section 10 waters. On August 15, 2019, Mountain Valley voluntarily suspended certain construction activities in specific areas of the Project where such activities may present a potential risk of take to federally-listed species or a potential risk of destruction or adverse modification of proposed critical habitats. A Cessation of Certain Activities Order was issued by the FERC on October 15, 2019. Mountain Valley was required to cease all work, with the exception of restoration and stabilization of the right-of-way and work areas. On October 17, 2019, the FERC approved limited activities at eleven locations. On October 23, 2019, the FERC approved limited activities at six locations. On October 29, 2019, the FERC approved Mountain Valley's Stabilization Plan and limited activities at three locations. On February 13, 2020, the FERC approved limited slip repair/mitigation activities at discrete locations. In May 2020, FERC issued partial approvals, contingent upon other outstanding federal authorizations from the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service, to change the crossing method of three waterbodies. On September 4, 2020, the U.S. Fish and Wildlife Service issued a new Biological Opinion and conference opinion for the Project. On September 25, 2020, the United States Army Corps of Engineers Huntington, Pittsburgh, and Norfolk Districts issued Nationwide Permit 12 verifications for the Project. On October 9, 2020, the FERC issued an Order partially lifting the stop work order and allowing certain construction to proceed. On October 16, 2020, the U.S. Court of Appeals for the Fourth Circuit issued a temporary administrative stay of the U.S. Army Corps of Engineers Huntington District's and Norfolk District's Nationwide Permit 12 verifications. On October 19, 2020 Mountain Valley informed the FERC that they have not begun activities that require a Nationwide Permit 12 in any of the three applicable U.S. Army Corps Districts, and would not do so while the Temporary Administrative Stay is in effect. On November 9, 2020, the U.S. Court of Appeals for the Fourth Circuit issued a stay of the U.S. Army Corps of Engineers Huntington District's and Norfolk District's Nationwide Permit 12 verifications. On December 17, 2020, the FERC authorized construction to resume between MPs 201.6 and 218.6.

As committed to in its Application and in accordance with the Certificate for the above referenced docket, Mountain Valley agreed to fund an Environmental Compliance Monitoring Program during construction of the Project. This report provides a summary of the FERC Compliance Monitors' construction review for this reporting period. The Compliance Monitors are responsible for reviewing Mountain Valley's construction and documenting compliance with the FERC Certificate.

During this reporting period, the Compliance Monitors issued fifty-one (51) Daily Monitoring Reports consisting of forty-eight (48) Acceptable Reports and three (3) Communication Reports. No Noncompliance Reports or Problem Area Reports were issued during this reporting period. No Level 1 or Level 2 variance requests were approved during this reporting period. A tabular summary of the daily compliance reports and approved variances is presented below.

SUMMARY OF COMPLIANCE MONITOR REPORTS AND APPROVED VARIANCES FOR THE MOUNTAIN VALLEY PROJECT

Compliance Level	Number of Reports and Variances this Reporting Period	Cumulative Number of Reports and Variances
Acceptable	48	10,374
Communication	3	2,879
Problem Area	0	38
Noncompliance	0	47
Serious Violation	0	0
Approved Level 1 Variances	0	92
Approved Level 2 Variances	0	75
Total Reports and Variances	51	13,505

During this reporting period, five (5) full-time Compliance Monitors conducted daily inspections documenting compliance with the Project's environmental requirements along the Project's right-of-way. The Compliance Monitors coordinated with Mountain Valley's Environmental Inspectors (EIs) to inspect and discuss areas of concern prior to construction, review areas potentially subject to variance requests, and clarify interpretations of the project requirements. The activities of the Compliance Monitors were directed by the Compliance Manager who coordinated with FERC as well as with Mountain Valley's field management and support staff. A brief summary of the activities conducted during the reporting period is presented below.

SUMMARY OF ACTIVITIES

The Compliance Monitors inspected various activities in progress along the Project, including:

- *Spread A Milepost (MP) 0 to 34.8 – repair, maintenance, and reinforcement of erosion control devices.*
- *Spread C MP 65.4 to 98.6 – repair, maintenance, and reinforcement of erosion control devices.*
- *Spread E MP 128.2 to 154.5 – repair, maintenance, and reinforcement of erosion control devices; review of non-Project related powerline company activities on an access road.*
- *Spread F MP 154.5 to 195.1 – repair, maintenance, and reinforcement of erosion control devices.*
- *Spread G MP 195.1 to 227.3 – repair, maintenance, and reinforcement of erosion control devices; review of non-Project related mining activities.*

The Compliance Monitors also inspected construction activities at several laydown yards.

COMMUNICATION REPORTS

Communication reports provide documentation of relevant meetings between the FERC Compliance Monitor and landowners, agencies, Project representatives, Environmental Inspectors, and/or Contractors. The three (3) communication reports below present compliance related information for keeping this weekly summary report relevant to current Project activities.

SUMMARY OF COMMUNICATION REPORTS FOR THE MOUNTAIN VALLEY PROJECT

Compliance Level/Report Number	Date Issued	Location (Spread/ Facility/ Milepost [MP]/ County/State)	Follow-up Required (Yes or No)	Description
SpreadG_28Dec2020_MP1	12/28/2020	Spread G MP 200.6	No	The Compliance Monitor conducted a routine inspection of Stony Creek along Norcross Road. Non-Project related mining operations from the local limestone quarry have returned to the area and sandbagged the left bank in two locations. In Spring 2019 numerous non-Project related sinkholes developed within the banks of Stony Creek in this general location. Both sandbag locations are above the Gravely Hill Road bridge. This is the same location as the uppermost sinkhole documented in 2019. The two recent sandbagged locations are hydraulically connected by a small channel off the left bank. Sinking waters at the upstream sandbagged location caused bank failure. Water breaches the left bank for a short distance and then returns to the main channel at the downstream sandbagged location. The small feature has been shaped/formed to help prevent the breach water from dispersing out into the flood prone area. None of this work is related to the Mountain Valley Pipeline Project.
SpreadE_29Dec2020_CT2	12/29/2020	Spread E MP 143.4	No	The Compliance Monitor conducted a routine inspection of access road MVP-GB-182. This area of the right-of-way received 4 inches of snow this past week. The Compliance Monitor inspected the conditions of the access roads and erosion control devices that could be seen from the roads. The Compliance Monitor observed that the access road was recently snow plowed and cinder added to the road base for traction. Mountain Valley informed the Compliance Monitor that the road was not plowed by the crew but by the non-Project related powerline company working in this area utilizing the same access road. The access road appeared to be stable and in compliance at the time of the inspection according to Project plans and procedures. No environmental issues were observed during the on-site inspection.
LaydownYard _30Dec2020_CT2	12/30/2020	Laydown Yard MVP-LY-068	No	The Compliance Monitor was informed by the Lead Environmental Inspector that there was a spill at laydown yard MVP-LY-068. The leak occurred from a service truck that stored used engine oil. About 3 gallons of used engine oil spilled onto the soil. The crew contained the spill immediately and began cleaning it up. There were no sensitive resources

SUMMARY OF COMMUNICATION REPORTS FOR THE MOUNTAIN VALLEY PROJECT				
Compliance Level/Report Number	**Date Issued**	**Location (Spread/ Facility/ Milepost [MP]/ County/State)**	**Follow-up Required (Yes or No)**	**Description**
				within 300 feet of the spill location. The Compliance Monitor was informed by the Lead Environmental Inspector that Mountain Valley will be prepare an Applicant communication report for the incident. Mountain Valley will also prepare a spill report. The Spill, Prevention, Countermeasure, and Control (SPCC) plan was followed. The Compliance Monitor will conduct a follow-up inspection to ensure that all of the spill material has been properly cleaned up and disposed. A follow-up inspection was conducted on December 31, 2020. The Lead Environmental Inspector prepared an Applicant communication report and spill report. All procedures in the Spill, Prevention, Countermeasure, and Control (SPCC) plan were followed. The Compliance Monitor ensured that all of the spill material was properly cleaned up and disposed. No environmental issues were observed during the on-site inspection.

PROBLEM AREA REPORTS

Problem area reports record an observation where an area or activity does not meet the definition of acceptable but is not considered a noncompliance. No problem area reports were issued by the Compliance Monitors during this period.

NONCOMPLIANCE REPORTS

Noncompliance reports record an observation where an area or activity that violates (is not in compliance with) the Project specifications, results in damage to resources, or places sensitive resources at unnecessary risk. No noncompliance reports were issued by the Compliance Monitors during this period.

SUMMARY OF LEVEL 1 AND 2 VARIANCE REQUESTS

No Level 1 or Level 2 variance requests were approved during this reporting period.

SELECTED PHOTOGRAPHS OF OBSERVED ACTIVITIES

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Spread G – Non-Project related sandbags along Stony Creek have been placed on the left bank and in the same general location as prior sinkholes (December 28, 2020) – MP 200.6 – Communication</td><td>Spread G – This is the upstream sandbag placement of the new non-Project related work. Water this side of the sandbags is the same as the uppermost sinkhole from 2019 (December 28, 2020) – MP 200.6 – Communication</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Spread A – The slope breakers along the ridge were functioning as designed (December 29, 2020) – MP 1.7 – Acceptable</td><td>Spread E – The access road was recently plowed and cinder added to the road base for traction. Per Mountain Valley, the road was plowed by the non-Project related powerline company working in this area utilizing the same access road (December 29, 2020) – MP 143.6 – Communication</td></tr>
</table>

	
Laydown Yard – MVP-LY-068 – A leak occurred from a service truck that stored used engine oil. About 3 gallons of the used engine oil spilled. The crew contained the spill immediately and began cleaning it up (December 30, 2020) – MP 0.0 – Communication	Spread F – Multiple temporary erosion controls were installed (December 30, 2020) – MP 194.7 – Acceptable
	
Laydown Yard – MVP-LY-068 – All of the spill was properly cleaned up, removed, and disposed (December 31, 2020) – MP 0.0 – Acceptable	Spread C – The installed erosion control devices at County Route 7 (Elk River Road) were in good condition and have functioned well. The vegetation was in good condition and no signs of erosion were observed (December 31, 2020) – MP 87.6 – Acceptable

	
Laydown Yard – MVP-LY-001 – The sediment barriers at the sensitive resources have been properly maintained and were functioning as designed (January 1, 2021) – MP 0.0 – Acceptable	Spread A – No issues noted at stream S-A120 (January 2, 2021) – MP 6.7 – Acceptable
	
Laydown Yard – MVP-LY-002 – The sediment barriers have been properly maintained and were functioning as designed (January 2, 2021) – MP 0.0 – Acceptable	Laydown Yard – MVP-LY-051 – Resource signage was clearly visible and the sediment barriers have been properly maintained (January 2, 2021) – MP 0.0 – Acceptable

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 51

February 21, 2023

July 21, 2020

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Washington, DC 20426

Re: Docket CP16-10-000 Mountain Valley Pipeline
NEW DATA ON INAPPROPRIATE NATURE OF PROPOSED MVP CROSSING OF THE APPLACHIAN NATIONAL SCENIC TRAIL ON PETERS MOUNTAIN

Dear Ms. Bose,

The Roanoke Appalachian Trail Club has previously filed statements showing that Mountain Valley Pipeline has profoundly negative visual impacts on the Appalachian National Scenic Trail (see Figure 1), with one to twenty miles of the MVP right-of-way visible off and on for 80 to 100 miles along the Trail (Accession Nos. 20170223-5090, 20161221-5276). This mapping has been verified by a field visits, including hikes with staff from the National Park Service, US Forest Service, Appalachian Trail Conservancy and EQT/MVP in June 2018.

In addition, RATC has used a study performed for the US Forest Service by MVP consultants to show that the proposed bore pit locations under the ANST on Peters Mountain could hardly be in a more hazardous location than that proposed by MVP – on High Hazard Areas #3 and #5 with steep, landslide-prone slopes in the epicenter of the active Giles County Seismic Zone (see Figure 2 and Accession No. 20170620-5108). The MVP project manager did not inspire confidence when I asked him in a live meeting (June 2017) where a 42" natural gas pipeline combining all of these hazards along with karst topography in valleys, had ever been completed – and he answered : "Florida." **The "best practices" document used by MVP is not designed for highland terrain and does not even contain the words "seismic" or "karst."**

In my role as Archivist for RATC, I have recently found two additional sets of data underscoring

1. The priceless value of the Symms Gap area on Peters Mountain and
2. The amount of volunteer time and money our club expended in its successful defense of Peters Mountain between 1991 and 2002. In the process, RATC helped establish the principle of **NO NET LOSS** of assets from threats such as utility projects.

ANY DECISION TO CROSS THE ANST ON THE CREST OF PETERS MOUNTAIN, ESPECIALLY IN THE SYMMS GAP AREA, IS EXTREMELY INAPPROPRIATE AND REPRESENTS AN ALMOST INCALCULABLE SCENIC LOSS

Priceless value of Symms Gap area on Peters Mountain

Our volunteers acquired the access to 17 miles on the crest of Peters Mountain in 1967. RATC was formed in 1932 to help complete the original ANST, and our volunteers played a major role in selecting, marking and building the trail from Roanoke to Damascus between 1932 and 1940. After World War II, our volunteers again played a leading role in moving the ANST far to the West, primarily on lands managed by the US Forest Service. The primary reasons for moving the AT almost 200 miles west was to provide more scenic views and better protection for the Trail.[1] (See Figure 3 for both ANST routes)

Acquisition of the right-of-way on Peters Mountain was, "beset with more delays, difficulties and frustrations than any other in Conference history," according to Thomas Campbell, the RATC volunteer who led the effort. Campbell was an experienced accounting executive with the Norfolk and Western Railroad (now Norfolk Southern), and he was finally able to negotiate and sign an agreement with the Celanese Corporation on behalf of RATC in 1967. It was worth the trouble, because, as he reported:

"The section, although difficult of access, contains at Symms Gap one of the most beautiful views east of the Mississippi."[2]

We agree that the views into West Virginia and the adjoining Peters Mountain Wilderness from Symms Gap are among the most beautiful on the ANST.

RATC expenditures of volunteer time and funds to protect Peters Mountain and establish "no net loss," 1991-2002

RATC and its partners finally protected almost the entire ANST corridor in their region between 1950 and 1987, a truly heroic effort. Almost immediately, they faced a serious threat. In October 1991, Appalachian Power (now part of AEP) proposed a huge 765 kV transmission line across Peters Mountain at Symms Gap, winding through Giles, Craig, Roanoke and Botetourt counties and impacting several highly scenic portions of the ANST. Led by volunteers like Dr. Bill Gordge and Hal Cantrill (who are still living), RATC mounted a lengthy and vigorous campaign. They hired lawyers, filed comments, provided testimony in writing and at the meetings of the State Corporation Commission and for the US Forest Service. They spent over $10,000 on legal fees and gave hundreds of hours of volunteer time.[3]

They were successful, in large part because both the State Corporation Commission and the US Forest Service recognized the terribly negative impacts of a major new utility project on the ANST corridor and on the cultural attachment of surrounding rural communities. **The entire project was moved about 40 miles south and now crosses the ANST in a valley on a road**. Both the SCC and the FS noted the negative visual impacts to the ANST as major reason for moving the project.

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[1] John W. McNair, Supervisor of the Jefferson National Forest, offered to help with such a relocation at RATC's Annual Meeting on January 5, 1940. RATC Archives.

[2] Campbell, T. Report to ATC Triennium, 1964-67. RATC Archives. See attachments for full text and agreement with Celanese.

[3] Legal fee, APCO powerline, 1990-2001. RATC Archives. Dellis, K. (2020). ApCo transmission line and the Appalachian Trail, 1991-2002. RATC Archives.

The December 2002 FS Record of Decision mentions RATC's advice on mitigation and includes statements that:

- "The off-site mitigation proposed by AEP to mitigate the impacts to the AT will be implemented. This includes the removal of the specified sections of existing transmission line and donation to the Forest Service of the 100-acre tract of land containing the AT on Peters Mountain" [this is approximately where MVP now proposes to cross the ANST]
- "Alternatives 1 through 6 would affect the Peters Mountain Area, where the effects of a transmission line were rated high." [All of these alternatives were rejected by the FS]
- "The West Virginia PSC approved a route that avoided all National Forest lands in West Virginia, thus avoiding the impacts related to Peters Mountain (cultural attachment, visuals along Peters Mountain and remote habitat) and the New River in the Wild & Scenic River Study Area."

The state governments of both Virginia and West Virginia as well as the FS all concurred that the crest of Peters Mountain was an inappropriate location for a major utility project. The mountain has not changed, and the viewshed is still exceptional.

Based on large part on experiences such as the precedent-setting AEP fight, the Appalachian Trail Conservancy's April 2000 Policy on Roads and Utility Developments (which RATC endorses and helped to write) states that,

> A utility line project may cross the Trail if and only if it is determined to be in the public interest as a result of an open, public environmental review process, and if and only if the project will cross the Trail once, and only once, **and be co-located in an area already affected by similar types of linear facilities or be located in an area where impacts would be negligible**. Further, a project **must not impact any special areas or resources; impacts must be mitigated on-site to the maximum extent possible; and, residual impacts associated with the proposal must be offset by off-site compensatory measures to the extent that there would be "no net loss" of the Trail's natural, cultural, scenic, and recreational values**.[4]

The ANST on the crest of Peters Mountain and the adjacent Peters Mountain Wilderness are areas of great scenic and cultural value. There are NO facilities there at present because they have been soundly and rightly rejected in the past. The impacts are far from negligible. MVP would have a major impact on special areas and resources. Due to the extreme hazards on both sides of the proposed ANST crossing, the Trail would have a highly explosive 42-inch pipeline right beneath it (an HDD is not feasible) in the middle of an active seismic zone on steep, landslide-prone slopes, with unstable karst at the bottom of the mountain and in the surrounding valleys.

It is hard to imagine how such a destructive and dangerous project could have "no net loss," but moving it away from Symms Gap and co-locating it with an existing utility would be a start, along with very large mitigation for the visual damages already inflicted.

Sincerely,

Diana Christopulos

Cc Victoria Craft, Bureau of Land Management
Job Timm, US Forest Service

[4] ATC Policy on Roads and Utility Developments, April 2000. Correspondence with Don Owen, former NPS and ATC staff member, July 9, 2020.

Wendy Janssen, National Park Service
Denise Nelson, National Park Service
Sandra Marra, Appalachian Trail Conservancy
Laura Belleville, Appalachian Trail Conservancy
Andrew Downs, Appalachian Trail Conservancy
Sen. Tim Kaine
Sen. Mark Warner
Rep. Morgan Griffith
Sen. John Edwards
Del. Chris Hurst
Del. Sam Rasoul
Giles County Board of Supervisors
Craig County Board of Supervisors
Roanoke Appalachian Trail Club Board of Directors
Elly Benson, Sierra Club Environmental Law Program
Nathan Matthews, Sierra Club Environmental Law Program
Ben Luckett, Appalachian Mountain Advocates
Greg Buppert, Southern Environmental Law Center

FIGURE 1. Mountain Valley Pipeline has a profoundly negative visual impact on the ANST (in **GREEN**), with one to twenty miles of the MVP right-of-way (in **BLACK**) visible off and on for 80 to 100 miles along the Trail. Locations in **RED**, including entire crest of Peters Mountain, can potentially see 15 miles or more of the MVP ROW. A June 2018 site visit I attended with other RATC volunteers and with staff from NPS, FS, ATC and EQT/MVP verified that this is true. I personally have seen the ROW while hiking up to Dragon's Tooth, part of Virginia's Triple Crown. *(Map by John DeGroot using data from USGS, Roanoke County GIS, Appalachian Trail Conservancy, Key-Log Economics and US Census Bureau)*

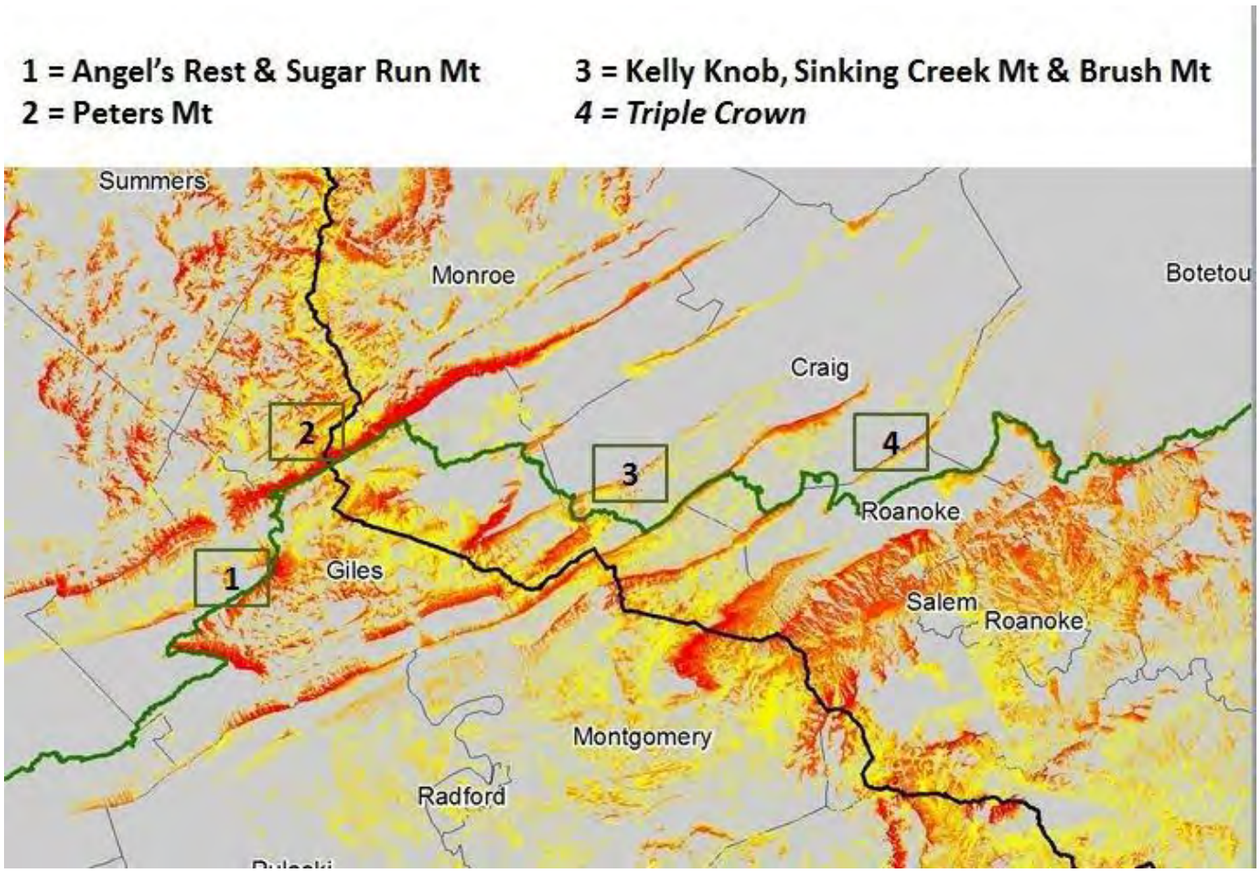


FIGURE 2A. The Giles County Seismic Zone is highly active and has witnessed two earthquakes near the MVP ROW in recent years. On September 13, 2017, Monroe County, West Virginia experienced the largest earthquake in decades, with the epicenter 1.5 mile from the proposed MVP route. Within a day, over 500 citizens notified the USGS that they had felt the earthquake. The Virginia Tech Seismological Observatory rated it a magnitude 3.7 earthquake, while the US Geological Survey pegged it at 3.2. *Sources: on left, Virginia Department of Mines, Minerals and Energy (seismic zone) and MVP (crossing); on right, Google Earth, MVP, USGS.*

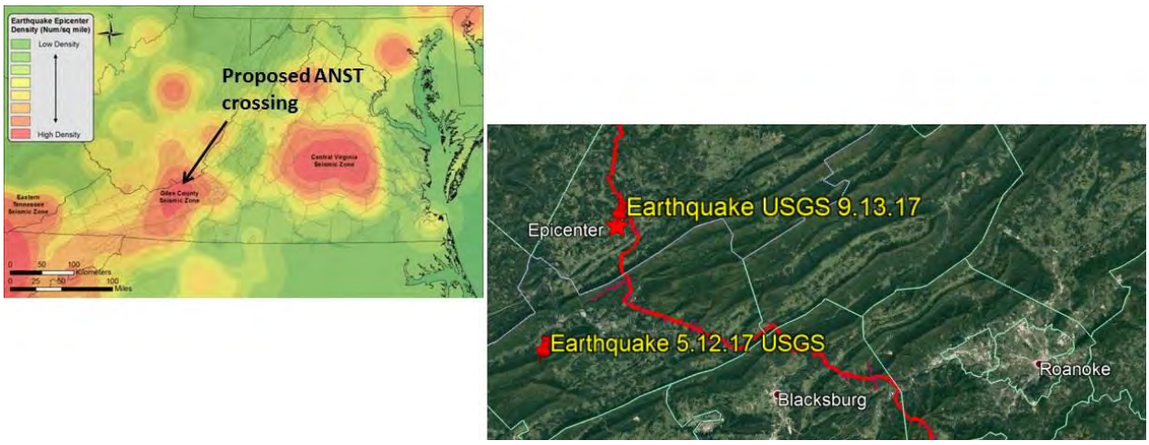
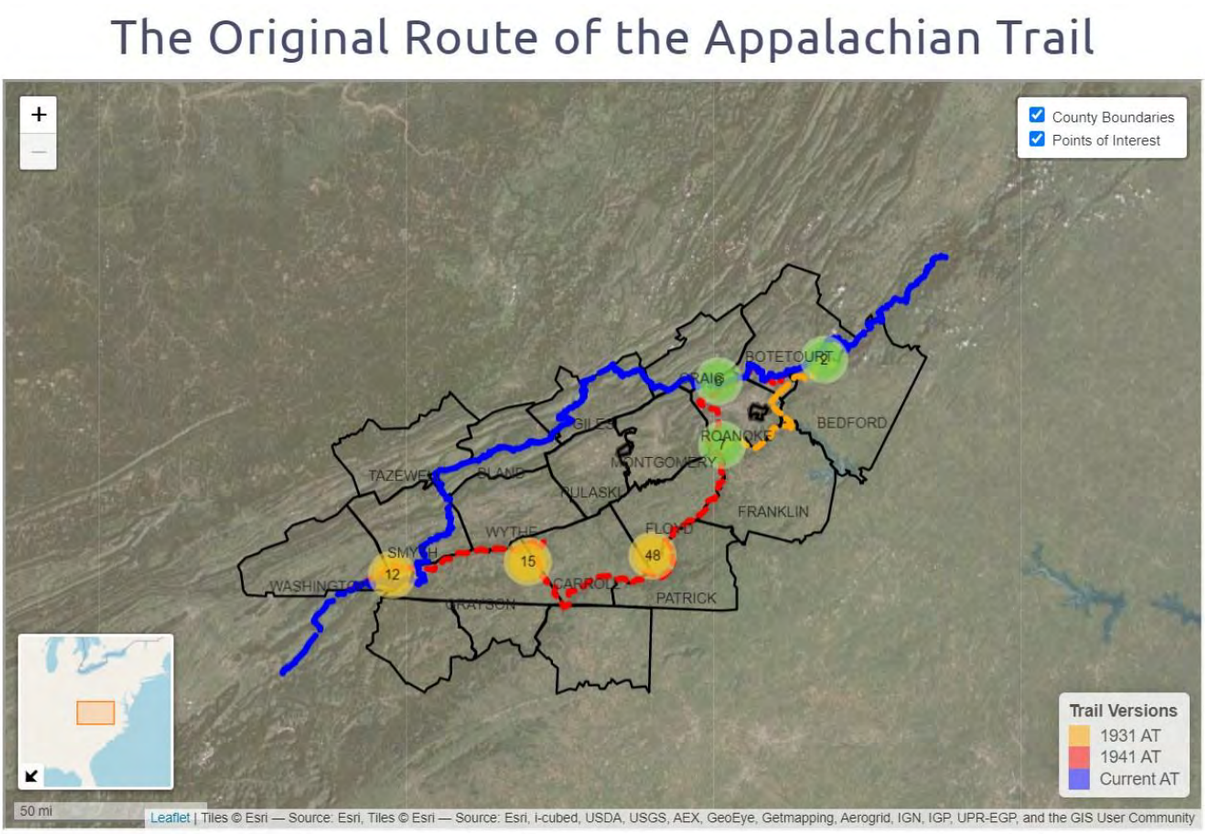


FIGURE 2b. The proposed bore pit locations under the ANST on Peters Mountain could hardly be in a more hazardous location than that proposed by MVP – on High Hazard Areas #3 and #5 (identified for the FS by MVP consultants) with steep, landslide-prone slopes and the epicenter of the active Giles County Seismic Zone (see Figure 2 and Accession No. 20170620-5108). **The "best practices" document used by MVP is designed for much less steep terrain and does not even contain the words "seismic" or "karst."** See "Earthquakes and pipelines: recipe for disaster," on RATC website (September 18, 2017) for more details. https://www.ratc.org/earthquakes-and-pipelines-recipe-for-disaster/

FIGURE 3. RATC's volunteers played central roles in designing and building the first ANST (1932-40, Virginia's Lost Appalachian Trail in **RED**) from Roanoke to the Damascus – and in acquiring, designing and building the current ANST that crosses the crest of Peters Mountain for 17 miles (constructed primarily 1950-87 in **BLUE**). Each major reroute covered 150-200 miles of the ANST. *Source: https://virginiaslostat.org/*



The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 52

February 21, 2023

Indian Creek Watershed Association
PO Box 711
Union, WV 24983
(304) 832-6331
Email: info@IndianCreekWatershedAssociation.org

November 9, 2020

George Washington & Jefferson National Forests
MVP Project
5162 Valleypointe Parkway
Roanoke, VA 24019
(via e-filing)

RE: Failure of the MVP 2020 DSEIS to Assess Impacts of New Information on Land and Water Resources Outside the JNF Boundaries on Peters Mountain in West Virginia

In the September 2020 Draft Supplemental Impact Statement for the Mountain Valley Project the Forest Service fails to fulfill its obligation to assess new information relevant to the impacts of its decision and plan amendments on land and water resources *outside* the JNF, including critical water resources on the West Virginia side downstream from the JNF on Peters Mountain.

FS Planning Rule requirements and directives clearly intend and state that the decisions and actions of the FS must consider the impacts of those decisions on non-JNF land and shared watersheds.

- **The USFS 2012 Planning Rule Final Directives** are explicit: "Watersheds relevant to the plan should include those lands outside the National Forest System that contribute surface or subsurface water flows to the plan area, and those that receive surface of subsurface water frow the plan area. Groundwater-dependent ecosystems should also be considered.
- **36 CFR 219.8(a)(1)(ii)** also directs that considerations of a new or revised plan should include: "Contributions of the plan area to ecological conditions within the broader landscape influenced by the plan area."

The FS purports that "effects related to the Court-identified deficiencies, changed circumstances or new information, and which result from actions occurring on NFS lands, including those effects off NFS lands resulting from actions on NFS lands, are addressed in this SEIS."[1]

Instead of complying with these directives and guidelines, however, the DSEIS ignores or dismisses new information and evidence that clearly indicate the likelihood of significant impacts beyond its borders. **This comment focuses on the portion of the JNF on the West Virginia side of Peters Mountain.**

[1]JNF 2020 Draft SEIS for Mountain Valley Pipeline Project (DSEIS), p. 12.

1. The land immediately adjacent to the JNF border on Peters Mountain is comprised of extremely steep slopes reaching into a complex karst system at the base of the mountain. The nearby Rich Creek cave and spring are severely compromised by the proposed construction. Spread G begins at the Wilson Mill Road crossing at the bottom of Peter's Mountain (approx. MP 195.2[2]).

2. Since the ROD was issued, the Rich Creek Cave has been partially mapped and dye tracing shows a clear underground connection that runs beneath the pipeline ROW (shown in Attachment 3 below).

3. **New information provided by MVP's own sedimentation modeling document confirms that construction should not be permitted on the West Virginia side of Peters Mountain because** of severe sedimentation impacts to Rich Creek, a headwater stream that parallels the MVP construction corridor as it courses down the mountain.

   The Geosyntec Report that was commissioned by MVP as the Court-ordered "independent" hydrological analysis of sedimentation and issued on May 8, 2020 clearly identifies the threat to Rich Creek on Peters Mountain, as shown by the attached documents:

   - **Attachment 1:** Figure 5-2, "Percentage Increase in Sediment Yields at Stream Segments" from MVP's Attachment A, prepared by Geosyntec.
   - **Attachment 2:** Rich Creek watershed detail from Figure 5-2, with annotations.

   As indicated in Attachment 2, which includes part of the legend to Figure 5-2, the Rich Creek tributary on Peters Mountain will sustain the highest category of impact: >30% increase in sediment yield during construction compared to baseline. This recent modeling is consistent with the sedimentation analysis previously performed for MVP by Environmental Solutions Inc (ESI), which identified Rich Creek as likely to experience a *permanent* baseline sedimentation increase as a result of MVP construction and operation.

4. **As the lead agency for protection of the JNF, the Forest Service should assert its authority to protect off-forest land by protesting all actions by the FERC to degrade its water and land.** The Forest Service should object to the issuance of any permits for construction of the pipeline on all land south of Wilson Mill Road (MP 195.1) until all of MVP's required permit authorizations, including both the Forest Service/BLM permit and the US Army Corps of Engineers NWP12, have been cleared by resolution of adjudication.

5. The vulnerability of the Peters Mountain slopes and Rich Creek Cave and Spring in Monroe County has been well documented. NEW INFORMATION in the following attachments serve as reminders and support of this request:

   - **Attachment 3** – Figures 23A and 23B from the Mountain Valley Watch Cave Report 2020,[3] showing recent dye tracings and LIDAR mappings of the area.
     In addition to the surface water sedimentation impacts noted above, the hazards of the karst terrain through which MVP will blast and trench its way between Wilson Mill Road

[2] According to the map on MVP's website at https://www.mountainvalleypipeline.info/ (last viewed 10/17/2020), MP 195.1 is the beginning of Spread G; therefore, ICWA is adopting MP 195.1 in its current request.
[3] Cave Report May 2020, Mountain Valley Watch, Acc. No. 20200911-5065, pp. 17, 18.

and the JNF have been shown to directly threaten the Rich Creek Spring and Cave – historic and critical resources of the HUC-12 Rich Creek Watershed depicted in MVP's Figure 5-2. The irreparable MVP construction damage caused to Canoe Cave in Virginia serves as a warning of what to expect.

- **Attachment 4** – Aerial map showing MVP's path between Wilson Mill Road and the Appalachian Trail crossing at the top of Peters Mountain.
  Except for tree felling, no construction has begun south of Wilson Mill Road, so it is imperative to protect Peters Mountain watersheds from further environmental hazards.

6. Two of the six "High Hazard Priority Sites" identified in the 2017 DSEIS documents and included in the 2020 POD Appendix G are located at the top of Peters Mountain at the boring sites (#3 in VA and #5 in WV). While the entire DSEIS is replete with empty assurances that construction and erosion and sedimentation controls will succeed, **even MVP could not bring itself to shout its lies from the sacred top of Peters Mountain, as they admitted:**

> **It should be noted that stability of the bore pit is not considered herein.** Temporary shoring will be developed by the bore contractor to all applicable safety standards to protect both the open bore pit and the stockpiled spoil material excavated from the bore pit. The landslide inspection team will evaluate the site to determine if any mitigation measures, in addition to those proposed by the contractor, are necessary.[4] (5.3. Page xx)

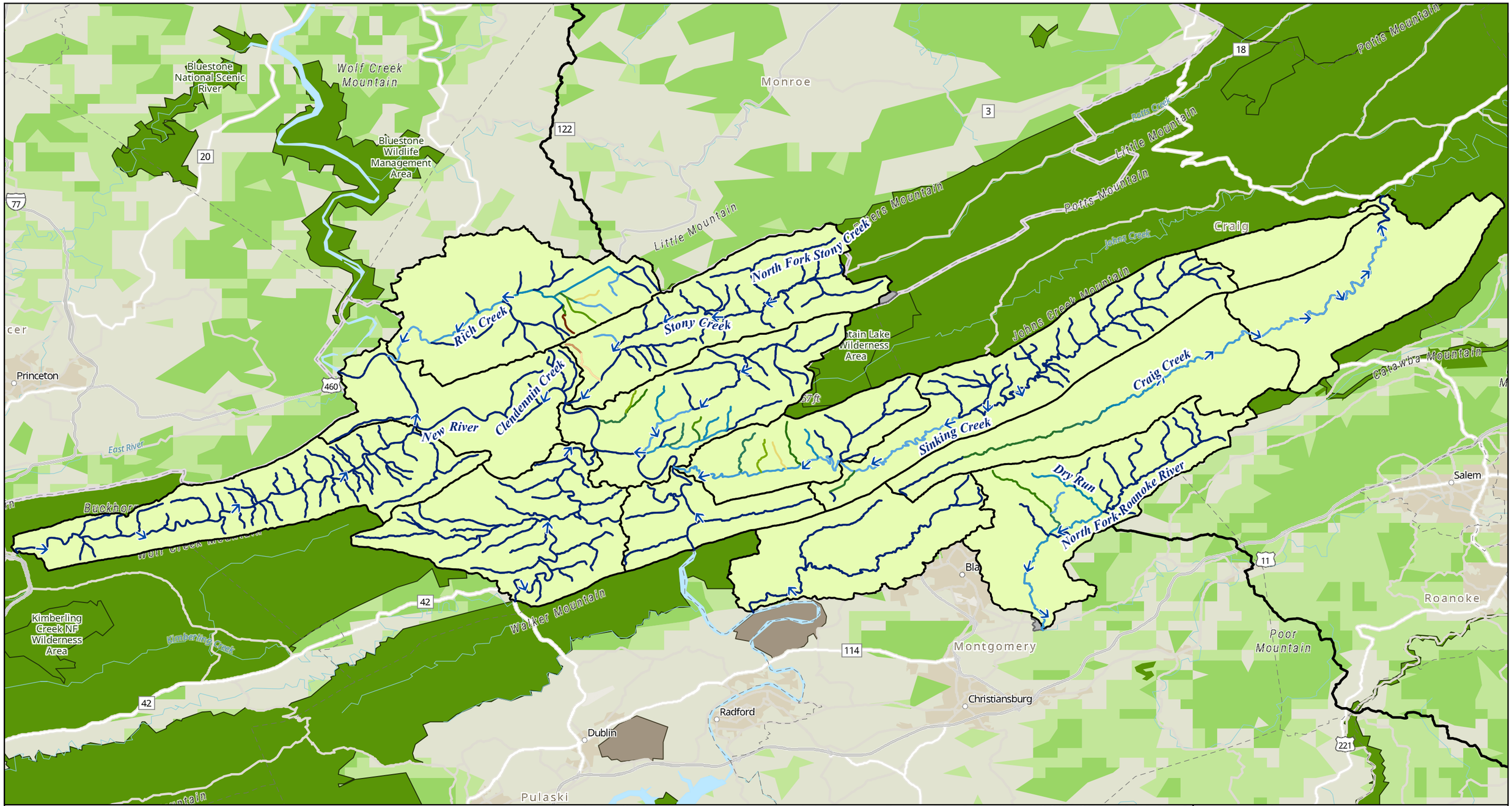
ICWA urges the FS to reconsider this doomed project before it is truly too late. Protect the water and lands in your charge and defend the JNF Forest Plan against becoming an encyclopedia of exceptions for the Mountain Valley Pipeline: **Choose the "No Action Alternative".**

Sincerely,

Indian Creek Watershed Board of Directors
Howdy Henritz, President; Scott Womack, Vice President;
Judy Azulay, Treasurer; Nancy Bouldin, Secretary

[4] MVP Plan of Development, Appendix G Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Route of the Proposed Mountain Valley Pipeline Project in the Jefferson National Forest, at 4.3 p. G-24

ATTACHMENT 1



Legend

- Flow Direction
- Proposed Mountain Valley Pipeline
- Watersheds Corresponding to Stream Segments
- HUC - 12 Watershed Boundaries

Note : Stream Segments from National Hydrography Dataset Plus 2 Flowlines USGS/USEPA - 2019-03-13

% Increase in Sediment Yield in Stream Segments During Construction Compared to Baseline *

>30%
15%
1%

*Dark blue line indicates less than 1% increase from Baseline

N

0 5 Miles

Percentage Increase in Sediment Yield at Stream Segments
Jefferson National Forest
(Virginia & West Virginia)

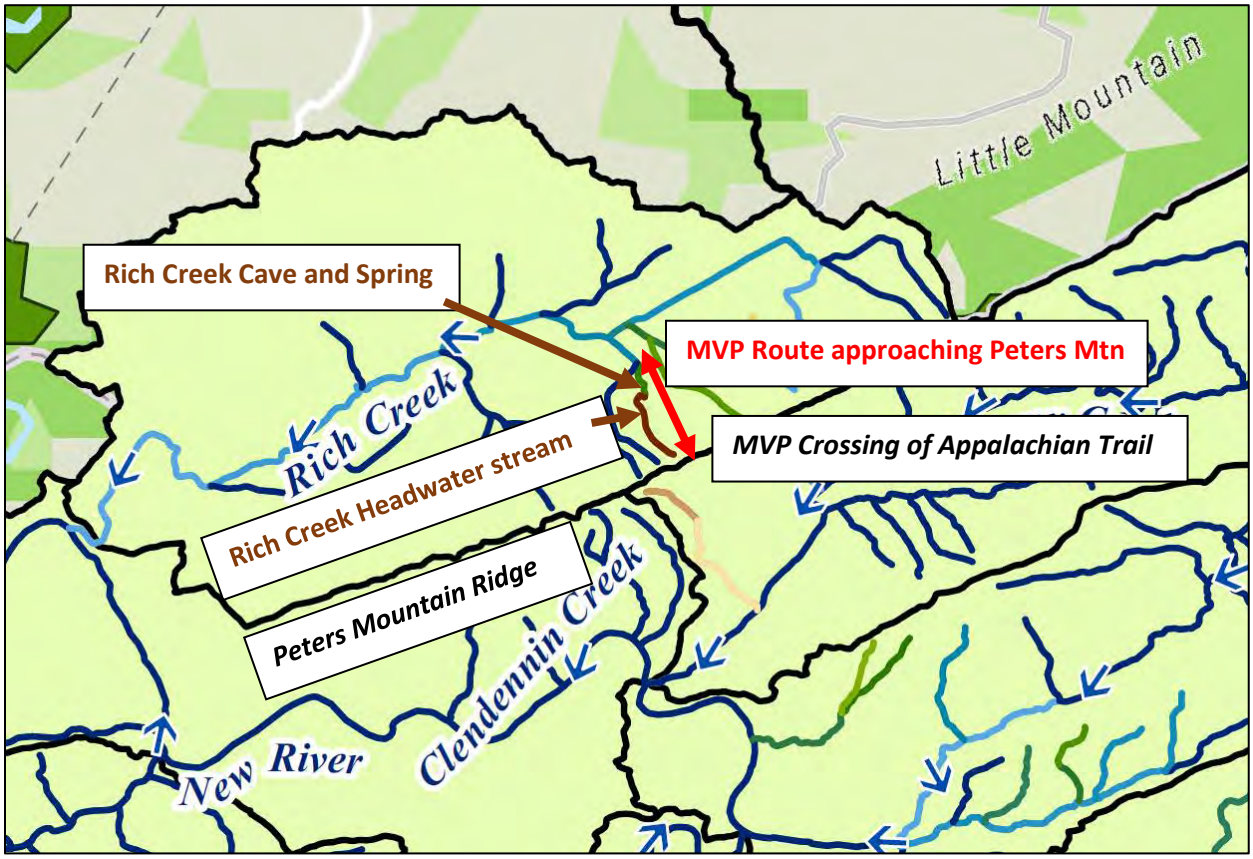
Geosyntec consultants
Austin, TX | May 2020

Figure 5-2

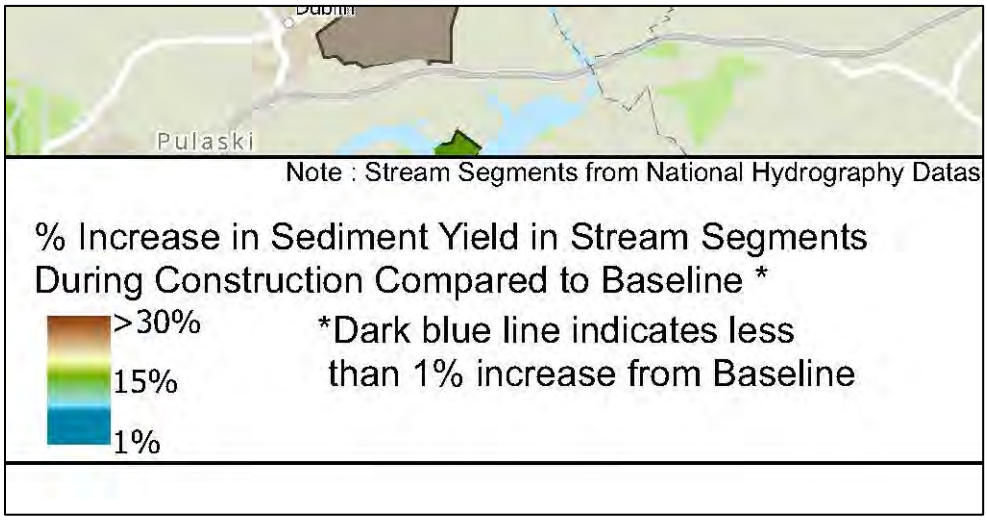
N:\M\MVP\Jefferson Forest\GIS\mxd\Figures_05092019\Figures_07012019_2.aprx 5/1/2020 11:33 AM

ATTACHMENT 2

Figure 5-2 Detail Showing Sedimentation Impact on Rich Creek Stream
>30% increase in sediment yield during MVP construction compared to baseline



From Figure 5-2 Legend



ATTACHMENT 3

FIGURES 23A and 23B from the Mountain Valley Watch *Cave Report, May 2020:*

Figure 23A: Topographic map showing location of MVP in relation to dye placement and trap placement which included Rich Creek Cave, Rich Creek Spring, Crabtree Spring, and a farm pond.

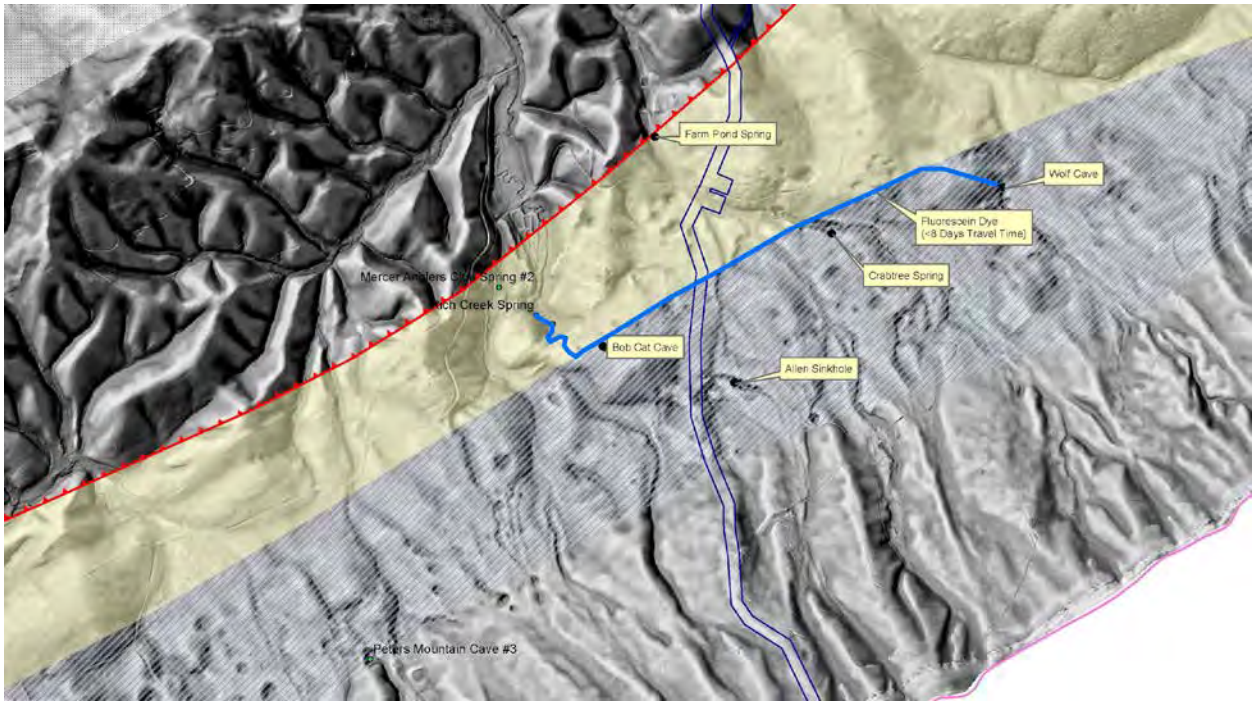


Figure 23B: LIDAR map showing location of MVP in relation to dye placement and trap placement which included Rich Creek Cave, Rich Creek Spring, Crabtree Spring, and a farm pond.

ATTACHMENT 4

Aerial View of MVP Route in Monroe County from Wilson Mill Rd (MP 195.1) to Appalachian Trail

So far, only tree-felling has occurred in this segment of the MVP route. This area will sustain unmitigable, irreparable damage once new construction activity begins. It should be excluded from MVP construction until all authorizations (including permits by the Forest Service and BLM and the US Army Corps) have been fully adjudicated.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 53

February 21, 2023

Document Accession #: 20160713-5029 Filed Date: 07/13/2016

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

In the Matter of

MOUNTAIN VALLEY PIPELINE, LLC	Docket Nos.	CP16-10-000
EQUITRANS, LP		CP16-13-000

COMMENTS OF THE VIRGINIA CHAPTER OF THE SIERRA CLUB ON HAZARDS ASSOCIATED WITH KARST TOPOGRAPHY IN THE AREA OF THE MOUNTAIN VALLEY PIPELINE

Appalachian Mountain Advocates hereby files the following report, *Geologic Hazards in the Karst Regions of Virginia and West Virginia: Investigations and Analysis Concerning the Proposed Mountain Valley Gas Pipeline*, on behalf of the Virginia Chapter of the Sierra Club.

Respectfully submitted,

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AN EXPERT REPORT ON

GEOLOGIC HAZARDS IN THE KARST REGIONS OF VIRGINIA AND WEST VIRGINIA

Investigations and Analysis Concerning the
Proposed Mountain Valley Gas Pipeline

Ernst H. Kastning, Ph.D., P.G.

July 3, 2016

Document Accession #: 20160713-5029 Filed Date: 07/13/2016

AN EXPERT REPORT ON

GEOLOGIC HAZARDS IN THE KARST REGIONS OF VIRGINIA AND WEST VIRGINIA

Investigations and Analysis Concerning the Proposed Mountain Valley Gas Pipeline

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FERC DOCKET CP16-10-000

Prepared as a Deposition of Record
for the Federal Energy Regulatory Commission
on behalf of

Protect Our Water, Heritage, Rights (The POWHR Coalition)
www.powhr.org

July 3, 2016

Executive Summary

The proposed corridor of the Mountain Valley Pipeline (MVP) passes through a significant area of karst as it crosses the mountainous Valley and Ridge Province (the Appalachian Fold Belt) in Summers and Monroe counties, West Virginia and Giles, Craig, Montgomery, and Roanoke counties in Virginia. Karst is a landscape that is formed by the dissolving of bedrock. Severe karst can create hazards for structures that are built on or across it. The environment, both on the surface and in the subsurface, is more easily degraded in karst than in most other terrains. Karst poses severe constraints on engineering, construction, and maintenance of large-scale structures built upon it or across it. Moreover, the karst in this mountainous region is much different than that in other areas. Siting a pipeline through the Appalachian karst poses significantly greater hazards than in karst areas where the terrain has lower topographic relief.

Karst is a critical factor in siting and management of a high-pressure gas pipeline such as the one proposed. However, other potential hazards such as land instability, weak soils, and potential seismicity are also highly significant in this region. When two or more of these elements act together, the resulting environmental threat from the pipeline is compounded and exacerbated.

The conclusion of this report is that the karst and associated hazards constitute a serious incompatibility with the proposed pipeline. The effect of these threats on the emplacement and maintenance of the line, as well as the potential hazards of the line on the natural environment, renders this region as a 'no-build' zone for the project.

Report Contents

The first two sections of this report are included as a summary of karst and its occurrence in the central Appalachian region. The first section provides a brief overview of the nature of karst and how it works as a system, including sinkholes, caves, integrated groundwater flow networks, and the inseparable relation between surface water and groundwater. The second section describes attributes of karst specific to the region of concern, namely the geologic fold belt constituting the central Valley and Ridge Province of Virginia and West Virginia.

Environmental issues and concerns relative to the proposed pipeline are identified and discussed in detail in the third section. Groundwater contamination is a concern related to construction of the pipeline as well as to its operation. Sinkhole collapse may occur where groundwater patterns are altered and in fill used in burying the pipe (the process of suffosion). Erosion of denuded land is likely, and steep slopes underlain by weak soils may become unstable and lead to soil creep and landslides. The threat of this hazard is exacerbated within the Giles County Seismic Zone, an area of enhanced seismic risk that is traversed by the propose pipeline. Allogenic water (flowing on impermeable rocks in the uplands before it reaches soluble rock below) as well as relatively pure water originating from ridge crests may be compromised in quantity and quality by the presence of the pipeline before it reaches the karst in the lowlands.

A long corridor, cutting a swath through these sensitive terrains may create extensive zones of land instability, collapse, flooding, siltation, and disruption of natural flow paths of surface and ground water. Caves, some of which have been designated as significant by public agencies and speleological organizations, may be intersected, thus compromising hydrologic and ecologic systems. The most dramatic negative results would occur where two or more hazards act in unison or result in a cascading series of events.

Geologic Hazards

The Mountain Valley Pipeline application is deficient and inadequate because it fails to address significant environmental hazards that would be created by the pipeline, if constructed as proposed. It fails to address geologic hazards that occur within areas in or near the proposed corridor and their potential impacts on the pipeline itself. Geologic hazards that are not adequately addressed by the application include:

- *Groundwater Contamination*: Karst terrains are uniquely vulnerable to augmented groundwater contamination owing to the nature of the groundwater aquifers that form in such areas. Thousands of people living in these potentially impacted areas depend on groundwater to supply their homes. The risk of severe groundwater contamination is increased during construction and may occur should a pipeline rupture in this karst terrain.

- *Vulnerability of Groundwater Recharge:* Allogenic recharge areas (where surface water from steep, upland mountain slopes enters karst aquifers at the base of those slopes) are especially vulnerable to disruption owing to hydrologic alterations that would be caused by the construction of the pipeline.

- *Enhanced Potentials for Surface Collapse:* Construction of the pipeline in mountainous terrain would likely alter hydrologic flows by channelizing subsurface waters. Should the pipeline trench intersect with below-ground karst features, results would include enhanced potential for collapse in the karst.

- *Accelerated Erosion:* Pipeline construction on steep slopes will remove native vegetation, cut into steep slopes, alter soils via compaction, remove surface soil over the pipeline trench and access roads, and will thus create potential for accelerated erosion.

- *Slope Instability:* Unconsolidated geologic material present throughout the area on steep slopes should not be considered as stable. Movement of such materials, especially if stimulated by excess rainfall or by seismic activity, can be expected to threaten the integrity of the proposed pipeline. Over half of the preferred route from Monroe to Roanoke counties has slopes that are 20 percent grade or greater. Almost 20 percent of the slopes along this route are 35 percent grade or greater.

- *Weak Soils:* Even if in the absence of such extreme weather or seismic events, soils on steep slopes can be subject to the slow and persistent downslope movement known as “soil creep”. This would threaten the integrity of underground structures such as pipelines,

especially where those structures run parallel to a slope. Soils on steep slopes should not be considered as stable. Several soil groups are high in plasticity and shrink-swell characteristic, resulting in poor drainage and low bearing strength that can induce downslope movement.

- *Seismic Risks:* The proposed route of the pipeline passes through an area with a history of severe seismic activity and enhanced seismic risk as determined by recent geophysical studies. A major seismic event would clearly threaten the integrity of the pipeline. However, even moderate seismic activity, in combination with other conditions, such as karst, severe slopes, and weak soils, pose elevated risks. By extension, in karst areas, the quality of groundwater may be threatened as well.

The above hazards occur as a direct result of the terrain typical to the region being traversed by the proposed pipeline corridor. Multiple geologic hazards are inherent to karst in mountainous regions such as that of concern here. Because of their potential to interact synergistically, they cannot be mitigated by engineering practice. For these reasons, large karst systems must be avoided during pipeline construction.

Examples of Geologic Hazards and Potential Interactions

Much of the pipeline corridor would encounter karst as it passes through the area that is the focus of this report. There are many specific locations where karst features are within or perilously close to the corridor. Four specific examples have been selected as important in order to illustrate cumulative environmental hazards that cannot be mitigated through engineering and construction practice:

- **Milepost 181-195 segment, in Monroe County:** The proposed pipeline crosses numerous interacting karst features, including springs providing allogenic recharge, sinkholes, caves, and a sinking stream. Within this segment, the corridor ascends the northern flank of Peters Mountain where it encounters steep slopes and unstable soils in an area of enhanced seismic risk and where numerous springs discharge waters that are essential to residences, community water supplies, and a commercial bottling facility.

- **Milepost 208-210 segment in Giles County:** Dye traces have documented multi-mile groundwater transport through karst aquifers and with extensive caves. The pipeline is proposed to cross Sinking Creek at a point where its waters have begun to descend into subsurface channels, within an area that is well populated, with numerous homes that depend on karst aquifers for household waters. The pipeline is proposed to enter this area after descending a long and steep mountain slope with potentially unstable soils within the Giles County Seismic Zone of enhanced risk from earthquakes.

- **Milepost 213-214 segment in Giles County:** The pipeline is proposed to cross a cave that is approximately 3000 feet in length, contains water, is inhabited by significant biota, has been designated as a cave conservation site, and is near the surface with little overlying bedrock. Furthermore, the proposed corridor crosses over the cave and runs along a slope

within potentially unstable soils. This would threaten the integrity of the pipeline if soil slippage were to occur. The site is within the Giles County Seismic Zone.

- **Milepost 220-226 segment in Montgomery County:** The proposed corridor crosses an area known as the "Mt. Tabor Karst Sinkhole Plain" - perhaps the most intensive karst terrain along the entire route, and associated conservation areas. Several dye tracings have documented the interconnected nature of karst areas and caves within this area. Along this segment, the corridor is proposed to pass through two cave conservation areas, a natural area preserve, and a major segment of the karst plain where scores of large, compound sinkholes are present at the surface. As a result, MVP has proposed an alternate corridor for study in this area. However, a greater length of alternate proposed corridor passes through cave conservation areas than would the original proposed corridor. Both proposed corridors pass through the watershed of areas containing sinkholes that have been shown by dye traces to provide discharge into the primary spring of the Mill Creek Springs Natural Area Preserve that discharges into Mill Creek, a tributary of the North Fork of the Roanoke River. This is a short distance upstream from where it serves as habitat for a federally protected fish, the logperch. Furthermore, both proposed corridors pass through steep slopes that would threaten the integrity of the pipeline within a significant cave conservation area. This area is also populated, with numerous homes that draw household waters from karst aquifers and have no access to alternative water supplies.

The above examples were specifically selected for this report to illustrate potential environmental problems along the corridor. There are many other examples of interacting geologic hazards over the entire length of the corridor within karst. This is typical of the entire region.

Conclusions

There are serious problems imposed by geologic and hydrogeologic constraints along the route of the Mountain Valley Pipeline. They fall into two basic categories: (1) the impact of the geologic setting on constructing and safely maintaining the pipeline and (2) the environmental impacts of the pipeline on the land that it would pass through.

As discussed in this report, the predominant geologic aspects are:

- Karst
- Hydrogeology
- Slope Stability
- Soil
- Seismicity

Although each of these five topics has serious specific considerations that have not been addressed by the applicant, the greatest concern is that all five topics are interrelated and are not mutually exclusive. These geologic attributes and the geologic risks are typical to the region and operate as **a system.** Therefore, they should not be merely evaluated on an individual basis.

Siting a pipeline through the Appalachian karst poses significantly greater hazards than in areas where the terrain has much lower topographic relief, and lacks similar geologic hazards. Steep slopes promote a profound influence of the pipeline on soil stability, erosion, and groundwater.

The analysis of this report unequivocally demonstrates that the Mountain Valley Pipeline cannot be safely built through the areas of Monroe, Giles, Montgomery, and Roanoke Counties that are characterized by karst terrain and steep slopes. Doing so would significantly threaten the structural integrity of the pipeline, and the ecological integrity of the surrounding environment. Many of the potential hazards are immitigable; they cannot be adequately circumvented with engineering or construction practices. The same is true should a catastrophic event occur, such as a breach of the pipeline.

Author of This Report

The author, Ernst H. Kastning, PhD, PG, has studied karst for over 50 years throughout the United States and abroad, and he has authored numerous publications on the subject. His primary expertise is karst along the entire Appalachian region extending from Alabama to New England. His résumé is appended to this report.

Contents

Contents – *Continued*

Introduction

This report summarizes significant environmental impacts and risks associated with the siting the proposed Mountain Valley Pipeline (MVP) through karst terrain of Giles, Montgomery, Craig, and Roanoke counties in Virginia, Monroe County in West Virginia, and a segment of Summers County that is adjacent to Monroe County in West Virginia. The report is based on an analysis of the proposed route and information submitted to date by MVP and the following agencies: U.S. National Forest Service, Virginia Department of Conservation and Recreation, and Virginia Department of Environmental Quality. Moreover, numerous other documents have been submitted to the Federal Energy Regulatory Commission (FERC) since the announcement of the pipeline proposal. These have been authored by intervenors, local experts, and concerned citizens who have spent countless hours researching, evaluating, and commenting on potential issues brought to light by this project. These contributions and documents have been reviewed and considered in compiling this report.

The scope of this report is to assess impacts of the proposed pipeline from three perspectives: (1) geologic constraints imposed on construction and operation of the pipeline, (2) potential hazards that are posed by the geologic setting on the pipeline if it is built, and (3) potential effects of the pipeline on the natural environment during its construction and operation, especially as those potential effects can be exacerbated by geohazards.

A large part of the MVP would traverse the Appalachian Plateau and Valley and Ridge physiographic provinces. These include some of the most prolific regions of karst in the United States (Davies, 1970; Herak and Stringfield, 1972; Davies and others, 1984; Kastning, 1986; Tobin and Weary, 2004; Palmer, 2007; Weary, 2008; Palmer and Palmer, 2009). The very nature of karst in this mountainous region is much different than that in other areas. Siting a pipeline through the Appalachian karst poses significantly greater hazards than in areas where the terrain has much lower topographic relief. The specifics of these problems are discussed in detail in Sections 2 and 3 of this report.

During the various stages of FERC decision making, it is imperative that geology be a major consideration for the segment of the pipeline that crosses the mountains and valleys of the Appalachian region. The very name “Mountain Valley Pipeline” suggests that this region of major topographic relief is a significant component for the route.

The karst of the counties of West Virginia and Virginia through which the route passes has been mapped at various scales using data developed from field surveys of karst features that are visible from the surface (Miller and Hubbard, 1986; Hubbard, 1988; Kastning and Kastning, 1995). Derivative maps showing the extent of karst-prone rock in these counties in relation to the proposed route of the pipeline are in Appendix B of this report.

Geologic systems, karst included, do not stand alone - they interact. With this in mind, the concerns about karst must be evaluated in context with other geologic processes that interplay. In this report, the effects of hydrogeology (both surface and ground water), slope stability, soils, and seismicity (earthquake potential) are included where they act in unison with karst processes in ways that can, and often do, compound environmental hazards.

As it concerns karst and other geohazards, this report is organized into four sections in order to synthesize the accumulated knowledge of this landscape in the affected region and the considerable information that has been submitted to FERC to date:

An overview of karst. This section includes the definition of karst, principle aspects of karst processes, and a summary of environmental factors and sensitivity typical in karstic landscapes.

Karst in the central Appalachian region of Virginia and West Virginia. The emphasis of this section is on karst in the six-county area through which the proposed pipeline route extends.

Environmental concerns related to the Mountain Valley Pipeline. This section specifies issues that must be addressed during the deliberative process by FERC.

Compounded hazards related to karst, slope stability, soils, and earthquakes. This section emphasizes how geologic factors act in unison or in sequence, compounding hazards along the route, causing higher levels of impact and concern.

Important Notes to the Reader

The first two sections are for the benefit of those readers who may wish to review the meaning of karst and the hydrogeomorphic processes associated with karstic landscapes and processes (especially related to those found in the region of the proposed pipeline). Those who have a good fundamental understanding of karst and its occurrence in the Appalachian Region may wish to proceed to Sections 3 and 4 that directly address potential problems along the MVP corridor.

References are cited in this report in one of two ways. Published literature is cited by author(s) and date and is keyed to a reference list at the end of the report. Relevant unpublished reports, including submittals to FERC, are identified where applicable.

To facilitate a quick perusal or locating key points, some phrases and sentences have been emphasized in **bold font**. This is primarily the case in Sections 3 and 4 that directly address potential hazards along the pipeline corridor.

This study was initiated at the request of individuals and organizations that are local stakeholders in the FERC review process, and would be adversely affected by the eventual outcomes. They include numerous residents, scientists, and citizen groups. Many of the individuals are registered intervenors in this process and have previously contributed findings, data, and interpretations to FERC. A significant amount of this information has been reviewed and compiled in this report. Those sources are acknowledged in the text.

The Tables and Figures cited in this report are located in Appendix B. This is because some of them are referred to often and in different places in the report.

Interactive Maps

It may be very useful for the reader to access and use two interactive map sites that have been created online for those involved with the Mountain Valley Pipeline issue. In both cases one is able to select among types of base maps and layers of data and zoom in or out in order to view levels of detail.

The Mountain Valley Pipeline Exploratory GIS Map is focused on geological hazards in the counties along the entire MVP route, with a focus on Virginia. This tool was created by Drs. Stockton Maxwell and Andrew Foy of the GIS Center, Department of Geospatial Science at Radford University. This map is located online at:

http://www.arcgis.com/apps/MapTools/index.html?appid=bcc1646d43ad4f7fbfd4953b5d722cc7

Another interactive map, primarily focusing on the affected counties of West Virginia, was created by the **Indian Creek Watershed Association** (ICWA). It is located online at:

http://indiancreekwatershedassociation.org/icwa-interactive-environmental-map

Both sites are being revised and updated as necessary by their compilers. It is recommended that the interested reader access these maps while reviewing this report or in future assessments and deliberations regarding potential environmental issues related to the pipeline.

The Author

Ernst H. Kastning, PhD, PG, has studied caves and karst for over 50 years throughout this country and abroad. His primary expertise is karst along the entire Appalachian region extending from Alabama to New England. Over the 31 years when he has lived and worked in Radford, Virginia, he has studied karst processes and environmental problems in counties of the greater New River Valley region and adjacent counties throughout Virginia and West Virginia. His publications on karst number over 100 and many directly address karst processes and environmental impacts in the area affected by the proposed Mountain Valley Pipeline. The author's brief résumé is appended to this report. His most pertinent publications relating to the karst region of this study are cited where appropriate and listed in the References Cited at the end of this report.

Section 1

Overview of Karst

A Working Definition of Karst

Once an obscure term, the word 'karst' is being used more and more by the public and the press, particularly in regions where it is prevalent or in situations where issues involving karst come to the fore, such as in the case of the Mountain Valley Pipeline. The concept of karst is not always an easy one to convey. A number of geological dictionaries and lexicons have defined the term. Moreover, there have been several specialized glossaries of karst that provide definitions of the myriad of features and the terminology that collectively define karst (*e.g.,* Monroe, 1970; Lowe and Waltham, 1995; Field, 2002; Poucher and Copeland, 2006; Palmer, 2007). An essential first step in discussing karst is to agree on its meaning.

A very simple, concise, one-sentence definition that generally suffices is:

Karst is a landscape that is principally formed by the dissolving of bedrock.

For clarity, it is useful to add that karst is characterized by sinkholes, caves, dry valleys (with little or no surficial drainage), sinking streams, springs and seeps, solution valleys, and various forms that are sculpted on the bedrock surface (collectively known as *karren*). Hydrologically, groundwater in karst terrains flows efficiently through openings in the bedrock that have been enlarged by the dissolution process. Surface water is rapidly conveyed underground at zones of *recharge* (typically where water enters sinkholes, soil, and vertical fractures in the bedrock) and then passes through a network of conduits (fractures, partings between beds of rock, and caves). The water eventually emerges at the surface in zones of *discharge* (springs, seeps, and wells). Karst forms in rocks that are soluble to various degrees when in contact with slightly acidic natural water. Commonly, the rocks that are most easily dissolved – to form karst terrain - are carbonate units, such as limestone and dolostone (sedimentary), marble (metamorphic), and sulfate units such as gypsum (sedimentary). Nearly all rocks may be dissolved to some degree. Only minor dissolutional features develop in materials with very low solubility in water, for example, granite, gneiss, sandstone and other silicate rocks. In most cases, these features are insignificant in terms of hydrologic and environmental impact. Most significant areas of karst in the United States are found within outcrops of limestone, dolostone, marble, and gypsum. Limestone and dolostone are the principal karst formers in the area under consideration in this report.

With respect to the history of geology, the study of karst (speleology) is a relatively new and blossoming science that draws largely on the principles of geology, hydrology, and physical geography. A thorough professional understanding of the processes that occur both at the surface and in the underground, and an appreciation for the integrated hydrologic system, necessitates a familiarity with the technical aspects of karst. Today the study of karst is multidisciplinary and quantitative, involving the principles of physics, chemistry, and mathematics. The importance of karst overlaps the biological and anthropological sciences as well. The level and scope of modern

karst studies are demonstrated by a proliferation of comprehensive monographs on the subject (notably those of Sweeting, 1973; Ford and Cullingford, 1976; Bögli, 1978; Jennings, 1985; Dreybrodt, 1988; White, 1988; Drew, 1995; Gillieson, 1996; Klimchouk and others, 2000; Gunn, 2004; Palmer, 2007; Ford and Williams, 2007; and White and Culver, 2011). Because the nature and processes of karst are complex, it is highly suggested that persons working with karst consult one or more of these specialized volumes. Additionally, the number of articles in scientific journals and proceedings volumes, and graduate theses on karst has expanded at a phenomenal rate in recent decades.

Requisites for the Development of Karst

Karst describes a three-dimensional landscape with characteristics that are the result of several contributing factors: (a) soluble rock (*e.g.,* most commonly limestone or dolostone), (b) structural controls that have modified the rock (*e.g.,* regional uplift or subsidence, folds, faults, and fractures), (c) chemically aggressive (acidic) circulating water that dissolves the bedrock, (d) porosity and permeability (hydraulic conductivity) that provide openings that allow groundwater to flow and dissolved material to be flushed through the system, (e) places of recharge where water can enter a karstic aquifer (*e.g.,* sinkholes, swallets, sinking streams) and places of discharge where water re-emerges at the surface (springs, seeps), (f) hydraulic gradients that create the potential for water to flow from high elevations through karst features to low elevations, and (g) sufficient time for karst to develop (typically thousands of years). Usually, but not always, there are both visual (surficial) features (*e.g.,* sinkholes, sinking streams, springs) and hidden (subsurficial) features (*e.g.,* caves and other enlarged conduits) in an area of karst. Depending upon local conditions and the size of drainage areas, the scale of karst landforms can range from quite small (*e.g.,* grooves in exposed rock outcrops and other karren) to quite large (*e.g.,* extensive cave systems, sizable sinkholes and clusters of compound sinkholes, and valleys formed by dissolution).

The composition of the rock, along with its porosity, permeability, and thickness of bedding will all affect the rock's susceptibility to be modified by contact with mildly acidic surface or groundwater. These effects will be more pronounced in areas that have significant humidity and precipitation, where topographic relief is high, and where rocks are at or near the Earth's surface. These conditions are prevalent in the Appalachian region and have contributed to the well-developed karst found there.

Recognizing Karst Features on the Surface

Karstic features on the surface can range from the extremely obvious (*e.g.,* large sinkholes, sinking streams, and/or springs), often overlooked features (*e.g.,* small sinkholes or dry valleys), subtle features (*e.g.,* swales), and very small features (*e.g.,* solutional sculpting of rock surfaces such as karren features).

Karst landforms of any size on the surface can sometimes be hidden from the casual observer. Large, dry valleys and solution valleys can inadvertently go unrecognized as karst – proverbially a "one can't see the forest for the trees" symptom. Although they may be obvious on a topographic

map or from aerial photographs, especially for those persons familiar with karst, the normal valley shape sometimes disguises the true nature of a solution valley.

In tall, thick forests, tree-coverage may hide even large sinkholes (closed depressions) from being detected with aerial photography or at times while travelling on the surface. Other karstic features are too small to be discovered by aerial photography or illustrated on a topographic map, especially on standard 7.5-minute quadrangles constructed with typical contour intervals of twenty or more feet. In some cases, even smaller contour intervals may not indicate closed depressions. Site visits are mandatory to research a potentially karstic area; one cannot rely solely on sinkholes depicted on a topographic map or mapped with aerial photograph. This is an especially important point for environmental assessments where karst is a factor of risk (Hubbard, 1991). Performing ground truth is the only proven way to detect the presence and abundance of small sinkholes. In the area of concern along the MVP, the proposed corridor crosses numerous places in karst terrain where subtle sinkholes may be the only ones present. Even very small sinkholes are important indicators of karst development, especially where subsurface features (such as caves and other openings) occur. In general, the presence of sinkholes of any size in a soluble rock terrain is an indicator of a subsurface hydrologic karst environment (a network of enlarged openings that have or still do conduct groundwater).

Karstic terrains often have very thin layers of soil overlying them because the soil may be piped away almost as fast as it develops. But this is not always what occurs. For example, where nearby steeply sloping hills drain onto karstic terrain, thick deposits of clay (or other alluvium and/or colluvium) may mantle the karstic landforms, especially in areas with relatively few small fractures in the bedrock. The only discernable evidence of karst may be wet-weather springs or swales (slightly sagging areas, too shallow for most people to refer to them as sinkholes). These slight depressions are sometimes detectable after a heavy rain when water ponds in them briefly or in early spring when the vegetation starts to grow in the swales earlier than on the surrounding area. As the soil is removed from below the vegetative root mat, these areas sag and may eventually collapse into the piping cavities below. Sometimes these collapses occur when farm animals suddenly drop from view while grazing on the greener pastures! Even farm vehicles have been known to suddenly break through a thin soil mat and fall into the cavity beneath.

Sinkholes formed by the physical process of piping (an engineering term; geologists generally name the process ‘suffosion’) are associated with the soil and regolith zone that overlies bedrock. Even though sinkholes may have formed in soft, loose, insoluble materials, they are still considered features of karst. The reason for this is that during the slow process of piping, tiny particles in these horizons tend to move downward into true karstic openings in the underlying bedrock (namely fractures) and be carried away as part of the groundwater flow. Over time cavities grow in the regolith and soil, including upward growth (termed *stoping*), until their thin roofs collapse, forming the sinkholes.

Suffosion (piping) collapses are very common in the karst regions of the Appalachians. It is usually wrong to consider this kind of subsidence to be an insignificant indicator of karst. On the contrary, most of these sinkholes would not have formed if there were no openings in the bedrock beneath to carry off particles.

Wet-weather springs may flow when wetter-than-usual conditions cause a temporarily high water table. A wet-weather spring may represent a former spring that flowed when local base level was at a higher elevation.

Seeps and small gravity springs exist where groundwater flow, generally just below the water table, intersects the natural ground surface. These areas of discharge also occur in outcropping rocks, where water that has been perched on an impermeable bed discharges at the surface where the beds are exposed. Seeps will sometimes develop where quarries, roads, railroad cuts, and other excavations (*e.g.,* for pipelines) cut through a hillside and into the bedrock. Discharge may be significant and result in major springs in some cases where major flow paths are intersected (such as caves having large streams).

All of the above characteristics are found in abundance in the karst landscapes of the Appalachian Valley and Ridge region. It would be very difficult to find a path or corridor for any use (roads, power lines, gas transmission lines) through this fold belt that would totally avoid karst. However, some areas within this region have more intensive karst than others.

Sinkholes as a Measure of Karst

The strongest surficial evidence for the presence of an efficient and well-integrated subsurficial drainage network is where sinkholes have formed at discrete points of recharge. Sinkholes form in response to surficial waters draining through the ground via the easiest pathway toward the local base level. Water does not travel into and through a sinkhole because the sinkhole has pre-existed – rather, as water travels through established zones of weakness (*e.g.,* fractures, faults, or bedding-plane partings), it gradually dissolves the bedrock and carries the solute away to points of discharge on the surface. Thus, sinkholes are formed contemporaneously with active recharge (Kastning and Kastning, 2001). Tiny soil and rock fragments are also piped away, augmenting the development of sinkholes in the process. Thus, dissolutionally enlarged openings (owing to chemical weathering) and mass wasting of soil cover and break up of bedrock (owing to physical weathering) both contribute to form hollowed-out closed topographic depressions that we call sinkholes (and are internationally known as dolines). Sinkholes can be of any size, as large or small as local geologic or other natural conditions and time permit. The shapes of sinkholes or clusters of sinkholes may provide clues to their origins, if they are mapped thoroughly and analyzed carefully (Kastning, 1989b; Kastning and Kastning, 2003). Sinkholes and other surficial karst features are often highly useful in interpreting geologic structure in the subsurface (Kastning and Kastning, 1981). Structural control is crucial in the establishment of hydrologic continuity among surficial features, such as sinkholes and other recharge zones, subsurficial drainage such as caves and other conduits, and discharge zones such as springs or seeps (Kastning, 1999).

Sinkholes are used as measures of karst in many site evaluations. The observed presence of closed depressions in soluble-rock terrain is correctly interpreted as evidence for karstic groundwater flow in the subsurface. These represent places of discrete recharge where water enters the ground at specific points. Conversely, the absence of closed depressions on the surface is too often interpreted as an indicator of poor or no development of karst in the subsurface. The latter view is an erroneous assumption in many karst regions, especially in areas of diffuse recharge where

water derived from precipitation percolates uniformly into the ground over an area, perhaps through an overlying insoluble bed (*e.g.,* sandstone) or through a thick mantle of soil and regolith. This can result in a surficial landscape with few if any noticeable sinkholes. Because of that erroneous assumption, small, shallow, and otherwise subtle sinkholes are often omitted from environmental studies and assessment. Even if subtle sinkholes are very numerous (and therefore important indicators of karst), not recognizing them or overlooking them can greatly alter conclusions about the presence and extent of karst in an area or at proposed construction sites.

There are many documented regions of karst where extensively explored and mapped caves lie beneath a surface devoid of sinkholes. **In areas underlain by soluble rock, the absence of sinkholes on the surface cannot be categorically interpreted as the absence of karst.**

Section 2
Karst in the Central Appalachian Region

Introduction

Large, complex karst systems are found extensively in the Valley and Ridge provinces of the Appalachian Plateau and throughout the boundary area straddling Virginia and West Virginia (Davies, 1970; Herak and Stringfield, 1972; Kastning, 1986). The primary belt of karst (*i.e.* the widest outcrops of soluble rock) extends from Mineral, Hampshire, Morgan, Berkeley, and Jefferson counties in northeastern West Virginia, southwestwardly through a double tier of counties along the western margin of Virginia, along its boundaries with West Virginia and Kentucky, to Lee County at the southwestern tip of Virginia at the Tennessee state line. Several narrow strips of karstic rocks in West Virginia parallel the primary belt. These extend from Monongalia and Preston counties in the northern part of the state to the widest of these belts in Pocahontas, Greenbrier, and Monroe counties in the southeast. Altogether, this expansive karst region lies within twenty-five counties in Virginia and eighteen counties in West Virginia, for a total of forty-three counties (Kastning, 1995b; Kastning and Kastning, 1995).

Caves are the best known karst features of this region. Tabulations of the Virginia and West Virginia Speleological surveys (VSS and WVSS, respectively) show that each state has over 4000 documented caves, nearly all of which lie within the area described above. This results in one of the highest densities of cave distribution in the United States. Most of the caves have been described in published compilations (Davies, 1958; Douglas, 1964; Holsinger, 1975). Additional descriptive accounts have appeared in various issues of the *West Virginia Speleological Survey Bulletin*, in guidebooks to previous NSS Conventions and the Eighth International Congress of Speleology (Schleicher, 1970; Virginia Region of the National Speleological Society, 1971; Hempel, 1975; Garton, 1976; Werner, 1981; and Medville and others, 1983), and in newsletters (most notably, *Virginia Cellars* of the VSS and the *West Virginia Caver*). Caves in Virginia that are important geologically, are fragile, contain unique organisms, or are environmentally sensitive have been officially designated as 'significant' by the VSS and the Virginia Cave Board, a collegial body of the Department of Conservation and Recreation (Holsinger, (1985). The George Washington and Jefferson National Forest includes a number of significant caves (Kastning and Kastning, 1992b). Thus the cave regions of the Virginias are well known and continue to challenge explorers, geologists, and hydrologists who are probing the physical and chemical processes of cave development and the hydrogeologic aspects of karst aquifers.

The geomorphic process of cave development is inherently complex, but essential for understanding the threat caves pose to the integrity of large high-pressure pipelines, and assessing the safety hazards of the pipeline with respect to communities along the route. This is especially true in the Appalachian fold belt (White and White, 1983; Orndorff, 1995). A comprehensive understanding of the origin of single caves, cave systems, or caves distributed over a large region, requires that all responsible factors are considered. Most important are (1) the lithology, solubility, porosity, and permeability of the host rock, (2) the chemistry of the groundwater and rates of

dissolution, (3) the structural setting, (4) the existing topography and evolutionary history of the regional landscape, (5) paleoclimates, and (6) the hydrodynamics of groundwater during speleogenesis (cave and karst formation). Factors and processes important to development of caves and karst in Virginia and West Virginia are outlined in the following sections, with an emphasis on the central Appalachian region.

Karst within the region of this report is discussed in detail in Sections 3 and 4. Maps showing the distribution of soluble rock in this region (likely to have karst) can be found in Appendix B (Figures 1, 2, and 3).

Lithologic Factors

Karsted carbonate rocks that host caves in the central Appalachian region are principally dense, crystalline limestone and dolostone, that occur within three zones that parallel the Appalachian structural trend (Hubbard, 1988; McCue and others, 1939). All of these rocks were deposited during the Paleozoic Era (570 to 245 million years ago). For lithologic descriptions of formations in Virginia and geologic maps of their distribution *see* Butts (1933, 1940), Rader and Evans (1993) and Virginia Division of Mineral Resources (1993). Stratigraphic correlations in Virginia are given in Rader (1982). Detailed descriptions of carbonate rocks in West Virginia and maps showing their distribution are found in McCue and others (1939) and various county reports published by the West Virginia Geological Survey from 1910 to 1940.

Karsted carbonate rocks in the two states occur in three zones as described here. First, the oldest beds, Cambrian and Cambrian-Ordovician in age (570 to 438 million years ago), occur along broad lowlands within the Great Valley, including the Shenandoah Valley of northern Virginia and the eastern panhandle of West Virginia and the southwestern extension of the valley through Virginia. Within the Mountain Valley Pipeline region, these rocks crop out in 46 counties (28 in Virginia and 18 in West Virginia; Kastning and Kastning, 1995). Karst in these rocks is generally mature in its development and the surficial terrain is characterized by sinkholes and lack of perennial drainage in small stream channels. Sinkholes are typically clustered where bedrock of high solubility is exposed or near the surface. In some of the broad valleys, beds of limestone have relatively low dip (0-15 degrees) and sinkholes are thus distributed over wide areas. In northern Virginia, caves of the Shenandoah Valley are small to moderate in length (only a few exceed one mile in length) and typically occupy particular beds of favorable solubility, commonly a single bed. However, **in the southwestern Virginia part of this zone, long caves are more common, with over thirty exceeding one mile in length. Additionally, the number of known caves per county is higher in southwestern Virginia than in the northern part of this zone.**

The second zone of carbonate rocks lies to the west, in the westernmost counties in Virginia and in several counties in West Virginia. These units are middle to late Paleozoic in age, specifically from the Silurian to Devonian periods (438 to 360 million years ago). This zone, which is generally narrower than that of the older carbonates to the east, is comprised of several narrow exposures of limestone and dolostone (Kastning and Kastning, 1995). **These bands run through many counties in West Virginia, including Monroe County. They also traverse parts of Giles and Craig counties in Virginia.** Rocks of this zone have been intensely folded and faulted and

steeply dipping beds are common. As in the zone of older rocks to the east, caves in the Silurian-Devonian units are generally confined within particular strata. Caves in these rocks are generally small to moderate in extent when compared with those in the karstic rocks to the east.

In the third zone, further to the west in the Appalachian Plateau of West Virginia, carbonate rocks are younger and are generally Mississippian in age (360 to 320 million years ago). The bedrock in the southern part of this zone is typically subhorizontal, with dips of a few degrees up to 15 degrees. **This explains the relatively broad exposures of carbonates of the Greenbrier Group in Pocahontas, Greenbrier, and Monroe counties of West Virginia. Rocks of this zone are host to the longest caves in the region and some of the longest in the United States. Moreover, the number of long caves per county is considerably higher in these rocks than in units of the other two zones** (Kastning and Kastning, 1995). This is particularly true for Monroe and Greenbrier counties in the central Appalachians.

Structural Control of Caves and Karst

The geologic structure of the cave regions of Virginia and West Virginia is complex. The entire area was subjected to large-scale tectonic stresses accompanying continental collision between the North American and African plates during the middle and late periods of the Paleozoic Era. Compressive forces acting in a northwestern-southeastern direction significantly shortened the crust in the Appalachian region, creating fold belts, extensive thrust faults, and fracture systems that characterize the structure. As a result, the regional strike of sedimentary beds is north-northeast, parallel to the trends of ridges and valleys. Dips are typically steep and at some localities beds may be vertical or overturned.

The Valley and Ridge Province is underlain by numerous parallel folds, many of which terminate to the northeast or southeast as plunging anticlines and synclines. Differential erosion during the late Tertiary and Quaternary periods (last 20 to 30 million years) has produced low valleys bounded by parallel mountain ridges. Under the humid-temperate and periglacial climates prevailing in this region during the late Cenozoic Era, dense, crystalline **limestone and dolostone beds have been significantly lowered through both dissolution and physical erosion, forming the floors of many of the broad valleys.** In contrast, dense, massive, well indurated (particles cemented with silica) sandstone units have resisted erosion and most ridge crests are underlain by these siliceous, relatively insoluble units. Beds of shale are typically exposed along the middle and lower walls of valleys. It is not uncommon for the topography to be inverted with respect to the structure, such as ridges being cored by synclines and valleys developed on anticlines. The valley of Sinking Creek, extending northeast through Giles County from Newport is a noteworthy example of the latter. **The relationship of karst features, such as sinkholes and caves, to exposures of soluble rock and regional bedrock structure (folds and strike-and-dip of bedrock) is easily seen by comparing maps.** For example, these correlations are very evident in Giles County when comparing the maps of Miller and Hubbard (1986) and Schultz and others (1986).

Caves are strongly positioned in conjunction with local structure. Most are located along the lower flanks of folds and beneath the lower slopes of valley sides. Caves are also prevalent

beneath the valley lowlands. Again, this is exemplified in Monroe County, West Virginia, and in Giles and Montgomery counties, Virginia. A fine example is the extensive sinkhole karst of the Mt. Tabor area, northeast of Blacksburg (*see* Sections 3 and 4 of this report)**. Also, a comparison of the locations and distributions of caves and sinkholes** (Miller and Hubbard, 1986) **with the lithology and structure of bedrock within in Giles County** (Schultz and others, 1986**) shows that karst features are strongly clustered and aligned in concordance with the geologic setting.**

Most long passages in caves of the Valley and Ridge Province are oriented along strike and are generally close to horizontal along their lengths. This is characteristic of conduits formed within the shallow-phreatic groundwater zone (Davies, 1960; Ford and Williams, 2007; Palmer, 1975, 1987, 1991; White, 1988). Many of these caves also have dip-oriented conduits and side passages of canyon-like cross sections that serve as tributaries to the strike-oriented master conduits. In most cases, dip-oriented passages convey infiltration from the surface, primarily through sinkholes and fractures, down steep gradients, to master conduits that ultimately carry water along strike to springs.

Faults also are a relevant component of geologic structure. The role of faults in controlling karst development is complex and defies generalization (Kastning, 1977, 1984). In some cases, faults provide zones of high permeability for groundwater flow and dissolutional enlargements of conduits. Under other circumstances, rocks of different lithologies and solubilities are in contact across the fault planes, hindering karstification on the side of the fault where the rocks are less soluble. However, in yet other cases faults have exerted very little influence on caves or surficial karst features. Thrust faults tend to have the greatest effect on karst processes, in many cases simply because they are laterally extensive and the displacements are large, juxtaposing rock units of differing lithologies. Caves may develop adjacent to a thrust surface or along fractures and brecciated material within the fault zone. New River Cave in Giles County, Virginia is a well-known and documented example of control by thrust faulting (Krinitzsky, 1947; Kastning, 1977). **Thrust faults have locally influenced development of passages in caves of the Appalachian Plateau, particularly in the Greenbrier limestones in West Virginia. It is imperative in hydrogeologic assessments that the exact role of faulting during speleogenesis be determined through detailed study at each specific site where faults exist.**

As in all karst regions, joints exert considerable structural control on development of caves and surficial karst features, such as sinkholes. Joints are avenues for the circulation of chemically aggressive groundwater. It follows that joint openings are enlarged as the bedrock on the sides of joints are dissolved. Some joints are initially more open than others and may in a self-ramifying manner enlarge at greater rates than other, less-open fractures nearby.

The degree of openness of fractures and differences in hydraulic gradients along particular conduits typically leads to a dendritic, subsurficial drainage network (Palmer, 1991, 2007). Most of the larger caves in the Appalachian region consist of a contributory network wherein water infiltrating from the surface is concentrated within the karst aquifer through tributary passages that carry discharge to master conduits of flow that in turn convey water to discharge points namely springs.

All of the bedrock in the fold belt is heavily jointed, providing considerable avenues for the circulation of groundwater. Joints commonly occur as sets in the Appalachian region, whereby the strikes of joints cluster within directional intervals. The dominant sets of joints are consistent with the structural fabric of the Appalachians. Most joints are generally parallel to the strike of the bedrock and thereby are also parallel to fold axes and the strike of thrust faults. Usually there are other joints sets that are perpendicular to the primary ones or formed as conjugate pairs, but the extents and densities of these joints are generally less than those of the primary set. Joint sets are most apparent in caves that are maze-like, wherein parallel passages of two or more orientations intersect one another (Palmer, 1975).

Structure has played a significant role in the origin of long caves in Monroe County of West Virginia. Several caves exceed five miles in length. The exposure of carbonate units of the Greenbrier Limestone at the surface is broad owing to relatively little deformation of rocks in comparison to the Valley and Ridge Province to the east. Folds are broad and their limbs have shallow dips. Faulting is relatively minor and thrust sheets, although numerous in some caves, are short and of small displacement.

As mentioned previously, sinkholes and other surficial karst forms are commonly positioned along structural trends, such as along strike within bands of exposed carbonate units and along faults and joints. **Sinkholes are often aligned along narrow outcrops of steeply dipping beds.** Excellent examples of sinkholes aligned along joints in shallow dipping rocks occur in the Elbrook and Conococheague formations in Pulaski County, Virginia, just west of the New River (Kastning, 1988, 1989a). **The Monitor Lineament in Monroe County is easily spotted as a remarkable straight line in aerial imagery. It is a six-mile-long string of sinkholes, likely caused by water flowing along an ancient fracture and slowly dissolving the limestone, resulting in subsidence and collapse** (Lessing and others, 1979; Lessing, 1981; Indian Creek Watershed Association, 2012). **Many sinkholes in the Mt. Tabor Karst Sinkhole Plain of Montgomery County, Virginia are clearly aligned, attesting to the likelihood of extensive groundwater flow paths along conduits in the underlying bedrock.** The latter two examples characterize conditions of concern regarding karst and the proposed pipe line (*see* Section 4 for further clarification).

Hydrogeologic Conditions

Many caves in the Appalachian region of the Virginias formed as part of a mature, well-integrated karstic drainage system. The longer caves consist of tributary passages converging on master conduits and draining to one or just a few outlets (springs). Many caves, originally formed under shallow phreatic conditions, contain active streams today. In some caves water courses follow the pre-existing paleo-drainage; however, in other situations, the present direction of flow may be contrary to former directions. Changes in flow following speleogenesis can be largely explained by subterranean stream piracy, whereby surficial streams suddenly find routes underground (Palmer, 1972). **Sinking creeks are common in the Appalachian karst regions of West Virginia and Virginia. A classic example is Sinking Creek in Giles County. (This would be crossed by the proposed Mountain Valley Pipeline near mile post 210 and is discussed in detail in Sections 3 and 4 of this report.) Saunders and others (1981) studied the**

hydrogeology of Sinking Creek, performing dye-tracing studies (including some of the longest in the state).

In the Appalachian fold belt, surface waters flow from mountain slopes toward base-level streams in valleys, forming regionally extensive, trellis drainage networks. Meteoric (storm) water flows steeply downhill from uplands underlain by relatively impermeable sandstone and shale. Water, that encounters carbonate rock exposed low on the slopes or in the broad lowlands in the valleys, commonly sinks and enters a karstic aquifer. Infiltration is often into a sinkhole where the entire flow of a stream is captured. (Such a discrete point of recharge is often termed a 'swallet.') Excellent examples of this process are found along the lower parts of the northwestern flank of Walker Mountain in Bland County. This site, one of the designated significant karst areas in Virginia, is known as the Skydusky Hollow Karst and contains several of the longest and deepest caves in the state, including the Newberry-Banes Cave System, and Paul Penleys, Spring Hollow, Banes Spring, and Buddy Penleys caves (Holsinger, 1985). A similar situation exists below the southeastern flank of Pearis Mountain in Giles County (*see* map of Miller and Hubbard, 1986). This is known as the Wilburn Valley Karst and includes Starnes, Wilburn Valley, Yer, and other notable caves. This system consists of multiple levels, passages of small cross-section, and numerous pits. This karst area continues to be actively explored and mapped.

There have been some significantly long dye traces in Giles County in addition to those of Saunders and other (1981) mentioned above. One of the longest dye traces within the karst region of Virginia (several miles in length) was performed within the Sugar Run drainage area southwest of Wilburn Valley (Savko, 2001, under the direction of this writer). In this case, flow through one of Virginia's longest caves travels from the headwaters of Sugar Run, following strike around the nose of a plunging anticline (as mapped by Schultz and others, 1986) to emerge at Wabash Springs, one of the highest-discharge springs in the state. **Researchers with the Virginia Karst Project of the Department of Conservation and Recreation placed dyes into some large caves in the headwaters of Clover Hollow. Some of the dye emerged over four miles distant, in the cave streams of Tawneys and Smoke Hole caves. These two caves are adjacent to Sinking Creek (in close proximately to mile post 210 of the proposed Mountain Valley Pipeline).**

The area where the MVP route crosses Sinking Creek (mileposts 210) is one the most significant examples of potential hazards associated with the project. Details of these problems are presented in Sections 3 and 4.

Groundwater of the Mt. Tabor Karst Sinkhole Plain has also been extensively traced with dyes in recent years, including studies by Hayman (1972) and more recently the Virginia Karst Project of the Virginia Department of Conservation and Recreation (Fagan and Orndorff, 2008). These studies reveal a relatively broad and low-lying karst plain exhibiting a well-developed and mature karstic groundwater network. For maps and descriptions, please refer to submissions to FERC by Registered Intervenors Tim Ligon (6 May 2016, submittal 20160506-5059), Louisa Gay (6 Jan 2016, submittal 20160201-5201 FERC) and S. René Hypes of the Virginia Department of Conservation and Recreation (17 March 2016, submittal 20160317-5126).

The area where the Mountain Valley Pipeline route crosses the Mt. Tabor Karst Sinkhole Plain (mileposts* 220 to 226*) is another significant example of potential hazards associated with the

project. Details of the problems associated with the Mt. Tabor Karst Sinkhole Plain are presented in Section 4.

Numerous dye-tracing studies to date, including some of phenomenal length, attest to the development of mature and well-integrated karstic aquifers in the counties of interest in this report, especially Giles, Montgomery, and Monroe counties. If additional dye-trace studies were to be performed in the karst of these counties, the findings would certainly further strengthen the known extent of aquifers.

Considering the extent of the soluble rock exposed at the surface in this region, a major conclusion is that much of the surficial karst (sinkholes, etc.) is tied to underlying extensive networks of groundwater flow (see maps of soluble rock in Appendix B of this report, Figures 1, 2, and 3) and map of Kastning and Kastning, 1995). Much of the karst of these counties includes large integrated systems and must be treated as such with respect to potential impact of construction and surface modification by the pipeline project.

Chronology and Sequence of Cave and Karst Development

Groundwater flow that is responsible for the dissolutional excavation of caves in carbonate rocks is guided by the lithostratigraphy (attributes of the host rock such as mineralogic composition, layering, and thickness of beds) and structure of the bedrock as described above. Hydrodynamic factors that force water through fractures and along bedding planes include the degree of porosity and permeability initially inherent in the rock and the secondary changes in these produced during the speleogenetic process. One very important factor is the hydraulic gradient, a measure that drives water through openings and which is derived from a difference in elevation. In general, steep gradients increase the rate of water flow and of dissolution. However, hydraulic gradients are intimately tied to the local relief in topography. The greater the differences in elevations on the surface between zones of recharge of water into an aquifer and zones of discharge of water from the aquifer, the greater the hydraulic gradients in developing conduits. The greatest development of caves occurs just below the potentiometric surface (water table). However, as the ground surface of the Earth is worn down through erosion, the water table drops and, hence, so does the zone of cave development (Palmer, 1987, 1991; White, 1988; Ford and Williams, 2007). As a result, the oldest caves are generally those well above local base level and the youngest are lower and closer to base level.

It is difficult to assess the age of caves, when they began to form, or the rates at which they are excavated by the circulation of water. However, some recent techniques have provided reasonable estimates. Various studies suggest that caves take nearly a million years to form in the greater Appalachian fold belt. Once those results are estimated it is also possible to calculate the rate that the surficial landscape is lowered by erosion.

When water tables drop in response to the lowering of the landscape, caves become air filled. However, most long caves in the Appalachian region have streams in them. This water is making its way from the surface to the present water table or to springs.

Both existing steep hydraulic gradients and active streams within caves are important aspects in assessing potential problems associated with siting a pipeline corridor through the karst of this region. Only sufficient dye-trace studies can properly delineate flow paths of groundwater within or near the proposed pipeline corridor where it crosses carbonate rock.

Section 3

Mountain Valley Pipeline Environmental Concerns

Introduction

To begin, there are three basic tenets when reviewing environmental concerns related to the Mountain Valley Pipeline:

(1) As previously stated, ***karst landscapes are among the most sensitive to environmental degradation. Moreover, these terrains can pose some of the most severe constraints on construction and development.*** This is well demonstrated in the vast literature on applied problems in karst. Often karst is considered a **'no-build'** zone for major construction projects.

(2) Also as previously stated, **the presence of karst features within mountainous landscapes, such as that proposed for MVP, poses challenges and creates hazards that are not present where karst features occur in non-mountainous terrain.** Topography of high relief adds considerably to environmental problems in karst.

(3) ***Areas of karst along the proposed route of the Mountain Valley Pipeline pose some of the most severe challenges and concerns for the MVP project.*** The intensity of karst as a hazard has been largely understated in the Resource Reports of the MVP application and in the Hazards Assessment by Draper Aden Associates, February 16, 2016, submittal 20160226-5404 (31274307).

Potential hazards related to karst are exacerbated when they combine with other hazards, especially soils with low physical integrity, slope stability, and potential for seismic events. MVP documents do not address the sequential or cumulative effects of these hazards. Because this is a highly important aspect of the siting process, these synergetic effects are discussed in detail in Section 4 of this report.

No gas pipeline as large as 42 inches in diameter has been constructed across the Appalachian fold belt. Existing large pipelines run over land to the west and east of these mountains, but not across them. The geologic hazards that are summarized in this report are likely partially responsible for the lack of existing large pipelines across the Appalachian ridges.

Environmental Hazards in the Appalachian Karst

It is important to delineate various environmental problems associated with karst in the Appalachian region. Karst poses environmental concern regardless of where it occurs, whether in

this mountainous region or areas of lower topographic relief (Dougherty, 1983). These are discussed below.

The proposed route of the MVP passes through karst in several places. Karst terrain is a significant environmental feature throughout a segment of the project extending from milepost 172 through 234, in Monroe, Giles, Craig, Montgomery and Roanoke counties (*see* for example, Submittal 20151125-5156 to FERC Docket CP16-10, C.E. Zipper and others, "Motion to Intervene and Protest," November 2015). By example, four specific areas in West Virginia and Virginia are of particular concern and are addressed in this section. They are, from northwest to southeast: (1) exposed karst from Little Mountain to Peters Mountain in Monroe County, (2) Sinking Creek at the intersection of Routes 604 (Zells Mill Road) and 700 (Mountain Lake Road) in Giles County, (3) the area of karst at Canoe Cave on Sinking Creek Mountain in Giles County, and (4) the Mt. Tabor Karst Sinkhole Plain, northeast of Blacksburg in Montgomery County. Significant geologic, hydrologic, and environmental problems associated with these are summarized in this section.

Carbonate-rock terrains pose environmental hazards that are unique with respect to the wide spectrum of bedrock types, and karstic landscapes are particularly sensitive to environmental degradation (LeGrand, 1973; White, 1988). Stresses induced by human activity in karstic terrain result in environmental problems that are much more acute than those that would occur in terrains underlain by either crystalline (metamorphic or igneous) or clastic (other sedimentary) rock. Problems such as groundwater supply and quality and land instability abound in the Appalachian region, as they do in most populated karst regions worldwide, especially those in areas of high topographic relief. **The New River Valley Region, which is largely coincident with the area addressed in this report, has historically been one of the most sensitive karst regions within the Valley and Ridge Region (Kastning, 1989a, 1990; Kastning and Kastning, 1998).**

Groundwater Contamination

Sinkholes, abundant features in the karst of the Virginias (Hubbard, 1984), serve as funnels through which surface water readily enters ground and the aquifer. These are viewed as points of discrete recharge. However, even where sinkholes are less evident or non-existent, water can readily drain into subsurface aquifers. In these circumstance it uniformly infiltrates into surficial materials (soil and underlying regolith) and then comes in contact with the underlying soluble rock. This is termed diffuse recharge. Upon contact with the bedrock, water continues to move downward along fractures. Once underground, water freely courses through enlarged conduits, including caves, and eventually emerges at springs and seeps or is pumped to the surface by domestic or other wells. **A karstic groundwater system is a well-connected 'geologic plumbing' network, and groundwater travels through it at rates similar to water traveling in constructed pipes. There is little or no filtration of this water and contaminants may quickly enter existing water supplies.**

The zone between the surface and the bedrock is known as the **epikarst.** This includes the soil, regolith, and the sculpted upper surface of the bedrock. Epikarst is a highly important zone with respect to environmental problems. Pipelines traversing areas underlain by soluble rock (karst terrain) will be largely constructed within the epikarst. In some cases, where the soil and regolith

are thin, trenching during construction may also include excavation of the bedrock. **Excavation of bedrock in karst, for example during trenching or quarrying, can be disruptive to groundwater flow and affect both quantity and quality of water** (Kastning, 2008). Soil and regolith above the bedrock is very thin in most places where the proposed MVP corridor crosses karst (*see* submittal 20151130-5432, November 30, 2015, Preserve Giles County, Section 6, especially p, 95, 97-98 via document pagination).

If there is one single environmental issue that stands out in the karst of the Appalachians, it would have to be the sensitivity of the karstic aquifers to groundwater contamination (Kastning, 1988, 1989a, 1990; Kastning and Kastning, 1991; White, 1988). This problem is universal among all karst regions in the United States that underlie areas of economic growth (Aley, 1972; Aley and others, 1972; LeGrand, 1973). Much of the karstic terrain of the Virginias lies in rural regions where environmental impacts are generally limited to those imposed by agricultural practices and highways (Davies, 1970). In some cases, karst lies within the confines of public land (parks, forests, and the like). On the negative side, the region's karstic groundwater problems are increasing with the advent of (1) expanding urbanization, (2) increased usage of environmentally damaging artificial chemicals, (3) shortage of repositories for hazardous wastes (both household and industrial), and (4) ineffective public education concerning waste disposal and the sensitivity of the karstic groundwater system. Urbanization is rapidly encroaching in the region and economic development is resulting in potentially severe karst-related environmental problems. For example, corridors for highways, high-voltage power transmission lines, and gas pipelines have emerged as threats to karst (Werner, 1983; Kastning, 1995a, 1996).

For some time, sinkholes in rural areas were highly susceptible to illegal dumping by landowners or by passersby (Hubbard, 1989; Slipher and Erchul, 1989; Kastning and Kastning, 1992a, 1993). Fortunately, this source of contamination has largely abated as the result of legislation and education. However, sinkholes continue to be infilled with brush and construction debris (generally excavated materials from elsewhere). Some of this has come from construction of corridors such as highways and transmission lines.

Efforts to bring attention to the **sinkhole contamination problem** have been moderately successful (Kastning and Kastning, 1991, 1993, 1994, 2001). Articles in local newspapers, educational materials published by the Virginia Cave Board (a collegial body of the Division of Natural Heritage, Virginia Department of Conservation and Recreation) and other publications have addressed this problem in the Virginias (Hubbard, 1989; Kastning and Kastning, 1990, 1992a, 1995; Zokaites, 1997, Veni and others, 2001).

Sinkholes have been filled with earth materials for the purpose of leveling the land for development. It is important to note that filling a sinkhole with anything is highly undesirable. Sinkholes are natural drains and points of recharge. Filling of sinkholes often leads to undesirable consequences such as groundwater contamination, clogging of natural conduits in the underlying bedrock, flooding on the surface after storms, and suffosion (piping) of the fill which may lead to subsidence or collapse. Emplacement of excavated material onto a karst terrain during the construction of a gas pipeline can lead to blockage of recharge, whether through discrete infiltration into sinkholes or through diffuse infiltration through the overburden.

Fortunately steps have been taken to legally protect the karstic environment in the Appalachian region. For example, both Virginia and West Virginia have enacted state laws that protect caves and their natural contents from vandalism and contamination. The Commonwealth of Virginia has established the Virginia Cave Board as part of the Department of Conservation and Recreation to take up matters relating to caves and karst in the Commonwealth, to advise other agencies, and to participate in education related to caves, cave science, and cave conservation.

An issue of environmental concern is the likelihood that sinkholes would be filled and drainage blocked as a result of installation of the Mountain Valley Pipeline. This can occur during construction wherein excavated material from the pipeline trench or from roads used to install the line will be displaced into nearby sinkholes. Additionally, erosion produced within the corridor may convey debris downslope into sinkholes. Blockage of natural drainage avenue through sinkholes is detrimental to recharge to an underlying aquifer as well as causing contamination of groundwater with sediment and chemicals associated with pipeline construction and maintenance.

The above paragraph expresses concern that sinkholes would be filled. I will note that the "Karst Mitigation Plan" submitted by the Applicant (Resource Report 6, Appendix D, p. 266-284 via document pagination) calls for **"stabilization"** of sinkholes. Although this term is not defined in the document, it may suggest filling.

The risk of **groundwater contamination by natural gas pipelines** is significant and real, despite the fact that methane, a primary constituent of natural gas, is volatile in the ambient environment. Natural gas transported by commercial pipelines includes many other constituents that could be non-volatile, especially in a groundwater environment. These include high-molecular-weight organic compounds that either originate in the geologic reservoirs or form via hydrocarbon synthesis under the high-pressure conditions that occur within the pipeline. As stated by Resource Report 1 in the application, "typical filtration and separation equipment" is planned for each of the proposed compressor stations, indicating that non-gaseous constituents are expected to be present. Commercial pipelines typically specify contractual limits on non-methane content for transportable fluids (*see for example,* FERC Gas Tariffs that are available on the internet for commercial gas-pipeline companies). Such tariffs typically state the expectation that some liquid contents will be included within the transported fluids. They also state non-zero limits for contaminants such as sulfur, oxygen, and water, the presence of which can stimulate hydrocarbon synthesis under high-pressure such as those that occur in pipelines.) Furthermore, solid particles known as **"black powder"** can accumulate in natural gas pipelines, and may contain toxic metals including lead, mercury, and arsenic (*see* submittal 20160512-5183 to FERC Docket CP16-10 by Sierra Club of Virginia, especially the section entitled "Soil and Groundwater Contamination" on pages 10 and 11 via document pagination). **Such particles, if present in a pipeline experiencing rupture, would likely be released along with gaseous and liquid hydrocarbons, and other contaminants, at the point of rupture.**

Collapse and Formation of Sinkholes

The potential for spontaneous or catastrophic subsidence or collapse in the karst regions of the Virginias is low. Nonetheless, **collapses occasionally occur throughout the karst.** Massive collapses in which homes or businesses are swallowed by newly formed sinkholes are rare. The most common causes for catastrophic sinkhole collapse are (1) over pumping of groundwater from karstic aquifers, resulting in a relatively sudden loss of buoyancy that uphold roofs of cavernous openings, (2) sudden or oscillatory changes in the position of the water table due to modifications to surficial runoff and infiltration to the karstic groundwater system, and (3) leaky pipelines, such as water mains or sewer lines. Most collapses occur within the overburden (soil or regolith) and seldom does bedrock fall into underlying voids.

Suffosion (Piping)

Collapse of surficial material in karst is very common in areas of construction, especially where fill is used to level land. There have been countless examples of sinkholes developing in these artificial fills. (This author has personally visited, studied, inventoried, documented, and advised landowners in at least 20 such cases from 1985 to the present.) This includes construction sites for road beds, parking lots, and buildings. It is not uncommon for sinkholes to form after construction and to damage structures built on the fill. The process responsible **(suffosion/piping)** may take years to manifest itself in collapse, but this is always a concern where fill is emplaced upon bedrock that may have openings allowing infiltration (*i.e.* karst).

In areas undergoing development, sinkholes are often viewed as unwanted holes in the ground. If they are filled in to produce level land, the potential for ensuing environmental problems is twofold: First, as stated above, naturally developed paths of infiltration are often blocked, leading to ponding or flooding on the fill. Secondly, over the long run, fill materials drain into the subsurface and settling may occur. These disturbances easily impact any structures built on the fill. Additionally, the increased weight of water, fill, and structures upon the cavernous bedrock could cause catastrophic collapse in the future.

The reason that collapses are more common (and more frequent) in artificial fill than in natural undisturbed settings is easy to understand. When fill is put down it is rarely compacted sufficiently to attain the structural strength and density of nearby natural overburden. Porosity in fill is typically much higher than that of the surrounding undisturbed materials. (*see* Figure 5 in Appendix B). This promotes a higher migration of groundwater through the fill, leading to suffosion and eventual collapse.

Intrinsic to construction of gas pipelines is the process of burying the pipes under fill material that came out of the trench, was cut from the slope, or was brought in with trucks. **Despite the effort to compact fill, the former trench will nonetheless become a zone of enhanced percolation and flow of groundwater.** This can be envisioned as two concentric tubes. The central tube is the gas pipe that carries the product. The outer 'tube' is the surrounding fill. Its outer boundary would be the former walls and floor of the trench. **Therefore, the result would be an outer, annular, artificial pipe that carries groundwater parallel to the gas pipeline.**

As within any aquifer, **discharge is proportional to the hydraulic gradient.** In basic terms this is the slope of the path of flow from high points of recharge down to low points of discharge. The steeper the gradient, the more gravity-induced potential is applied to the flow system. It follows then that the **infilled trench surrounding a pipe on steeper slopes will have a greater discharge than it would on gentler slopes.** By design, the MVP pipeline would in many places be constructed directly up or down steep slopes of the mountains in the region. Therefore, in this case, groundwater flowing in the fill alongside the pipe would likely have a relatively high discharge and velocity of flow. By extension, suffosion and collapse in the fill could ensue, even though this process may take years and go undetected until the surface finally collapses into the growing cavity. **Sudden and unexpected collapse of the material around the pipeline could have profound consequences such as breaks in the line and ensuing cascading calamities (*e.g.*, fire, explosion, and release of toxic gases into the atmosphere and uncontrolled release of pipeline liquids into the groundwater flow system).**

Although large-scale collapse of surficial materials within the study area occurs rarely, the likelihood for karst collapse will increase within the pipeline corridor if the pipeline is constructed. Such increased risk of collapse will occur as a direct result of the construction process. Collapse is a characteristic phenomenon in karst regions where piping (suffosion) is induced by emplacement of artificial fills. Excavation of a trench for a pipeline and subsequent refilling would create subsurface zones with enhanced groundwater flows, with potential to increase rates of underground dissolution at subsurface locations receiving those flows. Underground rock dissolution caused by surface water infiltration is usually undetected until the final roof of an enlarging cavity falls in; such processes could easily and suddenly impact the integrity of the pipe.

Erosion

Erosion of surficial materials may readily ensue when an area is denuded of vegetation. Construction of gas pipelines entails excavation of a trench and subsequent placement of fill once the pipe is laid. It is necessary to construct roads along the line to allow vehicles to service the process and, on very steep slopes, along the tops of ridges to tether heavy equipment used to lay pipe. That too results in significant removal of vegetation and cutting and filling. **In effect there are two adjacent corridors: one for the pipe and one for the road. Erosion becomes a large problem along this rearranged earth material, even if moderate revegetation is carried out.** Unlike other corridors (*e.g.*, highways and some power lines), a gas pipeline would in many places go directly up and down steep mountain sides. The steeper the slope, the greater the tendency is for erosion and the more severe it may become.

To see firsthand the effect of erosion along corridors one need only walk under existing high-voltage power lines in the Appalachia region. Access roads along these lines often exhibit erosion and gouging and typically need to be repaired to be useful.

Sediment from erosion moves downslope and eventually becomes deposited where land levels off at the base of steep slopes. A problem in karst terrains of this region is that they principally exist in relatively low-lying topography, including locations at the bases of slopes.

Sediment contributed from erosion in the uplands can notably impact the karst below by (1) infilling sinkholes and blocking points of discrete recharge, and (2) blanketing an area and hindering diffuse recharge to the underlying karstic aquifer.

There are many areas where the MVP corridor moves off steep mountain slopes and onto lowlands. In many cases the lowlands are soluble rocks that have karst. Hence there is a pronounced concern that erosional debris from the corridors may impact the karst environment, including local aquifers that supply water for consumption or agriculture.

Slope Stability and Potential Seismicity

The potential for downslope movement of surficial material adjacent to the installed pipeline is an important consideration in these counties. **Movement, whether gradual (surficial creep) or catastrophic (landslide, mudslide, rockslide, or debris slide), may place segments of the pipe under lateral pressure and cause displacement.** This is likely if the material in which the line is entrenched is differentially displaced rather than uniformly along the line. Sudden slope failures would cause displacement at specific locations along the pipe, perhaps breaking welds or bending pipe to the point of failure.

It has been suggested that damage from slope failure is less likely where the line is trending directly up or down a slope (in the direction of the maximum component of gravitational force) than where the line runs parallel along a slope and has little change in elevation over that distance. In the latter situation a slide or zone of enhanced creep may put a severe bend in the line, perhaps compromising the seams where pipe segments join. However, in situations where the line is running directly up or down a slope, severe problems with potential failure may still occur, especially if suffosion is occurring. Additionally, steep segments along the line will create other issues related to movement of groundwater alongside the pipe. Determination of slope steepness and properties of soils in the vicinity of the line are crucial in identifying where this may occur. A detailed discussion of this hazard, wherein slope instability, soil character, and possible seismic disturbances can interact in a compound manner, is presented in Section 4.

Maps of slope intensity were produced in April 2016 by Drs. Stockton Maxwell and Andrew Foy of the GIS Center of the Department of Geospatial Science at Radford University. Percent slope (with 100 percent slope being 45 degrees) was calculated for 100 meter by 100 meter quadrats. The map was produced as an ArcGIS product and is available from the Center (http://www.arcgis.com/apps/MapTools/index.html?appid=bcc1646d43ad4f7fbfd4953b5d722cc7).

The New River Valley (NRV) Regional Commission provides area-wide planning for the physical, social, and economic elements of the NRV district (Montgomery, Giles, Pulaski, and Floyd counties and the City of Radford). The Commission produced a Hazard Mitigation Plan for the area that was adopted in 2005 and approved by the Federal Emergency Management Agency (FEMA). It was updated in 2011 (http://nrvrc.org/what-we-do/community-development/2011-hazard-mitigation-plan; *specifically see* Section 4.4, *Geologic Hazards: Landslide, Rockfall, Karst, and Earthquakes*). The purpose of the plan is to recognize potential natural or artificial hazards and provide guidance for implementing responses to disasters. The plan included a **Landslide Rating Map** (*see* Appendix B, Figure 4,). Dr. Chester F. Watts of the Department of

Geology, Radford University, developed that map. This small-scale map shows Giles and Montgomery counties. Factors of safety were calculated over the area and are shown as color coding on the map. The proposed MVP route traverses areas represented by fairly high risk, particularly in Giles and Montgomery counties. This is expected as the highest ridges and greatest relief are in this area. The assumption for this map is that these slides would be induced by severe storms. But, as discussed later in this report, seismic events may also trigger slides. Parameters in the factor of safety equation included slope of the ground surface, total soil thickness, saturated soil thickness, tree root strength, tree surcharge, soil cohesion, effective internal angle of friction, dry-soil unit weight, moist-soil unit weight, saturated-soil unit weight, and water unit weight. ***This hazard plan is very relevant to the pipeline siting process and apparently has not been introduced or referenced by MVP nor by its consultants.***

Soils along the route of the proposed pipeline have been studied by Nan Gray (LPSS), Dr. Steven Hodges, and Meghan Betcher, who have assessed their strength characteristics (*see* Section 4 for this data). Drs. Carl Zipper and Robert Tracy have commented on the seismic (earthquake) potential of the area through information submitted to the Federal Energy Regulatory Commission (FERC). These are submittals 20150223-5031 and 20150401-5083 to Docket PF15-3. Furthermore, the U.S. Forest Service has expressed concerns with seismic risk faced by the proposed routing of the pipeline through the Jefferson National Forest (*see* Submittal 20160311-5013 to Docket CP16-10).

Dr. Richard D. Shingles of Virginia Tech (retired-emeritus), Meghan Betcher, Project Scientist at Downstream Strategies, and Darren Jones, GIS Technician for Roanoke County have compiled tables identifying the most severe slopes and associated soils along the pipeline corridor (Tables 1-A, 1-B, and 2 in Appendix B). The tables were compiled using data from MVP Resource Reports, Appendix 1-J, "Vertical and Lateral Slope Tables," soil data from the GIS Center of the Department of Geospatial Science at Radford University, and input from regional soil experts Nan Gray and Dr. Steve Hodges. The tables list affected soils and slope angles that are keyed to MVP designated mile indicators. These important data are presented in Section 4.

One of the most active earthquake zones in the mid-Atlantic region is the Giles County Seismic Zone (GCSZ). Bollinger (1981) and Bollinger and Wheeler (1983, 1988) present a detailed analysis of the zone with maps, geologic analysis, and seismic history that includes dates and magnitudes of recorded earthquakes in the area dating back into the late 1800s. The largest earthquake of record in the GCSZ occurred on May 31, 1897 and had an estimated Richter magnitude of 5.8 to 5.9 (Mercalli intensity VIII). It caused considerable damage in Pearisburg and surrounding areas, and it remains the largest documented earthquake in Virginia history (https://www.dmme.virginia.gov/dgmr/majorearthquakes.shtml). A recent peer-reviewed publication in a scientific journal (Biryol and others. 2016) confirms that the term "Giles County Seismic Zone" remains in scientific use, and that the GCSZ continues to be an area with enhanced seismic risk (see Figure 6, Appendix B)

Biryol and others (2016) describe the GCSZ as a "prominent, densely clustered seismic zone" that "is associated with the reactivation of normal faults in the old crystalline basement". The GCSZ is represented by these investigators as seismically active in their Figures 9 and 10 (not shown

here). The activity is being driven by underlying asthenospheric movement. (The asthenosphere is the upper layer of the earth's mantle, which lies below the lithosphere). Statements in the MVP application assert that the GCSZ is not a "significant seismic source zone."

MVP Resource Report 6, section 6.6.1.3, should be considered as non-credible by FERC based on the fact that the 1897 earthquake did occur. If the GCSZ is not a "significant seismic source", how would the applicant explain the origin of the 1897 earthquake? FERC should consider the GCSZ as a zone of enhanced seismic risk, which is consistent with an extensive record of peer-reviewed and published work (Bollinger, 1981; Bollinger and Wheeler, 1983, 1988; Bollinger; Biryol and others, 2016).

The preferred route of MVP passes through the center of the Giles County Seismic Zone as discussed in Section 4 and shown in Figure 6 (Appendix B). **Should a potential magnitude 4 to 6 earthquake occur once the pipeline is operational, there may well be a triggering of landslides on unstable or metastable slopes that could potentially disrupt the pipeline and cause significant collateral damage. Perhaps the pipeline itself may be directly broken by ground motion during an earthquake.**

It is clear that steep mountain slopes in the area of Monroe, Giles, Montgomery, Craig, and Roanoke counties are subject to mass movement including large landslides. Seismicity and severe runoff from storms have triggered these events in the past and can easily do so in the future. Earthquakes do not necessarily have to be large to do damage to the pipeline. Small events can easily trigger mass movement on metastable slopes. The Mountain Valley Pipeline would be most subject to these hazards in the many areas having steep slopes.

Ancillary Environmental Concerns Along the Pipeline Corridor

There are some other considerations relative to karst in the area under consideration. They concern the natural processes and relate to environmental hazards that are germane to siting a gas pipeline.

Valley-Train Aquifers and Allogenic Recharge to Karst

The term ***'allogenic recharge'*** describes the influx of surface water derived from a mountainside into an aquifer at a lower elevation. Allogenic recharge of karst aquifers is common in Monroe, Giles, Craig, Montgomery, and Roanoke counties as a direct result of the geologic structure of the area, where dense and weather-resistant sandstone tends to form ridgetops. Water originating here, and in other upland slopes, drains into lower-lying terrains that are often underlain by carbonate rock (limestone and dolostone) where karst is typically developed.

In conjunction with the previous comments on surficial processes, erosion, and groundwater contamination, there is another aquifer-related aspect found along mountain fronts, upslope from the valley lowlands. Unconsolidated material on the mountain slopes is extensive and much of this material occupies streambeds in smaller valleys that are cut into the slopes and flow directly downhill into the broader valleys where they become tributaries to the major streams in the lowlands. **These smaller tributary streams flowing off higher elevations, and the larger**

streams in the valleys, collectively form the rectilinear (lattice) drainage patterns that are characteristic of the Valley and Ridge Province.

Sedimentary material, such as alluvium and colluvium, found in the beds of the valley-side streams, are collectively known as **valley-train deposits**. Water flowing within these deposits is typically perched on underlying impermeable bedrock such as dense, crystalline sandstone in the highest elevations or shale further down the mountainsides. Therefore, water is unable to percolate further into the subsurface.

The importance of groundwater within valley-train deposits is often overlooked or not recognized at all. This is because most people in this region live in the low-lying valleys where the topography is gentle, and fewer homes exist in the steeper, higher elevations. Yet there are places where potable water is obtained from springs issuing from alluvium and colluvium in the streambeds. Contamination and disruption of these smaller, linearly confined aquifers can severely impact vital water supplies (Kastning and Watts, 1997).

Valleys with tributary streams flowing straight downhill to base level are visible all along the mountain fronts. Water flowing in valley-train deposits is often pirated directly into the bedrock where these small streams meet the soluble rock on the lower flanks of the mountains or in the valley bottoms. The point of recharge is often a well-defined sinkhole, pit, or other opening very near the contact of the carbonate rock with the insoluble rock upslope. Therefore, in the Valley and Ridge Province, **allogenic water from the uplands significantly recharges karst in the lowlands.**

Allogenic water derived from upland slopes should be viewed as an integral part of the overall drainage basin that contributes to a karst aquifer. Flow of storm water is very intense and rapid in steep allogenic streams. Thus, any events that alter the quantity and/or quality of water in the valley-train deposits will also rapidly impact that of the water entering a karst aquifer.

Herein lies another important concern about pipeline corridors that may be constructed through the Appalachian fold belt. What happens upstream may have significant consequences downstream. Any activity associated with construction and maintenance of a corridor in the uplands may cause ancillary problems in the lowlands. For example, **if the proposed pipeline were to significantly disturb valley-train deposits and their included water, this would impact the receiving aquifers downstream, including those developed in karst. Such occurrence may also impact users who obtain water directly from springs in the alluvium and colluvium in the upland streams. Negative effects would include reduced flow to springs, siltation, and contamination of the water supply.**

To reiterate, allogenic water, flowing from insoluble rock in the uplands, enters karst aquifers upon making contact with an outcrop of soluble rock. Upstream allogenic zones are important components of recharge for nearly all karst aquifers in this region. Documents submitted to FERC by Mountain Valley Pipeline and Draper Aden Associates do not address allogenic recharge. This is a major omission because allogenic recharge supplies drinking water for homes in karst areas. If constructed, the pipeline would not only directly impact water resources on and within karst terrains, it would also disturb the sources of allogenic water. Much of the

proposed pipeline corridor is sited in zones where allogenic recharge to karst aquifers is prevalent.

Importance of Establishing Protective Buffer Zones in Karst

A major consideration in protecting natural water supplies is the protection of contributing sources - the "upstream" areas of the flow system (Kastning and Kastning, 1997; Kastning, 2000). For surficial streams such protection entails environmental management of all tributaries within the catchment area (drainage basin). In groundwater-protection strategies, attention is usually focused on all zones that contribute recharge.

Recharge zones in karst vary considerably within a continuum. On one end of the spectrum is *diffuse recharge,* whereby water infiltrates through the soil zone or other overburden to the interface with the bedrock. Under these conditions, recharge occurs over a wide geographic area. At the other end of the spectrum is *discrete discharge,* a process whereby water enters the bedrock in distinct places. Sinkholes are excellent examples of discrete recharge. Some sinkholes take the full discharge of one or more surface streams; these locations are termed *swallets*.

As mentioned in the previous section, allogenic water is often derived from large contributing drainage areas or watersheds on upland slopes. In effect, if upstream areas contribute significant recharge to karst aquifers, they are inherently part of the greater aquifer system. If the contributing areas are subjected to construction impacts, buffer zones should be required to prevent contamination of groundwater through natural filtration. A buffer zone is an area that is identified as having significant impact on the main resource. **In general, buffer zones incorporate most of the drainage area that contributes recharge and that can be environmentally degraded through poor land-use practices.**

It is evident from the foregoing that in the case of sinkholes or sinkhole clusters, buffer zones may have to be one or more orders of magnitude larger than the size of sinkholes as indicated on a map or by other means (Kastning and Kastning, 1997; Kastning, 2000). The determination of the size of a buffer zone is based on any of several criteria: (1) the boundary of the drainage basin that contributes recharge to a sinkhole or a cluster of sinkholes, (2) the area within the contributing basin that is under potential development, (3) the natural settings, including topography, geologic parameters such as bedrock and structure, and vegetative cover, (4) inherent storm-water hydrological responses, and (5) proximity of land-use activities within the basin that may impact recharge at sinkholes and discharge at springs.

Virginia requires that resource protection areas (RPAs) be designated for land development around streams. This is required in the eastern part of the Commonwealth, and stream-buffer ordinances are in effect in various counties. Engineering criteria are available for stream buffers. Implicitly, buffers around recharge zones in karst serve a similar purpose in protecting recharge areas.

If it is known that a karst system is very extensive (often based on dye-trace studies) and that it is sensitive (*e.g.*, having rare or endangered species), it should be required that the entire area be protected with a buffer zone.

Karst terrains require special consideration for environmental protection. Environmentally sound engineering often requires that areas of karst be sufficiently delineated. This is especially true where recharge zones must be protected from contaminants introduced at the surface that may be readily conveyed into underlying aquifers discretely through infiltration at sinkholes or diffusely along dissolutionally widened fractures.

In the case of the Mountain Valley Pipeline, it is imperative to delineate buffer zones in areas of karst where it is known that there are a high densities of sinkholes, extensive mapped caves, long groundwater flow paths documented by dye-tracing, and significant allogenic recharge. Those areas include (but are not limited to): the Indian Creek to Peters Mountain area of Monroe County, the Canoe Cave area in Giles County, and the Mt. Tabor Karst Sinkhole Plain of Montgomery County, and the Elliston Karst Plain in eastern Montgomery and western Roanoke counties (discussed further in Section 4). Buffer zones would be intended to define areas that should be protected from pipeline development, especially where there are potential impacts to sensitive features within karst. Unfortunately, the MVP application routes the proposed pipeline through areas where potential impact to sensitive karst is likely. Documents submitted by Mountain Valley Pipeline and its consultants have not adequately considered buffer zones.

Water Originating Along the Eastern Continental Divide

Because water on the land surface sheds from the highest places downhill to the lowest places, the first and cleanest water comes from the uplands. Meteoric water (derived from precipitation – for example rain or snowmelt) will flow down each side of the dividing ridge. **The Eastern Continental Watershed Divide** represents an upland in the eastern United States and would be crossed by the proposed pipeline route. The Divide and adjacent ridges are sources for much of the water that flows eastward on the surface and through the subsurface from the mountain crests to the Chesapeake Bay and Atlantic Ocean. The divide also contributes water to streams that flow westward via the Ohio and Mississippi rivers to the Gulf of Mexico. Clean water in the uplands of the Appalachian Mountains is of prime concern owing to its importance as a water source, and it must remain clean. As this water subsequently enters allogenic zones, epikarst, and karst aquifers as recharge, its quality must be maintained. Both the contributing upland watersheds and the highly sensitive karst aquifers in the lowlands must be avoided by large-scale construction projects such as the Mountain Valley Pipeline.

The purity of upland water needs to be maintained. The Mountain Valley Pipeline and its consultants have not addressed this issue.

Impact of Corridors in Karst

Consideration of corridors is one of the most important aspects in addressing potential hazards posed by the MVP project. Pipelines, by their very nature, occupy corridors that cut across the landscape. In general corridors disrupt the natural environment by dissecting (partitioning) the landscape. This is important in karst as well as in all other types of terrain.

The United States is laced with several types of corridors, including those constructed for transportation (highways and railroad lines), those that transmit electrical energy (high-voltage power lines), and those constructed to transmit fluids (water, oil, natural gas). **Because about 20 percent of the land area in the United States is underlain by soluble rock, many corridors cross karst terrain** (Kastning, 1995a, 1996). **However, to date, nearly all existing natural-gas pipelines that cross karst do so in areas of low relief (low to moderate slopes).**

Corridors differ from other types of construction in one major way - they are narrow and linear. They transect the landscape, whereas buildings and similar constructs are site-specific, occupying sites that are compact in area and do not extend disproportionately far in a linear or curvilinear fashion. Corridors that pass through karst regions cut swaths across the landscape that are hundreds of feet wide. The MVP corridor would be a 50-foot-wide right of way and a construction corridor of 125 feet across. This could be wider on steep slopes.

In the case of highways and railroads, corridors are constructed with relatively gentle grades, generally less than a few percent or a few degrees in slope angle (maximum of 10 percent grade in most cases). This is necessary for efficient and safe movement of vehicles. **Corridors for power lines and pipelines are not so constrained and are often constructed over steep slopes, especially in order to shorten the route.** The movement of fluids in pipelines consumes considerable energy and requires compressor stations along the way. To minimize the expenditure of energy for transmission and also to minimize the costs of construction, design plans often call for the shortest route. However, costs of compressor stations or added costs for constructing on steep slopes are factors in the selection of routes. If the shortest routes are desired in the Appalachian Mountains, then steep ascents and descents would prevail over routes in lowlands and river valleys.

Areas of high relief and steeply sloping topography are not conducive for residential, commercial, industrial, or agricultural use and remain largely undeveloped. For this reason alone, **natural surroundings happen to be best preserved where slopes are steep. It follows that large areas of land may remain contiguous and natural landscapes and ecosystems within these tracts are preserved intact and safe from development.** However, transmission corridors cut across these areas, resulting in partitioning and fragmentation of natural areas.

Caves and other karst features occur in areas of steep slopes as well as in areas of lesser slopes. For this reason, karst landscapes are affected by corridors of all types and configurations. One of the principal environmental concerns in the selection of routes for the Mountain Valley Pipeline is the impact of karst. As previously discussed, the direction of groundwater flow in karstic aquifers is strongly governed by the structure of the bedrock. In most cases, flow is along the strike of the bedrock. This is particularly true in folded rocks such as those in the Appalachian

Mountain region. Fractures, caves, and sinkholes, as well as the axes of mountain ranges and intervening valleys, are commonly oriented parallel to the structural axes (*i.e.* along strike). This gives both the topography and the karst a hydrologic "grain," so to speak. **Hence, surface water and groundwater generally flows with the grain and less commonly across it. Transverse corridors, cutting across the grain, may lead to partitioning of flow systems** (*see* later discussion). **Additionally, longitudinal corridors that align along the grain may be positioned over karst for long distances, increasing the potential for harm of the underlying aquifers.** Other factors, such as slope stability and erosion of surficial materials, also become considerations. ***For these reasons, there is not a preferred direction for a pipeline corridor across mountainous karst.*** The compound effects of hazards in mountainous karst terrains is discussed more detail in Section 4.

There are five general types of environmental and construction problems associated with karst terrain and each is an important consideration in siting corridors (Kastning, 1995a, 1996): (1) land instability and collapse, (2) flooding and siltation, (3) groundwater contamination, (4) destruction of caves or their contents, and (5) disruption of hydrologic flow paths. They are addressed further here with respect to corridors, such as those of the proposed Mountain Valley Pipeline.

Instability and collapse.

In some localities, karst terrains may be inherently unstable and prone to unexpected collapse of bedrock. Sinkholes (dolines) forming upon catastrophic **collapse of a dissolution void (*e.g.*, cave)** in the natural environment of this region are relatively rare. However, if trenching for a pipeline were to remove enough bedrock above such a cavity, collapse of a thinned bedrock roof may be triggered during construction, or it may spontaneously occur at a later time, perhaps severely damaging the pipeline. Moreover, the weight of a pipe and its contents may be enough to collapse a thin roof span that has marginal stability.

As mentioned elsewhere, **suffosion of fill material around a pipeline** (*i.e.* development of cavities in the fill as particles are sapped downward into karstic openings by groundwater) is also likely cause stability problems and collapse. This may occur years after installation of a pipeline, as the sapping of particles and enlargement of a cavity in the fill material is a slow, but steady process.

Often the surface of soluble rock beneath the soil and regolith is pitted, with cutters (typically well etched and dissolutionally widened fractures) and grikes (intervening blades of bedrock separating cutters). Pinnacles (grikes) of bedrock under a pipe may lead to bending of the pipe as it sags into the space between pinnacles (cutters). Therefore, an uneven bedrock surface beneath an entrenched pipe may lead to differential subsidence, and thereby to deformation and failure of the pipe.

Flooding and siltation

Closed depressions, such as sinkholes, have no natural surficial outlets for excess meteoric water (derived from precipitation). Under normal conditions, sinkholes drain to the subsurface at rates sufficient to allow the recharge water to efficiently percolate into the underlying aquifer. However, at times the bottoms of sinkholes become silted and wholly or partially plugged. This may cause sinkholes to periodically flood under storm conditions. Siltation is often caused by erosion brought on by improper land use adjacent to sinkholes. **Disruption of the surficial topography, clear-cutting, and removal of vegetation along corridors often lead to flooding and siltation in sinkholes** unless proper mitigating measures are implemented.

Pipeline corridors are kept relatively clear of vegetation. Access roads leading to the corridors and also running parallel to the pipelines for maintenance are also devegetated. Both of these components augment erosion and, when corridors are located within or topographically above karst in mountainous terrain, it is likely that the sediment thus derived may be washed into sinkholes, causing siltation and flooding.

Contamination of groundwater.

Accidental spills along a pipeline may occur during construction or maintenance. Of course, if an active line ruptures, the products may easily enter groundwater, including that in karst. **Hydrocarbon compounds** released from gas pipeline ruptures may be carcinogenic.

Destruction of caves or their contents.

Corridors may intersect caves, especially during the excavation of a trench. Occasionally, small caves are totally obliterated. In other situations, new artificial entrances may be added to caves during excavation. Aside from the degradation or elimination of the aesthetic character of a cave (*e.g.,* broken speleothems), there may also be subtle, yet significant, damage to delicate cave ecosystems. In some cases, the effects may be catastrophic. Globally rare or endangered fauna may be threatened or killed. For example**, in the Mt. Tabor Karst Sinkhole Plain, cave conservation areas have been delimited in order to protect rare troglobitic species known to inhabit some of the caves. In some cases, archeological sites in caves may be disturbed.**

Disruption of hydrologic flow paths.

Corridors, once in place and during the construction phase, have the potential to significantly alter the direction of water flow and to disrupt zones of recharge and discharge, particularly in karstic aquifers (Figures 5A and 5B). **Transverse corridors,** cutting across the hydrologic and structural grain, may not only partition the surface environment when such previously contiguous and undeveloped areas are segmented, but may do likewise to flow networks for surface water and groundwater. Partitioning of aquifers occurs (1) where flow paths are interrupted by excavation or (2) where infilling occurs during construction of corridors or after subsequent erosion and

siltation. This may be an issue in the **Mt. Tabor Karst Sinkhole Plain** where dye traces have shown multiple flow paths. Another highly significant example of disruption of groundwater flow occurs where the line is routed across **Sinking Creek in Giles County** (MVP milepost 210). Both of these locations are discussed in detail in Section 4. The region between Fort Lewis Mountain and Poor Mountain in Roanoke County is underlain by karst *(see* Appendix B, Figure 9). Entrenchment of a pipeline may affect the **Elliston-Lafayette Karst Plain** and water provided by the Spring Hollow Reservoir.

Derangement of drainage networks brought on by corridors can result in severe imbalances in the water budget, and thereby critical lowering of water levels in wells or reduction of discharge through flow systems, including caves. Blockage of natural flow paths could cause back flooding upstream of the blockage. Alteration and derangement of flow paths can readily impact existing water supplies and can change the hydrologic character of caves, severely affecting the growth of speleothems or disrupting delicate biological ecosystems. Unfortunately, once corridors are in place, these effects may not be easily detected from the surface and it may be too late to correct any harm that may have been done. Canoe Cave in Giles County (Appendix B, Figure 7), Slussers Chapel Cave, and others in the Mt. Tabor Karst Sinkhole Plain (Appendix B, Figure 8) are among those of particular concern (*see* discussion in Section 4). Caves and springs along the corridor in Monroe County, between mileposts 181-187 and 194-195, as well as caves in the Ripplemead area in Giles County may also be impacted in this way.

Partitioning of the natural environment

Broad corridors result in dividing natural areas into smaller tracts (Figure 5C). This can severely impact the biological realm. Some land animals may not travel or migrate across a cleared zone and their normal movement may become curtailed or altered, decreasing the diversity of species within smaller tracks. Conversely, newly created open space may provide avenues for undesirable invasive species (animals or plants) to invade an area. Further discussion on partitioning (fragmenting) topic is found in Appendix A.

Partitioning may also disrupt aquatic and terrestrial species that inhabit caves. Some species are globally rare or threatened (including examples in the Mt. Tabor Karst Sinkhole Plain). These species have been identified and listed by the Natural Heritage Program of the Virginia Department of Conservation and Recreation (DCR) which maintains an extensive database of such organisms. S. René Hypes of DCR, in her letter of May 17, 2016 to FERC (20160317-5126(31318143)), identifies some of the species of crucial concern. Avenues of natural migration of animals through caves in a karst aquifer may be severely altered through partitioning by a pipeline corridor. To ensure that this would not occur would require intensive additional study in specific caves and karst areas, including biological inventories.

A Recent Bellwether of Potential Gas Pipeline Problems in the Region

It is instructive here to refer to a recent gas-pipeline incident in the region of interest regarding the threat of groundwater contamination:

In 2014, **Columbia Gas of Virginia (CGV)** installed a 16-mile long, 8-to-10-inch-diameter pipeline from Peterstown, West Virginia, over Peters Mountain to the Celanese Acetate Plant in Narrows, in western Giles County, Virginia. This line was installed to bring natural gas to the Celanese plant. It was buried in a trench excavated through karst over a recharge area that supplies water to a spring that is used as a water supply by the **Red Sulphur Public Service District** (RSPSD) in Peterstown, West Virginia. In 2015 the Dominion Pipeline Monitoring Coalition (DPMC) registered a formal complaint to the Virginia Department of Environmental Quality (DEQ) regarding several serious issues arising from the new pipeline. These included erosion and sedimentation issues and contamination of groundwater of the RSPSD water supply by diesel fuel from heavy machinery involved in the construction process (*see* Complaint and Request for Compliance Enforcement letter from DPMC to DEQ, dated November 11, 2015). DEQ had inspected the sites in April and May of 2015 and listed several non-compliance citations on the part of CGV with respect to the Celanese pipeline (*see* letter from Robert J. Weld to Rick Webb, dated December 22, 2015). The citations include (1) failure to properly install and maintain sediment control structures, (2) failure to identify and protect sensitive environmental features, and (3) failure to preserve watershed hydrologic function through the development and implementation of a storm-water management plan. Slope stability was also found to be a contributing factor. More recently, additional comments on the CGV Celanese pipeline were submitted by Louisa Gay to FERC, in a letter dated June 20, 2016, addressing how these problems can be extended to other sensitive areas along the route, including the Mt. Tabor Karst Sinkhole Plain.

The CGV Celanese pipeline is a 10-inch-diameter pipe. (CGV is interested in upgrading this to a 12-nch pipe). The problems associated with the pipe installed in 2014 were manifested within a year, and caused a lengthy shutdown of the RSPSD water treatment plant, considerable public outcry, and attention in the media. **The hazardous situations that ensued with this relatively small gas line, as bad as they were, would pale in comparison in magnitude with similar hazards associated with a 42-inch pipeline.** The diameter of a 42-inch pipe is 4.2 times that of a 10-inch pipe, and the cross-sectional area of a 42-inch pipe is 17.6 times that of a 10-inch pipe. It follows that **environmental problems or catastrophic failure of a 42-inch pipe would be at least an order of magnitude larger those corresponding to a failure of a 10-inch pipe. All of this is exacerbated by the long distance that these lines extend over the mountainous and high relief of the Appalachian fold belt in this region.**

Summary

The potential problems discussed in this section regarding pipelines and their corridors as they cross karst landscapes are paramount considerations that must be addressed. Much of the foregoing topics has not been adequately addressed (or in some cases not at all) in the documents submitted by Mountain Valley Pipeline or its consultants in the application process.

Section 4

Compound Effects of Geologic Hazards:
With Significant Examples Along the Pipeline Corridor

Introduction

Any one of the individual hazards discussed to this point is of high concern in ascertaining the viability of an environmentally safe natural-gas pipeline in the Appalachian Valley and Ridge Province. However, karst processes (both on or below the surface), slope stability, soils, surface hydrology, severe weather, seismicity, and natural habitats are interrelated into a natural system. Similarly, the hazards discussed in Section 3 rarely operate alone in this region. Two or more can act simultaneously or they may occur sequentially as a cascading series of events. In fact, one hazard may induce another. (For example, an earthquake may trigger a landslide that, in turn, may block and disrupt a stream.) This section explores potential compounded effects along the pipeline corridor in detail.

Karst is an important environmental consideration in its own right over much of the proposed pipeline route through these counties. However, in most cases, the karst environment can be impacted by changes in its upstream recharge zone, movement of eroded or landslide induced material onto the karst from above, contamination of surface streams that provide recharge to underlying aquifers, and other events. The specific sites discussed in detail below illustrate compound hazards.

The documents submitted by MVP and its consultants in general do not address the aggregate effects of multiple hazards. By addressing hazards individually, combined effects of interrelated simultaneous or cascading events are overlooked. In most cases a hazardous condition or event will be complex, with multiple components. It is imperative that a potentially threatening project such as this maximum-size, highly pressured natural gas pipeline be analyzed systematically based upon compounded potential hazards. The four selected sites discussed later in this section illustrate the need for this approach.

Potential Slope Failure Along the Proposed MVP Corridor, Compounded by Soil Character and Seismicity

The following discussion has been adapted from material compiled by Richard D. Shingles, Ph.D. with major contributions from Meghan Betcher (Project Scientist at Downstream Strategies), Nan Gray (Licensed Professional Soil Scientist), Darren Jones (GIS Technician for Roanoke County), Carl E. Zipper, Ph.D. and Steven C. Hodges, Ph.D. (Professors, Crop and Soil Environmental Science, Virginia Tech), Robert J. Tracy, Ph.D. (Professor of Geosciences, Virginia Tech), and Alfred M. Ziegler, Ph.D. (Professor Emeritus of Geology, University of Chicago)

An important aspect of geologic hazards along the proposed corridor of the Mountain Valley Pipeline (MVP) is the compound effect of slopes, soils, and potential earthquakes (seismicity). The following is a summary of parameters that impose these hazards along the corridor in Monroe County, West Virginia, and Giles, Craig, Montgomery, and Roanoke counties in Virginia.

Steep slopes are presented first, in relation to soil characteristics that could exacerbate slope failure. Tables of slopes and soil conditions (Appendix B) list these relationships and are keyed to MVP designated mileposts. The seismicity of the area is then summarized. A seismic event could trigger slope failure, especially after soils and vegetation have been disturbed or removed during construction. However, slopes may be unstable or metastable and failure could be triggered by other contributing factors such as severe storms and precipitation or erosion that lessens slope stability. Soils on unstable slopes can also exhibit a form of slow and persistent movement known as 'soil creep' that can exert significant effects over time.

The dictionary definition of **"soil creep"** describes a well-documented phenomenon, *i.e.* "slow down-slope movement of earth materials under the influence of gravitation." Soil creep has been documented to occur in steep-slope terrain by numerous studies and is endemic to Giles County owing to the abundance of shrink-swell soils (*e.g.,* Young, 1960; Yamada, 1999; Oehm and Hallet, 2005).

Steep Slopes

The path of the MVP corridor through Monroe County crosses successive valleys and ridges - characterized by steep slopes (Table 1A, Appendix B, compiled by Meghan Betcher) and karst terrain. Streams, springs, and groundwater in this region provide drinking water to the population of the county, both through private springs and wells and by public drinking-water providers. The construction of the MVP would pose a significant threat to water supplies for a large number of the residents of this and neighboring counties.

The MVP is projected to cross several **"zones of critical concern" (ZCC)** - defined as "a section of corridor along streams within a watershed that warrants detailed scrutiny owing to its proximity

to a zone of recharge and susceptibility to potential contaminants." Among the most susceptible in Monroe County are the Big Bend Public Service District (PSD) and Red Sulphur PSD.

The preferred route crosses the ZCC for the **Big Bend PSD** in at least two locations within the county, at Mileposts 175.71-176.06, where slopes are greater than 30 percent with an average maximum vertical slope of 62 percent for approximately one mile.

A significant part of the ZCC for the **Red Sulphur PSD** lies within an area of karst. The proposed route crosses through this ZCC at least three times and runs along a ridge of Little Mountain where slopes average over 40 percent for more than a mile. The extent of the projected MVP that descends on the west slope of Peters Mountain, in the headwaters of the Red Sulphur PSD, traverses slopes greater than 40 percent for nearly a mile. Construction in this area in 2014 for the Celanese 10-inch Natural Gas pipeline in Giles County resulted in significant turbidity in the Red Sulphur PSD, that has since adversely impacted the drinking-water quality. This PSD serves 4,000 households and is supplied by a groundwater well and spring located in karst terrain. A diesel-fuel spill in this right-of-way resulted in a two-week shutdown of the PSD in July, 2015. (See "Watch group files complaint over Columbia gas pipeline project", http://www.newsleader.com/story/news/local/2015/11/12/pipeline-watch-group-files-complaint/75647890/). These problems resulted in considerable controversy and press coverage, leading to investigation and suggested corrective measures that were imposed by the Virginia Department of Environmental Quality. Additional concerns about this situation are presented Section 3.

In addition to impacts to public drinking water systems, many **private drinking water sources** may be impacted by the MVP in this area. A large part of the rural population obtains drinking water from private springs and wells, many of which are located on the steep slopes of Monroe County and fed by waters from within the karst aquifer. These private water sources are at risk from adverse changes in water quality and quantity owing to disruption of flow patterns.

Table 1-B (Appendix B, compiled by Richard D. Shingles and Darren Jones) shows the most severe slopes along the proposed route from Giles County through Roanoke County. The proposed MVP descends from Peters Mountain into Giles County and runs southeastward for about 15 miles across ridges and valleys to Newport, at the eastern end of the county. There it turns northeast, running along the northwestern flank of Sinking Creek Mountain into Craig County and then crosses Sinking Creek Mountain and runs southeast again, over Brush Mountain, and into the Mt. Tabor Karst Sinkhole Plain in Montgomery County. Table 1B (Appendix B) includes twelve areas along the MVP route along the west-east route where the maximum slope averages over 40 percent. Seven of these most severe slopes extend for approximately one mile each. One of the steep zones is at the three-way intersection of Mountain Lake Road, Zells Mill Road, and Sinking Creek (within 300 feet of the Link Covered Bridge, near MVP milepost 210). Another steep zone is above Canoe Cave and related karst features there.

In summary, over half (53.5 percent) of the preferred route from Monroe to Roanoke counties has slopes that are 20 percent grade or greater. Over one-third (36 percent) of the slopes that exceed 20 percent grade are 35 percent grade or greater, requiring "special engineering techniques" according to MVP. Thus 19 percent of the slopes along this route are over 35 percent in grade, creating very serious construction problems that in turn would

enhance the likelihood of both erosion and slides on slopes.

Soils

The possibility of significant erosion problems, and ensuing slides following construction, is greatly enhanced by a preponderance of the **active shrink-swell soils with significant plasticity**: Carbo, Faywood, Frederick, Nolochucky, Poplimento and Sequoia. Additionally, these soils have **poor drainage** and hence, **low bearing strength** that would enhance sliding on steep slopes. Table 2 (Appendix B, created by Dr. Steven Hodges) lists soils that contribute to slope stability and their key attributes. These pose severe engineering challenges. The construction of the MVP on slopes of 35 percent or higher will require extraordinary techniques, where machines for excavating trenches and laying pipe are attached by cable to heavier equipment atop ridges. This would result in considerable additional clearing of ridge tops and slopes. Soils of poor bearing strength would become loaded with the force of heavy machinery. Indeed, the weight and vibrations of heavy machinery atop ridges covered with these soils, and supporting other heavy machinery, can push saturated cohesive soils over and down ridges (*see* drainage and hydrology ratings in the tables). Thus, ironically, **the extraordinary solution that MVP plans to use for laying pipe on very steep slopes would compound the engineering problems and threaten the integrity of the pipeline.**

It is interesting to note that Giles County is blanketed with slip-swell soils, far more than any of the other counties along the route (compare Tables 2 and 3, Appendix B). It also has more areas of karst (approximately 80 percent of its land area) and is very close to the center of the Giles County Seismic Zone. **Giles County alone would severely impede construction and maintenance of a safe and viable gas pipeline.**

Bedrock

Data in Tables 1 and 2 (Appendix B) underestimate a likely potential cumulative threat. Further hazards occur in sites with relatively undisturbed thin surface soils and regolith. **The extraordinary engineering techniques of MVP would disturb the subsoil, break its structure, expose the subsoil to rainfall and erosion, and compact soils during reclamation.** If the native surface soils are unsuitable, the disturbed soil will very likely be much more so. Depth-to-rock ratings are included in Table 2 because some of the severe ratings result from shallow soil depth. One reason why Giles County has not become highly developed is that steep slopes covered in fragile soils are highly prone to slope slides. The unstable character of these mountain slopes is evidenced by well-documented, extensive and large, historic landslides along the southeastern flank of Sinking Creek Mountain (Schultz, 1986,1993; Schultz and Southworth, 1989; United States Forest Service, 2000; Whisonant and others, 1991). Such slopes will not be able to bear the load that MVP is planning to impose.

Based on depth-to-rock associated with predominant soils along the MVP route, extensive blasting will likely be necessary. Blasting will occur in areas of sink holes, springs, and wells. The extent

of karst underlying these soils, especially in the vicinity of the karst systems associated with Pig Hole, Echols, Smokehole, Tawney's and Canoe caves and the extensive Clover Hollow karst system along Zells Mill Road, presents significant threats to both residential water sources and to the structural integrity of a large, high-pressure pipeline.

Based on their soil studies, Nan Gray and Steven Hodges judge this region as a **no-build zone for the pipeline**. Upon a close reading and scrutiny of MVP Resource Report 7-Soils (Appendices 7-A1, 7-A2, 7B, 7C, 7D and Table 7.2-4), Gray observes that the contractors for assessing soils along the route "report the dangers of the route in significant detail." The details indicate **approximately 60 percent of the route through West Virginia and Virginia is in karst and/or shrink-swell soils, making it unsafe and unsuitable for the type of construction** proposed in the application. (*see* Review of Resource Report 7 in the Motion to Intervene and Protest (Docket CP16-10-000) submitted by Preserve Giles County (20151201-5127).

Giles County Seismic Zone

The Giles County Seismic Zone (GCSZ) further complicates hazards along the proposed MVP corridor. At Pearisburg, the county seat of Giles County, the planned MVP route passes a very short distance from the center of the active Giles County Seismic Zone (GCSZ; *see* map of Figures 6A and 6B in Appendix B). The Virginia Department of Mines, Minerals and Energy (DMME) has designated the GCSZ as a "Seismic Hazard" (DMME. Mapping Seismic Hazards in Virginia. http://dmme.virginia.gov/ DGMR/EQHazardMapping.shtml). The agency web site reports, "Most earthquakes in Virginia are not associated with a known fault, but occur within three distinct seismic zones…," one of which is the otherwise well-documented Giles County Seismic Zone. This zone was not recognized in the MVP resource reports depicting seismic zones in relation to the proposed pipeline. The GCSZ does not appear in Figure 6.1 of Appendix 6-D of their report on geologic hazards. The source of this map was likely a smaller-scale map of seismicity in the entire United States on which the GCSZ did not appear owing to resolution considerations of the map. Nonetheless, omission of the GCSZ is serious because seismicity provides a significant threat along the pipeline route.

Bollinger (1981) and Bollinger and Wheeler (1983, 1988) have described the GCSZ in considerable technical detail. In their recent peer-reviewed paper, Biryol and others (2016) provide a new and major understanding of seismicity in the southeastern United States, including the GCSZ. They confirm that the term "Giles County Seismic Zone" remains in scientific use, and the GCSZ is considered to be an area with enhanced seismic risk. Dr. A.M. Ziegler, Professor Emeritus of Geology from the University of Chicago, in his letter of November 25, 2015, provides further comment on the GCZS, including reference to mapping of the zone by DMME (Figure 6).

MVP Resource Report 6 (Geology) acknowledges that the GCSZ is "primarily known for being the epicenter of a strong May 31,1897 earthquake that was subsequently characterized under modern standards of MM-VIII, magnitude 5.8." MVP dismisses a recurrence of such an event during the life of the pipeline as being exceedingly small. However, the March 9, 2016 letter from U.S. Forest Service to the FERC challenges this conclusion, requesting a more rigorous study of

the GCSZ. This letter references pertinent publications, including findings indicating that ridgetop amplification of ground shaking of approximately 0.12 G from seismic activity may have been responsible for massive slope slides along Sinking Creek Mountain, reported by Whisonant and others (1991). **These findings forecast the potential for future seismically induced slides on steep slopes in the area.**

The U.S. Forest Service letter cites research by Schultz (1993) that "shows that the rock block slides (along Seeking Creek Mountain) may have been emplaced as a single catastrophic event of short duration." Schultz and Southworth (1989) state: '**The apparent clustering of large landslides near the Giles County, Virginia seismic zone suggests that seismic shaking may have been an important triggering mechanism**."

An important understanding of the effects of earthquakes in the vicinity of the proposed pipeline needs to be emphasized. **Even though a very-high-magnitude earthquake (Richter magnitude 5.0 or greater) has not occurred in the GCSZ since 1897, the more time that elapses, the more likely it is that such event may occur.** This is simply a basic tenet of magnitude-frequency analysis of natural events (such as earthquakes, volcanic eruptions, floods, storms). The recurrence interval for a 5.0 earthquake in the GCSZ is not well determined, yet the possibility exists that one can occur at any time.

The probability of the catastrophic 1897 re-occurring is unknown and *that* is a problem. However, catastrophic seismic activity - like the 5.8 magnitude quake of 1897 in Giles and 2011 in Mineral, Virginia (less than 200 miles from Giles County) are not the only or primary concern. Of equal importance for a 42-inch high-pressure gas pipeline in this area are frequent moderate earthquakes. Bollinger and Wheeler (1983) report nine earthquakes in or near Giles County over a 22-year period (1959-1981), the largest of which was mb = 4.6. MVP Resource Report 6, (Table 6.4-1) indicates a 4.3 GCSZ quake in 1974 and five additional earthquakes of a magnitude of 4.0 or greater within 100 miles of the MVP pipeline for the period 1976-2006. On the basis of these reports, ground shaking of the magnitude 4.0 or higher is highly likely during the planned life time of the pipeline. Given the history of slope slides in Giles County, there should be genuine concern that the combination of steep slopes, poor soils and moderate ground shaking could contribute to an *immitigable* failure with catastrophic consequences. Emergency response time, let alone mitigation, would be moot. This is a major concern that has not been adequately addressed in the MVP resource reports.

Therefore, continuing seismic activity in the GCSZ (a high frequency of magnitude 2.5 or larger earthquakes), produces a major risk when compounded with the already co-existing problems of karst, slope, and soil hazards at sensitive locations along the proposed pipeline route. This poses severe engineering challenges in constructing the pipeline, and calls into question whether the pipeline should be built at all.

Compounding of hazards along the preferred route alone suggests that avoidance of the region altogether is in the best interest of MVP and FERC, and certainly to the overwhelming majority of residents of Giles and adjacent counties. Many of the residents submitted comments to FERC, demonstrating their anguish over the very real threat to water supplies in karst

and the possibility of a catastrophic pipeline failure.

With or without a significant seismic event, slope failure is in itself a significant continuing concern. In commenting to FERC on March 30, 2015, Dr. Robert Tracy (Professor of Geosciences at Virginia Tech) states: "Even holding constant the seismic hazards, along the MVP route most subject to seismic activity, there is a very high probably of differential slope failure, with slide masses moving at differential rates with abrupt boundaries (effectively soil faults) separating masses."

Four Examples of Compounded Geologic Hazards Along the Corridor

The foregoing discussions illustrates the most important concerns related to the proposed pipeline. Four sites along the route have been selected for elaboration in order to describe how hazards indeed do interact in this region. This by no means implies that these are the only areas of potential problems along the route as there are many more along the preferred route, such as in the vicinity of Ripplemead and Pembroke in Giles County (MVP mileposts 200-205), Pig Hole Cave area on the southwestern flank of Salt Pond Mountain in Giles County (MVP mileposts 207-209), and the karst plain near Elliston and Lafayette in eastern Montgomery County and western Roanoke County (MVP mileposts 230-240; *see* Appendix B, Figure 9). Compounded hazards also exist along the various alternative MVP routes. In some specific places perhaps only one or two of the hazards may be dominant. In all of the following cases, the severity of the hazards is significant and should not be ignored. It is important that all contributing potential hazards along every mile of the pipeline route, and their cumulative impact be taken into account during FERC deliberation process. Interacting, compound hazards are particularly troublesome and must be considered together as this may cause greater damage and dangers than would occur if they occurred individually.

Karst from Indian Creek to Peters Mountain, Monroe County

Monroe County, West Virginia is well-known for a large number of caves, some of which are extensive (Hempel, 1975). Indeed, it is home to extensive areas of karst (*see* Appendix B, Maps 1 and 3). The proposed Mountain Valley Pipeline poses some significant concerns where it passes through the county.

The significant areas of potential problems associated with karst have been identified in letters and depositions by citizens and experts in Monroe County. Among those who submitted comments to FERC include, Dr. Alfred F. Ziegler (Professor Emeritus of Geology, University of Chicago, and resident of the county), Dr. Paula C. Dodds (Licensed Professional Geologist, Laurel Mountain Preservation Association), Harold 'Rocky' Parsons (geologist, expert on karst, member of the Monroe County Planning Commission), and Judy Azulay and Nancy Bouldin (members of the Indian Creek Watershed Association (ICWA). It is highly recommended that their input be considered. It is also instructive to consult the Karst Hydrology Atlas of West Virginia (Jones, 1997) for an overview of extensive dye traces performed in that state over the years.

There are several areas of karst where the pipeline could inflict significant potential environmental impact. Some of those are outlined here – the details are in the reports listed by the people above. Of particular interest are the letters from the Indian Creek Watershed Association of October 14, 2015 and November 13, 2015. The letters from Parsons, dated June 6 and November 26, 2015, provide additional information.

Of particular concern are karst features close to where the proposed corridor crosses Indian Creek near Greenville (MVP mileposts 181-182). Indian Creek, which drains significant karst to the east, flows directly into the New River to the west. Surface water and water in the underlying karstic aquifer would be at risk from the pipeline.

Another area of concern lies along Ellison Ridge and in the Hans Creek Valley (MVP mileposts 182-187). Numerous springs are located in this vicinity. Hans Creek is a sinking stream. Considerable recharge enters the underlying aquifer at its insurgence and emerges 0.3 mile downstream. There are numerous subtle karst features, mostly sinkholes, that indicate that this is an important recharge zone.

Numerous karst features occur between Little Mountain and Peters Mountain (MVP mileposts 194-195). As reported in the above cited letters to FERC from the Indian Creek Watershed Association, there are several caves, sinkholes, and a sinking stream in the karst that would be crossed by the pipeline at this locality. There are many springs along Peters Creek Mountain that provide water for all three of the water districts in the county, serving up to 70 percent of the households, public schools, and other users. One of the most at risk is the Red Sulphur Public Service District. Sweet Springs Valley Water Bottling Company, an award-winning water bottling company, derives water from these springs.

As with other mountain ridges along the pipeline corridor, there is significant allogenic recharge to karst aquifers from upland, non-carbonate terrains in this part of West Virginia. The karst aquifers identified above receive considerable recharge from allogenic sources. Hence, watershed delineation and establishment of buffer zones are critical in addressing impacts.

Slope stability and seismicity are ‘red flags’ in the Indian Creek to Peters Mountain section of the corridor. As seen in the data in Table 1-A (Appendix B), average maximum slopes are in excess of 40 percent. The likelihood of mass movement, including slides, is present along this segment of the corridor, leading to potential problems of slope stability as outlined in this Section of the report.

This part of Monroe County also lies within the Giles County Seismic Zone (*see* Appendix B, Figure 6A). Dr. Alfred M. Zeigler comments:

> “The U.S. Geological Survey (Bulletin. 1839-E) reports that there was a ‘landslide of considerable proportions’ also reported at the time, on the face of Wolf Creek Mountain in Giles Co. The authors of this bulletin, published in 1990, searched for surface expression of ‘neotectonic’ features, such as recently active faults, without success, but did report ‘a giant rock-slide complex on Sinking Creek Mountain,’ also in Giles County, and [hypothesized] that it had been caused by seismic shaking, as had the ‘numerous other rock

> falls and slides in the area.' They also implied that crustal warping might be indicated by variations in the elevation of terraces along the New River. Of course, a major rock-slide would completely disrupt a pipeline and this prospect would be worse than crossing a fault. This is because a fault is a known quantity with a known location and sense of movement, and could probably be allowed for by the pipeline engineers. The location of rock-slides, however, would differ each time and the effects could not be allowed for, even if they could be predicted.

In summary, the karst areas in Monroe County, where the proposed pipeline is routed, are subject to the compound hazard conditions that are described earlier in the section. This includes all of the concerns about karst as well as hydrogeology, slope stability, soil strength, and seismicity.

Sinking Creek Along Zells Mill Road, Giles County

Perhaps the most perplexing juxtaposition of the Mountain Valley Pipeline with the geologic and hydrologic settings is at MVP mileposts 208 to 210, where the proposed corridor would come down Salt Pond Mountain and cross Sinking Creek in Giles County (*see* Appendix B, Maps 1 and 2). This results in a situation in which the complexities result in a proverbial 'weak link' along the route of the pipeline.

First, the area comprised of the flanks of Salt Pond Mountain and Sinking Creek at its base include one of the most significant areas of karst in the county. The caves at the upstream reaches of Clover Hollow (including Clover Hollow and Stay High caves) have water that has been dye-traced to flow to two other significant caves along Sinking Creek, Smokehole and Tawneys caves (Fagan and Orndorff, 2008). The latter caves are less than 0.2 mile from MVP milepost 210, where the pipeline would cross Sinking Creek. This is one of the longest dye-traces performed in Virginia to date (on the order of four miles in straight-line distance). Another one of the longest traces in this vicinity, from where Sinking Creek crosses U.S. Route 460 to the New River, was performed by Saunders and others (1981). Dye placed in Sinking Creek near Smokehole and Tawneys caves emerged at a spring along the New River, over seven miles distant. This information leads to a clear conclusion that **this is an area of extensive and well-integrated flow networks in the subsurface. Hence constructing a pipeline across this area would risk contamination of sizable karst aquifers.**

Even though Sinking Creek at this intersection with Mountain Lake and Zells Mill roads has perennial flow, it is in this reach that a substantial part of the streamflow sinks into its bed and into the soluble bedrock beneath. From here to its confluence with the New River, Sinking Creek continues to lose flow and late in some years the surficial streambed is entirely dry and all of the water is in its subsurficial route.

It is likely that where the MVP would cross Sinking Creek (milepost 210), some of the sinking water is running beneath the stream bed and that it would not be flowing deeply in the karst. Should MVP select to drill a horizontal hole beneath Sinking Creek for the pipe at this intersection, there would be an immitigable problem with groundwater. Such a horizontally drilled hole would undoubtedly intersect the path of water flow in the bedrock beneath the creek. This would interrupt

the natural subsurface flow, influencing groundwater resources supplying numerous homes. This placement, within a zone of active and sustained groundwater flow, would also cause unwanted future problems with the pipe, in an aqueous groundwater environment.

Any other choice for a pipe of this size crossing Sinking Creek is also untenable. It would then have to be placed above the stream in some fashion, perhaps suspended on a bridge-like structure. Diverting the flow of Sinking Creek in some way would also not be possible, given the perennial subsurface component of the stream and well-documented frequent flooding of the streambed in response to significant storm and snowmelt runoff.

Groundwater problems constitute only one of the severe challenges at this site. From the data on slopes (*see* above) and slope maps, it can readily be seen that the corridor would descend very steeply from the flanks of Salt Pond Mountain to where it would meet Sinking Creek. The slope here is nearly 55 percent (Table 1-B) and the soils (namely a very rocky Carbo, the most active and problematic of the shrink-swell clays) have poor strength (Table 2). Thus slope stability, owing to the combination of a severe slope and the worst slip soil, is a critical issue at this location. This, in addition to close proximity to the center of the Giles County Seismic Zone (Appendix B, Figure 6A) could induce landslides on metastable slopes. Thus, the Route 700 – Route 604 intersection is one of the worst locations for a large high-pressure pipeline.

So, as with the previous case in Monroe County, **the Sinking Creek site is not suitable for the pipeline.** Crossing Sinking Creek over a reach where it is losing water to the subsurface is a very poor choice. Hydrologic conditions, whether on the surface or in the subsurface would severely impact construction and contribute to degradation of the pipe once it is in place. Also, should a failure in the pipeline occur at Sinking Creek, contaminants would follow the established routes of infiltration and be introduced into the extensive groundwater system of Sinking Creek extending all of the way to the New River (as determined by the dye traces by Saunders and others (1981). Moreover, a pipeline failure would severely impact residents drawing water from wells. Apparently MVP was not aware of these highly important constraints imposed by Sinking Creek. **This location is obviously a 'no-build' option.**

Canoe Cave and Karst, Giles County

The proposed route of the Mountain Valley Pipeline appears to go right over Canoe Cave, located along the northwestern flank of Sinking Creek Mountain in Giles County (*see* Appendix B, map of Figure 7). The cave lies beneath the centerline of the proposed MVP corridor between mile posts 213 and 214. At approximately 3000 feet in length, the cave has water and significant biota (letter from S. René Hypes of the Virginia Department of Conservation to FERC dated March 17, 2016).

Although Canoe Cave is still being explored and surveyed, it and its environs have been designated as a cave conservation site by the Virginia Cave Board and the Virginia Speleological Survey. These organizations maintain a list of significant caves and karst areas (Holsinger, 1985). The list is periodically brought up to date to include discoveries of new caves, new passages in caves, or new significant and sensitive findings within caves.

The entrance to the cave is located about 3500 feet downslope from the crest of Sinking Creek Mountain. This is a fine example of a major cave located below a zone of allogenic recharge from which it derives its water (see previous discussion above). In fact, springs in the colluvium above the cave are reportedly being used as water supplies. Water from this zone enters the soluble rock in the vicinity of Canoe Cave and it is likely that the water encountered in the cave is from a swallet just east of the cave entrance that takes allogenic water from above. Both this swallet and the cave entrance are within a few feet of the center line of the proposed pipeline. In places Canoe Cave is very near the surface, with little overlying bedrock. There is a spring further downslope that may be the exit from water in the cave. This is well illustrated in Figure 7 (Appendix B) and discussion of the Hypes letter referred to above.

Canoe Cave, the colluvial material, swallet, and spring together constitute a hydrologic groundwater system. Steep slopes Frederick soil series at this location indicate that the material above and over the cave is prone to significant mass movement (*see* Table 2, Appendix B and discussion above in this section). If the pipeline is constructed, this location could be highly problematic (1) should a severe rainfall event occur and enable downslope soil movement, (2) should a sizable earthquake occur (the area is in close proximity to the Giles County Seismic Zone), or (3) should slow and persistent downslope soil movement (soil creep) deform the pipe. Any of these may be sufficient to cause rupture.

Mt. Tabor Karst Sinkhole Plain and Associated Areas, Montgomery County

Arguably the most significant area of karst in the path of the proposed MVP pipeline is the broad lowland area of exposed carbonate rock that constitutes the Mt. Tabor Karst Sinkhole Plain. It is located northeast of Blacksburg in a residential area along Mt. Tabor Road. The proposed MVP pipeline traverses the karst plain for four miles, from mile post 220 to mile post 226 (*see* Appendix B, Figures 1, 2, and 8). The area is well documented in maps that have been submitted by various individuals and groups. Letters submitted to FERC by S. René Hypes (April 6, 2015; March 17, 2016; May 20, 2016), Louisa Gay (January 6, 2016), and Tim Ligon (December 7, 2015) are among those especially informative and provide detailed information showing sinkholes, dye traces, and the proposed route of the pipeline. It is important to note that the Virginia Department of Conservation and Recreation, the Virginia Cave Board, and the Virginia Speleological Survey have delimited two cave conservation sites that are traversed by the proposed corridor: Slussers Chapel Cave Conservation Site and Old Mill Conservation Site. The proposed routes of the pipeline, shown on the aforementioned maps, traverse these sites. The proposed corridor also passes through a segment of the Mill Creek Springs Natural Area Preserve, as shown in the Hypes letter of May 20, 2016.

Recently (April 21, 2016) MVP proposed an alternative route in the Mt. Tabor Karst Sinkhole Plain in order to address issues raised by the Virginia Department of Conservation and Recreation (Hypes letter of March 17, 2016). The alternate corridor is designed to avoid some of the more imposing sinkhole complexes traversed by the proposed corridor. The new route is shown in the Hypes letter of May 20, 2016. However, the alternate path would traverse the two cave conservation sites. In fact, the length of the proposed alternate corridor within these conservation sites exceeds that of the original proposed corridor. Furthermore, the proposed alternate corridor

would still be positioned on soluble rock and for an extended length along the lower flank of Brush Mountain where slopes are undesirably steep (*see* data on slopes and soil for this stretch of the pipeline a presented in Table 1B, Appendix B). This leads to very similar slope stability problems that are identified and discussed above for the Monroe County sites and Canoe Cave.

Further along this alternate path, the route passes over another part of the Mt. Tabor Karst Sinkhole Plain. The density of sinkholes appears to be less along this path based on those identified on topographical maps and aerial photography. (It is very likely that a high number of small sinkholes are present that do not show at that scale). Nonetheless, based on extensive dye-traces performed in the area, there is considerable reason to assume that the plain of karst is contiguous in the subsurface. A well-integrated aquifer underlies the entire Mt. Tabor Karst Sinkhole Plain wherein groundwater is efficiently conveyed from places of recharge (sinkholes as well as the interfluves among them) to places of discharge, including the identified springs in the area – such as the primary spring that discharges to Mill Creek Springs Natural Area Preserve (as documented by the 20 May 2016 letter by Hypes). Moreover, there are many wells in the plain that draw water from the aquifer. This water is used for domestic and agricultural needs in an area that is not served by public water supply.

As with the other three case examples discussed above, the Mt. Tabor Karst Sinkhole Plain is also subject to material being derived from uplands such as Brush Mountain and washed onto the karst plain. Slope and soil conditions on Brush Mountain, while not as severe as on Sinking Creek Mountain (Table 1-B, Appendix B), nonetheless contribute material washed onto the sinkhole plain. This area is also within the Giles County Seismic Zone (Appendix B, Figure 6A). Therefore, siting the MVP through the Mt. Tabor Karst Sinkhole Plain is another situation where environmental impacts and hazards are compounded.

There is every reason to believe that the entire Mt. Tabor Karst Sinkhole Plain is a single, extensive, and well-integrated karst aquifer. The only solution that would ensure that a pipeline would not negatively impact this karst and the underlying aquifer would be to entirely avoid the Mt. Tabor Karst Sinkhole Plain and its contributing watershed.

Additional Sites

The four sites evaluated in detail above were selected to illustrate the scope of environmental problems associated with the proposed Mountain Valley Pipeline. They inherently exhibit compound hazards. There are several other places along the proposed corridor that should not be ignored in the deliberation process. For example, Milepost 215.7-215.8 in Craig County, a steeply sloping site declared "unconstructable" by MVP's routing engineer, passes immediately above two sinkholes and through a third. A second example is near Elliston and Lafayette in eastern Montgomery and western Roanoke counties (*see* Appendix B, Figure 9). There are several caves in this area (Wickersham, 1988), including Dixie Caverns (a popular show cave that offers tours to the public) and Goodwins Cave (the longest known cave in the county). Both of these are listed as 'cave conservation sites' by the Virginia Cave Board (within the Department of Conservation and Recreation) and the Virginia Speleological Survey (Holsinger, 1985). Additionally, the Spring Hollow Reservoir, a major water source in the greater Roanoke area, has been constructed on karst

terrain. The route of the proposed pipeline passes within a mile or so from these features; and the mile-wide corridor includes an extended recharge zone on the karst plain in the lowlands between Paris Mountain and Poor Mountain (Appendix B, Figure 9).

Summary

Four of the most compelling sites where compound hazards are pronounced have been discussed above. It bears restating that there are other areas of karst along the proposed corridor between and among these sites and in Roanoke County to the east and within the larger region. There is no doubt that the extensive karst of the Appalachian Mountains poses an unacceptable risk in constructing a durable pipeline within this very dynamic regional setting.

There are two likely consequences when compound hazards act in unison. First the combination of severe slopes, poor soils, and disturbances and loading during construction of the pipeline can lead to severe erosion and sedimentation and damage to surface water and aquifers that are vital to residents and to the ecosystem. Second, construction in areas of severe slopes, slip soils, and likely ground shaking from earthquakes raises the real possibility of an immitigable failure of the pipeline and ensuing catastrophic events. These issues support the conclusion that this region is a no-build zone for a gas pipeline of this size.

Conclusions:

Karst Terrain in Appalachians as a 'No-Build' Zone

Construction of a large, 42-inch-diameter gas pipeline across the central Appalachian fold belt is without precedent. The magnitude of this undertaking is daunting. The size of the high-pressure pipe and a terrain that is high in relief and complex in its geology poses considerable risks for planning, avoiding known risks, engineering design, and construction challenges. The Mountain Valley Pipeline proposal creates concern for significant risk of adverse impacts due to the nature of the terrain that the line would cross.

There are serious problems imposed by geologic and hydrogeologic constraints. They fall into two basic categories: (1) the impact of the geologic setting on constructing and safely maintaining the pipeline and (2) the environmental impacts of the pipeline on the land that it would pass through and to the population that is concerned about safety and relies on clean available groundwater.

As discussed in this report, the predominant geologic factors are:

Karst Hydrogeology Slope Stability Soil Seismicity

Although each of these five topics has serious specific considerations that have not been adequately addressed by the applicant, the greatest concern arises when it is realized that all five types of hazards are prominent in the region and often compounded. Where and when they occur together, geologic attributes operate as a system and not individually. A problematic condition in one may cause consequences in one or more of the others. Severe slopes and high-slip soils would challenge engineering design of the pipeline and its operation and maintenance. Such challenges are enhanced by the potential for significant seismic events owing to the proposed location of the pipeline.

The region addressed in this report (Monroe County and a segment of Summers County in West Virginia and Giles, Craig, Montgomery, and Roanoke counties in Virginia) is the most environmentally sensitive along the entire proposed pipeline route. Crossing the Valley and Ridge Province in general raises profound questions and concerns.

I have reviewed materials to date submitted by Mountain Valley Pipeline (MVP), including contributions from their consultants, in its application to the Federal Energy Regulatory Commission. Additionally, I have studied numerous submissions by agencies (U.S. National Forest Service, Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality), by county governments, and by groups and individuals who live, work, and own property in the affected counties. My evaluations, analysis, and conclusions are based upon careful review of these documents in light of my experience as a professional geologist with

over 50 years of applied experience in karst and environmental geology, especially pertaining to the Appalachian region of the eastern United States.

Mountain Valley Pipeline has not adequately addressed many of the environmental concerns germane to this region, contrary to FERC policy to "avoid and minimize" adverse effects. Moreover, MVP has totally ignored compound effects of hazards. Numerous findings that have been generated and submitted by registered intervenors, professionally done with due diligence, have brought to light considerable details, many of which bring aspects of the MVP application into question.

The geologic environment, including active processes in karst, slopes, soils, and earthquakes, are a physical part of an overall natural system. However, the findings discussed in this report extend into the biological ecosystem as well. Lifeforms, whether in the forests, grasslands, soil, streams, or in caves and groundwater are an integral part of the system (discussed in Appendix A). Erosion and sedimentation, contamination of surface streams, wells, and aquifers, and partitioning (as mentioned earlier and discussed in Section 3) are destructive to the entire ecosystem, biological as well as physical. The concerns advanced in this report extend well beyond the geological setting.

Karst is one of the most environmentally sensitive geologic landscapes on Earth. It is a major underlying component in the region of this report. Mountain Valley Pipeline and its consultants have barely 'scratched the surface' in adequately assessing the three-dimensional attributes of karst and identifying the hazards that it imposes on construction and safe maintenance of the pipeline. Merely mapping sinkholes that appear on topographic maps and aerial imagery not only misses subtle karst features on the surface, but totally ignores the complex, well-integrated, efficient networks of groundwater flow through extensive karst aquifers. Detailed inventories of all sinkholes, caves, recharge areas, and springs, along with systematic dye-tracing, are necessary in order to identify a route through a veritable gauntlet of such features. Based on lengthy experience in studying this region and professional familiarity with karst processes in general, I am confident that a safe and environmentally sound route for a pipeline of this magnitude cannot be identified, engineered, constructed, nor maintained through the karst of the rugged Valley and Ridge Province.

I strongly suggest that the reader, as part of due diligence, closely examine the environmental problems that have occurred shortly after the recent construction of the Columbia Gas of Virginia (CGV) pipeline on Peters Mountain servicing the Celanese plant near Narrows, Virginia. This example, existing in the very setting of the proposed MVP route, serves as an omen. The CGV pipeline is a 10-inch-in-diameter pipe. The proposed MVP 42-inch pipe is 4.2 times larger in diameter and 17.6 times the cross-sectional area than a 10-inch pipe. In turn, the amount of construction and movement of material during trenching would be much greater, adding to the enormity of erosion, groundwater disruption, and failure of slopes. More ominously, if the integrity of this large pipe were to be compromised, the resulting catastrophic events would be at least on order of magnitude greater than with a 10-inch pipe. These are reasons enough to seriously weigh the potential consequences of constructing the MVP pipeline through the hazardous terrain of the Valley and Ridge Province.

As stated in Section 4 of this report, "there are two likely consequences when compound hazards act in unison. First the combination of severe slopes, poor soils, and disturbances and loading during construction of the pipeline can lead to severe erosion and sedimentation and damage to surface water and aquifers that are vital to residents and to the ecosystem. Second, construction in areas of severe slopes, slip soils, and likely ground shaking from earthquakes raises the real possibility of an immitigable failure of the pipeline and ensuing catastrophic events. These issues support the conclusion that this region is a no-build zone for a gas pipeline of this size."

The identified problems associated with the pipeline, potentially a major intrusion into the Valley and Ridge region, impact the entire natural environment. Deliberation related to the MVP application must approach the natural system as a whole. In turn, human quality of life is intimately tied to the natural ecosystem. Degradation of the natural environment has direct consequences on individuals and communities living on or near path of the pipeline, including local economies dependent on nature-based tourism.

Mountain Valley Pipeline has routed its proposed pipeline through one of the most environmentally sensitive areas of our nation. As a direct result of the routing, the pipeline (if constructed) would be subjected to serious geologic impact. Many of the potential hazards discussed in this report have not been adequately identified in the MVP application, nor have suitable mitigation measures been advanced. This report, along with the meticulous scrutiny by the U.S. Forest Service (*see* Submittal 20160311-5013 to Docket CP16-10 (31305006)) and reviews by the Virginia Department of Conservation and Recreation (letters from S. René Hypes, March 17 and May 20, 2016) provide a detailed accounting of severe potential hazards along the proposed MVP corridor.

My recommendation, based on the multiple environmental issues and potential hazards, is for FERC to reject the application. The stakes are very high and the risks are far too great.

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Appendix A

Ecological Implications of Partitioning the Landscape by the Proposed Mountain Valley Pipeline

The following discussion has been adapted from material compiled and submitted to FERC by Brian Murphy, Ph.D., Professor, Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, Virginia)

Threats posed by the construction of a large high-pressure pipeline through a region characterized by geologic hazards discussed in this report apply to all native species, not just humans. Additionally, the proposed Mountain Valley Pipeline would partition the lands that it traverses. The following discussions address ecological issues as they affect wildlife in or near the path of the proposed pipeline corridor. The ecosystem is intimately linked with the geologic environment that has been addressed earlier in the body of this report.

Any map of gas pipelines in the eastern United States clearly shows that past construction has paralleled the mountains on either side of the Eastern Continental Divide, rather than trying to cross this hazard-prone and ecologically sensitive zone (*e.g.,* http://naturalgas.org/naturalgas/transport/). Trying to cross the heart of the Appalachian Mountains continues to be a very bad idea, for all the reasons discussed above and summarized below.

Native Aquatic Fauna

Native aquatic fauna (many of them threatened or endangered) rely on clear mountain streams for survival. Erosion and sedimentation caused by the construction and operation of the MVP would have severe impacts on water quality, and thus on these sensitive species. Erosion from the mountain slopes crossed by the MVP is inevitable. The steepness of slopes to be crossed far exceeds those recommended by the Bureau of Land Management (BLM) for road construction related to oil- and gas-related energy development in their "Gold Book" (http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/gold_book.html). Roads to be constructed on slopes between 8 and 16 percent require special permission from the BLM, and construction beyond 16 percent is prohibited owing to the potential for severe environmental damage. The FERC "normal" guidelines for erosion and sedimentation control (ESC) on pipeline projects contain no special recommendations for severe slopes (which can exceed 80 percent on the MVP as currently routed), and sedimentation problems on numerous previous FERC approved projects show the inevitable result. The TRANSCO pipeline in central Virginia, the very pipeline that MVP will connect to, is still causing stream sedimentation problems some 30 years after its construction, and that pipeline is in "flat" terrain compared to the mountainous terrain of the MVP plan. Another FERC approved project (the Tennessee Pipeline) was expected to have extreme erosion potential in Tennessee owing to severe terrain. Those problems indeed materialized despite special precautions designed for mitigation, and threatened freshwater mussels were negatively impacted as a result. While not a FERC approved project, the recent erosion, stream

sedimentation, and groundwater contamination problems on the Williams Pipeline connector to the Celanese plant in Narrows, Virginia clearly demonstrate the dangers of building in this terrain. Not only will severe slopes lead to inevitable erosion, but the planned "reclamation" of these areas is completely inadequate. The MVP plan to "reclaim" the construction zone by planting grasses is untenable. The soils are shallow and poorly developed and will not support such vegetation. Furthermore, mass movements would accelerate problems of erosion and sedimentation. When reclamation fails, the pipeline corridor would be invaded by a host of nonnative invasive plant species that can thrive in this poor-quality soil. Those invasive plants would spread quickly throughout the corridor and would cause expensive control problems for the U.S. Forest Service and adjacent landowners.

Interior Forest Species

Interior forest species will be negatively impacted by fragmentation of the forest caused by the linear pipeline corridor. The corridor will divide what are now large unbroken tracts of forest. Birds of the interior forest and many other animals (*e.g.* bears, salamanders, etc.) cannot effectively use the resultant smaller tracts, and many cannot or will not cross the corridor during daily or migratory movements. Many of these animal species and many species of interior-forest plants, cannot function properly within as much as several hundred feet of the forest edge. The pipeline corridor would not just permanently modify the forest within the 125-foot construction corridor, but impacts of the clearing would allow sun and severe weather to penetrate what once was interior forest. This would change the moisture regime and consequently the plant species found in this extended zone. Invasive plants would penetrate what once was interior forest, and invasive animals would readily utilize the corridor and thus negatively impact interior-forest animals that they once never encountered. The zone of major impact on the forest would not be confined to the 125-foot construction corridor. An effective corridor of degraded ecosystems may result that would be five to ten times that wide.

Appalachian Karst and Biodiversity

Dissolution and erosion of limestone and dolostone in this region have created an extensive karst landscape, creating a network of sinkholes, underground streams, caves, and the like. This has also resulted in unusual communities on these carbonate rocks. During glaciations of the Pleistocene Epoch, the Appalachians acted as a mesic and thermal refuge for a number of species and communities. In a similar manner, after the retreat of the glaciers, cold-adapted communities, such as cranberry bogs, remained in refugia in cooler parts of the Appalachians, well south of their usual range. The prevalent carbonate rocks and karst in this ecoregion are associated with unique fauna within caves, including bats, salamanders, and a wide variety of invertebrates. The diversity and distribution of these species are not yet adequately known, but they likely rival cave faunas around the world in richness and endemism. Cave habitats in the Appalachian region include several federally listed rare and/or endangered species including the Madison cave isopod, Townsend's big-eared bat and Indiana bat. (From: https://lccnetwork.org/lcc/appalachian)

Partitioning (fragmentation) of ecosystems by construction has been studied in many places on the Earth. There is an extensive literature addressing the effect of swaths of denuded land (*e.g.* corridors) on distribution of animals and plants distribution and movement and migration of animals. How construction allows the introduction of invasive species is also a topic of major concern among ecologists. The recent bestselling book, *The Sixth Extinction* (Kolberg, 2014) is a valuable resource in understanding these global problems. Chapter 9 discusses fragmentation of forests and Chapter 10 addresses invasive species.

Additional supportive information on the ecosystems of the Appalachian Mountains and biodiversity on land, in streams, and in the subsurface can be found on the following web sites:

http://applcc.org/cooperative/our-plan/section-1/biodiversity-hotspot
https://lccnetwork.org/lcc/appalachian

Appendix B

Tables, Figures, and Maps

The tables, figures, and maps in this appendix have been cited in the text of the report. They are included here in one place in order to facilitate referring to them because most are referenced several time and in different sections of the report.

The three tables, 1-A, 1-B, and 2, show data related to slopes and soils along the route of the proposed Mountain Valley Pipeline. They were compiled by Dr. Richard D. Shingles from sources identified in Section 4 of this report and stated on the tables themselves. The primary references to these tables is in Section 4 of this report, beginning on page 44 with the discussion on slope failure.

The first three figures (regional maps) are described in detail below. The remaining figures (4 through 9) have self-explanatory captions. The significance and content of each figure are given in the appropriate places in the text.

Notes on the Regional Maps

The first three Figures are maps that been adapted and compiled by Dr. Richard D. Shingles from ArcGIS mapping by Drs. Stockton Maxwell and Andrew Roy of the GIS Center, Radford University. Data used in the mapping originates from various published sources and base maps available from online databases.

Figures 1, 2, and 3 show the general configuration of selected stratigraphic units with respect to the path of the proposed Mountain Valley Pipeline. They illustrate areas of outcrop of carbonate rock units that are considered soluble, in this case limestone and dolostone.

Soluble rocks are typically prone to the development of karst on the surface (sinkholes, swallets, sinking streams, dry valleys, springs, etc.) and/or in the subsurface (enlarged fractures, cavities, enterable caves, etc.). Sinkholes that are large enough to be indicated on the maps have been incorporated from mapping by Hubbard (1984, 1988) and Miller and Hubbard (1986).

It needs to be pointed out that soluble rocks may or may not always exhibit developed karst on the surface. However, in this region it is highly likely that karst landforms can be found throughout the delineated areas, especially where karst is present in the subsurface (caves and other openings).

One of the most striking observations is the amount of soluble rock within the counties. Giles County has the greatest area of exposed soluble rock (approximately 80 percent coverage) and Montgomery is also high (approximately 60 percent coverage). In terms of potential environmental problems, these two counties are the most significant of those along the MVP pipeline corridor. However, Monroe County in West Virginia and Craig and Roanoke counties in Virginia also have extensive areas of karst.

It should be understood that karst features (sinkholes, caves) as shown on these maps are incomplete. Those shown are sinkholes identifiable on topographic maps and aerial imagery. Many of those have been verified during field reconnaissance. These surveys of karst were completed prior to the year 2000 (Hubbard, 1984, 1988; Miller and Hubbard, 1986). This data has subsequently been incorporated into the karst maps of Tobin and Weary (2004) and Weary (2008). Countless smaller sinkholes remain unrecorded owing to the resolution and techniques used in the mapping process (Kastning, 1989b; Kastning and Kastning, 1993, 2003). As discussed in Section 3, the identification of small sinkholes is an important step in designating buffer zones during development and construction in karst terrains (Kastning, 2000; Kastning and Kastning, 1997).

Exploration and mapping of karst features within areas traversed by the proposed pipeline corridor continues. For example, a new cave entrance was discovered in early 2016 at a distance of approximately 1000 feet from milepost 223 along the proposed corridor in the Mt. Tabor Karst Sinkhole Plain. This is a potentially significant karst feature that has not yet been fully explored or mapped. Initial explorations have found cavities large enough for human entry and extend approximately 100 feet vertically and 300 feet horizontally. Additional cavities are very likely awaiting exploration. Air flows within the new cave indicate a connection to one or more other openings on the surface at unknown locations. (These details are via personal communication from Dr. Carl E. Zipper, and indirectly from personnel who have explored the new cave on behalf of the Virginia Speleological Survey,)

Figure 1: Valley and Ridge Province: Karst-Bedrock and Sinkholes

This map shows the entire length of the Mountain Valley Pipeline as it extends across Monroe County in West Virginia, and Giles, Craig, Montgomery, and Roanoke counties in Virginia. It is a small-scale map providing an overview of the extent of karst in the region. The topography is shown in shaded relief and the carbonate rocks prone to development of karst are superimposed. Major sinkholes in Giles and Montgomery counties, Virginia, are shown.

Figure 2: Giles to Mount Tabor Plain in Montgomery County, Ridges & Valleys, Soluble Rock and Prominent Karst Features

This is an expanded map (larger scale) of part of the area shown in Figure 1, specifically for Giles and Montgomery counties in Virginia. It includes details of sinkhole distribution. The red-circled areas (in Virginia) from left to right are (1) Sinking Creek, along Zells Mill Road, Giles County, (2) Canoe Cave and Karst, Giles County, and (3) Mt. Tabor Karst Sinkhole Plain, Montgomery County.

Figure 3: Monroe County from Little Mountain to Peters Mountain: Steep Slopes & Soluble Rock

This is an expanded map (larger scale) of part of the area shown in Figure 1, specifically for Monroe County in West Virginia. As in Figures 1 and 2, areas of soluble rock are indicated. The proposed Mountain Valley Pipeline is outlined as a 1.5-mile wide corridor. Steep slopes are indicated within that corridor.

Table 1-A. Ridge and Valley Severe Slopes and Soils on MVP route: Monroe County

Mile Posts	Distance miles	Mountain	Ave. Max Vertical Slope %	Predominant Soil Types
175.71-176.06	0.97	Wind Creek crossing, within Zone of Critical Concern for Big Bend Public Water Supply	61.81	Ceteache Litz complex
176.57-176.68	0.11	Crossing of tributary to Stony Creek	57.02	Ceteache Litz complex
180.33-180.66	0.33	High Top	40.46	Ceteache Litz complex, Dekalb channery loam
181.82-183.9	2.08	Crossing of Indian Creek; ridge above Hans Creek, crosses tributaries to Hans Creek	42.76	Litz silt loam, Dekalb channery loam
184.81-186.84	2.03	Ellison Ridge and Hans Creek crossing	51.60	Lily sandy loam, Dekalb channery loam, Laidig channery loam
187.90-187.95	0.05	2,393 ft. Mountain	61.49	Ceteache-Litz complex
190.59-191.48	0.89	Little Mountain	46.38	Frederick and Dunmore, Dekalb channery loam
192.55-192.84	0.29	Little Mountain	41.01	Dekalb channery loam and Weikert channery silt loam
193.62-193.71	0.09	Slope leading to Painter Creek crossing and Red Sulphur PWSD	55.14	Weikert channery silt loam
194.75-195.69	0.73	Peter's Mountain western slope and RS PWSD	48.64	Laidig channery loam

Table derived from MVP 1-J Slope Tables, MVP 7.5 Minutes Topo Maps, and Mountain Valley Pipeline Exploratory GIS Ma

Table 1-B. Ridge and Valley Severe Slopes and Soils on MVP route: Giles Co. - Roanoke Co.

Mile Posts	Distance miles	Mountain	Ave. Max Vertical Slope %	Predominant Soil Types
196.94 - 198.03	1.09	Peters Mountain east slope	59.4	Nolichucky very stony loam
198.87 - 199.92	1.05	Down slope west of Kimbalton	45.7	Frederick very stony silt loam
200.12 - 201.04	0.92	2317 ft Mountain	36.1	Braddock sandy loam
201.43 - 202.42	0.99	2330 ft Mountain	46.7	Carbo silty clay loam very rocky
203.1 - 204.23	1.13	2500 ft Mountain	47.5	Nolichucky very stony sandy loam
204.26 - 204.76	0.5	2493 ft Mountain	39.5	Frederick very gravelly silt loam
204.77 - 205.58	0.81	2500 ft Mountain	46.0	Frederick very gravelly silt loam
206.79 - 207.27	0.48	2683 ft Mountain	55.1	Carbo, Frederick
207.82 - 208.24	0.42	Down and cross slopes	50.0	Frederick gravely silt loam
209.71 - 209.88	0.23	Down slope to Rt 700 & Rt 604	54.9	Carbo silky clay loam very rocky
209.93 - 210.51	0.58	Rt 700 to Winding Way Dr	40.5	Braddock, Gilpin, Sequoia
211.4 - 212.35	0.95	Newport: Rt 700 to Rt 42	54.0	Frederick gravel-outcrop complex
213.65 - 213.76	0.11	Canoe Cave	56.4	Frederick: Newport to Canoe Cave
214.5 - 214.92	0.42	Rock outcrop complex	44.5	Carbo
220.05 - 220.83	0.78	Slope to Mt Tabor Sinkhole Plain	50.0	Berks-Clymer
225.96 - 226.26	0.3	Paris Mountain western slope	73.3	Carbo - Chilhowie
229.54 -229.82	0.28	Slope : Mont-Roanoke Co. Line	73.3	unclassified
234.66 -235.17	0.51	Slope: Mont-Roanoke Co. Line	60.8	unclassified
236.12- 236.84	0.72	Poor Mountain	64.51	Sylvatus Very Channery Silt Loam
237.67 - 238.94	1.27	Poor Mountain	52.2	Sylvatus Very Channery Silt Loam

Table derived from MVP 1-J Slope Tables, MVP 7.5 Minutes Topo Maps, and Mountain Valley Pipeline Exploratory GIS Map

Table 2. Soils that Contribute to Slope Stability and Their Key Attributes

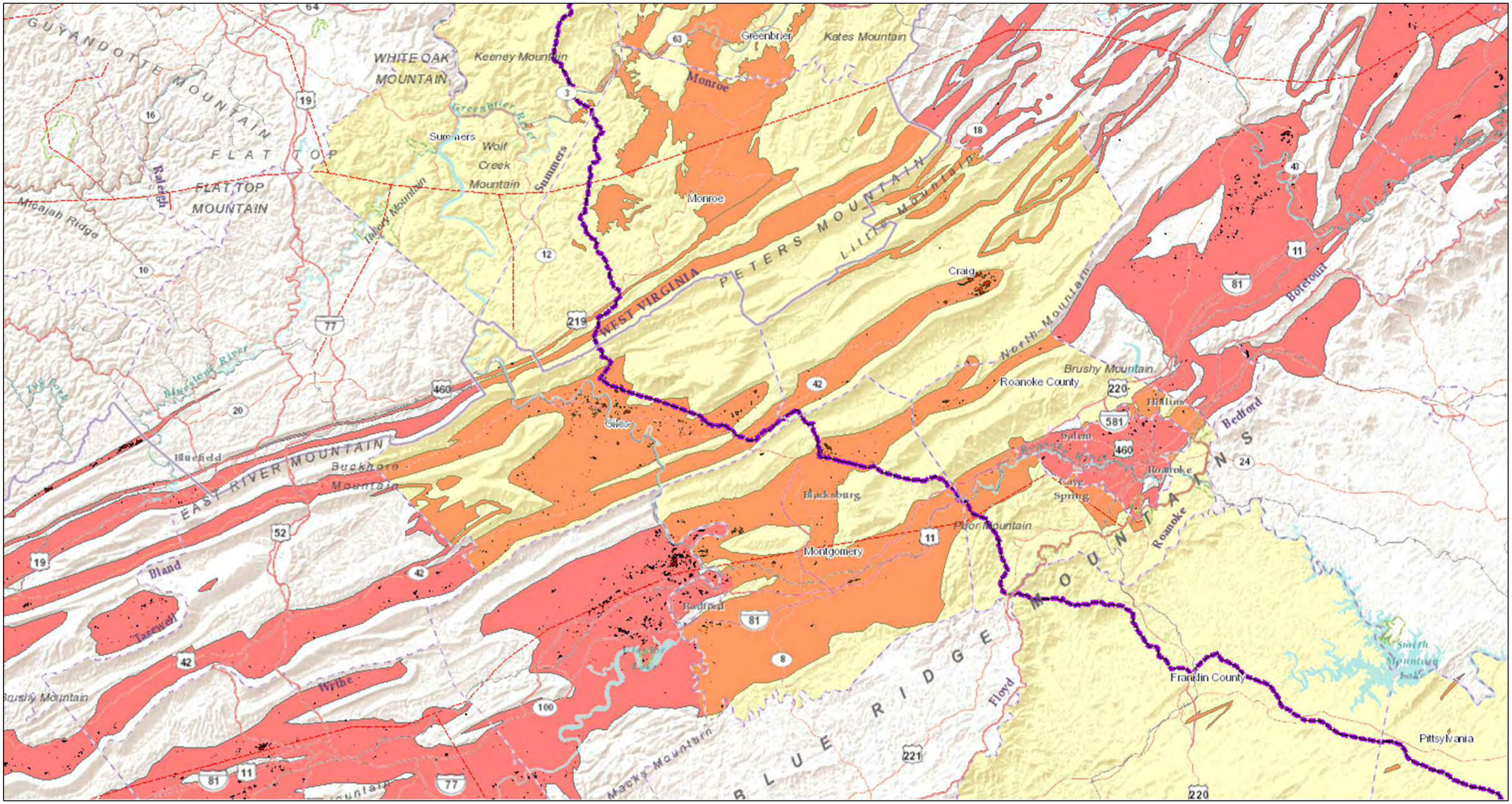
Soil Series	(1) Plasticity Index	(2) Shrink-swell Potential	(3) Bearing Strength (for Roadfill)	(4) Drainfield/ Suitability	(5) Depth to Rock	(6) Hydrology	(7) Mineralogy
Allegheny	15	L	Good	Mod (Flooding)	>60”	Flooding	Mixed
Bailegap	20	L	Poor (Stony)	Sev	40-60”		Siliceous
Berks	10	L	Poor	Sev (Depth)	20-30”		Mixed
Braddock	33	M	Fair	Mod (Perc)	>60”		Mixed
Carbo	55	H	Poor (LS, SS)	Sev (Perc)	20-40”		Mixed
Chagrin	NP, Sandy	L	Good	Sev (Flooding)	>60”	Flooding	Mixed
Chavies	10	L	Good	Mod (Flooding)	>60”	Flooding	Mixed
Cotaco	15	L	Fair (Wetness)	Sev (Wetness)	>60”	Wetness	Mixed
Drall	10	L	Poor	Sev (Sandy)	40-60”		Siliceous
Faywood	45	M	Poor (LS)	Sev (Perc)	20-40”		Mixed
Fluvaquents	No Data	No Data		Sev (Flooding)		Flood plain	No data
Frederick	55	H-M	Poor (LS)	Sev (Perc)	>60”		Mixed
Gilpin	15	L	Poor (Thinness)	Sev (Depth)	20-40”		Mixed
Jefferson	15	L	Good	Slight	>60”		Siliceous
Lehew	7	L	Poor	Sev (Depth)	20-40”		Mixed
Lily	15	L	Poor	Sev (Depth)	20-40”		Siliceous
Nolichucky	25	M	Poor (LS, SS)	Mod (Sev Perc)	>60”		Siliceous
Poplimento	60 Clayey 30 silty	H-M	Poor (LS, SS)	Sev (Perc)	>60”		Mixed
Sequoia	40	M	Poor (LS)	Sev (Perc)	20-40”		Mixed
Timberville	30	M	Fair (LS, SS)	Sev (Wetness)	>60”	Flooding	Mixed
Wallen	10	L	Poor (Stony)	Sev (Depth)	20-40”		Siliceous

Compiled by Dr. Steven Hodges, Soil Scientist, from USDA NRCS 1985 Soils Survey of Giles County, Virginia: Tables 10 – 16.

Notation: L = Low, M = Medium, H = High, Mod = Moderate, Sev = Severe, Perc = slow percolation; Depth = shallow, LS = low strength, SS = shrink-swell.

Special construction techniques are required for plasticity scores over 30, M, H, Poor, Mod, Sev and mixed. Blasting required for depth < 60”.

Figure1. Valley and Ridge Province: Karst-Bedrock and Sinkholes



June 27, 2016

1:577,791

0 5 10 20 mi

0 10 20 40 km

MVP_125ft_buffer

MVP_Route_Most_Recent

Natural_Gas_Market_Hubs

Natural_Gas_Liquid_Pipelines

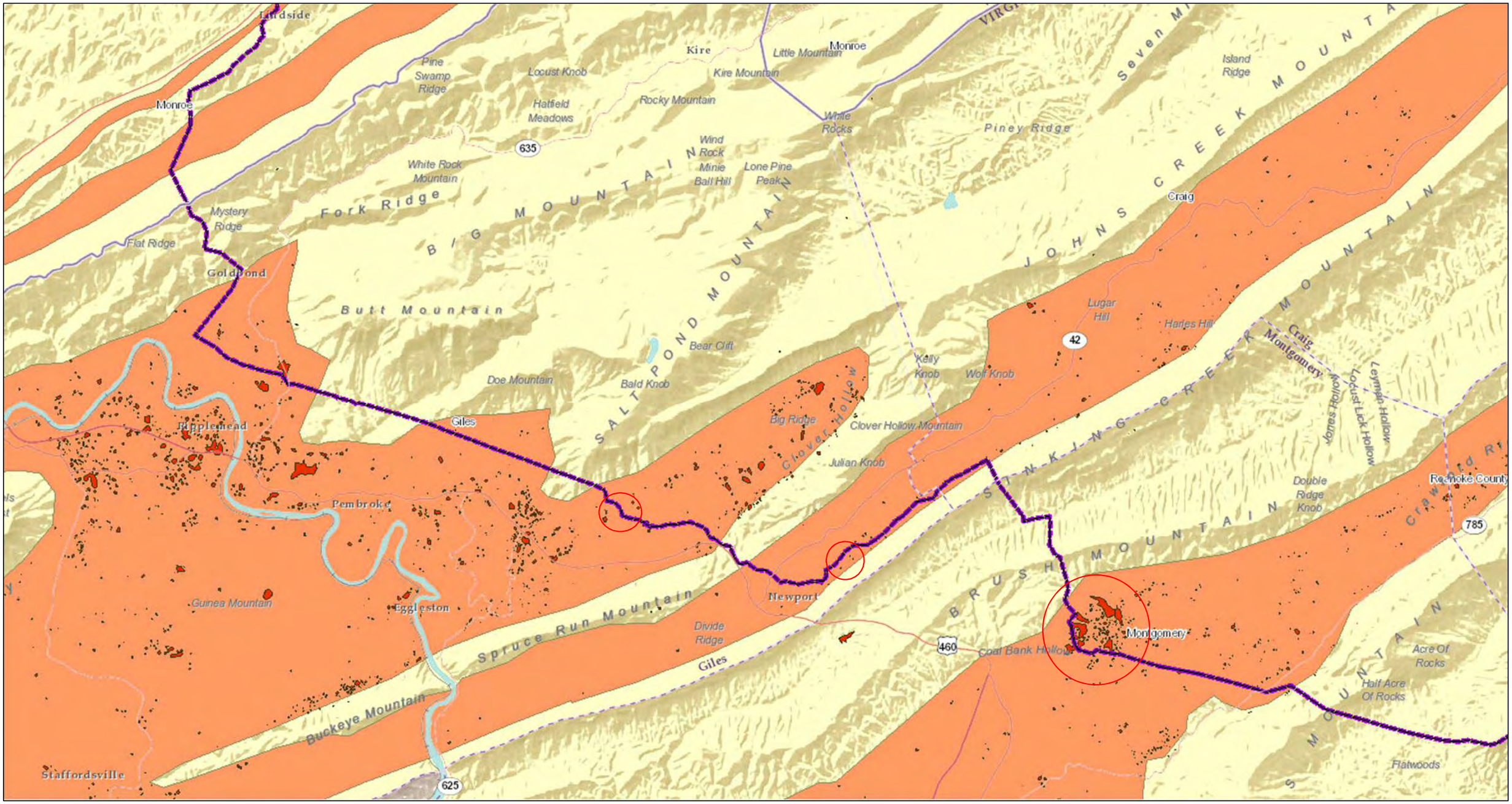
Affected Counties

Sinkholes from VDMR

Karst Bedrock

Sources: Esri, DeLorme, USGS, NPS
Sources: Esri, USGS, NOAA

Figure 2. Giles to Mount Tabor Plain: Ridges & Valleys, Soluble Rock and Prominent Karst Features



June 27, 2016

1:144,448

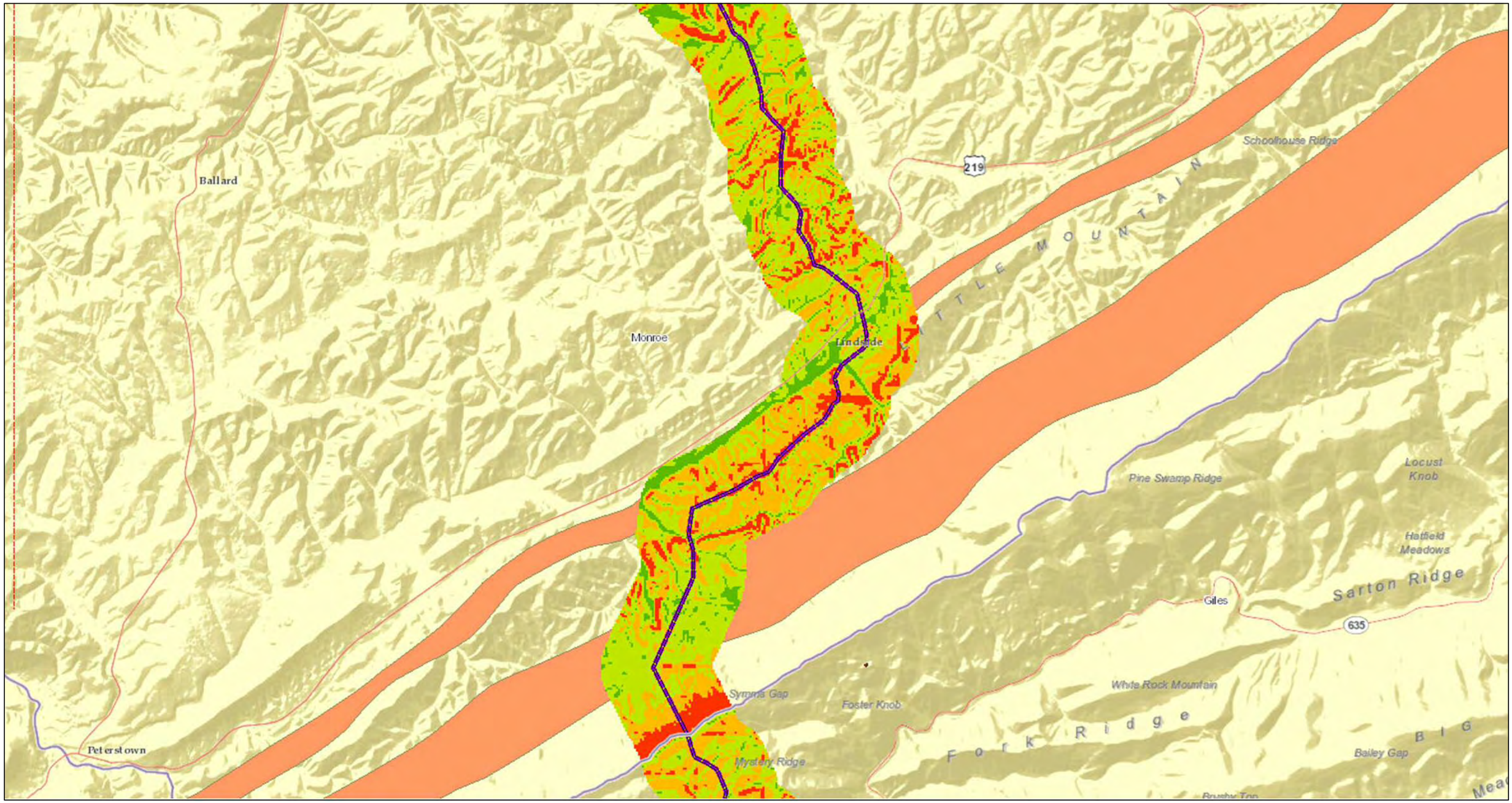
0 1.75 3.5 7 mi

0 2.75 5.5 11 km

- MVP_125ft_buffer
- MVP_Route_Most_Recent
- Natural_Gas_Market_Hubs
- Natural_Gas_Liquid_Pipelines
- Affected Counties
- Sinkholes from VDMR
- Karst Bedrock

Sources: Esri, DeLorme, USGS, NPS
Sources: Esri, USGS, NOAA

Figure 3. Monroe County from Little Mountain to Peters Mountain: Steep Slopes & Soluble Rock



June 27, 2016

1:72,224

0 0.75 1.5 3 mi

0 1.25 2.5 5 km

- MVP_125ft_buffer
- MVP_Route_Most_Recent
- Natural_Gas_Market_Hubs
- Natural_Gas_Liquid_Pipelines
- Affected Counties
- 0 – 7
- 8 - 25
- 26 - 40
- > 40
- Sinkholes from VDMR
- Karst Bedrock

Sources: Esri, DeLorme, USGS, NPS
Sources: Esri, USGS, NOAA

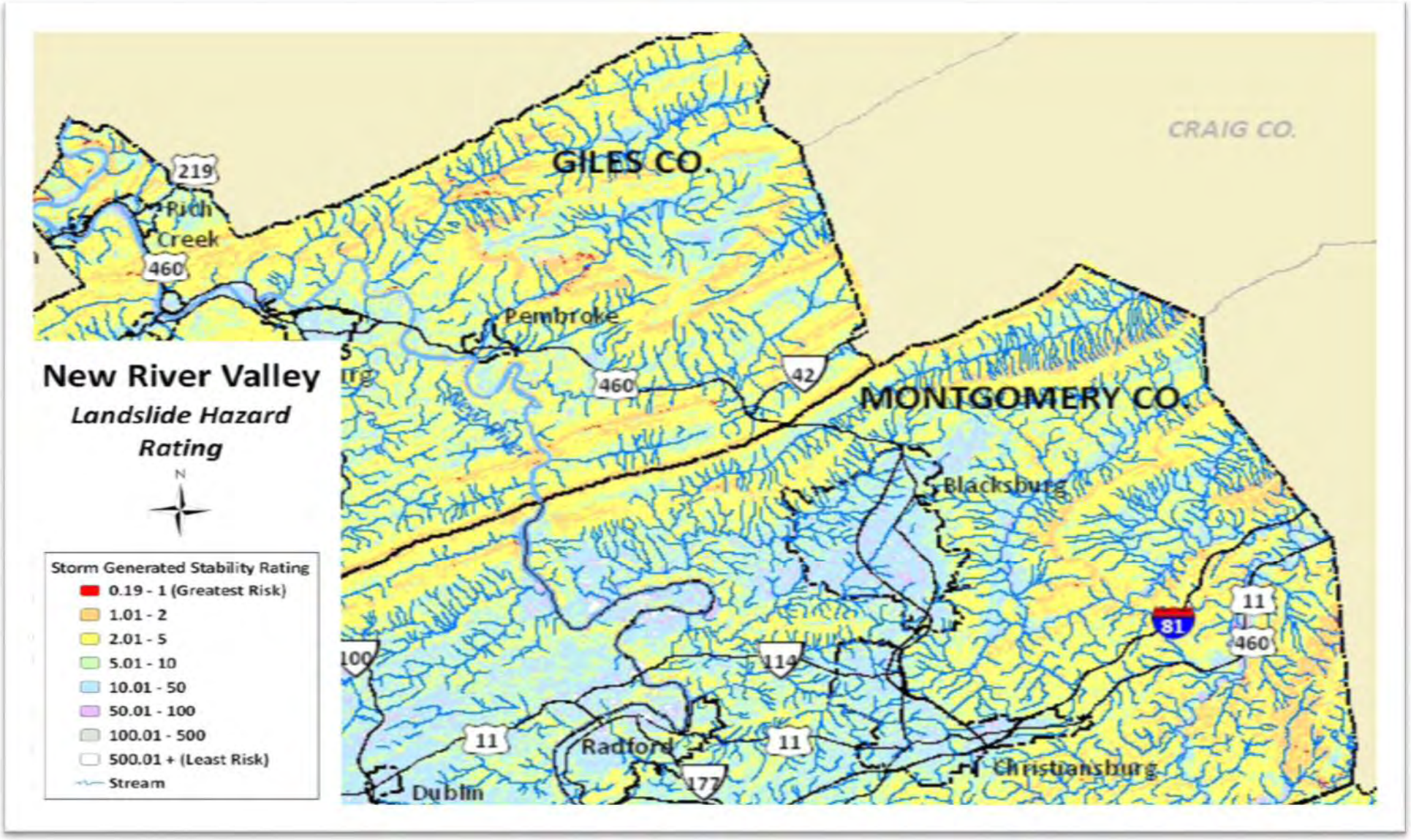


***Figure** 4. A part of the New River Valley Landslide Hazard Rating map excerpted from the* 2011 New River Valley Regional Commission's Hazard Mitigation Plan, *as described and referenced in Section 3 of the text. In essence, this is a map of slopes that are prone to failure in response to large storms. Seismic shocks in the Giles County Seismic Zone may also cause failure as well in the areas of risk. The values in the explanation are factors of safety derived using a Level I Stability Analysis Model.*

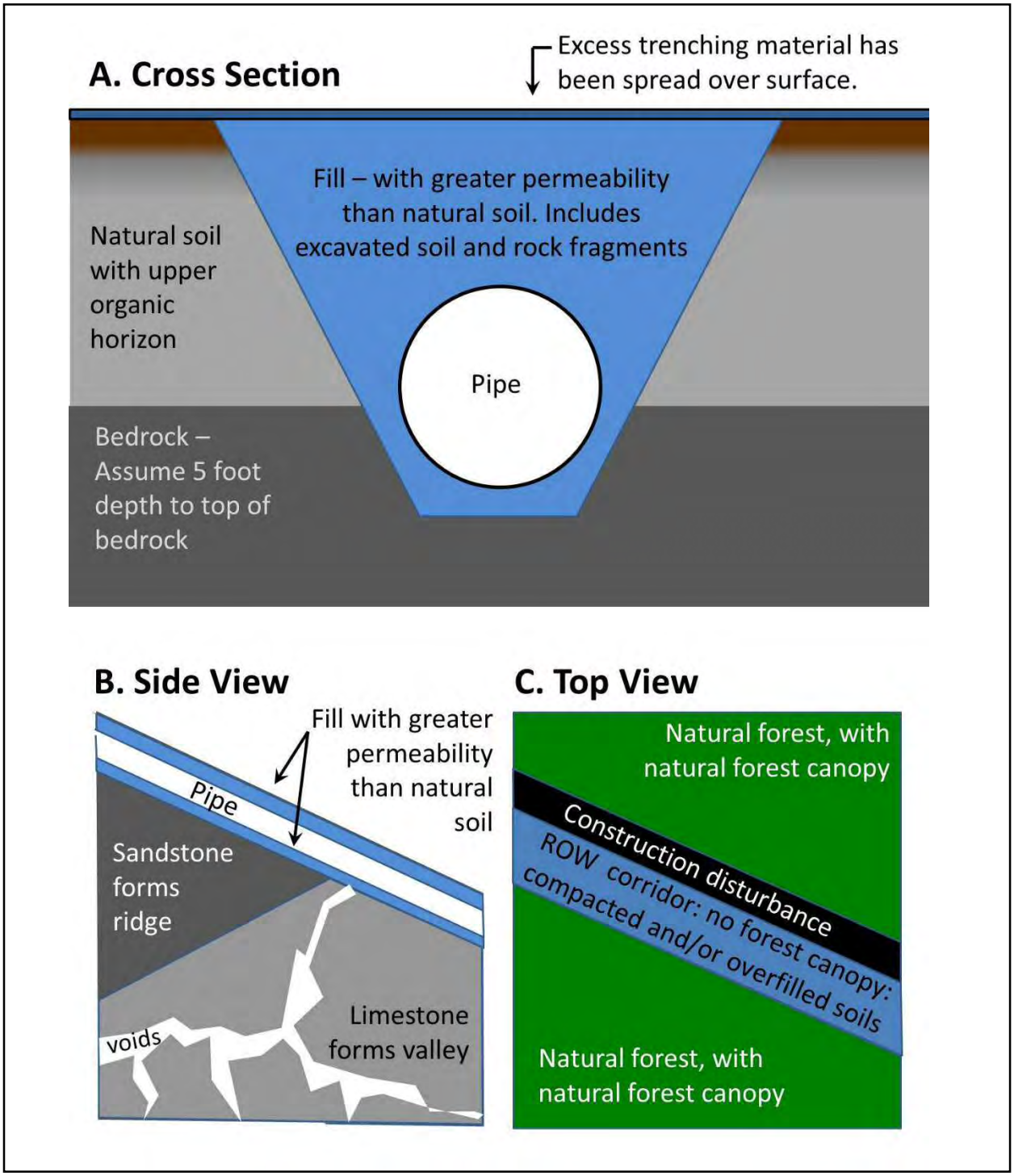


Figure 5. *Sketch of pipeline configuration. (A) Cross section of pipeline showing typical dimensions, bedrock, natural regolith (and soil) zone, and fill materials after construction. (B) Longitudinal section showing typical surface slope with pipeline in filled trench. Variations in substrate include insoluble bedrock upstream in allogenic recharge zone (here depicted as sandstone) and soluble bedrock with developed voids (here depicted as limestone). (C) Plan view indicating that the pipeline right-of-way corridor (including disturbed adjacent zone) has transected a forested area (for discussion, see Appendix A).* Drawing by Dr. Carl Zipper.

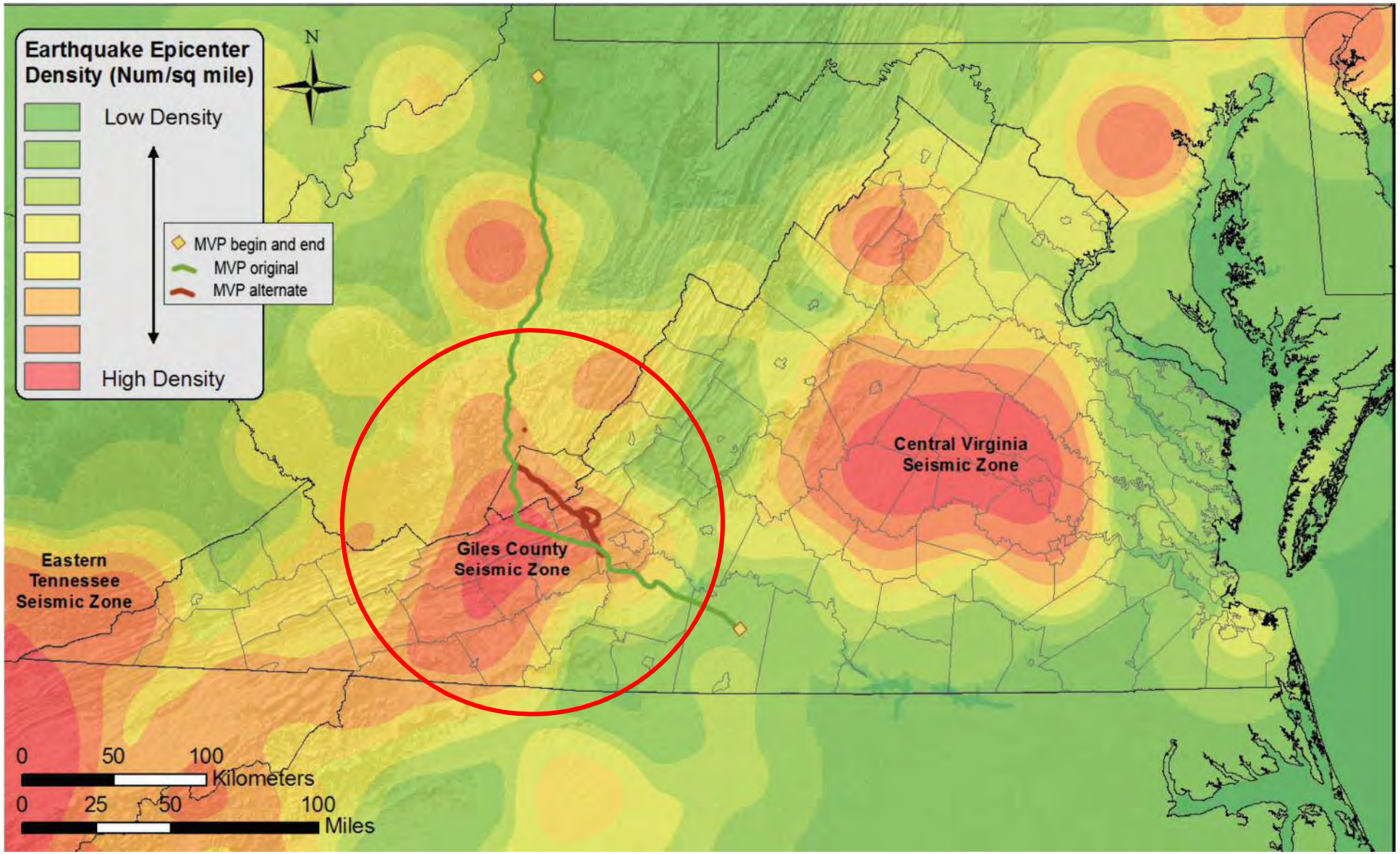


Figure 6-A: *Seismic Zones in Virginia and West Virginia. The Giles County Seismic Zone is clearly shown in relation to the routes that have been proposed by Mountain Valley Pipeline (green and brown lines, added by Dr. Alfred M. Ziegler). Note the proximity of the proposed pipeline routes to the center of the seismic zone. The source map, entitled "Earthquake Epicenter Density," is from "Mapping Geologic Hazards," on the website of the Virginia Department of Mines, Minerals: (http://dmme.virginia.gov/DGMR/EQHazardMapping.shtml).*

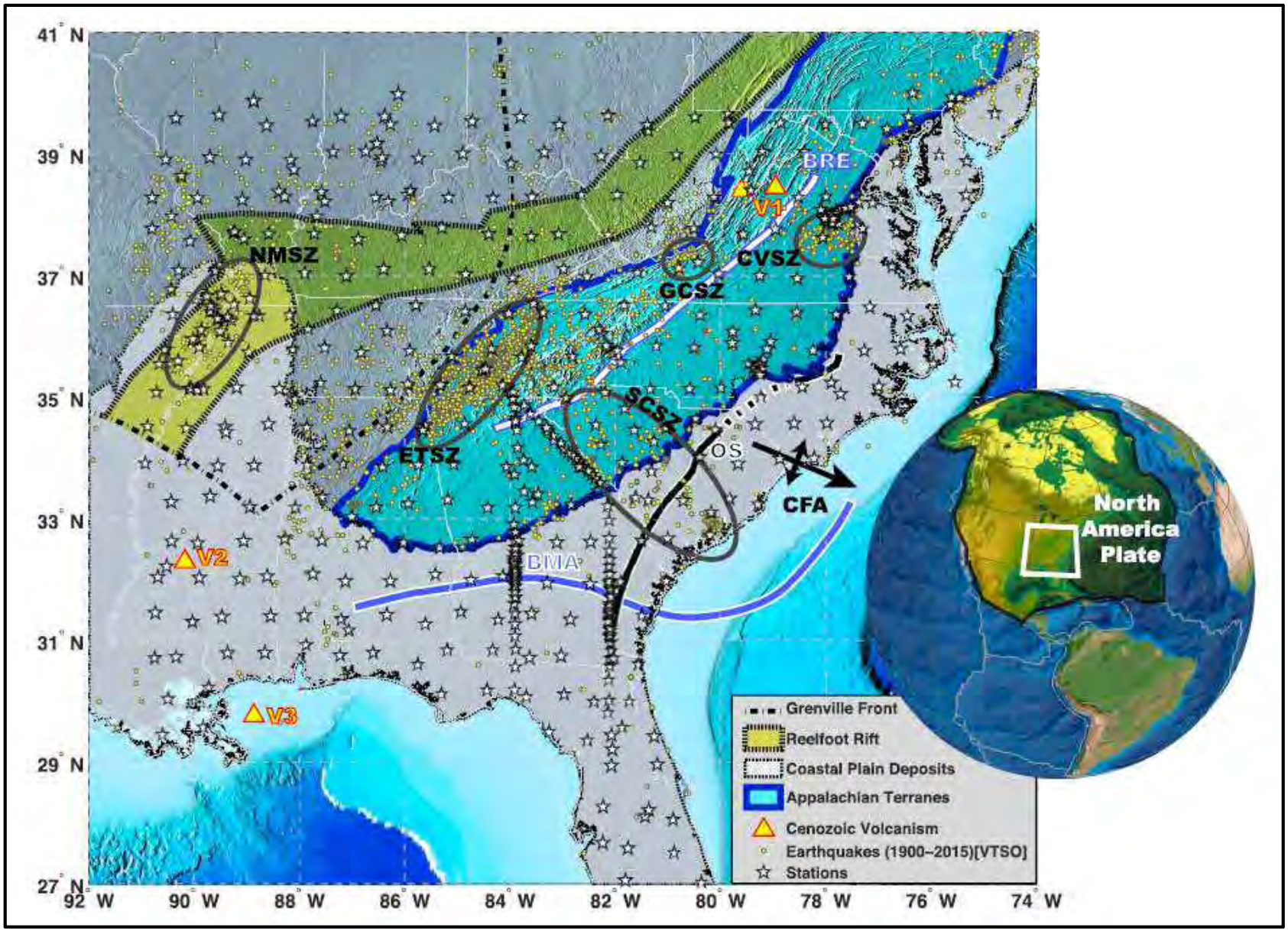


Figure 6-B. Map showing significant seismic features of southeastern USA. The Giles County Seismic Zone (GCSZ) is located in upper right. Stars represent seismographic stations. The map is excerpted from Biryol and others (2016), which is a copyrighted work, and should not be distributed. (Below) Map of Virginia seismic hazards prepared by Virginia Department of Mines, Minerals and Energy, https://dmme.virginia.gov/DGMR/EQHazardMapping.shtm

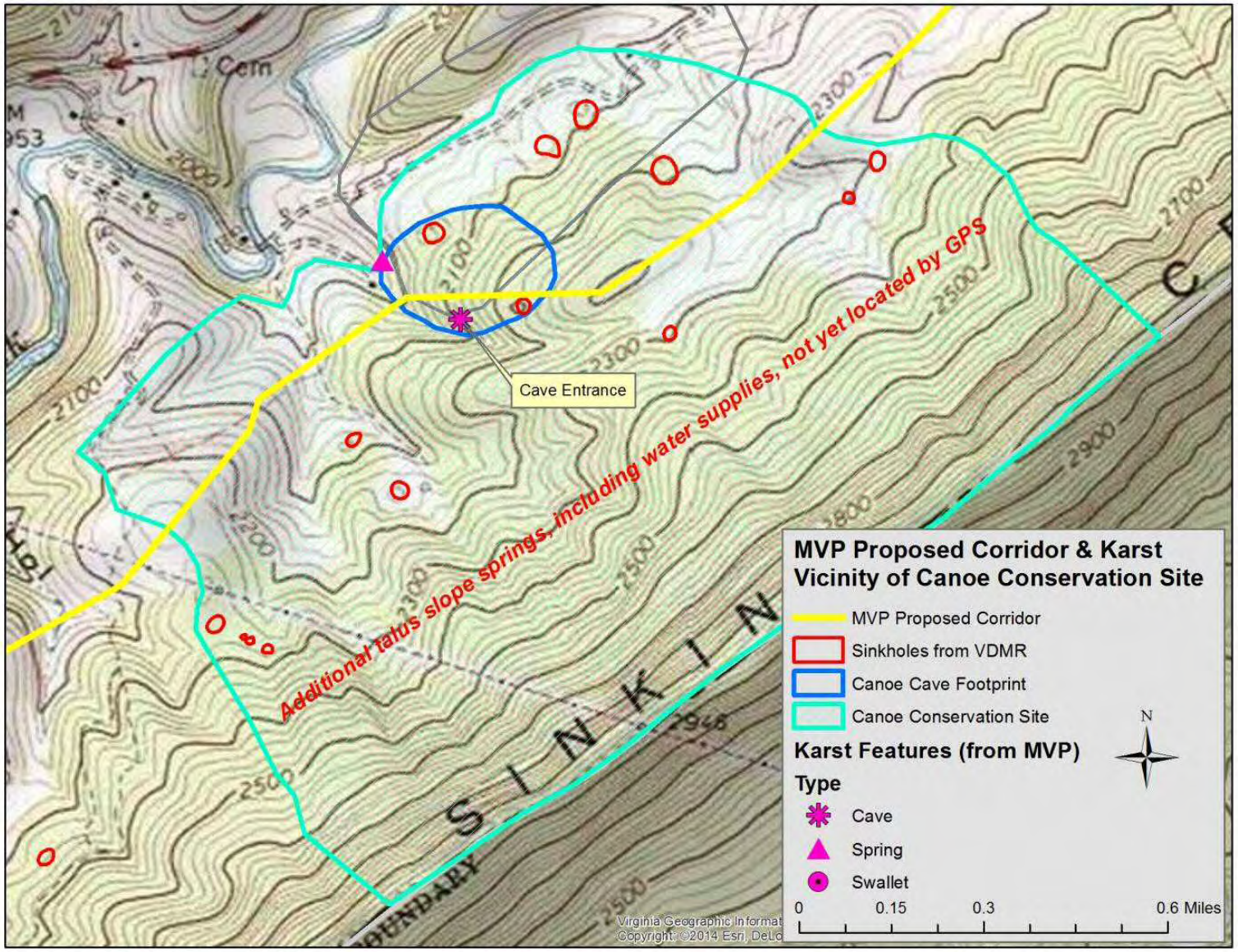


Figure 7. *Area around Canoe Cave, Sinking Creek Mountain, Giles County, Virginia. The proposed route of the Mountain Valley Pipeline passes over Canoe Cave and within a few hundred feet of its entrance. Sinkholes that take allogenic recharge (swallets) and a spring directly downhill from the cave (a likely resurgence of water from the cave) are indicated. The area outlined in light blue is a designated cave conservation site.*

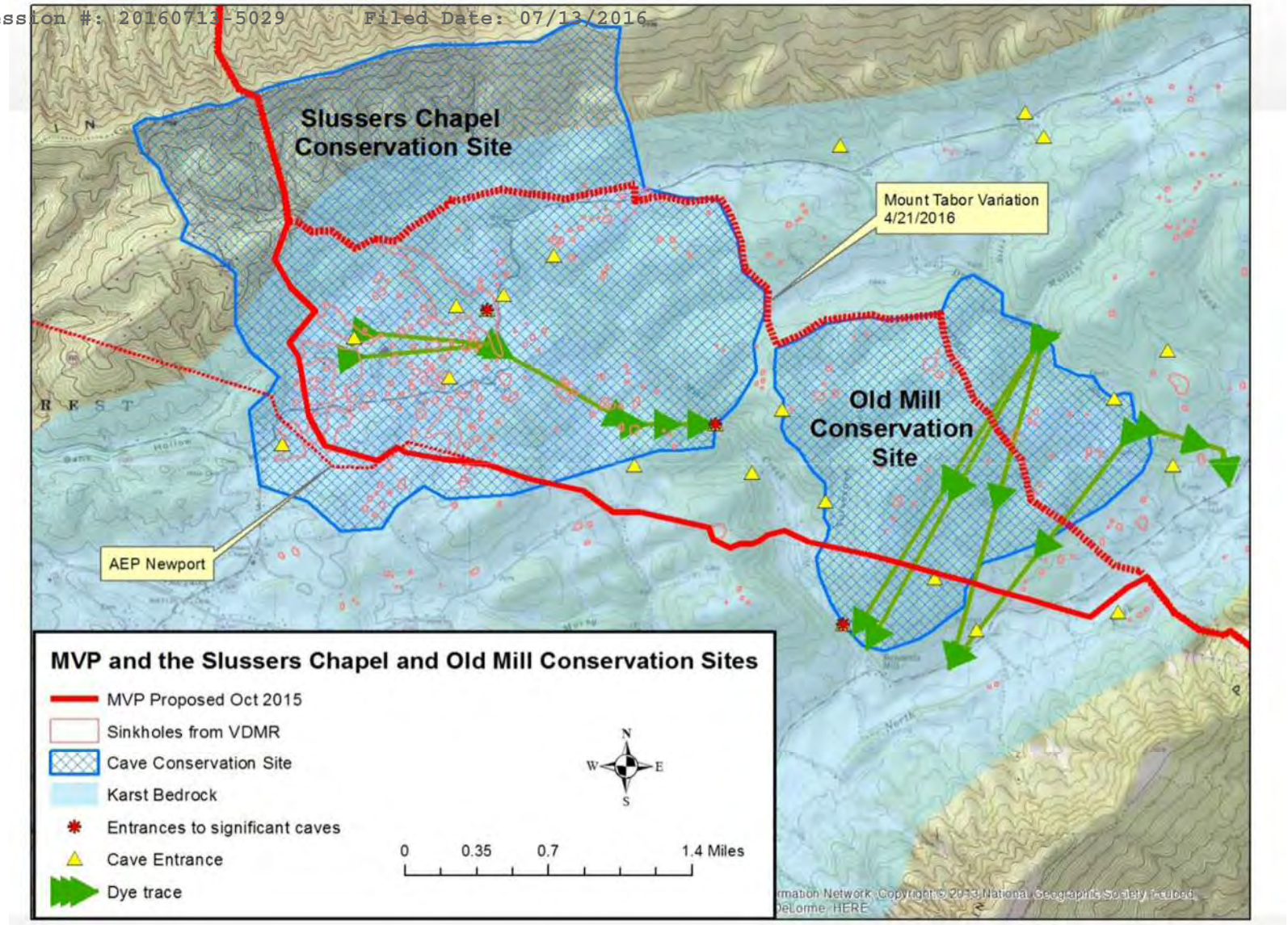


Figure 8. A part of the Mt. Tabor Karst Sinkhole Plain, Montgomery County, Virginia. The original proposed route of the Mountain Valley Pipeline (the southernmost solid red line) passes through the Slussers Chapel Cave and Old Mill Cave conservation sites (outlined in blue). The northern dashed red line is an MVP suggested alternative. Sinkholes are shown in faded red and numerous dye-trace paths are indicated in green. The entire karst plain (shaded in light blue) is underlain by karsted bedrock. This is a large contiguous area of karst with an extensive, well integrated groundwater network that both alternate routes pass over.

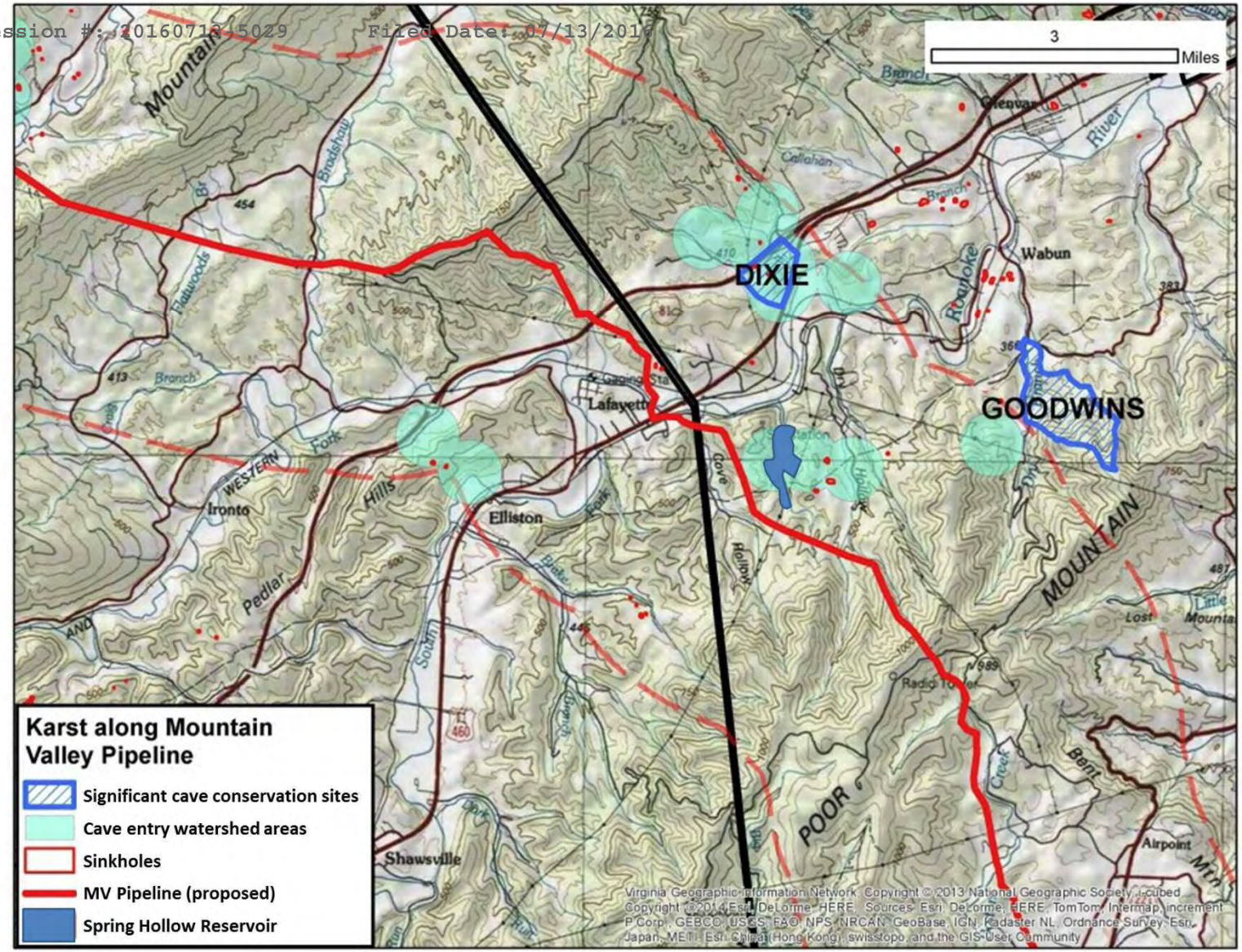


Figure 9. *Area of karst in the vicinity of Elliston and Lafayette, eastern Montgomery County (left) and western Roanoke County (right). This map shows the Dixie Caverns and Goodwins cave conservation areas, sinkholes, and watersheds contributing recharge to these karst features. The Spring Hollow Reservoir, lying within the karst, is also indicated. The dark black line is the county boundary between Montgomery and Roanoke. The proposed MVP pipeline route and a two-mile-wide corridor boundary are shown by the solid red and dashed red lines respectively.*

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ERNST H. KASTNING, JR., PH.D., P.G.
P.O. Box 1404, Radford, Virginia 24143-1404
(603) 545-9396 ernst@skyhopper.net

GEOSCIENTIST….HYDROGEOLOGIST….ENGINEER, HISTORIAN….FREELANCE WRITER

Resource Management …. Education and Interpretation …. Natural and Human History

Summary of Qualifications

Ph. D. and M. S. Degrees in Geology with extensive professional experience as a Scientist and Educator in resource management including environmental problems associated with land use and hydrogeological problems associated with management of fragile ecosystems both above and below ground. Demonstrated ability to lead cross-functional teams, to coordinate and manage complex problems. Designed and implemented policies and procedures with respect to applied geosciences, engineering geology, and hydrogeology. Outreach education and interpretation regarding geologic, environmental, and historic resources. Includes over forty-seven years of experience with karst processes. Retired from university teaching.

Expertise and ***Knowledge***:

- *Project Leadership*
- *Administration & Planning*
- *Program Development*
- *Needs Assessment/Evaluation*
- *Alliances/Partnerships*
- *Performance Analysis*
- *Regulatory Issues/Compliance*
- *Risk Assessment/Evaluation*
- *Instructor/Facilitator*
- *Data Collection/Analysis*
- *Presentations*
- *Report Writing*
- *Community Relations*
- *Problem Solver*
- *Computer Proficient*

Selected Accomplishments

Produced high-quality geotechnical and hydrogeologic studies for a wide range of clients including engineering/environmental consulting firms, governmental organizations (local, state, and federal), and developers. Have authored over 40 technical consulting reports and cartographic products. Recognized expert in my field, providing input to governmental agencies, military bases, planning committees, civic organizations, citizen-action groups, and educational institutions. *

Managed and ***advised*** projects, including the geologic mapping program of the New Hampshire Geological Survey, projects of geotechnical consulting companies, and graduate-thesis research of a number of graduate students. These have included grant and proposal writing, budget management, and public outreach and education. *

Regularly presented and ***submitted*** results of research and geotechnical findings at professional and technical meetings, symposia, public hearings, and as an expert witness in courts of law. Have authored approximately 15 monographs, 80 articles and geologic maps, and 60 abstracts in the geologic literature. Have led over 30 field trips. Designed and scripted high-profile, museum-quality displays and exhibits. Accomplished cartographer, photographer, editor, and media spokesperson. *

* Detailed supportive information available on request.

Professional Experience

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICE, Concord, NH 2007-2011
Manager of Geologic Mapping –New Hampshire Geological Survey
Water Consevationist – Drinking Water and Groundwater Bureau

- Managed bedrock and surficial geologic mapping (1:24,000-scale-quadrangles) under the National Cooperative Geologic Mapping Program (StateMap) of the U.S. Geological Survey.
- Supervised 4 to 5 contract geologists as well as personally mapping surficial geology.
- Provided for GIS compilation and assembly of maps for on-demand availability.
- Worked with various federal and state agencies as well as with local governments.
- Gave presentations at professional meetings and leading geological field trips including public outreach and education programs.
- Involved in grant proposal writing, budgeting, financial operations, and personnel allocation.

ENVIRONMENTAL ENGINEERING, INC., Blacksburg, VA 2007
Consulting Engineer.

- Conducted various geophysical investigations.
- Provided for remediation of ground-water contamination, in cooperation with the Virginia Department of Environmental Quality.

RADFORD UNIVERSITY, Radford, VA 1985-2006
Professor/Associate Professor – Department of Geology

- Taught Geomorphology, Hydrogeology, Advanced Groundwater Hydrogeology (graduate course), Environmental Geology (beginning and intermediate), Physical Geology, Historical Geology, and occasionally special topics (e.g. Karst Geology).
- Advised graduate students, 1996-2006 (Senior advisor for two completed M.S. degrees).
- Instructor, Elderhostel courses, Department of Continuing Education.
- University service: Departmental, college, and university-wide committees.
- Highly active in research, publishing, outreach, and consulting.

UNIVERSITY OF CONNECTICUT, Storrs, CT 1981-1985
Assistant Professor/Instructor – Department of Geology and Geophysics

- Taught Hydrogeology, Engineering Geology, Advanced Hydrogeology, Field Problems in Hydrogeology, Geomorphology, and introductory and seminar courses.
- Advised graduate students (Senior advisor for five completed M.S. degrees).
- Served on various departmental, college, and university-wide committees.
- Highly active in research, publishing, outreach, and consulting.

Previous positions included Assistant Professor at Murray State University (KY), Geologist, Environmental Geologist, Geophysicist, Hydrogeologist, Research Scientist, and Analytical Engineer at organizations including the University of Texas, Radian Corporation, Texaco, Inc., and Pratt and Whitney Aircraft

Education & Certification

Doctor of Philosophy in Geology, The University of Texas at Austin, Austin, Texas, 1983
Master of Science in Geology, The University of Connecticut at Storrs, Storrs, Connecticut, 1975
Bachelor of Electrical Engineering, Rensselaer Polytechnic Institute, Troy, New York, 1966

Certified Professional Geologist (Commonwealth of Virginia) – Active

Document Content(s)

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 54

February 21, 2023

625 Liberty Avenue, Suite 2000 | Pittsburgh, PA 15222
844-MVP-TALK | mail@mountainvalleypipeline.info
www.mountainvalleypipeline.info

July 30, 2019

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Re: Mountain Valley Pipeline, LLC
Docket No. CP16-10-000
Response to Data Request

Dear Ms. Bose:

On October 13, 2017, the Federal Energy Regulatory Commission issued an order granting a Certificate of Public Convenience and Necessity to Mountain Valley Pipeline, LLC.

On July 10, 2019, the Office of Energy Projects issued a data request with respect to epoxy coatings. In this filing, Mountain Valley submits a response to the request as well as a verification from the respondent.

If you have any questions, please do not hesitate to contact me at (412) 553-5786 or meggerding@equitransmidstream.com. Thank you.

Respectfully submitted,

MOUNTAIN VALLEY PIPELINE, LLC
by and through its operator,
EQM Gathering Opco, LLC

By: Matthew Eggerding
Assistant General Counsel

Attachments

Cc: James Martin, FERC
Paul Friedman, FERC
Lavinia DiSanto, Cardno, Inc.
Doug Mooneyhan, Cardno, Inc
Service List

Mountain Valley Pipeline, LLC
Mountain Valley Pipeline Project
Docket No. CP16-10-000

Response to Information Request Issued July 10, 2019

Request:

Please provide toxicological environmental and health information for Fusion Bonded Epoxy (FBE) coatings (3M™ ScotchkoteTM Fusion Bonded Epoxy Coatings and 3M™ ScotchkoteTM Liquid Epoxy Coatings, or their equivalents) used for coating the project's pipeline and associated utilities. Evaluate and report on the toxicity of the FBE from all potential exposure pathways including from direct and indirect human contact, ingestion or inhalation; as well as environmental pathways (leachability and mobility) in air, soils, surface water, and groundwater. The evaluation should likewise include an analysis of human and environmental exposure from the degradation of FBE due to exposure to sunlight, and sloughing (chalking) of the material.

Response:

Fusion bonded epoxy (FBE) and other epoxy coatings have been in use since at least the 1960s in various applications. This class of products has been studied extensively. To Mountain Valley's knowledge, there is no evidence that the use of epoxy coatings present a risk to human health, aquatic life, or other environmental receptors through any foreseeable exposure pathway.

I. Pipeline Coatings are Required to Prevent Corrosion

Coatings serve a necessary role in protecting the pipeline from corrosion. The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) has promulgated regulations prescribing "minimum requirements for the protection of metallic pipelines from external, internal, and atmospheric corrosion." 49 C.F.R. § 192.451. Two methods of corrosion protection are mandated: (1) external protective coating and (2) cathodic protection system. 49 C.F.R. § 192.455(a). Coatings adhere to the pipeline and provide the first line of defense against corrosion. Cathodic protection applies a small electrical current onto a pipeline which provides supplemental protection against corrosion. An advantage of epoxy coatings over certain other coating types is that they do not electrically shield the cathodic protection system even if the coating fails.[1] The PHMSA regulations also require that the coating must be inspected and, if necessary, repaired prior to lowering the pipeline into the trench and the entire corrosion-protection system must be monitored on an annual basis. 49 C.F.R. §§ 192.461(c), 192.465.

Mountain Valley's Final Environmental Impact Statement (FEIS) outlines the steps Mountain Valley will take to ensure that the coating on its pipeline is adequately maintained during installation. A protective coating of FBE or approved coating is applied prior to the delivery of the pipe joints to the Project right-of-way. The primary coating used for the Mountain Valley Pipeline Project is 3M Scotchkote FBE 6233, which accounts for approximately 95% of coated pipe surface area of the Mountain Valley Pipeline Project. Sections of the coating that are

[1] U.S. Government Accountability Office, Pipeline Safety: Additional Actions Could Improve Federal Use of Data on Pipeline Materials and Corrosion 20 (GAO-17-6399) (Aug. 2017).

disturbed during the pipe bending and welding process are recoated by a coating crew. Prior to installation of the pipe, the pre- and field-applied coating are inspected visually for scratches and other defects and inspected electrically for pin holes and voids. Any damage to the coating must be repaired before the pipe may be lowered into the trench. FEIS 2-40.

II. Evaluation of Human Health and Environmental Risk from Use of Epoxy Coatings

Epoxy coatings have been in use for over 50 years and have been the subject of numerous scientific studies. To respond to this information request, Mountain Valley has evaluated and provided available published studies, representations from the coating manufacturers, and other relevant sources of information.

A. Epoxy Coating Use in Other Applications

Epoxy coatings are in widespread use in numerous applications that bring them into contact with people and the environment. Epoxy coatings are typically used to protect steel pipes, fittings, and related products from corrosion caused by the environment. In addition to pipelines, epoxy coatings, and in particular FBE coatings, are used to protect steel rebar in construction, submerged structures in aquatic environments (e.g., steel pier pilings), ships, and drinking water and wastewater infrastructure (e.g., interior and exterior of drinking water mains and valves).

The accepted use of epoxy coatings in drinking water infrastructure is particularly relevant to this information request. Most states, including Virginia and West Virginia, require that pipes and other equipment that come into contact with drinking water in the water treatment and distribution systems must conform to the NSF/ANSI 61: Drinking Water System Components – Health Effects standard. According to NSF International,

> NSF/ANSI 61 is a performance-based standard that evaluates the amount of contaminants that leach from the products into drinking water, rather than setting prescriptive limits on content. This differs from U.S. Food and Drug Administration requirements and some international standards that are based only on prescriptive content requirements.
>
> NSF/ANSI 61 requires analysis for any chemicals that leach from a material into drinking water and a toxicological evaluation of concentrations leached to ensure that they are below levels that may cause potential adverse human health effects. The toxicological evaluation criteria are based on lifetime exposure to the concentration of contaminants in drinking water.[2]

Epoxy coatings have undergone the NSF/ANSI 61 toxicological review process and been certified for use in applications that bring them into contact with drinking water—including lining the interior of water mains and distribution pipes.

[2] NSF/ANSI 61: Drinking Water System Components – Health Effects Standard Overview, https://www.nsf.org/newsroom_pdf/overview_nsf_ansi_61.pdf.

As noted above, the primary coating for the pipeline is 3M Scotchkote 6233. Another product sold by the same manufacturer—3M Scotchkote 6233W—has received NSF/ANSI 61 certification.[3] As stated in the letter included in Attachment A, the manufacturer confirmed that these two coatings have the *same formulation*.[4] Thus, an identical FBE coating to that used on approximately 95% of the pipeline has undergone a toxicological review process deemed adequate by the relevant authorities in Virginia and West Virginia for use on the interior of drinking water lines. This provides important evidence that FBE coatings in general (which share similar chemical compositions) and the primary coating used by Mountain Valley in particular (i.e., 3M Scotchkote 6233) do not present a risk to human health, including when the pipe coating is exposed to groundwater that may serve as a source of drinking water.

B. Chemical Constituents of Epoxy Coatings

Mountain Valley is aware that members of the public have expressed concern that certain alleged ingredients or degradation byproducts of the epoxy coatings used by Mountain Valley may present a toxicity hazard. This is an overly simplistic and unscientific basis upon which to base conclusions about potential human health or environmental risks. The simplified formula for determining risk is hazard plus exposure. That is, the use of a product does not pose an actual risk unless it contains a human health or environmental hazard and there is a likelihood that persons or environmental receptors will be exposed to that hazard at levels sufficient to cause harm. Risk assessment principles allow the reasonable and scientific differentiation between those hazards that should be avoided or minimized and those that are not cause for concern. The potential hazards of the epoxy coatings used by Mountain Valley identified by commenters fall into the latter category.

1. Effect of Fusion-Bonding Process on Chemical Constituents

Mountain Valley possesses safety data sheets (SDSs) for each of the FBE coatings used on the Project. It is important to understand that the chemical ingredients listed in the SDSs are for the coatings in their *uncured powder form*. That form is not indicative of the chemical constituents and properties of the coating when it is applied to the pipe.

Upon application to the pipe, the FBE coating in its powder form will be heated, which causes the resin and hardener components to react. The resin will undergo chemical cross-linking, which creates a strong polymer network with negligible solubility. According to the manufacturer of most of the coatings used by Mountain Valley, 3M, any minor quantities of constituents that remained unreacted would be physically entrained in the cured coating with limited ability to leach into the environment.[5] Thus, the chemical ingredients identified in the manufacturers' safety data sheets for the pre-applied coatings used on the Project are *not*

[3] A listing of products with NSF/ANSI 61 certification can be found at http://info.nsf.org/Certified/PwsComponents/Listings.asp?.
[4] Letter from 3M to William Limpert (Apr. 1, 2019), included herein as Attachment A.
[5] Refer to the Material Declaration on 3M EMD Products Sold in the USA (Oct. 23, 2018) ("3M Product Declaration"), which is included as Attachment B.

reflective of the substances that are actually present at the Project site. The manufacturer has further stated:

> The information provided on the Safety Data Sheet is based on the product's hazards before it is reacted and cured on the pipe. The warnings are based on the presence of substances at very low amounts in the powder prior to application and cure. These substances are expected to be encapsulated in the polymer matrix when the coating is applied and fully cured onto the pipe and would be dispersed throughout the coating and not migrate onto the surface or leach out of the coating. These substances are used in many consumer products and/or occur naturally as impurities from naturally-occurring minerals.[6]

The fusion-bonding process is completed prior to the pipes' arrival at the Project site. Unreacted FBE coating will be used only for field application to welds and repairs. This means that there is a minimal potential for unreacted FBE coating constituents to be released to the environment from the pipeline.

2. Presence of Organic Solvents in FBE and Other Epoxy Coatings

Mountain Valley is aware of several public commenters who have alleged that the FBE coatings used on the Project—3M Scotchkote 6233 in particular—may leach high concentrations of organic solvents, including methyl isobutyl ketone, and ortho-, meta- and para-xylene, into groundwater. The commenters rely on a study from 2015 (M. Francis, *Fate and Decomposition of Pipe Coating Materials in Abandoned Pipelines* (July 3, 2015)), which in turn cites leaching data from a 1989 American Water Works Association study (K. Alben et al., *Leachate from Organic Coating Materials Used in Potable Water Distribution Systems* (Jan. 1989)). The 1989 study reviewed the potential for solvents to leach out of *solvent-based* epoxy coatings that are sprayed onto the pipe surface in liquid form. In contrast, FBE coatings are applied in powder form and cured by heat, which means that solvents are not involved in the coating process. According to the 3M Scotchkote Product Information included as Attachment C, "Scotchkote FBE Powder Coatings are finely ground powders that react when heated. *They do not contain solvents*." Accordingly, there is no justification for any assertion that the FBE coatings are a source of organic solvents to the environment.

As detailed in the descriptions of the specific coatings below, approximately 99.8% of the total pipeline length will be covered by pre-applied FBE coatings (98.3%) or field-applied liquid epoxy coatings that contain no organic solvents (1.5%). In total, Mountain Valley estimates only approximately 0.2%—or approximately a total of 3,500 feet dispersed throughout the 303-mile pipeline—will be coated with specialty coating products containing organic solvents. There is no basis to assert that this limited use of epoxy coatings containing organic solvents presents any human health or environmental risk. The 1989 Alben study found the rate of organic solvent leaching was highest immediately after the coating is applied and rapidly decreases over a matter of days. Proper curing of the coating was found to limit the rate at which leaching may occur.

[6] Letter from 3M to William Limpert (Apr. 1, 2019), included as Attachment A.

For the Project, Mountain Valley has followed the manufacturers' recommendations for proper curing time, which limits any potential for leaching. Furthermore, the *highest* concentration of leached organic solvents documented in the 1989 study (coating samples immersed in water shortly after application) nevertheless remained *below* the applicable U.S. Environmental Protection Agency drinking water standards. In short, the allegation that the epoxy coatings used on the Project are a source of harmful organic solvent contamination to surface water and groundwater is baseless.

3. Coatings Used on the Project

Mountain Valley uses various specialty coatings for the Project. The coatings are referenced below with a brief description of the chemical ingredients in their *unreacted* form. Copies of the respective Safety Data Sheets (SDS) are included in Attachment D. As discussed above, the ingredients listed in the SDS are likely to be present in the cured form of the coating only in minimal quantities (if at all) and physically entrained in the coating.

a. Pre-Applied (or Mill-Applied) Coatings

3M Scotchkote 6233. This is the primary coating used for the pipeline. As noted above, Mountain Valley estimates approximately 95% of the total pipeline area will be coated with this product. This FBE coating is applied to the pipe sections prior to their arrival at the Project site. The attached SDS lists the constituent ingredients present in the product's *unreacted* form.

A public commenter has alleged that an unreacted form of this coating contains two potential carcinogens: quartz silica and titanium dioxide. The first substance, quartz silica, is a common mineral and the primary constituent of sand. The second substance, titanium dioxide, is a common pigment used in most paints and cosmetics that is approved by the U.S. Food and Drug Administration (FDA) as a safe additive to foods for human consumption. 20 C.F.R. § 73.575. These substances are identified as carcinogens based on chronic inhalation of the particles over long periods of time, typically occupational exposures associated with the manufacture of products using these materials. Because the pipe coating arrives at the site in its cured form bonded to the pipe, there is no reasonable potential for inhalation of these materials—and no potential for inhalation exposure when the pipe segments are buried.

The same public commenter has alleged that this coating contains a purported reproductive toxin, 4-4'-isopropylidenediphenol, based on their review of the SDS. This substance, however, has been approved for use in food packaging by the FDA. 20 C.F.R. § 177.1580. Moreover, the substance is present in a concentration less than 1% of the total coating by weight and is bound in the coating through the fusion-bonding process. Should any of the substance leach from the coating or be formed as a degradation product, it has low mobility in soil and readily biodegrades under most environmental conditions.[7] Thus, the likelihood of human exposure to this substance

[7] National Institutes of Health, Bisphenol A, https://pubchem.ncbi.nlm.nih.gov/compound/Bisphenol_A#section=ICSC-Environmental-Data.

through a drinking water pathway appears to be minimal and certainly no more than the likelihood of exposure of this same coating in use to protect drinking water pipelines (see above).

3M Scotchkote 6352. This FBE coating is applied with Scotchkote 6233 as part of a dual-layer pipe coating system to provide an Abrasive Resistant Overcoat (ARO). The Scotchkote 6233 / 6352 system is used in very rocky soils, open cut streams and road crossings, conventional bore applications, and other specialty bore locations. Mountain Valley estimates approximately 2% of the total pipeline length will have this dual-layer coating system.

The ingredients of 3M Scotchkote 6352 in its *unreacted* form are listed in the attached SDS. The potential for exposure to constituents of this coating is effectively the same as for 3M Scotchkote 6233. The only ingredient not also present in 6233 is feldspars, which refers to a class of common rock-forming minerals that make up over 50% of the Earth's crust.

Powercrete DD. Similar to 3M Scotchkote 6352, this liquid coating is applied with Scotchkote 6233 as part of a dual-layer ARO system. This solvent-free coating is reacted from two components: Powercrete DD Part A (resin) and Powercrete DD Part B (hardener). The attached SDSs list the ingredients for each part.

According to the manufacturer, this coating polymerizes to 100% solids when the Part A and Part B components are mixed and reacted. This coating is applied to pipe sections prior to their delivery to the Project site, so the raw ingredients are not expected to be present onsite. Any unreacted constituents are expected to be physically entrained in the coating and therefore present minimal potential for leaching. Mountain Valley estimates approximately 0.8% of the pipeline will be coated with Powercrete DD.

SPC SP-2888. SPC SP-2888 is a liquid coating that can be pre-applied or field-applied. It is a two-part product consisting of a base and a hardener. This product is 100% solids and solvent-free according to the manufacturer. The attached SDSs list the ingredients for each part. When applied at the shop, this coating will be completely polymerized by the time it has reached the Project site. Any unreacted constituents are expected to be physically entrained in the coating and therefore present minimal potential for leaching. Mountain Valley expects approximately 0.8% of the pipeline will be coated with pre-applied SPC SP-2888.

b. Field-Applied Coatings

The field-applied coatings are two-part epoxies that consist of a resin and a curing agent/hardener. When combined, the hardener reacts with the resin to trigger the rapid polymerization and curing process. As discussed above, this reaction ensures that the coating becomes non-soluble and adheres to the pipe. Any trace quantities of unreacted ingredients become physically entrained in the cured coating. The field coatings are applied in liquid form. The chemical reaction continues for a short time period (typically less than one hour but timing depends on atmospheric conditions) until the epoxy coating hardens into a solid.

The liquid two-part coating is either hand or spray applied. The coating is allowed to cure and the manufacturer-recommended test procedures are followed to verify coating is fully cured.

Mountain Valley expects to use four different field-applied epoxy coatings for the Project: (1) SPC SP-2888; (2) Denso Protal 7200; (3) Denso Protal 7125; and (4) Powercrete R-95. The SDSs for each of these coatings are included in Attachment D. Mountain Valley estimates that less than 2% of the total pipeline length will be covered by field-applied epoxy coatings.

SPC SP-2888. SPC SP-2888 is a SPC SP-2888 is a solvent-free product used to coat girth weld areas, bare pipe or fittings, or damaged areas in the pre-applied coating at or above 50 ℉ temperatures. Mountain Valley estimates this coating will be used for approximately 84% of all field-coating applications, totaling 1.46% of the total pipeline length.

Denso Protal 7200. Denso Protal 7200 is a solvent-free product used to coat girth weld areas, bare pipe or fittings, or damaged areas in the pre-applied coating at or above 50 ℉ temperatures. Mountain Valley estimates this coating will be used for approximately 4% of all field-coating applications, totaling 0.7% of the total pipeline length.

Denso Protal 7125 and Powercrete R-95. The only coatings used on the Project that contain organic solvents are Protal 7125 and Powercrete R-95. Protal 7125 is a specialty coating designed to be applied in cold weather conditions between -4 and 50 ℉. This product is designed to quickly cure in cold temperatures. Because construction is generally suspended during the winter, this coating has been used much less frequently than Denso Protal 7200 and SPC SP-2888. Mountain Valley estimates this coating represents approximately 8% of the field-coating applications, so approximately 0.1% of the pipeline may be coated with Protal 7125.

Powercrete R-95 is primarily used to coat the joints of pipe with the Scotchkote 6233/Powercrete coating system. The coating is the least commonly used coating on the Mountain Valley Pipeline Project. Mountain Valley estimates it accounts for approximately 3% of all field-coating applications, so less than 0.1% of the pipeline may be coated with this product.

C. FBE Coating Leaching Test Performed by Mountain Valley

Mountain Valley conducted leaching testing on samples of the primary coating used on the Project, 3M Scotchkote 6233, in July 2018. That coating is pre-applied to most pipe sections at the factory and accounts for approximately 95% of the overall coated length of the pipeline. The testing was conducted on samples removed from pipes that were stored outside at a pipe yard in West Virginia. These pipes had been exposed to the environment for several months at the time of sampling.

The removed coating samples were collected in three 32-ounce sample jars and sent to an accredited laboratory for testing. The laboratory tested the samples using the U.S. Environmental Protection Agency's Method 1311 Toxicity Characteristic Leaching Procedure. That test method involves exposing the sample to a highly acidic solution to rapidly leach constituents from the tested material. The resulting leachate is then analyzed for the presence and concentration of a list of potentially harmful substances.

No volatile or semivolatile organic compounds were detected in the pipe coating samples. Nor did the testing identify the presence of any other harmful substances. The only metal detected was a de minimis concentration of barium, which is a naturally occurring alkaline earth metal

commonly found in groundwater. The concentration of barium detected in the coating leachate, 0.111 mg/l, is approximately *20 times lower* than the U.S. Environmental Protection Agency's standard for drinking water. The testing results are included as Attachment E.

D. Potential for Inhalation Exposure to Sloughed Coating

Photodegradation of the polymer in the epoxy coating, which results in a chalky residue on the pipe surface, is well-known and well-studied phenomenon. Mountain Valley is not aware of any study that has identified an environmental or human health risk from this residue. In addition, as discussed in the section above, Mountain Valley's July 2018 testing of FBE coating that had been stored outside and exposed to the elements for several months did not identify the presence of any harmful substances.

In Mountain Valley's experience, the chalky residue is well-adhered to the pipe surface and does not become airborne in the wind. This is consistent with the industry's expected rate of photodegradation. Generally, only 1 mil (0.001 inch, or 0.025 millimeter) per year of a coating exposed to sunlight will degrade, which indicates that the total quantity of dust available to be released from exposed coated pipes and mobilized into the atmosphere by wind is extremely limited.

According to the 3M Product Declaration, photodegradation of the coating can form aldehydes, amides, various aromatics, and other byproducts. These byproducts are expected to cause no or minimal human health or environmental impacts because they would be created in extremely small quantities and may be subject to further photodegradation and biodegradation in soil and subsoil environments. Mountain Valley is not aware of any studies suggesting that any epoxy degradation products occur in a sufficient concentration to present any environmental or human health risk.

III. Integrity of Exposed Pipe Coating

Consistent with PHMSA requirements and standard industry practice, Mountain Valley employs measures to monitor and ensure that the integrity of its pipe coating is not compromised.

Mountain Valley conducted an evaluation of stored coated pipe segments in the summer of 2017. The photodegradation was measured on the Mountain Valley pipe and was determined to be equal to or less than the industry-expected rate. Mountain Valley had implemented protective measures that substantially decreased the coating degradation of pipes stored for long periods in construction yards. When pipe is stored stacked in construction yards, the photodegradation occurs on the outer pipe joints in the stack that are most exposed to sunlight. Mountain Valley took the proactive step of shuffling the pipe in the stacks to prevent the photodegradation from occurring at one location on the coated pipe surface. Mountain Valley will employ this measure as necessary until all pipe segments are installed.

In addition, in August 2018, Mountain Valley engaged the coating manufacturer in a discussion on the minimum coating thickness necessary to maintain the coating's integrity and sampled the average pipe coating thickness of its stored pipes. Mountain Valley determined that the coating thickness on its stored pipes remained above the manufacturers' recommendation. Mountain

Valley expects that all pipes will be installed in the trench well before the coating thickness drops below an acceptable level.

The pipe coating monitoring and protective measures discussed above are employed by Mountain Valley as part of a general coating integrity management strategy for its stock of pipes. Nevertheless, the coating on each individual pipe is inspected for damage and thickness before the pipe is installed in the trench. This testing is conducted by running a device called a "Holiday Detector" across the pipe. That device uses an electrical current to detect any defects in the coating. Any damaged coating or coating thin spots must be repaired prior to installation, or the pipe segment is not installed.

Respondent: Jeffrey Klinefelter
Position: Vice President, MVP Construction & Engineering
Date: July 30, 2019

Mountain Valley Pipeline, LLC
Mountain Valley Pipeline Project
Docket No. CP16-10-000

Response to Information Request Issued July 10, 2019

ATTACHMENT A

LETTER FROM 3M

(APRIL 1, 2019)

3M Electrical Markets Division

3M Austin Center
6801 River Place Blvd.
Austin, TX 78726-9000

Science. Applied to Life.™

April 1, 2019

William Limpert
wflimpert@gmail.com

Dear Mr. Limpert:

This letter is in response to your request regarding 3M™ Scotchkote™ Fusion Bonded Epoxy 6233 and 6233W. Please note there is no difference between 6233 and 6233W. The W is a designation for potable water applications.

These products are composed predominantly of polymeric materials and inorganic compounds. If the products are applied as per 3M application guidelines and fully cured upon application, they are expected to resist degradation and have negligible water solubility under normal environmental conditions.

Chalking is a phenomenon that occurs when epoxy-based coatings are exposed to UV for an extended period of time. It is not unique to 3M products. The chalk is composed of polymer degradation products (not typically known with specificity) that are created by exposure of the surface of the pipe to UV light from the sun. Although we have not conducted studies to confirm their exact identity, the degradation products are generated in low quantities, have low water solubility, and are therefore not thought to enter the environment in amounts capable of producing an adverse human health effect. We are not aware of any evidence to suggest it is harmful to human health.

The information provided on the Safety Data Sheet is based on the product's hazards before it is reacted and cured on the pipe. The warnings are based on the presence of substances at very low amounts in the powder prior to application and cure. These substances are expected to be encapsulated in the polymer matrix when the coating is applied and fully cured onto the pipe and would be dispersed throughout the coating and not migrate onto the surface or leach out of the coating. These substances are used in many consumer products and/or occur naturally as impurities from naturally-occurring minerals.

We hope this information is helpful.

Best regards,

3M Electrical Markets Division Regulatory Affairs

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 55

February 21, 2023

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Figure 1. Stockpiled pipe in the USA.

Study of stockpiled fusion bond epoxy coated pipe

Keith Coulson FICorr, James Ferguson, TC Energy, Calgary, Canada and David Milmine, DM Professional Services Ltd, Calgary, Canada.

TC Energy is a pipeline owning and operating company based in Canada, and has been in business for over 65 years, delivering energy solutions to millions of North Americans. Their natural gas systems operate over 93,000 km of pipeline transporting more than 25% of North America's supply. In addition, it has nearly 5,000 km of liquid pipeline system providing over 2 billion barrels of oil daily, and it was as part of this liquids system that a major new oil pipeline project was designed to secure an even larger reliable energy infrastructure within Canada and the USA. The project comprised of some 530 km in Canada, while the USA systems added just over 1,400 km of pipeline to connect with the US refining hubs in Illinois, Oklahoma, and the Gulf Coast of Texas. Pipe for the project was originally procured, manufactured and coated in the years 2009, 2010 and 2011. The pipe was then stockpiled in large quantities at several sites throughout Canada and the USA at locations close to the pipeline right-of-way. Once stockpiled, most of the pipe remained un-used until an inspection and remediation programme was started in August 2018.

The majority of the pipe stored in the outer layers of the stockpiles was coated with a whitewash acrylic resin coating to reduce or eliminate the effects of UV degradation. The inner piping at the stockpiles was not protected, as it was determined that the overlaying whitewashed coated pipe would eliminate the influence of UV degradation. The only exception being the overhanging pipe ends.

site in the USA, and to determine its fitness for purpose as a pipeline coating. The assessment programme was carried out on pipes with the applied UV-resistant paint, as well as evaluating any degradation due to environmental exposure on pipe with little or no UV exposure.

Effects of Ultraviolet Exposure on Fusion Bond Epoxy Coatings

When exposed to ultraviolet rays, FBE coatings undergo polymer degradation, commonly referred to as chalking. Previous studies of exposed weathering of FBE coating had identified that this UV exposure could have a serious deleterious effect on the inherent physical properties of the coating (1,2). This phenomenon is common to all FBE coatings that are primarily designed only for below ground service. Kehr (3) stated that, if undisrupted, this layer of chalked FBE will protect the underlaying FBE and enable the coating to retain most of its original properties. However, if this protective layer of chalked coating is removed by rain, wind or intense periods of UV exposure, then the new surface starts to suffer from the repeated process of chalking. As this breakdown and delamination of the outside layers continue, it is accompanied by a noticeable reduction in the coating thickness (2). Work by Cetiner and Kehr concluded that this coating thickness reduction could average between 10 to 40 microns per year. The actual degree and effects of chalking depend upon the following factors:

- The amount of exposure to UV, for example, the 12 o'clock position on a pipe generally suffers more coating breakdown than the less-exposed 3 or 6 o'clock positions.
- The intensity and duration of direct exposure to the elements. For instance, UV intensity in areas of the southern USA would be far greater than those in Canada, and hence lead to quicker and more rapid breakdown and chalking of the coating (4).
- Availability of water due to rain and morning dew.

Previous studies also demonstrated that when exhibiting chalking and reduced coating thickness, some FBE coatings would exhibit a reduction of their resistance to cathodic disbondment (5). But common to all FBE coatings is their struggle to retain their original flexibility when examined in accordance with the Canadian Standards Association (CSA) Z245.20 cold temperature flexibility test method (6). This aesthetic change of gloss and chalking clearly is accompanied by an embrittlement of the coating, as exhibited by loss of adhesion through the dry adhesion testing (DAT), and reduction of flexibility performance. Any form of reduction in the interaction of UV and the coating via tarping, whitewashing or any other means would therefore be clearly beneficial in reducing or eliminating the UV damage to the polymeric structure of the FBE.

Pipe Data

Specific pipe sections representative of the pipe stocks were subjected to evaluation, namely;

i. 36-in. OD × 0.465-in. WT., API Spec 5L (44th Edition), PSL 2 PSL Grade X70 SAWH pipe coated externally with FBE to the requirements of CSA Z245. 20 System 1A4, but noted as without any evidence of the application of an acrylic UV deterioration mitigation system (herein referred to as whitewash).

ii. Same pipe and FBE coating but exhibiting the presence of a post coating applied whitewashed UV deterioration mitigation acrylic paint on all exposed areas, exclusive of the pipe ends.

This piping was generally stored four or five high with 19 mm ropes used as separators, see Figure 1.

Figure 2

In total, the whitewashed pipe in the storage facility was estimated to constitute at least 20% of the approximately 24,000 joints of 24m pipe lengths. This pipe had been stored for approximately 18 to 24 months before the application of the acrylic whitewash. That whitewash UV protective coating had been reapplied once after a period of about 4 to 5 years. In all cases, the last few feet at both ends were left bare, so as not to overcoat the stencil and pipe identification markings on each pipe end. However, even after replenishing, the whitewash acrylic resin coating appeared to have significantly faded, as shown in Figure 2. This fading potentially denotes that the effectiveness of this whitewash to resist UV degradation had gradually been reduced during its UV exposure over a 4 to 5 year period.


Figure 3 Coated pipes from inside of stockpile removed for assessment

Protocol for Assessment

The objective of this refurbishment assessment was, firstly, to determine the effects that weathering had on the pipe underneath the faded whitewash and to ascertain the quality of that FBE coating. Secondly, to establish a benchmark performance criterion for the coating on pipes that were stored internally in the stockpile and not exposed to UV.

An inspection and test plan (ITP) was prepared to assess the integrity of the pipe coating. The examination consisted of the following:

- FBE coating that had been coated with whitewash acrylic UV protective coating.
- FBE coating from pipes stored in the internal segments of the stockpile that was not exposed to UV (refer to Figure 3).
- FBE coating on the pipe ends or overhanging pipe that was not whitewashed but was exposed to some UV.

The ITP stipulated the following testing activities:

- Documentation of pipe numbers and correlation to location in the stockpile for selected pipe piles.
- Measurement of dry film thickness (DFT) on selected pipe. Frequency and location on pipe to be determined and documented, for example. 12 and 6 o'clock positions.
- Measurement of DAT in accordance with ISO 21809-3: Annex Q: Adhesion Test (7).
- Holiday detection inspection on selected pipes.
- Submission of selected pipe for laboratory testing at laboratories in the USA.

Objective of the Assessment

1) To enumerate the correlation between DFT and DAT with the integrity assessment evaluations stipulated by the Canadian Standards, and 2) by conducting. a series of laboratory testing, establish to the regulators that the dry adhesion and dry thickness testing does quantify the quality of FBE coatings being held at the stockpiles.

3) To confirm the expected conclusion that the non-UV-exposed FBE coating was still fit for purpose as a below ground anti-corrosion coatings.

Results of the Field Assessment Programme

Initially, 12 joints of pipe that had been whitewashed and stored on the outside layers of the stock piles were removed. These 12 pipe joints, along with three joints from the interior of the stockpile, were assessed as specified in the ITP defined in the above protocol for assessment.

Figure 4 illustrates the configuration of the whitewashed and non-whitewashed pipe in the stockpiles. All pipes were identified via the stenciling or barcodes.

The results of the DAT and DFT testing are given in Table 1. With a few exceptions, the FBE coating on the piping that was whitewashed still had acceptable coating thickness measurements. The company's coating specification stipulated a requirement of 406 to 457 microns of FBE coating during manufacture. A range of 404 to 468 microns was recorded on this whitewashed coating, putting it completely in the range originally stipulated for this coating. However, the DAT's performed on those white washed pipes no longer consistently met the minimum requirements expected of this coating. Table 1 illustrates that eight out of the 10 test joints failed to attain the acceptable DAT ratings of 1 or 2. On the other hand, the pipe that was not whitewashed and was exposed to UV continuously during storage (ie the overhanging exposed pipe ends) exhibited complete failures in DAT evaluations. In addition, this UV-exposed non-whitewashed FBE coating had a remaining coating thickness in the range of 162 to 215 microns. In comparison to the company specified coating thickness, it was apparent that an average coating loss of approximately 25.4 microns per year occurred on UV exposure. This coating deterioration was generally within the accepted industry range of 10 to 40 microns for FBE coating loss per year, when exposed continuously to UV (3).

Initial testing on non-whitewashed coated pipe that had been stored in the interior of the stock piles provided excellent results and showed they were clearly fit for purpose (Table 1).

In addition, two additional non-whitewashed joints from the interior of the stockpiles were more comprehensively examined at the stockpile site, and the results of that assessment are given in Table 2. Basically, each joint was quarantined and tested at three separate locations along each pipe. At each location DAT and DFT testing was completed at the 12, 3, 6 and 9 o'clock positions. All coating on those pipes provided excellent results. The DAT test results were of the highest standard, with each test producing a prefect rating of 1. Also, the average coating thickness was within the range of 450 microns, which was totally comparable with the original factory recorded average thickness readings of 430 microns.

Two test rings from each of these two pipes were then deemed as the focus for further laboratory testing. Each test ring was of sufficient size to allow for specimen preparation to perform the range of applicable tests according to Table 4 of CSA Z 245.20-14 and Clause 7.3.3.3 of the company's specification TES-CO-FBE-GL Revision 09. One test ring from each pipe was shipped to a 3rd party lab in Texas, USA, and the other test ring from each pipe remained for testing at coating laboratory at the storage site.

Laboratory Assessment Programme

The non-whitewashed coated pipe that had not been exposed to the elements, and the whitewash-coated pipe, were assessed according to CSA Z245.20-14 Table 3 criteria for the following properties:

1. 2.5°degree flexibility testing at −30°C
2. 24-hour cathodic disbondment test at 3.5 V and 65°C
3. 24-hour water soak adhesion test at 75°C
4. Additional 1.5° flexibility at −30°C (three specimens, in accordance to Clause 7.3.3.3 of TES-CO-FBE-GL Revision 09), was included to examine and check for any stress, strain or pigment migration markings

The use of differential scanning calorimetry was not considered for this programme due to the deleterious moisture absorption effects on the interpretation of those thermal tests (8).

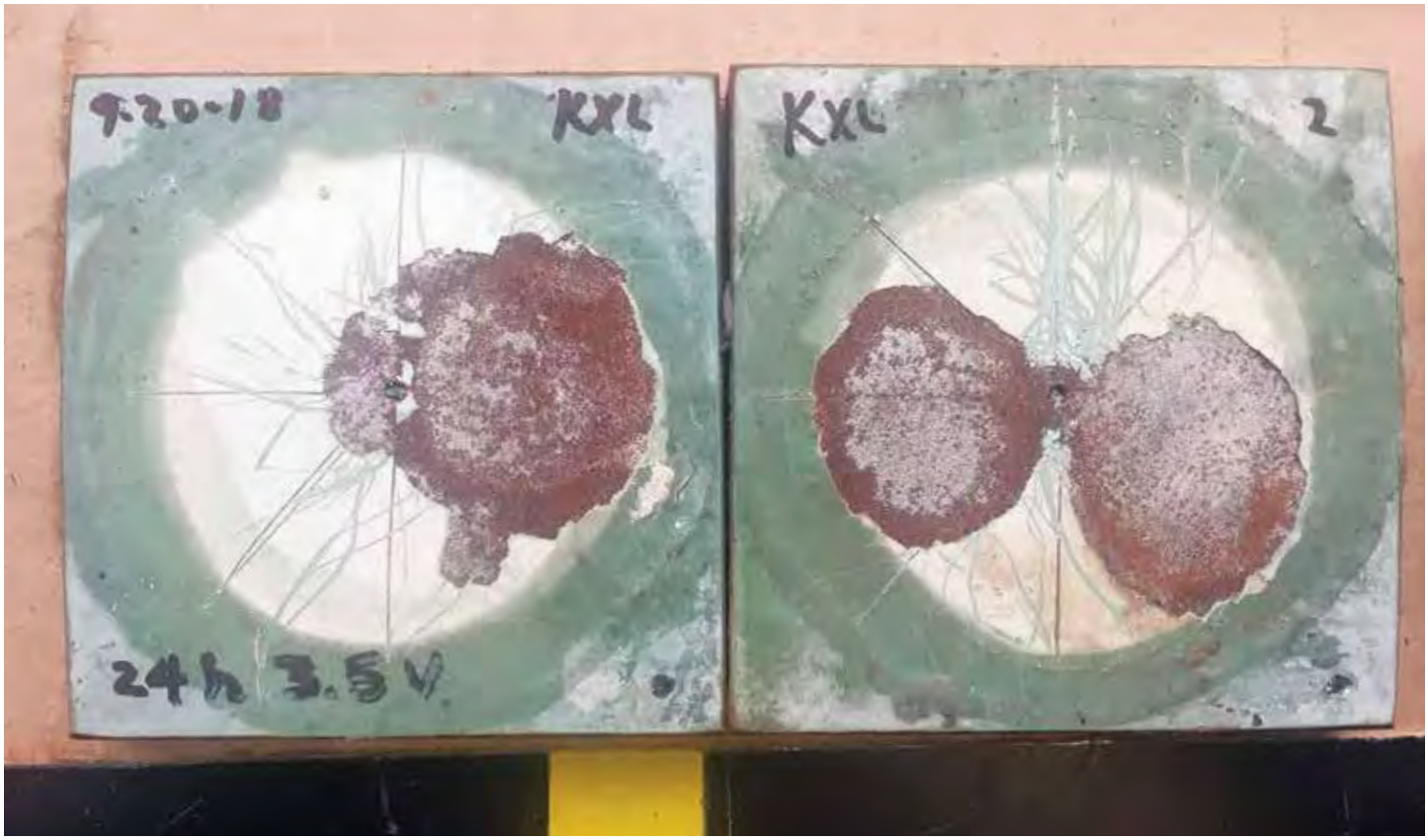

Figure 5. Cathodic disbondment test results for the non-whitewashed pipe ends exposed to ultraviolet.

Results of Laboratory Testing of Whitewashed Piping and Exposed Pipe Ends

The CD results of the non-whitewashed pipe ends exposed to UV were deemed total failures (Figure 5). Whereas the whitewash protected coatings fared much better with cathodic disbondment testing (CDT) results of approximately 5 mm disbondment, and water soak adhesion ratings of 2. However, this whitewash FBE coating demonstrated a serious deterioration in its flexibility performance.

The flexibility tests were all deemed failures on the UV-exposed pipe ends and whitewashed piping. The testing degree per pipe diameter length of pipe was reduced from 2.5 degrees to 2 degrees and then 1.0 degree, however all of which demonstrated similar results of cracking within the coating.

Results of Laboratory Testing of Non-Ultraviolet Exposed Pipe

Overall, the laboratory test results on non-ultraviolet exposed pipe proved to be excellent. The results are given in Tables 3 and 4, and clearly demonstrate the coating that was not exposed to UV or weathering was still totally fit for purpose and retained most of the properties it exhibited at its production.

Observations

All non-whitewashed pipe that was exposed to continuous UV at the storage site, such as pipe ends and stenciled areas, were deemed no longer fit for purpose. Coating loss was approximately 25.4 microns per year.

All coated pipe that was tested from the internal areas of the stockpile, and thus not exposed to weathering, was deemed to be totally fit for purpose by passing all the required CSA tests. The only exceptions were the pipe ends that may have been exposed to UV due to overhang in the stockpile.

All whitewashed coating exhibited good retention of coating thickness and cathodic disbondment and hot water soak adhesion characteristics. However, the flexibility of the underlaying FBE had been adversely affected to the point where the coating was no long acceptable. This depression of the flexibility levels of the coating could have been caused by the combination of moisture absorption and elevated temperatures. When the faded whitewash coating no longer acted as a reflective mechanism, the surface temperature of the coating increased during the prolonged periods of exposure to intense sunlight. A future study is required to understand if pigment migration, plasticiser effects or changes in mechanical properties due to moisture absorption were the actual root causes of the phenomenon, whereby only the flexibility properties of the coating were affected in such a deleterious fashion.

The whitewashed protective coating was originally applied some 18 to 24 months after the pipe was coated. In the intervening years, there was only one other application of this whitewash coating. From the results gathered in this programme, it can be inferred that if the whitewash coating had been applied on a more regular basis; for example, every two years, this deterioration of the coatings' flexibility may have been prevented.

Conclusions

The non-protected FBE coatings exposed to UV for periods of up to 9 years completely failed to retain their original properties and attributes. Conversely, coatings that were completely protected from any UV exposure still possessed all their original coating thickness and physical traits.

Even after nearly a decade, the use of whitewash UV protective coatings proved to be extremely successful in preserving and retaining the original DFT thicknesses of the FBE coating. Apart from the elasticity of the coating, UV protective coatings conserved many of the physical characteristics of the underlaying FBE coating. A more frequent application of non-faded whitewash coating to potential UV-exposed coatings, could possibly have also maintained the elastic characteristics of the FBE coating.

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A thanks also to Casey Bajnok of TC Energy for supplying background details of the project, and to Heather Traub and Kat McTavish of TC Energy for graphic and editorial support.

Tables

Table 1: Dry film and dry adhesion test results September 19-20, 2018 on US stockpile pipes, stockpiled for 9-10 years.

Pipe Number	Dry Adhesion Test Rating on Non-Whitewashed Fusion Bond Epoxy Exposed to Ultraviolet	Dry Adhesion Test Rating on Whitewashed Fusion Bond Epoxy Exposed to Ultraviolet	Thickness of Non-Whitewashed Fusion Bond Epoxy (microns)	Thickness of Whitewashed Fusion Bond Epoxy (microns)
A1009A26216	5	4	165 - 206	412 - 457
A1009A22997	5	3	124.5 - 188	416 - 546
A1009A22998	5	2	157.5 - 200	409 - 526
A1009A26247	5	2	142 - 162.5	396 - 434
A1009A25692	5	4	124.5 - 142	396 - 450
A1009A25343	5	4	190.5 - 208	391 - 429
A1009A26360	5	4	145 - 231	409 - 444
A1009A25787	5	4–5	206 - 234	424 - 485
A1009A26356	5	3	142 - 213	381 - 450
A1009A26853	5	3	180 - 260	412 - 465
A1009A41511	5	5	157.5 - 234	290 - 368
A1009262078	5	5	129 - 292	292 - 348
A1009A05252	1 (see note 1)	Internal pipe	388 - 452	-
A1009A05256	1 (see note 1)	Internal pipe	370 - 450	-
A1009A05238	1 (see note 1)	Internal pipe	404 - 450	-

Notes: 1. Signifies an excellent pass. Specification required a coating thickness of 406 to 457 microns of FBE

Table 2: Dry adhesion testing on non-ultraviolet exposed pipe at US storage site on December 10, 2018.

Test Pipe	Dry Adhesion Test No.	Test Temperature (C)	Dry Adhesion Test Rating	Average Fusion Bond Epoxy Thickness (microns)	Intersect Angles (degrees)
34189	1	15.5	1	422	40
34189	2	11	1	423	40
34189	3	14.5	1	471	40
34192	4	19.5	1	476	40
34192	5	10.5	1	449	40

Table 3: Laboratory test results for non-ultraviolet exposed pipe at US storage site on December 11, 2018.

Test	Pipe No.	Fusion Bond Epoxy	Results	Canadian Standards Association Z245.20-14	TC Energy Specification
24 water adhesion at 75°C	34189	3M6233-11G	1	1-3	1-3
24 water adhesion at 75°C	34192	3M6233-11G	1	1-3	1-3
24 CDT at 65°C	34189	3M6233-11G	3.3 mm	11.5 mm	5.5 mm
24 CDT at 65°C	34189	3M6233-11G	3.8 mm	11.5 mm	5.5 mm
24 CDT at 65°C	34192	3M6233-11G	3.3 mm	11.5 mm	5.5 mm
24 CDT at 65°C	34192	3M6233-11G	3.5 mm	11.5 mm	5.5 mm
2.86-degree bend at −30°C	34189	3M6233-11G	Two cracks	NR	NR
2.86-degree bend at −30°C	34192	3M6233-11G	Pass (no stress marks)	NR	NR
2.47-degree bend at −30°C	34189	3M6233-11G	Pass (no stress marks)	Pass	Pass
2.47-degree bend at −30°C	34192	3M6233-11G	Pass (no stress marks)	Pass	Pass
DAT Test at 16°C	34189	3M6233-11G	1	NA	1-2
DAT Test at 17°C	34192	3M6233-11G	1	NA	1-2

Notes:
CDT = cathodic disbondment testing, DAT = dry adhesion testing, mm = millimetres, NA = not applicable, NR = not recorded

Table 4: Laboratory test results for non-ultraviolet exposed pipes at the 3rd party Laboratories in Texas, January 10, 2019.

Test	Pipe No.	Fusion Bond Epoxy	Results	ACSA Z245.20-14	TC Energy
24 water adhesion at 75°C	34189	3M6233-11G	1	1-3	1-3
24 water adhesion at 75°C	34192	3M6233-11G	1	1-3	1-3
24 cathodic disbondment test (CDT) at 65°C	34189	3M6233-11G	3.5 mm	11.5 mm	5.5 mm
24 CDT at 65°C	34189	3M6233-11G	3.6 mm	11.5 mm	5.5 mm
24 CDT at 65°C	34192	3M6233-11G	3.4 mm	11.5 mm	5.5 mm
24 CDT at 65°C	34192	3M6233-11G	4.6 mm	11.5 mm	5.5 mm
3.03-degree bend at −30°C	34189	3M6233-11G	Pass (no stress marks)	NR	NR
3.03-degree bend at −30°C	34192	3M6233-11G	Pass (no stress marks)	NR	NR
2.51-degree bend at −30°C	34189	3M6233-11G	Pass (no stress marks)	Pass	Pass
2.55-degree bend at −30°C	34192	3M6233-11G	Pass (no stress marks)	Pass	Pass
Dry Adhesion Test (DAT) at 16°C	34189	3M6233-11G	1	NA	1-2
DAT at 17°C	34192	3M6233-11G	1	NA	1-2

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 56

February 21, 2023

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF VIRGINIA
ROANOKE DIVISION

****

MOUNTAIN VALLEY PIPELINE, LLC,

Plaintiff,

vs.

EASEMENTS TO CONSTRUCT, OPERATE, AND MAINTAIN A NATURAL GAS PIPELINE OVER TRACTS OF LAND, et al.,

Defendants.

CIVIL CASE NO.: 7:17CV492
MOTIONS HEARING
9:21 AM - 7:56 PM
ROANOKE, VIRGINIA
DAY 1 OF 2

Before:
HONORABLE ELIZABETH K. DILLON
UNITED STATES DISTRICT JUDGE
WESTERN DISTRICT OF VIRGINIA

****

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INDEX OF WITNESSES

WITNESSES ON BEHALF OF THE PLAINTIFF:

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///

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EXHIBITS ON BEHALF OF THE DEFENDANTS:

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you're ready.

MR. MASSIE: Thank you, Judge.

ROBERT JOSEPH COOPER, PLAINTIFF'S WITNESS, SWORN

DIRECT EXAMINATION

(Plaintiff's Exhibit 1 marked)

BY MR. MASSIE:

Q Would you state your name, please?

A Robert Joseph Cooper.

Q And what is your position with MVP?

A I'm the senior vice president of engineering and construction for Mountain Valley Pipeline.

Q Are you the person in overall charge of this project?

A Yes, sir.

Q And what functions report to you?

A I have overall responsibility to complete the project: Engineering, construction, the various functions to procure the pipe and obtain the land rights. I either have personnel that report directly to me or have personnel that are responsible to the project under me to complete those tasks.

Q You may step back just a little bit from the microphone there. Thank you.

What is your educational background?

A I have an associate's degree in drafting and design and a bachelor's degree in mechanical engineering from the West Virginia Institute of Technology.

Q And what experience do you have in the gas industry?
A This is my fifteenth year with EQT. And during that time, I've held various roles and been involved in the construction of a couple of thousand of miles of pipeline, including between 200 and 300 miles of pipeline that are under FERC jurisdiction, as well as building compressors and other activities for the company.
Q And altogether, how many pipeline projects have you worked on?
A In terms of --
Q Number.
A Number? I would say 100; but FERC projects, about a dozen, ten or a dozen.
Q And what do you define a FERC project to be?
A There are projects that don't fall under the jurisdiction of FERC as being an interstate natural gas pipeline and there are others that do. So those projects that fall under their umbrella, then, are required to follow that process. And so those are the ones that I would use the words saying they are a FERC project.
Q Is Mountain Valley Pipeline a natural gas company?
A Mountain Valley Pipeline is a natural gas company. We've been organized under the Natural Gas Act to build interstate natural gas pipelines.
Q Does it hold a certificate of public convenience and

necessity from the Federal Energy Regulatory Commission, known as FERC?

A Yes, sir.

Q If you'd look on your left, is the document marked Exhibit 1 a copy of the certificate order issued to FERC -- issued by FERC to Mountain Valley Pipeline?

A Yes, sir.

MR. MASSIE: We offer Exhibit 1.

THE COURT: Any objection, Counsel, or Mr. Howard, Mr. Howard?

All right. Admitted without objection.

(Plaintiff's Exhibit 1 admitted)

(Plaintiff's Exhibit 2 marked)

BY MR. MASSIE:

Q All right. Also, if you would, look to your left. There's a document there. What is that? It's marked as Exhibit 2.

A Looks like a summary overview of the project.

Q Do you have a map of the route and some facts about the pipeline?

A That's correct, sir.

MR. MASSIE: We would offer Exhibit 2.

THE COURT: Any objection?

Admitted without objection.

(Plaintiff's Exhibit 2 admitted)

BY MR. MASSIE:

Q All right. May we take a look at Exhibit 2 on the screen, please?

What are we looking at, Mr. Cooper?

A All right. If you look at the map portion on the right-hand side, it shows the general route of the pipeline from its beginning in Wetzel County, West Virginia, traversing through West Virginia, and then crossing into Virginia.

In Virginia, it covers the counties of, or some portion thereof, of Giles, Craig, Montgomery, Roanoke, Franklin, and Pittsylvania, where it has its terminus where it connects to the Transco pipeline system.

Q Okay. Can we go back to the enlarged version?

And what is the approximate length of the pipeline?

A The approximate length of the pipeline is 303 miles.

Q And there's a diameter mentioned here. Explain that, please.

A The pipeline diameter is 42 inches. So the pipe is a round circle, and the diameter across that circle is 42 inches.

Q And the compression -- compressor stations are located in Virginia or West Virginia?

A There's three stations for this project, all of which are located in the State of West Virginia.

Q And the terminus for the project is Pittsylvania County?
A Yes, sir.
Q And the right-of-way for the pipeline itself -- so I'm not talking about access roads or work areas or that, but what is the basic right-of-way for the pipeline?
A The permanent right-of-way after the pipeline is finished is intended to be 50 feet.
Q What is the purpose of this pipeline?
A This pipeline's purpose is to connect gas supplies, predominantly in southwestern Pennsylvania and north central West Virginia, with other markets in the country by traversing the route that's shown and connecting into Transco's interstate system. And from there, the suppliers or owners of that gas can market it to the various markets up and down the Eastern Seaboard and over to the Gulf Coast or into Florida.
Q And you described some producing regions. Do they have names or designations of what they are?
A Typically, the formations that are currently being drilled to supply this would be referred to commonly as the Marcellus or the Utica shale. There's also a formation known as the Upper Devonian shale. And those shales are very prominent in western Pennsylvania, north central West Virginia; and some of the Utica supply is even over into Ohio.

Q And what is the status of pipeline availability there now?

A With the current supplies that are in that area and the projected increase of those supplies, it is difficult for all the gas that the producers can produce to get to market, because there's not enough pipelines to carry it from those areas to the areas in the country that have demand for it.

MR. TEANEY: Objection, Your Honor. I think there wasn't foundation for the witness' knowledge of this information to offer it. This sounds like opinion testimony. He hasn't been qualified as an expert in natural gas markets or pipeline markets.

THE COURT: Mr. Teaney, I would recommend you make your objection when the question is asked, and not after the answer is given. So I'm going to overrule your objection, since he's already supplied the answer.

MR. TEANEY: Thank you, Your Honor.

THE COURT: Thank you.

BY MR. MASSIE:

Q What is the primary receipt point for the gas?

A There's a location in Wetzel County known as the Mobley interconnect, where there are other pipelines that can bring gas into the Mountain Valley Pipeline.

Q And you mentioned the final termination point is Transco. Can you explain what that is, please?

A That's correct. There's Station 165 in Pittsylvania County. There are several pipelines that connect the gas system up towards the Eastern Seaboard of the country, and can also traverse gas backwards. Ultimately, it can go all the way to the Texas-Louisiana -- you know, those other areas where there are demand centers, like industrial demand, or demand for power generation.

There's also interconnects with other pipelines that could carry the gas to Florida as well.

Q Besides the Transco location, are there any other interconnects on the pipeline?

A There's an interconnect with the TransCanada pipeline system. The pipeline is known as the WB. And that particular interconnect on the map is very close to what you see is the Harris compressor station. The actual connection to the pipeline is very close to the property where that station will be built, and so there will be the ability to take gas off of MVP onto that pipeline, should marketers choose to do so.

Q Is there any opportunity for deliveries in this area?

A Yes. There will be two physical connections to the pipe, sometimes called taps, for Roanoke Gas, to allow them to have supplies to continue to meet the demands for their customers.

Q Now, you mentioned the capacity of this pipeline, I think -- did you say to BCF? Have I asked you that?

A You haven't yet, sir, but --
Q What does -- well, first, what does that mean, capacity and BCF? Explain that, please.
A The pipeline, based upon its diameter, or the size of the hole, and the pressure at which it operates, can move so much natural gas through it. So, typically, capacity is designated as the engineered capacity, when you combine the inlet pressures, the compression capability, and the outlet pressures.

In this case, BCF stands for 2 billion cubic feet per day, where the cubic foot is a cubic foot of natural gas at standard atmostpheric pressure and temperature. And that gas has a thermal energy content of 1,000 BTUs.
Q Now, 2 BCF, can you put that in context for us, what it means, what kind of volume it is?
A This time of year, nationwide daily gas demands or consumption in the United States currently are above 70 billion cubic feet per day, sometimes as much as 78 billion cubic feet a day, so...
Q As an interstate pipeline, is this pipeline regulated by FERC?
A Yes, sir.
Q And as a FERC-regulated pipeline, what access must it provide?
A It's called "open access," is the phrase that's used.

That means marketers who can get their gas to the pipeline and meet the quality requirements can move their gas on the pipeline if there's space on the pipeline.

Q As a FERC-regulated pipeline, will MVP own any of the gas?

A Mountain Valley Pipeline is a transporter. So our role is to create the connection from one area to other areas and take the gas that is owned by the shippers, and we're paid a fee to move it from point A to point B.

Q And the terms I think you used are "transporter" -- meaning MVP, right?

A Correct. We do not have ownership of the gas. We have a responsibility to take gas that's given out to us and transport it to someplace else.

Q And what does the name "shipper" then refer to?

A As I used the word "shipper," I meant it to be the companies that represent the owners of the gas.

Q Does MVP have any agreements in place with shippers of gas for this pipeline?

A Yes. In this case, the capacity of the pipeline has been precontracted with various shippers of gas; so the full capacity of the pipeline has already been signed up with by shipping companies that wish to move gas from its beginning to the end.

Q May we see Exhibit 1 at pages 5 to 6? And if we could

bracket the shippers listed there, please.

Okay. What is this showing in the FERC order?

A These are the names of the companies who have signed up to ship gas on this pipeline. And then it shows their commitment to how much gas on a daily basis that they are going to ship.

Q All right.

A It is --

Q Go ahead.

A As I say, there is a difference in the units of measure here. You'll notice that in the overview, we listed the word "billion cubic feet," and in these ratings, it's listed as a dekatherm; the difference there being that natural gas doesn't all have a uniform energy content of 1,000 British thermal units at standard conditions. There's some slight variations that the shipping tariff that FERC's allowed into that thermal content. So to sell gas on a uniform basis for all players, that energy content is measured and then sold on a dekatherm basis.

However, the point of -- if all of the gas were at 1,000 British thermal units at those standard conditions, then it's an equal measure. This is just a way to account for the variations in the energy content.

Q So if you add up the numbers in the right-hand column and convert them to cubic feet, what does it come out to be?

A At standard conditions, it would come out to the 2 billion cubic feet that we have stated earlier.
Q And have the agreements -- do they have a certain name?
A To get the certificate, we had to demonstrate something called a precedent agreement, which is the commitment to live up to the contract that you've signed up for to ship the gas.
Q And are those filed with FERC?
A They were.

MR. MASSIE: May I approach, Your Honor?

THE COURT: You may.

(Plaintiff's Exhibit 3 marked)

BY MR. MASSIE:
Q Mr. Cooper, I'm showing you what's been marked as Exhibit 3. And I'll ask you: Are those a collection of the precedent agreements that have been filed with FERC?
A They are.

MR. MASSIE: We offer Exhibit 3.

THE COURT: Any objections?

MR. TEANEY: No objection.

THE COURT: Admitted without objection.

(Plaintiff's Exhibit 3 admitted)

BY MR. MASSIE:
Q And what is the duration of the precedent agreements, Mr. Cooper?
A Well, I believe the answer is 20 years for the service

contract. The precedent agreements actually get translated into an active transportation agreement once we move forward. This is the commitment to move the gas, and then the follow-on has to be completed prior to constructing the pipeline, which we have done. But these are essentially the same terms; it's just the proof that you'll do it versus the actual agreement to ship.

Q Let me ask the question a different way. What is the commitment period?

A The shipping period is identified as 20 years, sir.

Q And would that include the entire capacity of the pipeline for 20 years?

A As I stated earlier, yes, this is what's called a fully subscribed pipeline. So for the next 20 years, the shippers have committed to keep the pipeline full.

Q Are there documents that show the approved route for the pipeline?

A Yes, sir.

Q What are they? What are they called? What are they known as?

A They're called alignment sheets. And those are what we have to submit to FERC to govern the route, as well as the construction of the pipeline.

Q And what sets do we have in this case?

A There's the set that established the majority of the

route, which was filed in October of 2016. And then there is a supplement that was filed in December to account for the mandated route changes, predominantly what has already been talked about here, a variation known as 250, and also changes that needed to be made to complete a horizontal directional drill of the Pigg River here in Virginia.

Q Do the alignment sheets show the approved route?

A Yes, sir.

Q Is MVP seeking possession of the approved route?

A Yes, sir.

Q Is MVP seeking possession of anything that is not on the approved route?

A No, sir.

MR. MASSIE: Approach again, Your Honor?

THE COURT: You may.

(Plaintiff's Exhibit 4 marked)

BY MR. MASSIE:

Q Mr. Cooper, I've shown you a thumb drive that's been marked as Exhibit 4.

A Yes, sir.

Q What is on that thumb drive?

A This has the alignment sheets from the two submittals that we just discussed.

Q And have you reviewed those alignment sheets and marked your initials on the thumb drive?

A Yes, sir.

MR. MASSIE: We offer Exhibit 4.

THE COURT: Any objection?

MR. CLARKE: Your Honor, I just object because I really haven't had an opportunity to review this. I understand there was a thumb drive that was made available for us this morning, but I don't have a computer here to look at it. So I think it's improper to be introducing that in this manner.

THE COURT: Were you provided with the alignment sheets previously, pursuant to discovery?

MR. CLARKE: Your Honor, I've been provided with a number of sets of alignment sheets. So I'm not sure what's on that drive.

MR. MASSIE: Well, I would represent to the Court that these are the alignment sheets produced in the case, and also the alignment sheets on file with FERC.

MR. ELIJAH HOWARD: Your Honor, I'd also like to object as well, due to the fact that the alignment sheets that he referred to as well, after spending six hours reading their instructions, I was informed by his office that they were unfindable, there was no parcel numbers, even using their instructions, and mine weren't even on there. So, therefore, I don't understand what is even on these new ones being submitted.

MR. MASSIE: I just -- may I answer that, Your Honor?

THE COURT: You may.

MR. MASSIE: In your case, you asked us where your property was, and you were given exact locations to go to to look, correct?

MR. ELIJAH HOWARD: Right, and they were not there; they didn't exist.

THE COURT: I am -- since we're at a preliminary injunction hearing, where the standards are not as formal, I'm going to admit the thumb drive. If you find that there are errors in the thumb drive that you wish to bring to the Court's attention, you may do so.

MR. CLARKE: Thank you, Your Honor.

THE COURT: Thank you.

(Plaintiff's Exhibit 4 admitted)

BY MR. MASSIE:

Q You also mentioned acquisition, Land. Is that a group that is also responsible to you?

A The Land Group that's responsible for obtaining the route for this pipeline is responsible to me to obtain that land. The direct company employees and the contractors that work in that aren't directly in my supervisory chain.

Q Are you aware that Land is preparing maps showing the approved route over individual tracts?

A I am.
Q And have you looked at the exhibit maps filed in this case?
A I have.
Q And are those exhibit maps maps that have been created to show the approved route over individual tracts?
A Yes, sir.
Q Has Land attempted to acquire easements from owners affected by the pipeline?
A Yes, sir.
Q And what success have you had?
A In the project as a whole, we've acquired approximately 85 percent of the tracts to build the project. The remaining tracts that we haven't acquired are the tracts that are involved in this court, as well as a similar proceeding in northern and southern West Virginia.
Q And have offers been made to the people in the path of the pipeline?
A Yes, sir.
Q At least $3,000 to each?
A Yes, sir.
Q Were you able to acquire the tracts by agreement?
A 85 percent of them. But none that are here that we're talking about today.
Q Do you have construction contracts in place to build the

pipeline?
A Yes, sir.
Q Describe what they are, please. And unless it's necessary, if you need to withhold confidential or proprietary information, the Court may let you do that. But just describe them generally.
A Okay. As we sit today, there are -- the pipeline is -- the main pipeline construction has been awarded to three general pipeline contractors, each of them building a segment or segments of the pipeline. The approximate 303-mile length has been divided up into nine mainline segments and a couple of minor segments that go along with it. Each of those segments will be built, simply put, by a pipeline construction crew.

In addition to that, there are 12 contractors that have been identified to build the compression stations in the interconnect facilities, and they're divided amongst six companies to do the civil engineering and preparation work, to build the site where that facility will be, and then six general contractors to do the mechanical construction of that facility.

MR. MASSIE: Approach again, please?

THE COURT: Certainly.

(Plaintiff's Exhibit 5 marked)

BY MR. MASSIE:

Q I show you a group of documents marked as Exhibit 5. What are those?

A These are the master construction services agreements with the various contractors. And then in addition, there are the purchase orders that govern the specific work, that make reference to the master services agreement in terms of how things will be done and what controls those things.

MR. MASSIE: We offer Exhibit 5.

THE COURT: Any objection?

MR. TEANEY: One moment, Your Honor.

MR. DeTURRIS: I would --

THE COURT: Mr. DeTurris?

MR. DeTURRIS: Well, are you admitting this as all of the construction agreements, or as a sample of one?

MR. MASSIE: I believe the witness testified that these are the construction agreements and purchase orders.

Just as an aside, there may have been some duplication in the production of copies, but this is meant to be a complete set.

MR. DeTURRIS: You're representing it's a complete set. I just can't judge that here, standing, in one minute. But you're saying it's the complete set?

MR. MASSIE: That's our intention and our hope.

MR. DeTURRIS: Okay. No objection.

THE COURT: All right. Admitted without objection,

then.

(Plaintiff's Exhibit 5 admitted)

BY MR. MASSIE:

Q Okay. Mr. Cooper --

MR. CLARKE: Your Honor?

THE COURT: Yes?

MR. CLARKE: I'm sorry, Your Honor. Stephen Clarke.

THE COURT: Yes, Mr. Clarke?

MR. CLARKE: Could they just -- could the witness just identify the documents he has by the series of Bates numbers on them, just to confirm that we have the same set that the witness has?

THE COURT: Certainly.

If you could do that -- do you understand what Bates numbers are?

THE WITNESS: I do.

THE COURT: Very well.

THE WITNESS: It will take me a moment to leaf through them.

THE COURT: Sure.

THE WITNESS: I'm showing the first document starts with MVP001-0007. And that's the signature. I'm just making sure that I haven't thumbed past the start point. Pardon my delay.

It appears that that -- it appears the first master

services agreement, the last Bates number on that would be MVP001-0079.

MR. MASSIE: Proceed, Judge?

THE COURT: Well, and then there are other documents after that?

THE WITNESS: Yes, ma'am.

THE COURT: All right. So my last page is MVP001-0303. Is that correct?

THE WITNESS: That is correct.

THE COURT: Anything else, counsel?

MR. DeTURRIS: I believe his testimony was that there were three master services agreements. I was just wondering if he can identify where they all start and begin. That would be helpful for us.

THE COURT: Are all three included in this exhibit, sir?

THE WITNESS: That's what I'm leafing through now, Your Honor. Give me just a moment, please.

THE COURT: Certainly.

While he's doing that, I'll let the people -- I should have announced this at the beginning, and I failed to do so. But if anyone is having a hard time hearing, we have some headphones that might assist. So if anyone -- you can raise your hand if you request a set of headphones, but I'll be glad to -- we have a couple pairs here.

Would anyone like a pair of headphones? I see some people in the back. I'm sorry I didn't do this earlier. Just make sure you don't go home with them.

THE WITNESS: All right. Bates numbers MVP001-0080 through MVP001-0152 are purchase orders, issued to one of the master services agreements.

The next master services agreement begins with MVP001-0153, and I believe its last page is MVP001-0218.

Bates numbers MVP001-0219 to MVP001-0226 is a purchase order that's associated with one of the master services agreements.

The next master services agreement begins with MVP001-0227, and the last page for that master services agreement is MVP001-0294.

BY MR. MASSIE:

Q And does that -- I'm sorry. Go ahead.

A One last document. There's a purchase order that begins with MVP001-0295 and ends with MVP001-0303.

So to be clear, the documents that were presented in front of me represent the master services agreements for the three mainline pipeline contractors and their associated purchase orders. The mechanical and civil contractors that are associated with facilities, predominantly the compression stations in West Virginia, are not within this group of documents.

Q These are the mainline contractors?
A This is the pipeline construction service agreements, and the purchase orders that are associated with them.
Q Thank you.
THE COURT: And the stations, you said, are not in Virginia; is that correct?
THE WITNESS: The three compression stations are in West Virginia.
THE COURT: All right.
THE WITNESS: Ultimately, there will be one interconnect, which is the terminus at Transco in Pittsylvania County, and its contract isn't represented.
THE COURT: Thank you, Mr. Cooper.
Anything else, Counsel, Defense Counsel?
MR. DeTURRIS: I'm okay now. Thank you.
THE COURT: Very well.
Mr. Massie, we've come to 12:30, so I think this is a pretty good break. I do want to go ahead and allow our IT people to set up the courtroom number two. So let's go ahead and take our lunch break now, and we will resume at 1:30.
But I do want to ask counsel if you can give me an estimate of how long you think we will be in proceedings today. How much more do you anticipate? And I know we just started with this issue. So Mr. Massie, can you give me an estimate?

MR. MASSIE: Well, my part with this witness, I estimate at 30 minutes additional. My part with the next witness, I estimate at 20 minutes. I can't judge the cross-examination.

THE COURT: I understand that.

MR. MASSIE: I'm not sure about that.

THE COURT: All right. And we'll have arguments after all of the witnesses, too.

Counsel for defendants, any idea?

MR. TEANEY: I expect the cross of Mr. Cooper -- this is Derek Teaney, for the record. Cross of Mr. Cooper could go 40 minutes to an hour, depending on how in-depth Mr. Massie takes him on these documents. And then I will be doing cross of Mr. Long, so I would --

MR. TERPAK: Mr. Long, I think not that long. Five, ten minutes.

MR. CARROLL: And, Your Honor, Jeremy Carroll. Multiple counsel may also be cross-examining, however.

THE COURT: I understand. I was trying to get an overview.

MR. CARROLL: I think my cross-examination of the two witnesses would be five to ten minutes.

MR. LOLLAR: Charles Lollar. I would think ours would be five to ten minutes.

THE COURT: Okay. All right. That gives me a

better idea. And I know you have witnesses, too, though.

MR. TEANEY: That's correct, Your Honor.

THE COURT: Any idea -- have you consulted with one another? Any idea how long you'll need for your witnesses?

MR. TEANEY: Mr. Lovett has two of them. I don't want to speak out of turn for him.

MR. LOVETT: Just a guess, Your Honor, I would say -- we have four witnesses. Probably a half hour each, on average; some longer, some shorter.

THE COURT: All right.

MR. TEANEY: To clarify, that's four experts. We do --

MR. LOVETT: Four experts, oh, yeah. Then there will be landowners after that.

MR. HOWELL: Right, followed by a series of landowners with maybe 15 minutes each.

THE COURT: Okay.

MR. LOLLAR: I think that's right. That includes our landowners.

THE COURT: All right. I was just trying to get a general idea.

All right. Then let's go ahead and take a recess for lunch, and we'll resume court at 1:30. And we should have some extra space upstairs.

THE MARSHAL: All rise.

THE COURT: If you could turn in your headphones if you have them, and you can have them after lunch.

(Lunch recess, 12:31 p.m. to 1:36 p.m.)

THE COURT: All right. Good afternoon.

Mr. Cooper, if you would take a seat on the stand.

Oh, I hear myself.

Mr. Massie, do you want to try your mic?

MR. MASSIE: I'm afraid to.

THE COURT: All right.

(Off the record)

BY MR. MASSIE:

Q Mr. Cooper, does MVP have a proposed schedule for this project?

A Yes, sir.

Q And what is its proposed schedule?

A The proposed schedule is to be able to begin tree clearing on or about February 1st, so that we can manage the species impact windows, many of which close on March the 31st, and complete the construction of the pipeline facilities by the end of 2018.

Q And if you begin on February the 1st, 2018, what will be the first activities that will need to be performed?

A On the properties in this hearing, it will be staking the limits of the disturbance and felling the trees.

Q And what is the window of time that tree felling should

occur?
A For properties that are impacted by various species mitigation plans, the predominant ones, which are for two bat species, that window, for the most part, closes March the 31st.
Q And what are the circumstances behind that?
A As part of the requirements, we must go out and survey for the presence of bat portals, or bat hibernacula; and where they are known, we need to have the trees laying down before March 31st because the bats hibernate, so when they come out to begin to fly around, they don't choose the trees that we would cut down to roost in after they come out of the cave.
Q And what is the period within which you can fell trees without restrictions?
A That window opens up on November the 15th and closes March the 31st.
Q So is that winter, in essence?
A That -- it could be called winter, yes.
Q If MVP is not able to fell trees by March 31, what are the potential consequences?
A The potential consequences are that, depending upon how many properties and where that is, the project would have to be delayed for up to a year.
Q And the next window, then, to begin tree felling is

November 15?

A For the most part, that's correct.

Q And give the Court some idea of the area to which this restriction applies.

A As we said today, there are roughly 100 miles in Virginia, a little over 100 miles in Virginia. There are close to 20 that are definitely within the bat window, but based upon the portals that we haven't surveyed, that could expand to about 75.

The way this works, you have to understand if there's a portal there or not, because we're outside of a window where we can what's called mist-net or catch the bats. You have to assume that they might live there, and then the safety zone for getting the trees down to not cause damage to the species is March the 31st.

Q And if you have possession by February 1, how would the tree felling proceed?

A In those locations where the state of Virginia has approved an erosion and sediment plan, then we would ask for permission from the FERC to proceed, which would allow us to do full earth-disturbing activities.

Should we not have erosion and sediment control plans finalized in various areas from the state, then we would petition FERC to approve what's called a non-mechanized tree felling plan, in which, essentially, we would cut trees, but

leave the stumps and roots in place for erosion control until those plans are finalized from the state of Virginia.

Q And I think I tried to answer a question for the Judge earlier about that, but was my answer correct to the Judge?

A If you'll repeat your answer, I'll --

Q Okay. I don't won't try to do that. But when you say "non-mechanized," you mean what exactly?

A Simple answer: Take a chainsaw and cut a tree down.

Q And how does that interact with the erosion and sediment control restrictions?

A Hand tree felling is not considered a soil-disturbing activity, and therefore isn't required to have an approved erosion and sediment control plan and those controls in place to cut a tree.

But once you start removing the stumps and the roots and disturbing the soil, you're replacing what's already there with these approved erosion and sediment barriers during the window of construction.

Q And is it practical to skip around and cut some areas at one time and cut some areas at another time?

A It is not ideal for the tree felling to do that. Building the pipeline --

Q I'm sorry?

A I said it is not ideal for tree felling. It's -- it can be a little bit for tree felling. It does not work for the

actual pipeline construction.

Q And if you are not able to achieve possession to commence this tree felling and complete it within this time frame that you discussed, how does that translate into a year of delay and the in-service date?

A If the trees aren't down by the required window, that means you have to wait until the window opens back up. And so that leaves portions of the right-of-way that have the trees standing to go through the limitations that are on the project for the various species mitigation plans, meaning the permit assumes that there's only so much impact on the species, one of which is, in the case of bats, not disrupting the trees where they might roost.

Depending upon how much of that tree cover is left, it makes it unviable to do much construction.

Individual tracts that might leave it, on the surface may sound like, well, that's okay, you can go around them. The problem is, depending upon where that tract lies in relation to the approved access roads, which are also approved and part of the project, that tract might block access to much larger portions of the right-of-way; and even though you were able to cut trees, for instance, on land that you already had the rights to be on, you can't go in and do the other construction work, because you can't get through between the access to do the rest of the work for the pipeline.

So a discontinuous right-of-way from a tree cutting standpoint can disrupt the ability to do the whole project.

Q Well, you're asking now to start on February 1st. And the next window, you said, was November the 15th, correct, for the bats?

A Yeah, the next fully assured window is November the 15th.

Q And what -- that would be called the winter season for construction as well, I guess?

A Well, it would be the winter season for tree felling.

Q Right. But as far as any construction of the pipeline, what are the differences in the schedule to work in the winter versus work in the summer?

A Part of what translates into a longer delay than, say, a month-for-month if you delayed on the trees, is that if you don't complete the work during what we'll call the summer, or spring, summer, fall, when you get into the winter months, the ability to work is made much more difficult.

We all know what it's like to be in the cold. We've had a lot of cold here recently. It's just harder to do everything. It also becomes much more constraining from assuring that the way we're constructing the pipe is done in a safe manner. We also have different moisture content, that also then makes things more difficult for us to maintain those erosion and sediment controls.

All those examples greatly slow down the efficiency of

work, particularly December, January, and February, and even March, on the right-of-way.

So it ends up taking a lot longer to do the same amount of work during that winter time frame. You have a lot more days where you're just completely off the right-of-way, particularly if you get a cold snap and you freeze the surface and it's a little moist underneath, because it makes it difficult for the construction equipment to maneuver without sliding. So that winter time period becomes very inefficient and lengthens the time in which the project has to work.

Q Now, if the project were delayed a year, have you looked at the financial consequences of that?

A We have, sir.

Q And what are the categories of consequences?

A Things that we've been able to identify include:

Lost revenue to the partners.

Penalties that we will have to pay to the various contractors that we've signed up to cancel their contracts for this year, because they view it as they reserved this work and if we cancel it, then they've lost opportunity to collect other work, so there are terms in the contract to pay them penalties.

There are expenses that the project will incur during that delay period that involve keeping the project going,

managing the materials, managing the other things that are necessary to be ready to go to work in the following year. So those are the things for us.

There's also the delay in tax revenues, and the delay in the money that would be spent in the area, either from the construction work force, which is expected to be close to 6,000 during the construction time frame, and then the money that they would spend in the community, everything from hotel rooms to gas to meals, supplies that will be purchased by the various pipeline contractors to build the pipeline, et cetera.

Q All right. Well, let's go back to the top of the list, the lost revenue. Explain what you mean by that.

A As we discussed earlier, this pipeline is fully subscribed by the shippers. So when we can place the pipeline and its facilities in service, the monthly reservation charged to make the pipeline available to the shippers will be between 40 and $50 million a month. That's the revenue that Mountain Valley Pipeline receives for being able to transport 2 billion cubic feet of gas a day.

Q All right. And if you take 12 months as a delay period, or possible delay period, is that 12 times the numbers you just mentioned?

A Yes, sir. So it's -- it's a substantial amount of money that is not provided back to the partners in the project for

their spending the money to build it and use that revenue to do the other things their businesses would do.

Q Well, is it possible that that money is going to be earned at some point in the future, just not this particular year?

A One can make the argument that because the revenue under the project starts once you go into service and that 20-year term starts then, that that $40 to $50 million a month is received on the last year of the contract, 20 years later.

I have a personal opinion -- and if I'm allowed to say that, I will -- that it's hard to get that back.

MR. TEANEY: Objection, Your Honor. It appears that the witness is about to offer an opinion, and he has not been qualified as an expert to offer opinions.

THE COURT: Mr. Massie?

MR. MASSIE: I think it's a calculation and it's not really an opinion, but -- and I think he is qualified fully, most knowledgeable on this whole project.

THE COURT: Well, perhaps you can establish a foundation.

MR. MASSIE: Sure.

THE COURT: And I'll sustain the objection by Mr. Teaney at this point.

MR. MASSIE: Okay.

Well, let me go at it a little different way, all

right?

BY MR. MASSIE:

Q The suggestion has been made, right, that receiving $40 to $50 million a month 20 years from now, or some indefinite time period from now, is the same as receiving that money today.

As a manager of this project, is that a correct assumption?

A If the revenues for that time period don't show up, each of those businesses who would have had that available to them to do things in 2019, they will not have it available. That's the basis for my answer.

Q The first year that they would have that, then, would be the first year that the project goes into service, correct?

A That's correct, sir.

Q You also mentioned additional construction costs. Are you familiar with the construction contracts?

A I am, sir.

Q Did you negotiate the construction contracts?

A I was involved in negotiating the contracts, yes, sir.

Q Did you approve the construction contracts?

A Yes, sir. One of them was signed by my predecessor, but I was involved in the purchase orders that -- understand, there's -- the master services contract that we discussed, that's the governing document of how the contractor and MVP

will interact. The purchase orders govern specific items, and, in particular, the pay items and how they will be executed.

So I was involved in all the purchase orders. One of the MSAs, I was not.

Q And are you familiar with the consequences of beginning work now versus beginning work later under these contracts?

A I am, sir.

Q And would you explain those consequences to the Judge, please?

A As I mentioned earlier, because the contractors view this as a reservation charge, and have signed up to do a job and be paid money to do that, there are terms in the contract that allow for a couple of categories that we call delay or work cancellation charges. The delay charges tend to be additional compensation, as it takes longer to get started.

As an example, from a limited notice to proceed standpoint, if we exceed a certain date and still haven't allowed them to begin to cut trees, the concept is, in order to get the trees down by those restriction dates, they will have to hire more tree clearers than they had envisioned in their base contract. They will have to pay them more overtime to cut trees in a more condensed manner. Each date you progress closer to the deadline, the monetary charge for doing that escalates, until you get to the point that it's

moot because it's nonviable.

Similar charges occur from the standpoint on the construction of the pipeline, because the way the contract is structured, the expectation is that they start and they finish by their contracted date. So as you delay further out letting them start construction or mainline activities, the same concept applies. In order to complete by the date that's anticipated, they'll have to make adjustments in how they planned on staffing and operating the job. And so there's additional costs to make that happen.

Ultimately, if we were unable to build the project this year because of continued delays, the contracts also have termination charges that say, I signed up to work with you, I intended to work with you, I anticipated that I would be having revenue and doing a job, and now you're telling me no. So there's a safety net for the contractor to at least have some revenue, even though we wouldn't be building the project. And so those items get paid in an escalating manner as we go through the spring.

I think the terminus date on the last one, if you got that far out, is in either June or July, without referencing the paperwork directly.

Q And have you estimated the additional construction charges for an in-service date of 12-18 versus 12-19?

A If we had to incur all the charges that are anticipated

in the contracts in aggregate for the pipeline project, it would be approximately $200 million.

There's a very minor amount of that that's associated with the facilities. The majority of that would be for the pipeline contractors.

Q Now, you mentioned a third category of loss. I think you described it as overhead, or additional expenses of the company.

A Yeah. There's several factors that go into that category, one of which: You have individuals that are working. You have to pay their wages and salaries and benefits for that delay period while you thought you were working and now you aren't, and then you'll have to pay them on the back end.

There's functions that aren't contracted, or aren't at least stoppable, during that window when you're not constructing. So you want to retain those folks.

In a lot of cases, it's about retaining the talent that you've acquired, because if you release them -- you've picked people who you know can do this job and work in this terrain to build this pipeline correctly, and if you release them and say, I'm sorry, I don't have any work for you, they are going to go find somewhere else to work. And they may not be available to us when we want to start up, you know, in the following year.

There are rents on facilities we have where equipment and materials are stored. There's the individuals associated with running those facilities that have to be here longer.

There are some other things that are kind of unique to this project, one of which is the pipeline material. The pipeline is coated with a protective material. It's an epoxy. As it sits in the sun, it ages or oxidizes and actually becomes thinner. And so we have to continue to monitor that and inspect it. And prior to it becoming -- there's some margin when you coat it, but prior to it becoming too thin to use, you have to protect it from the sun. And so that includes either some sort of additional temporary coating, or the other thing you can do is you can restack the pipe.

It's kind of like turning over when you're sunbathing: You take the part that's seen the sun and put it on the bottom and you put another part on the top. Because the coating needs to be protected, you have to do that very carefully.

And the pipe that would need to be restacked -- which isn't nearly all of the job, but the pipe that would need to be restacked, should we get this delay, the physical cost of handling it to restack it is about $1 million. So that's one example of additional costs that occur if we get delayed.

Q And what is your estimate of the total such cost?

MR. TEANEY: Your Honor, at this time, defendants would object to the calculation or summary of these numbers, and that's based on discovery in this action.

The total value was not provided by MVP until an answer for interrogatory. They did not provide the documents that supported that number. We asked about those at deposition; they have not been provided to date. We don't have the documents that are about to support the number that I believe they're trying to elicit from the witness.

Because those documents would have been responsive to discovery requests that were propounded, and because of the ongoing obligation to supplement discovery under 26(e), we believe that the number would be excludable under Rule 37.

MR. MASSIE: Well, may I just --

THE COURT: You may respond.

MR. MASSIE: -- inquire of the witness on this and build a little better foundation for his answer?

THE COURT: You may.

BY MR. MASSIE:

Q All right. Was this a category of expense that was discussed at your deposition?

A Yes, sir.

Q And did you go over the concept of these charges at your deposition?

A Yes, sir.

Q And multiple witnesses asking you about the same topic?

MR. TEANEY: Objection. I believe these are leading questions at this point, on direct.

THE COURT: Mr. Massie, if you would refrain from leading, please.

And I note the objection was by Mr. Teaney. If you would say your name just for the record when you object, I would appreciate that.

MR. TEANEY: Certainly. In the future I will, Your Honor.

THE COURT: Thank you.

BY MR. MASSIE:

Q So do you remember how many attorneys questioned you on this topic at the deposition?

A I don't, sir, but it was more than one.

Q And did you answer the different categories that go into this topic at the deposition?

A I did, and I tried to explain how we had developed the number.

Q And did you give a total number for your estimate at your deposition?

A Yes, and that was 40 to $45 million.

MR. TEANEY: Objection, Your Honor. That's the number to which we are objecting.

THE COURT: I'll strike that.

MR. TEANEY: Thank you, Your Honor.

MR. MASSIE: All right. I'm just leading up to it.

THE COURT: I understand.

BY MR. MASSIE:

Q And was this estimate also in the answer to interrogatory?

A It was.

MR. MASSIE: I would only say in response, Judge, that the number was given in the answer to interrogatory, and it was given at the deposition and he was questioned about it at the deposition. And he -- there's no new information about it.

There was a request for an itemization of it. The deposition concluded Tuesday night at 8 o'clock, or something like that, and last night I was able to give an itemization of it to counsel. So that's the history of the discovery issue on that.

THE COURT: Are there any documents that support that itemization, Mr. Massie?

MR. MASSIE: It was not -- as we understood the conversation at the end of the deposition, it was a question, Can you give us an itemization? I don't recall anybody asking us for all documents on this.

That was one of the problems that we had with the original request. And if you remember, the solution was that

we would try to provide an answer in a deposition, and hopefully that would be adequate discovery on the issue. So I feel like we have provided an adequate basis for this in including an extended deposition on the topic, plus an itemization, which I'll grant you was not provided until last night, but that's what we understood the request to be from the deposition just two days before.

THE COURT: Thank you.

Mr. Teaney, anything else?

MR. TEANEY: Thank you, Your Honor.

Just to reply, my recollection of the deposition is different. I believe that -- and, unfortunately, we don't have the benefit of the transcript, but I believe I asked Mr. Cooper about documents that supported it and asked for a supplemental provision of those documents.

The challenge here, I think, without having the documents to probe this number, I went out -- this is a horrible example, but I went out for lunch today and I spent $15. And when I try to expense that, my boss will probably say that's okay without a receipt. If I came back to my boss and tried to expense a $45 million lunch, he'd want to see the documents from me to establish what exactly I had for lunch.

And when we're talking about a number as high as the number that they're trying to establish here, you know, I

think we're entitled to see the basis for it. And that's the basis for the objection.

We are unable to probe sufficiently that information. If there are -- if documents responsive are available, they should have been provided. They were not. Rule 37 provides for the exclusion of the information.

THE COURT: I'm going to overrule the objection. I'm going to -- I'm not going to preclude the testimony of the estimate, but I -- that will go to the weight that the Court gives that testimony.

MR. MASSIE: Thank you, Judge.

MR. TEANEY: Thank you, Your Honor.

BY MR. MASSIE:

Q So the question, which you may have already answered in response to my dialogue, was: What was your total estimate of this category of expense?

A The estimate provided was between 40 and $45 million.

Q Now, in addition to these types of damages, are there any intangible losses that MVP will suffer from delay?

A Well, certainly the ability to elicit other business from other shippers that may wish us to become their transporter and build them a project. It will bring great doubt in their mind that we can complete the project as contracted.

It also has the ability to make it difficult for us in our negotiations when we resume with the other pipeline

contractors to come back. They're certainly going to be much more wary of entering into the contract, which may either make it difficult to find workers or make it difficult to find workers at similar costs.

Q May we look at page 28 of the FERC certificate?

Do you recognize this provision?

A I've seen it, yes.

Q And would you simply read it for the record, please?

A "The proposed projects in this proceeding, are designed to primarily serve natural gas demand in the Northeast, Mid-Atlantic, and Southeast regions. Through the transportation of natural gas from the projects, the public at large will benefit from the increased reliability of natural gas supplies. Furthermore, upstream natural gas producers will benefit from the project by being able to access additional markets for their product. Therefore, we conclude that the proposed project is required by the public convenience and necessity."

Q That is the finding of FERC in the certificate order, correct?

A That is correct.

Q And are each of these items that are mentioned here dependent on the in-service date for the project?

A That is my understanding.

Q That is, both the ability of producers to ship and the

ability of consumers to receive are dependent on the in-service date for the project, correct?

A Correct. The gas moves from either end until it's done.

Q Now, you also mentioned, I think, the total cost for the project?

A The management committee for the project has approved a capital budget of $3.7 billion.

Q And you mentioned an expected employment from the project?

A When we're into mainline construction this summer, we should have approximately 6,000 workers, including the construction staff, the inspection staff that oversees the construction staff, and various support groups to manage the different tasks that go on during the construction process.

Q And you also mentioned indirect effects on the economy from this project.

A Yes. There's some. Completion of the project when it's done is about $7 million in taxes in the state of Virginia, the Virginia portion of the project.

MR. TEANEY: Objection. I don't know if -- this is Derek Teaney, for the record. I object to the question and the answer and move to strike them. I think they're calling for information that the foundation for his knowledge has not been laid.

THE COURT: Again, Mr. Teaney, I would appreciate

your objection when the question is asked.

Mr. Massie, would you like to respond?

MR. MASSIE: Well, I think your point is a good one, Judge. But beyond that, I think as project manager, he would be familiar with the prospective benefits of the project, and I think he's familiar with the research that's been done on these topics and published by the --

THE COURT: Well, maybe you can establish that foundation first.

MR. MASSIE: Okay. I will.

THE COURT: I'll strike it. I'll strike it for now.

MR. MASSIE: All right. Thank you.

MR. TEANEY: Thank you, Your Honor.

BY MR. MASSIE:

Q Just as far as the tax figure is concerned, where does that come from?

A There were studies and reports that were done as part of building the pipeline. It's my understanding those are reports that have been filed with FERC and are available. And I'm repeating the numbers that I've seen from those reports.

Q All right. And it is your understanding those are filed reports with FERC?

A That is my understanding, yes.

Q So they would be a public record of this number?

A That's my understanding, yes.

MR. MASSIE: All right. We offer the number: 7 million.

THE COURT: All right. It appears there's no objection, so that will --

MR. TEANEY: No objection.

THE COURT: The Court will accept that. Thank you.

MR. MASSIE: Thank you, Judge.

BY MR. MASSIE:

Q All right. If the Court allows possession, possession of the property, can you tell us how the work will proceed?

A Yes. It might be helpful if I had a diagram, but in general --

Q Hold on. I'll get you one.

MR. MASSIE: May I approach, please?

THE COURT: You may.

(Plaintiff's Exhibit 6 marked)

BY MR. MASSIE:

Q Okay. Mr. Cooper, I'm showing you what's been marked as Number 6.

MR. MASSIE: For counsel's reference, this is part of the project -- yeah, you've got it. Okay. You're ahead of me.

BY MR. MASSIE:

Q Tell me what Exhibit 6 is, please.

A Exhibit 6 is a drawing with some labels that provides the basic steps of how a pipeline is constructed from the beginning until restoration is complete.
Q And is it a reasonably accurate depiction of the process in this case?
A Yes, it is.
MR. MASSIE: We offer Number 6.
THE COURT: Any objection?
MR. TEANEY: No objection.
THE COURT: Admitted without objection.
(Plaintiff's Exhibit 6 admitted)
MR. MASSIE: May we display it, please?
BY MR. MASSIE:
Q Okay. Mr. Cooper, take us through the process, please.
A All right. Starting with the portion that's labeled Number 1, the first steps that you do is you go out and stake the right-of-way; survey where you're going, and then stake accordingly.
In our particular case, we'll go out and stake the limits of the disturbance prior to knocking the trees down. Obviously, during that process, you'll have to go back and re-stake that before you start doing the other activities, because you'll knock a lot of them down as the trees fall.
The next step will be clearing the trees, which then we'll go next with grading. Sometimes there's a word known

as "grubbing." That's where you're actually removing the stumps and the various things that are there to prepare the other activities.

Block 4 depicts stockpiling the topsoil. The way we build these pipelines, we preserve the topsoil, because it helps in restoration, and then we have to preserve it in a pile so it's there to use at the back end. It just doesn't get mixed in with the other earth that we disturb.

And then in 5, then we'll, as it depicts -- it says re-stake the center line. There's also a lot of other staking that goes on. We'll have to stake all the various boundaries, limits of the disturbance, various restrictions around wetlands and water bodies and other things that we're required to under the permits.

And then, after we've got things surveyed off, in here, we've also installed the erosion and sediment control plans as approved by the two state agencies, so that as we have removed the soil, we have other controls to protect the various hillsides and land while we have taken away its natural cover.

And then we begin ditching. Slightly different than the picture in Number 6. This shows a trencher that's done by a wheel. We probably will not do very much of that because of the terrain and because of the fact that we're not flatland in Oklahoma, where you can just plow through it very quickly.

Most of ours will be done by excavators, so they will scoop the right-of-way essentially a bucket at a time.

There will also be some places where there's rock, and in a lot of cases that can be removed with an excavator. And we have other approved techniques in the process to do that if the excavator can't.

Then we prepare the trench bottom. So as we put the pipe back in, imagine that it needs support, but you also have this protective coating on it. So you don't want to leave sharp edges and rocks and other things in the right-of-way, because that then impedes your ability to protect it from corrosion years down the road. So we'll prepare the trench bottom and smooth it out and get it padded.

And then we do this step called stringing the pipes, and that's where we take the pipe from storage and we lay it out on the right-of-way.

Once we do that, in step 10, what that is depicting is, even though this pipe is large, we can actually bend it in the field. So to begin to manage the contours, both left-and-right and up-and-down, we -- for lack of a better word, we custom-fit the pipeline to the trench that we're able to dig.

In places, there's limitations on the bend, because, as I said, there's a coating that we've put on it. On those places where we can't bend sharp enough to stay within the

approved right-of-way, we have purchased premade fittings that are of a sharper angle that then get welded in and substitute for bending of the pipe.

So once we've figured -- you know, laid those all out, then we begin to line those up and weld them together. So you are beside the ditch; you weld several components together. You have to test those welds to make sure they've been installed correctly, and then you provide a coating on those welded joints to make sure they're protected from corrosion as well.

There's several steps to that. This pipeline will have both manual welding, where you have individual men and women who lay weld material, and we'll also be using automated machines that will put the welding in as well.

Once that's done, step 13 basically shows us surveying so that we know what pieces of the pipe are where. That's called as-building the footage. That helps us true-up from minor deviations from the original design drawings.

Then we inspect it. Volumetrically, we'll either use what's called an X-ray or a radiograph. There are some techniques where you use ultrasound. And you validate that that weld has been made according to the procedures you've done so that it is strong and being able to be used in the ground.

Then once we've done those steps, we'll go along --

step 16 shows us inspecting that coating. And there are repair techniques if there are minor damages that occur.

And then in 17, we take those segments that we've built, and in certain groups, we lower that into the ditch. And then, again, we make sure that we know where it's surveyed from a depth-of-cover standpoint, and then we begin the backfilling process.

And then when that's done -- and backfilling also includes standards and specifications to make sure what goes in on top of the pipeline doesn't have material in it that will damage the pipe. It's also done in the beginnings of how we install the various controls to manage water intrusion onto this disturbed right-of-way until we get it revegetated.

Then we will test the pipeline in segments. That's known as hydrostatic testing. We'll essentially fill the pipeline with water, raise it to the required pressures to validate that the pipe has the integrity to hold the gas when we put it in it, both from the pretested spiral welds and straight-seam welds that the manufacturer of the pipe made, as well as the welds that we installed and have already looked at them volumetrically. Now we test them for strength. Then we have to dry that pipe, clean it up, get it ready for service.

And then once we've completely got the top in place, ultimately then what we do is we put the topsoil back, we put

the vegetation back as it's required, and then we have to continue to monitor that until such time as we get the vegetation back that the various permits require us to be before we can leave the right-of-way.

We have to manage the erosion and sediment control devices that are keeping the soil there until we get enough natural growth that it replaces that. Then we can remove those erosion and sediment control devices and ask to be released from further monitoring of the right-of-way from, ultimately, FERC, but also the state environmental control agencies.

Q Now, to reach an in-service date, how many of these steps would have to be completed?

A We have to be out through 20, item 20. We've got to be hydrotested and tied in, meaning the pipe is connected from beginning to end, and all of the tests have been associated. And then we can begin the in-service process.

Q Even though there's some reclamation to be done?

A Correct. There will be an initial reclamation as you put the pipe together, but we'll have to monitor the pipe to the requirements of the certificate, and also from the various state agencies.

In this case, the National Forest and the other federal agencies we'll be crossing each have their own requirements on making sure that before we're released from managing the

right-of-way, that it has been revegetated.

Those steps can go on after the pipeline begins its service life, and always does, or in my experience has always done that.

Q Now, is there a term "menial construction," or "menial construction method"?

A That's essentially what I've described here. Because, as you see in the drawing or as I've described it, there are several different types of pieces of equipment, and so as you break these steps down, what you're essentially doing is starting at a point, and you wish to go to that point and go to another point, and work each of these steps in sequence, so that the folks that are doing, for example, the trenching are staying ahead of the people that need to be preparing to bond the ditch, who are staying ahead of the people that are stringing the pipe, bending the pipe, welding, and so on.

So you start the train, if you will, and then that train works along the way. And then, if you can't go somewhere, you have a property that you didn't get the trees cleared on, or that you don't own, you're left with the option of you have to stop that, and then gather up all these various segments as they get to that endpoint and remove them off of the right-of-way and move them around to the next place that they can work. And that may not just be the next property. Depending upon where the next access road is and the terrain

between those two, it may block off a much longer linear segment of the route that you can begin to then come back in and do these detailed steps.

Obviously, if you do skip around, then at some point when you're capable of coming back to that, then you repeat all these steps at the places in between. But you can't get, essentially, step 20 and then in-service completed until you've connected the segments from beginning to end.

Q And is it practical to skip around a large number of properties like those involved in this case?

A It is not.

Q This certificate was issued on October 13, 2017, correct?

A Yes, sir.

Q And since that time, has the company filed implementation plans with FERC about completion of the work or describing its progress towards beginning the work?

A Yes.

MR. MASSIE: Sorry, I forgot to ask.

THE COURT: That's fine. You don't need to ask each time.

MR. MASSIE: It's okay to walk around?

THE COURT: Yes.

(Plaintiff's Exhibit 7 marked)

BY MR. MASSIE:

Q Okay. Mr. Cooper, I've shown you what's been marked as

Exhibit 7. Can you tell us what that is, please?
A The beginning of it is the implementation plan as filed on October the -- October of 2017.
Q And was that your first implementation plan?
A Yes, sir.
Q And in it, does the document describe the status of conditions, for instance?
A Yes, sir.
Q And what other information is provided? Just general topics.
A It's the supporting documents that support what we're saying on those items. As part of the certificate, there are certain requirements of things that FERC wishes to see done before you can work; most usually in a specific area, but some of these conditions involve some administrative and other things that you have to do globally with a project. And so these documents provide the basis whether we go back to FERC. And they establish the condition; we provide them either our evidence that we believe we've satisfied it and turn that in to them, or we provide them an update on the status of that at the time of the filing.

Any of those that are left open or unresolved require supplemental filings as you go forward and complete those activities and the work.
Q And has MVP made a supplemental filing?

A Yes. I have to look and see if it's attached in here.

(Plaintiff's Exhibit 8 marked)

BY MR. MASSIE:

Q Is it Exhibit 8 in front of you?

A Why, yes, it is.

So on December 20th of this year, we supplemented the initial filing. The certificate had 40 items in which they wished us to complete or do certain activities. So as of this filing here in December, it only addresses those items that were remaining open and that needed additional support as of this filing.

Q All right. And I believe Number 8 -- you can correct me, but is that an abbreviated version without all of the exhibits, to cut back on some -- to save some space?

A Yes. This appears just to be the text of the conditions and the status, without all of the supporting documentation that goes with it.

MR. MASSIE: We offer 7 and 8.

THE COURT: Any objection, Counsel? Or Mr. Howards?

MR. TEANEY: No objection, Your Honor.

THE COURT: Admitted 7 and 8 without objection, then.

(Plaintiff's Exhibits 7 and 8 admitted)

BY MR. MASSIE:

Q And based on your work to date, when does the company

expect to receive a notice to proceed from FERC for the initial work of tree felling?

A In Virginia, or at all?

Q Well, project-wide.

A Project-wide, we've requested a limited notice to proceed to start some work in West Virginia. We had requested that staff reply to us by today. They had asked some other questions earlier this week; we believe we've responded to those. So we will be expecting their response either today or the first of the week, unless there's some other question that they need answered. I --

Q And in Virginia?

A In Virginia, we haven't asked for anything yet, predominantly because we need to work through this proceeding.

As has been stated in my deposition, and I think already here by some of the other folks, we currently don't have the approved erosion and sediment control plans from the Virginia Department of Environmental Quality. We obviously have been working with that staff and that department for many months on getting those approved.

And to explain what those are, as you get to wetlands or water bodies or stream crossings or the general things for the right-of-way, there are different techniques on how we manage erosion of that bare soil off of the area that we're

allowed to disturb.

You'll hear the term "limits of disturbance." The idea is that's the maximum boundary in which we're allowed to work in, and we need to keep the soil and those erosion activities inside of that. It also identifies things like, as we get close to a stream crossing, how we manage that.

Storm water management is a supplement -- or not supplement, but it's related -- on how you're going to manage not just the erosion during the work, but how you're going to manage storm runoff up until the point that full restoration is done.

So the status of where we are now with them is we have worked with them on modifications and variations to those various standardized techniques. We believe we have submitted everything they want in the final modifications; expecting any day the first of the plans back.

The plans are broken up by work segments. So at the state's request, and we agreed, we worked in great detail on, one, to get the master techniques, if you will, approved, that then they can be reapplied to the others.

We essentially have all of the plans in their hands. We believe we've come to agreement on what all the controls are. So we would expect one back relatively soon, the others following.

The reason we haven't asked for specific work in Virginia

yet depends largely on the outcome of what we're doing here. If we have access to all of the properties, then we can go to the FERC and ask permission to begin tree felling; and not just tree felling by hand, but we can actually ask to go in and do the work that would include mechanized tree felling.

If we don't receive them relatively soon, because hand tree felling is not considered an earth-disturbing activity and it does not require erosion and sediment plans, we will apply to the FERC for a non-mechanized tree felling plan that will allow us just to cut the trees without the erosion and sediment plans, then followed behind that with establishing those controls and doing the rest of the work.

So we're fast approaching the window where going ahead in a normal work plan will not be viable by the species windows, and we'll have to ask for that more limited set of work to start.

THE COURT: Mr. Massie, can I ask a few questions here? I just have a couple questions.

MR. MASSIE: Oh, sure.

THE COURT: Mr. Cooper, you said you had -- with regard to West Virginia, you had requested FERC permission. Is that for tree felling only, mechanized or non-mechanized?

THE WITNESS: We've asked for -- it's a limited notice to proceed. It's for mechanized tree felling. Currently, we asked for some work on access roads and laydown

yards as the beginning steps.

In a similar manner to what I've described we're doing with Virginia, we asked for a limited scope, because there's a lot of information that the project exchanges with the FERC staff, and if this was a way for them to do a relatively quick review and give us feedback to tell us the specific information they want to see to grant the notices to proceed, because they are the master controller of going to work; and they have several things they need to verify that are in place, including the environmental conditions for the area we're asking.

THE COURT: Let me ask you this: You said -- so you've asked for mechanized tree felling in West Virginia. But you noted, in Virginia, you've not asked yet because of the need to work through this proceeding.

I understand there are West Virginia proceedings that have not reached this point yet. Is that correct?

THE WITNESS: It -- well, yes. There's two pieces, Your Honor.

In West Virginia, I have the approved erosion and sediment control plans from the state environmental control agency, so I'm allowed to do earth-disturbing activities where I have the right to be on the land. And so this limited notice to proceed only included properties that are in that 85 percent of the project that we have, versus in

Virginia, because I need to know which way I'm here. If I get clear to be able to work straight through, I will likely ask for notices to proceed to do mechanized tree felling if I have the Virginia DEQ piece.

If not, if I have the properties, then I will include them in the non-mechanized tree felling request, so that we can go into February and March and cut trees.

THE COURT: Thank you for explaining that. I appreciate it.

Thank you, Mr. Massie.

(Plaintiff's Exhibit 9 marked)

BY MR. MASSIE:

Q Okay. One more exhibit, Mr. Cooper. What is Number 9?

A Number 9 is a weekly status report. Once we have a certificate, the FERC staff require us to provide them updates on where things are, what work is going on.

Let me make sure I'm reading this correctly.

Yes, this is a weekly status report from November the 8th.

So in addition to supplements when we believe we have completed the environmental conditions, from the beginning of the project to the end, we are required to provide them a weekly update of the various activities on the project, and this is one of those reports.

Let me see if there's more than one in this paperwork

group.

Q So this stack runs from November 8, 2017 to when?

A I'm getting down to the last one, sir.

Through January the 3rd.

MR. MASSIE: We offer number 9.

THE COURT: Any objection, Counsel, or the two Mr. Howards?

MR. TEANEY: No objection.

MR. CLARKE: Your Honor, I would just ask, similar to before, if the witness could confirm the Bates numbers or the sequence of the Bates numbers, because the document that I have, they sort of skip around. I just wanted to confirm that I have what's been handed to him.

THE COURT: Mr. Massie, can you tell me, are the -- did you skip around in the Bates numbers here? Are these --

MR. MASSIE: I didn't mean to. I meant to copy sequentially the Bates numbers.

THE COURT: It looks like we go from 9276; the next one is 11132. Are each -- is each weekly report a different set of Bates numbers?

MR. MASSIE: That may be true. I'm not certain of that answer.

THE WITNESS: I can segregate them, Your Honor, if you wish.

THE COURT: Mr. Clarke, is that what you require?

Do you want him to go through and segregate these, or can you take a look at it and then, on cross perhaps, ask him questions about it?

MR. CLARKE: That's fine, Your Honor. I'd be happy to do that.

THE COURT: That's fine. Let's do it that way.

BY MR. MASSIE:

Q If the Court is willing to grant immediate possession, will MVP post a bond to secure the amount of just compensation set by the Court for purposes of the bond?

A Yes. We're willing to do what the Court requires to assure there's just compensation for the landowners.

Q Now, I believe with our original filing in this case, you gave a declaration; is that true?

A I did, sir.

Q And are the statements made in your declaration correct?

A Yes, sir.

MR. MASSIE: Those are all the questions I have. Thank you, Judge.

THE COURT: All right. Let me just note that Exhibit 9 is admitted.

MR. MASSIE: Thank you. I forgot to ask that. Thank you again.

(Plaintiff's Exhibit 9 admitted)

THE COURT: Counsel, have you agreed who is going to

go first with regard to cross-examination? Mr. Teaney?

MR. TEANEY: Your Honor, I believe I have that privilege, or burden, I suppose.

THE COURT: Very well.

MR. TEANEY: Thank you, Your Honor.

I'll note that we've gone a little bit longer than the estimated time for direct for --

THE COURT: I'm shocked by that.

MR. TEANEY: Yes. You'll probably be equally shocked when I note that I may not be able to conform to my earlier estimate of cross.

CROSS-EXAMINATION

BY MR. TEANEY:

Q Good afternoon, Mr. Cooper.

A Hello, sir.

Q Let me first note or ask, who is your employer?

A Pardon me one second, sir.

Q Certainly.

A My employer is EQT Gathering, LLC.

Q Okay. So you are not paid by Mountain Valley Pipeline, LLC?

A I am dedicated over to that project fully, and I am paid by EQT Gathering, LLC. However, the project in total reimburses the various partners if they have employees that are assigned to it.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 57

February 21, 2023

Technical Brief

UV Protection of Coated Line Pipe

Background

Fusion bonded epoxy (FBE) is a one part powdered epoxy coating that is sprayed onto the hot metal substrate where it melts, flows and cures to give a corrosion resistant coating. The first line pipe coated with FBE was placed into service in 1960[1]. Since that time, FBE coatings have become the most commonly used coating for new pipeline construction in North America. FBE coatings are formulated to meet both the requirements of the applicator who will apply the coating and the performance requirements of the end user (pipeline owner).

The primary raw materials used to formulate FBE coatings include epoxy resins, curing agents (hardeners), catalysts, pigments and fillers. Other additives may be used to control the flow characteristics, improve adhesion performance and provide other useful benefits. While there are several types of epoxy resins commercially available, those based on diglycidyl ether of bisphenol A (DGEBA) or novolac chemistry are the two epoxy resin types most frequently used in FBE coatings. While these epoxy resins can be used to make polymers with a wide range of properties and are very versatile in many ways, they are aromatic and thus have poor ultraviolet (UV) light resistance limiting their use in exterior applications.

UV Exposure – Chalking

Due to the presence of the aromatic group, epoxy resins generally absorb at about 300 nm and will degrade in the presence of UV light and humidity via photoinitiated free-radical degradation. This polymer degradation is known as chalking and results in the formation of a loose powdery residue on the pigmented coating surface. The residue on the polymer surface protects against further degradation unless it is removed. Removal of this protective barrier (either by natural or mechanical means) exposes a fresh surface which is then subject to further UV exposure and degradation.

Numerous studies have been conducted to investigate the UV degradation of epoxy resins[2-5]. One study investigated several possible weak links in amine cured epoxy systems and reported that the presence of the aromatic bisphenol moiety is primarily responsible for the absorption of UV light[6]. Modification of the polymer backbone by changing the chemistry (use of alternate diglycidyl ethers such as diglycidyl ether of bisphenol F and/or varying the curing agent) can have some impact on the degree chalking but does not eliminate the phenomena. In other words, all FBE pipeline coatings based on aromatic epoxy resins will chalk but there may be some difference in the degree of chalking due to slight differences in the chemistry of the various formulations.

Efforts have been made to improve the UV stability of epoxy products; however, to date commercial success of epoxy resins with improved weatherability has been limited[7-9]. These resins are much higher in price and end users have other ways to limit UV exposure as will be discussed later in this paper.

In addition to the susceptibility of specific FBE formulations to UV attack, the degree of chalking also depends on direct exposure to UV, the intensity and duration of the UV radiation, and the availability of water on the coating surface[1]. A pipe stored above ground experiences the most chalking on the top (12 o'clock position), less on the sides (3 and 9 o'clock positions) and little or none on the bottom (6 o'clock position). Since the degree of chalking is dependant on the intensity and duration of the UV radiation and the presence of moisture, it is not surprising that variations in the degree of chalking observed in the field appear to be geographic-location specific.

Effects of Chalking on Coating Performance

The chalking process is polymer degradation and thus thickness loss is an obvious concern. Thickness loss is caused by alternate chalking and removal of this loose surface material by wind, rain, tidal splash or blowing particulate. The rate of thickness loss depends on the rate of removal of the protective layer as well as the factors that determine the degree of chalking reviewed in the previous section. Field experience suggests that there is considerable variance in the rate of thickness loss which tends to relate to location/geography. The chalking process takes some time to get started. One study reported a thickness reduction in the 12 o'clock position of about 20 µm (3/4 mil) after approximately a year of storage in northern US and southern Canada[10]. Historical observation suggests that measurable thickness loss typically begins within 9 to 18 months[1]. Once started, the typical rate of loss is in the range of 10 to 40 µm (0.375 to 1.5 mil) per year.

As long as thickness has not been substantially reduced, weathering appears to have only minimal effects on the performance of FBE coatings. One published study of pipe coated in the US and installed in the Middle East showed no significant reduction in either flexibility or short-term cathodic disbondment tests (65°C, 3% NaCl, and 48 hour duration) after 3 years in a stockpile[11]. The Cetiner study, which evaluated pipe that had been stored for approximately one year, showed no measurable reduction in performance in either the 48-hour cathodic disbondment test or hot water adhesion tests. There was however a measurable reduction in flexibility as measured by the CSA FBE flexibility test method at -30°C[12]. Based on this work, Cetiner and coworkers recommended that pipe stored for longer than one year should be protected from UV radiation.

Again, it is important to keep in mind that the rate of chalking/thickness loss can vary considerably and is dependant on the susceptibility of the specific FBE formulation to UV attack, the intensity and duration of the UV exposure, the availability of moisture, as well as the rate at which the protective chalk layer is removed.

Common Industry Solutions

Many different methods have been used throughout the industry to protect coated pipe from UV radiation. As a preventative measure, many applicators apply additional coating thickness at the time the FBE coating is applied in order to compensate for any thickness loss that may occur during the time between when the pipe is coated and when the pipe is actually installed. The typical procedure in most cases is to provide a barrier between the sun and the coated pipe. The barrier could include any of the following:

1. Covering pipe stock piles with tarps.
2. Applying white wash to the UV exposed upper layer of the stock pile.
3. Applying an overcoat of an aliphatic polyurethane to the entire coated surface
4. Applying an overcoat of polyester powder coating. (Separate spray booths are required due to the incompatibility of epoxy and polyester systems)

Selection of the barrier is dependant on the length of time the UV exposure is expected. In the short term, a water permeable paint such as latex is sufficient. For longer term storage or permanent above ground usage, selection of the barrier coating and surface preparation are crucial. Prior to use, any UV-barrier coating should be evaluated for their ability to adhere to the FBE coating. Any residual chalking must be removed before application of a UV-barrier coating. The long-term adhesion performance of the UV-barrier coating can be improved by roughening the FBE coating surface with sandpaper or a light abrasive blast. For storage over two years; a weldable primer should be applied to the cutback area. This helps prevent corrosion in the cutback area and undercreep of the FBE coating.

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EXHIBIT 58

February 21, 2023

https://www.wdrb.com/news/ntsb-releases-final-report-in-2019-lincoln-county-pipeline-explosion/article_257f7604-3495-11ed-bcd8-f3df5b2883ae.html

NTSB releases final report in 2019 Lincoln County pipeline explosion

Sep 14, 2022

WDRB Sky Cam

LOUISVILLE, Ky. (WDRB) -- The National Transportation Safety Board has released its final report on the explosion and fire from a 30-inch natural gas pipeline near Danville, Kentucky.

In the report released on Wednesday, the agency said a "manufacturing defect" and "ineffective cathodic protection" led to the pipeline rupture.

The August 2019 accident killed one person and destroyed five nearby homes in Lincoln County. Fourteen homes were damaged and 30 acres of land was burnt in a fire.

Enbridge owned and operated the pipeline. The NTSB said the explosion happened because of a "pre-existing manufacturing defect — known as a hard spot."

The agency said that, along with degraded coating, led to cracking in the pipeline causing the explosion.

Cathodic protection prevents corrosion where the coating has been damaged, according to the agency.

The NTSB said Enbridge "underestimated the risk posed by hard spots" and that its integrity management program did not accurately assess the pipeline condition or estimate risk, contributing to the accident.

In an emailed statement to the Associated Press, Enbridge spokesman Michael Barnes said the company was “deeply sorry for the impact to the community and to the family who lost a loved one." He called the findings “a stark reminder" of the importance of safely maintaining and operating the company's pipelines.

The NTSB issued safety recommendations to the Pipeline and Hazardous Materials Safety Administration and Enbridge Inc. The safety recommendations address topics including incomplete evaluation of risks, incomplete assessment of threats and missed training opportunities.

Barnes said in the statement that the company takes the NTSB recommendations “very seriously" and has “worked diligently to understand the contributing factors to this incident and (has) made tremendous strides to change our procedures, processes and conducted extensive inspections in an effort to make our pipes safer than ever."

Enbridge pipelines carry about one-quarter of the crude oil produced in North America and one-fifth of the natural gas used in the U.S. Several of its pipelines have been the subjects of lengthy legal and political fights and two of the largest inland oil spills in U.S. history.

Victims of the explosion sued the operator in July 2020, alleging it failed to maintain and repair the line prior to the explosion.

To read the NTSB's full report, click here.

Related Stories:

- Victims of Lincoln County pipeline explosion sue line operator
- Ky. firefighter honored for saving 2 people following Lincoln Co. gas line blast
- NTSB preliminary report assesses damage caused by Lincoln County, Ky. pipeline explosion
- Family of woman killed in Lincoln County natural gas explosion files suit against pipeline companies
- Federal investigators in Lincoln County, Ky. to assess health effects of Aug. 1 gas pipeline explosion
- 2 pipelines damaged in Lincoln County explosion could be up and running by end of August
- Beshear wants broader investigation of LG&E Bullitt County pipeline
- Homeless survivors in limbo as NTSB probes deadly Kentucky pipeline blast
- Pipeline blast kills one in Lincoln County, Kentucky

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 59

February 21, 2023

U.S. Department of Transportation
Pipeline & Hazardous Materials Safety Administration

Pipeline Safety Stakeholder Communications
Pipeline Safety Connects Us All

Fact Sheet: Corrosion

Quick Facts:

- Corrosion is the natural process where materials made from metal deteriorate through an electrochemical reaction known as oxidation (rusting).
- Corrosion on pipeline systems can be prevented through material selection, protective coatings, cathodic protection systems, corrosion inhibitor additives, and line cleaning to remove water & other contaminants.
- Data show that from 1998-2017 approximately 18% of pipeline incidents on average were caused by corrosion.
- Improved technologies continue to lead to better prevention, monitoring, detection, and mitigation of pipeline corrosion, for both newly installed and existing pipelines.
- Federal pipeline integrity management regulations promote early identification of corrosion issues on pipe or pipeline equipment by requiring periodic inspections, testing, and assessments, and timely repair or replacement where necessary.
- Corrosion is considered a time-dependent threat which means it grows or worsens with time if left unmitigated. As a result, early detection and mitigation are necessary to minimize the impact of corrosion.
- Refer to other fact sheets on PHMSA's Stakeholder Communications website for specific discussions of internal corrosion, external corrosion, selective seam corrosion, and stress corrosion cracking, microbiologically-influenced corrosion, and AC & interference corrosion.

What is corrosion and why does it occur?

Corrosion is the deterioration of a steel pipeline that results from an electrochemical reaction with its immediate surroundings. This reaction causes the iron in the steel pipe or other pipeline appurtenances to oxidize (rust). Corrosion results in metal loss in the pipe. Over time and if left unmitigated, corrosion can cause the steel to lose its strength and possibly render it unable to contain the fluid in the pipeline at its operating pressure. Because pipelines are extremely long-serving and critical infrastructure, it is paramount for pipeline operators to maintain the physical integrity of pipelines. Fortunately, there are effective methods for preventing and mitigating corrosion damage to pipelines, including many that are very technologically advanced that deal with various types of corrosion. When these protective measures are effective, or when sufficient mitigative efforts are sustained, steel pipelines can last indefinitely.

Corrosion can be characterized by where and/or how it occurs. For example:

- *External corrosion* occurs due to environmental conditions on the exterior

surface of the steel pipe that can cause an electrochemical interaction between the exterior of the pipeline and the soil, air, or water surrounding it. Galvanic and atmospheric corrosion are common types of external corrosion.

- *Internal corrosion* occurs due to a chemical attack on the interior surface of a steel pipe from the products transported in the pipe. This can be from either the commodity transported, or from other materials carried along with the commodity, such as water, hydrogen sulfide, and carbon dioxide.

- *Other types of corrosion* can occur due to specific material defects or environments. These include stress corrosion cracking (SCC), microbiologically-influenced corrosion (MIC), stray current interference corrosion, and selective seam corrosion. These types of corrosion problems can be exacerbated by environmental conditions, manufacturing processes, pipe wall erosion from the transported commodity, physical location with respect to other structures, and applied stresses resulting from routine and normal pipeline operations.

What are the risks from corrosion?

Corrosion can result in gradual and usually localized metal loss resulting in reduction of the wall thickness of the pipe. If not prevented or mitigated effectively, the result can be through-wall pinholes in the pipe material or a loss of pipe strength at that location that can causes a crack or split in the pipe wall. The result is either leakage from the pipe (typical) or an open break failure (rupture) of the pipe (much less typical) unless the corrosion is repaired, the affected pipe section is replaced, or the operating pressure of the pipeline is reduced.

Where corrosion involves a longitudinal seam of a pipe or cracks in the pipe, the likelihood of a break or rupture increases. Stress corrosion cracking and selective seam corrosion are in this category. Hydrogen cracking or embrittlement can also weaken a pipeline when isolated points of elevated steel hardness exist - this is a rare material defect present in some older types of pipe.

Left untreated, corrosion can weaken the pipe where the corrosion occurs, and make the pipe more susceptible to overpressure events, earth movement, and other external stresses. Thus, corrosion can sometimes also increase the risk of other types of pipeline failures.

Pipeline failure rates from corrosion

Transmission and gathering pipelines. Historically, corrosion is one of the two most prevalent causes of pipeline failures, most often manifesting as leaks or seeps. For the 5-year period of 2013-2017, approximately 17% of reported incidents on gas transmission, gas gathering, and hazardous liquid pipelines were caused by corrosion.

Natural gas distribution pipelines. Over the same 5-year period (2013-2017) approximately 1% of incidents on natural gas distribution pipelines were caused by corrosion. Natural gas distribution system mains and service lines operate at much lower pressures and are typically made of non-corrosive materials (like plastic). Even if a gas distribution line is made of steel, the likelihood of a pipe rupture is low because of the lower operating pressures, and most corrosion failures would result in leaks.

What is being done to prevent/mitigate pipeline corrosion?

- Modern manufacturing processes for steel pipe and protective pipe coatings are subject to rigorous fabrication, inspection, and quality control standards to reduce the occurrence of defects that can lead to corrosion-related failures.

- Operators use coatings, cathodic protection systems, pipe cleaning techniques, product quality controls, and other approaches to prevent corrosion.

- Federal pipeline safety regulations require pipeline operators to develop and implement integrity management programs and continually inspect and assess the integrity of pipelines that could affect areas of high consequence, such as populated areas or environmentally sensitive areas. Operators are required to periodically inspect and assess their pipelines for corrosion and other integrity issues, and repair or replace affected pipe. Inspections are typically performed using one or more types of specialty inline inspection (ILI) tools, hydrostatic pressure testing, or a process called “direct assessment”).

Corrosion: What more can be done

- *Public*: Be aware of pipelines located near you. Always respect the pipeline right-of-way and be observant for signs of pipeline damage, leakage, or security concerns. Remember that your and your community’s safety may be involved. Know the phone numbers and call the pipeline operator and local public safety officials immediately to report any pipeline safety concerns.
  - Be observant of changes to soils and vegetation around pipelines. These could be signs of a leak. Report these and possible earth movement or other conditions that could impact the pipeline to the pipeline operator immediately.
  - Note any suspicious activity, especially at aboveground pipeline facilities such as valve or pumping stations; report such activity to local public safety officials and the pipeline operator immediately.
  - Do not dig or build on a pipeline right-of-way. Always call to have underground facilities located and marked before you dig (dial 811).

- *Industry*: Pipeline operators should follow current regulations, guidelines, and standards to ensure the integrity and security of their pipeline facilities. This includes evaluating all potential threats that may impact the integrity of their pipelines.

- *Regulators*: PHMSA must continue to work closely and in cooperation with other organizations to ensure pipeline integrity management requirements address evolving concerns. Federal and state pipeline safety regulators must continue to inspect operators' integrity management programs to ensure they are effectively identifying and assessing potential threats, including corrosion, and are implementing appropriate activities in a timely manner.

Corrosion: Where can I learn more?

- PHMSA: Pipeline Incident 20 Year Trends
- PHMSA Community Liaison Services
- NACE International
- Association of Oil Pipelines: Fact Sheets

Date of Revision: 09242018

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 60

February 21, 2023

Accufacts Inc.
"Clear Knowledge in the Over Information Age"

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Date: October 1, 2020

To: Ms. Jaclyn H. Prange
Natural Resources Defense Council, Inc.
111 Sutter St., 21st Floor
San Francisco, CA. 94104
jprange@nrdc.org

Re: Accufacts' Observations on the Use of Keystone XL Pipeline Pipe Exhibiting External Coating Deterioration Issues from Long Term Storage Exposure to the Elements

1. Introduction

This report provides my expert opinion regarding the current state of the coating on pipes proposed for the Keystone XL Pipeline, namely the risks that deteriorated fusion bonded epoxy ("FBE") coating can pose to the integrity of the pipeline and measures that could address these risks to avoid a pipeline release. External FBE coating deterioration at one major storage location on pipe to be used on the Keystone XL Pipeline is discussed in a recent article.[1] According to that article, the 36-inch diameter mainline pipe for the Keystone XL Pipeline was manufactured and FBE coated in the years 2009 through 2011 and has since been placed in outside storage. The pipe has been stockpiled at numerous sites in Canada and in the U.S. awaiting authorization for construction, which has undergone various delays. Without effective protection from the elements, it is not unusual for such exposed stockpiled pipe to undergo degradation from ultraviolet ("UV") attack and weathering, as mentioned in the article. This is especially important given the unusually long time the FBE coated pipe has been stored outside, which raises obvious questions about the adequacy of the coating's protection. The possible effects of sunlight to degrade FBE coatings have been known for some time.[2] The loss or degradation of FBE can result in significantly increased risk of an oil spill from leaks, but more likely large volume pipeline ruptures from external corrosion,

[1] Technical Article by Keith Coulson, FI Corr, James Ferguson, TC Energy, Calgary, Canada, and David Milmine, DM Professional Services Ltd, Calgary, Canada, Journal of the Institute of Corrosion Management, "Study of stockpiled fusion bond epoxy coated pipe," Issue 153, January/February 2020, pp. 16 – 21. Attached as Exhibit A.

[2] For example, see the Oil & Gas Journal article, "Stockpiled FBE-coated line pipe can be subject to UV degradation," April 16, 2001.

especially given the elevated temperature operation of the Keystone XL Pipeline. The Pipeline and Hazardous Materials Safety Administration ("PHMSA") and the National Transportation Safety Board ("NTSB") incident investigation websites contain many transmission pipeline incident investigations reflecting that corrosion is still a major cause of pipeline failure, even after inline inspection ("ILI"), or "smart pig" runs. Corrosion still remains a significant cause of liquid transmission pipeline failures and pipeline operators relying on ILI tools should know and confirm the limitations of such important assessment methods.[3]

I find the Corrosion Management article's conclusions about the Keystone XL Pipeline FBE coating especially important:

> "The non-protected FBE coatings exposed to UV for periods of up to 9 years completely failed to retain their original properties and attributes. Conversely, coatings that were completely protected from any UV exposure still possessed all their original coating thickness and physical traits."[4]

It is my opinion that all of the pipe for Keystone XL that has been stored outside should be tested to see if it meets the minimum National Association of Corrosion Engineers ("NACE") standard, such as minimum FBE thickness and proper adhesion to the steel pipe wall before installation.[5] Pipe segments whose FBE coating do not meet the minimum NACE standard should have the FBE removed and new non-shielding FBE coating reapplied utilizing quality control and quality administration procedures as stipulated by the minimum requirements presented in NACE's Standard Practice for FBE coating. Given the many interconnected safety requirements placed on the Keystone XL Pipeline by the PHMSA Recommended 57 Special Conditions, it is my opinion that the pipeline operator can proceed with the use of the pipe segments only if those segments meet the NACE Standard Practice.[6]

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[3] See PHMSA website: https://portal.phmsa.dot.gov/analytics/saw.dll?Portalpages&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FHL%20Performance%20Measures&Page=Serious%20Incident%20Rate%20and%20Cause.

[4] Technical Article by Keith Coulson, FI Corr, James Ferguson, TC Energy, Calgary, Canada, and David Milmine, DM Professional Services Ltd, Calgary, Canada, Journal of the Institute of Corrosion Management, "Study of stockpiled fusion bond epoxy coated pipe," Issue 153, January/February 2020, p. 19.

[5] NACE, "Standard Practice Application, Performance, and Quality Control of Plant-Applied Single-Layer Fusion-Bonded Epoxy External Pipe Coating," NACE SP0394-2013, revised 2013-10-04.

[6] Final Environmental Impact Statement for the Keystone XL Pipeline, "Final PHMSA Recommended Conditions identified in Appendix U of FEIS," dated April 26, 2011.

While I believe it would be a violation of the Bureau of Land Management ("BLM") permit/PHMSA Recommendations, and I do not advise such imprudent action because it would significantly increase the risk of pipeline release incidents, should the company disregard the requirements and proceed with the installation of pipe with degraded FBE coating, additional precautions should be required of the Keystone XL Pipeline that go well beyond federal minimum pipeline safety regulations and the PHMSA Special Conditions. This is especially important given the unusually high operating temperature and the associated dramatic increase in external corrosion risk threats that can be expected to significantly increase the risks of an oil spill on the Keystone XL Pipeline as discussed in further detail in this report.

Key observations supporting my opinion are explained below.

2. Experience and Qualifications

I am the president of Accufacts Inc., which is a company that provides specialized technical and safety expertise concerning hydrocarbon infrastructure including, but not limited to, such specialized matters as pipeline and pump/compressor station siting, design, operation/maintenance, integrity management, corrosion control, and pipeline safety regulatory development, especially as it relates to transmission pipelines, such as the Keystone XL Pipeline proposal. My CV is attached to this report as Exhibit B, and demonstrates my education and experience allowing me to comment as an expert on these matters.

3. Important Pipeline Coating Background

U.S. federal pipeline safety regulations require that new liquid transmission pipelines, such as the Keystone XL Pipeline, meet certain minimum standards concerning external coating on steel pipelines to reduce the potential for external corrosion attack that might cause a pipeline to fail.[7] Specifically, corrosion can cause the loss of pipe metal that can result in the failure of the pipeline causing an oil spill.

Broadly speaking, regulations require that new pipelines have two forms of corrosion control: external coating and cathodic protection, though the cathodic protection system does not have to be in operation during the first day of pipeline operation. These regulations do not define a specific coating material but rather outline basic intended requirements for coating performance. Various standards or practices have been developed to assist in guiding the industry in the application of coatings, such as FBE, over the years such as the previously

[7] 49 C.F.R. §195.559 What coating material may I use for external corrosion control?

cited NACE standard.[8] Cathodic protection, or CP, is usually intended to work in concert with a pipeline coating to help reduce the threat of external corrosion on buried pipelines.[9] While implementation of an effective CP system is much more complex and challenging in the field, a CP system for pipelines usually utilizes an impressed current approach to control corrosion of an external steel pipe surface. Impressed current design introduces a small direct current ("DC") into the pipeline segment, making the pipe segment a cathode (thus the name cathodic protection). The pipeline is also connected to a weaker, more easily corroded metal (the anode) that corrodes as the electrical current leaves the anode, thereby consuming the anode rather than the steel pipeline that the system is intended to protect.

There can be a wide variation in the effectiveness of CP systems to protect against external corrosion, especially if the pipeline is using older forms of coating, such as tape or coal tar enamels, that are shielding to the CP current. Operators should periodically survey operation of their coating/CP systems as the effectiveness of such systems can quickly deteriorate/change over time, increasing the risk of pipeline failure from corrosion. While applying to gas transmission pipelines, the recently proposed new area classification rule provides some important technical requirements concerning above ground coating surveys intended to validate buried coating and CP system effectiveness.[10] The science associated with pipe coatings and CP systems are the same for gas transmission and liquid transmission pipelines. Many gas transmission pipeline segments (usually immediately downstream of compressor stations) can exhibit elevated operating temperatures, such as those that will occur on the Keystone XL Pipeline, possibly accelerating corrosion threats. PHMSA technical personnel understand the importance of coating and CP performance to assure the integrity of a pipeline like the Keystone XL Pipeline that will operate at elevated temperatures increasing the risk of an oil release from corrosion threats.

While the above explanation of the CP system approach is simplified, field application and effectiveness on a pipeline is much more complex and challenging, depending on such variables as the type of external coating, its condition (which can change with time), soil conditions, the state of the anodes, as well as design, operation, and maintenance of such CP systems. Unfortunately, as uncovered too frequently in pipeline failure investigations such as the 2015 Plains All American Refugio Santa Barbara, CA and 2010 Enbridge Line 6B

[8] NACE, "Standard Practice Application, Performance, and Quality Control of Plant-Applied Single-Layer Fusion-Bonded Epoxy External Pipe Coating," NACE SP0394-2013, revised 2013-10-04.
[9] 49 C.F.R. §195.563. Which pipelines must have cathodic protection?
[10] PHMSA, "Notice of proposed rulemaking, "Docket No. PHMSA-2017-0151, Pipeline Safety: Class Location Change Requirement," issued September 3, 2020, p. 61.

Marshall, MI corrosion failures, complying with minimum federal safety regulations does not mean that a particular pipeline's external corrosion protection program will be effective.[11]

Even if the minimum regulatory requirements were sufficient, ineffective coatings create corrosion risks that cannot be fully mitigated with other corrosion control measures. Less experienced pipeline operators may try to offset coating deterioration by increasing the power input of the small CP DC to such an extreme that the current can and often does blow the coating off the steel pipe (called cathodic disbondment), defeating the very purpose of the coating and the CP system. Furthermore, advances made in ILI tool technologies, especially in the area of general corrosion attack, have lulled some pipeline operators into overly relying on such periodic ILI to reduce the operating and maintenance costs associated with coating and CP design, monitoring, operation, maintenance, and repair. Running an ineffective or poorly selected ILI tool in a pipeline does not mean that this assessment approach will uncover corrosion threats, either general or selective forms of corrosion, before they grow to pipe failure. For example, there are many forms of selective corrosion attack (such as pitting or some forms of cracking corrosion) that ILI tools cannot reliably detect nor the operator reliably evaluate. There is a reason the PHMSA special conditions 36 through 39 have been incorporated into the Keystone XL Pipeline's permit. These specific special conditions attempt to address some of the more selective forms of corrosion that can vary with time and can have very high unpredictable corrosion rates. PHMSA Conditions 36 to 39 identify the threat of "interference currents" that can rapidly rip the steel off buried pipe, as well as include other testing methods to assure the coating and CP systems are working as intended on the Keystone XL Pipeline. PHMSA clearly understands the challenges in the field and the wide variation in the performance of a CP system that can be negated by poor coating, especially over time. PHMSA has placed other requirements on the Keystone XL Pipeline to assist in gauging coating/CP system effectiveness, and further requires that these measures be integrated with ILI data to help identify corrosion "hot spots" that can result in an oil spill.

In order to understand the risks associated with corrosion threats introduced by pipeline coating, it is important to understand that coating technology and application falls into two basic types: shielded versus non-shielded coatings.

[11] NTSB report, "Enbridge Incorporated Hazardous Liquid Pipeline Rupture and Release Marshall, Michigan July 25, 2010," Accident Report NTSB/PAR-12/01, adopted July 10, 2012, and PHMSA, "Preliminary Factual Report Plains Pipeline, LP, Failure on Line 901," February 2016.

3a.) Shielded external coatings

External coating on steel transmission pipelines has been used for many decades since the advent of cathodic protection in the mid 1940's and technical advances in its use on pipelines in the 1950's and 1960's. Historically, coatings such as asphalt/tar, tape wrap, coal tar enamels, various plastic applications and approaches, and early generations of FBEs, etc., or their combinations, were shielding to CP current. Such shielded coating systems utilized CP current to deal with areas where coating was penetrated, such as tears, holes, or gaps that would permit the CP current to directly reach the external corrosion site on the pipe where the coating defect has exposed the pipe metal. Shielded coatings, however, do not allow CP current to reach corrosion sites under such nonconducting coatings where the coating has separated from the outer pipe wall (i.e., where coating disbondment has occurred). Much of the transmission pipeline mileage in the U.S., because of its age of construction, utilizes shielded coating materials where disbondment renders CP approaches ineffective.

The disadvantage, therefore, of shielded coatings is that disbondment of the coating from the pipe, which occurs for various reasons, can create external corrosion sites that are not mitigated by CP as the protective current cannot reach the specific corrosion site(s) under the separated coating because the nonconductive coating stops the CP DC current from reaching the corrosion site. Corrosion attack can then occur under the separated coating well beyond coating penetrations (i.e., holes or cracks). Shielded coating disbondment can form not only corrosion conditions conducive to general corrosion attack (larger areas of metal loss along the pipe), but more specialized or more selective forms of local external corrosion, such as selective seam corrosion ("SSC") or stress corrosion cracking ("SCC"). These forms of insidious cracking type corrosion can be very difficult to reliably estimate time-to-failure using engineering critical assessments. Cracking forms of specialized corrosion also can be very challenging to identify or access via ILI smart pig technologies, including even the more recently advanced multiple crack and corrosion technology tools.

Therefore, shielded coated pipelines, even those in full compliance with PHMSA pipeline safety regulations intended to focus on the prevention of external corrosion, can easily fail from external corrosion in disbonded coating environments. When it comes to disbonded coatings, ILI tools are not foolproof as has been clearly demonstrated in such high-profile pipeline corrosion failures as the 2010 Marshall, Michigan, the 2013 ExxonMobil Mayflower, AR, and 2015 Refugio pipeline ruptures.[12]

[12] PHMSA Corrective Action Order to ExxonMobil Pipeline Company for March 29, 2013 Pegasus Pipeline Rupture in Mayflower, AR, "Re CPF No. 4-2013-5006H," May 10, 2013.

3b.) Non-Shielded external coatings

Non-shielded coatings are defined as those coatings that allow some CP current to effectively reach the pipe surface metal should the coating physically fail for whatever reason, such as disbondment, penetration, or cracking, as some of the CP protective current can pass through the coating because it is not "shielded." The last several decades have seen advancements in non-shielding coating technologies in pipelines using later generation, more modern formulated FBEs, or specialized polymers designed to be non-shielding. It is only in the last decade or two that newer pipeline construction projects have acknowledged the risks of older shielded coating technologies in pipeline applications and have been taking advantage of advances in non-shielding coatings, such as modern FBE coatings, in new installations. Nevertheless, the utilization of non-shielding coatings and their advantages over shielded coatings are not well appreciated by many pipeline operators.

PHMSA has acknowledged these advances, and promulgated safety regulations that require non-shielded coatings on new gas transmission pipelines that wish to operate at higher design factors, as such pipelines can be at higher risk to the more specialized forms of cracking corrosion such as SCC that are sensitive to shielded coating disbonding.[13] While such regulatory advancements calling for specific non-shielded coating in new pipelines have not similarly advanced in federal liquid transmission pipeline regulations, PHMSA has included warnings to liquid transmission pipeline operators about the risks associated with SCC, which occurs less frequently in liquid transmission pipelines but is exacerbated by shielded coatings.[14] PHMSA is well aware of the coating technology developments and advantages of non-shielding coatings when it comes to new transmission pipelines and recommended non-shielding coating for the Keystone XL Pipeline.[15] This is especially important given the higher risk of external corrosion for this pipeline from higher operating temperatures, as discussed later in this report.

As a condition for granting the Keystone XL Pipeline certain right-of-way permits, the BLM required the pipeline operator, TC Energy, to incorporate PHMSA's Recommended 57 Special Conditions identified in the Final Environment Impact Statement, or FEIS, into the pipeline's design, construction, operation, and maintenance.[16] Among these conditions is the obligation that external coating applied to the Keystone XL Pipeline be **non-shielding**.

[13] 49 C.F.R. §192.112(f) Additional design requirements for steel pipe using alternative maximum allowable operating pressure.
[14] 49 C.F.R. §195.599 What standards apply to direct assessment?
[15] Final Environmental Impact Statement for the Keystone XL Pipeline, "Final PHMSA Recommended Conditions identified in Appendix U of FEIS," dated April 26, 2011.
[16] Bureau of Land Management Appendix F BLM Special Stipulations MTM-98191, MTM-98191-01," paragraph 34, p. 11.

Specific Special Condition #9 requires: "All pipe must be protected against external corrosion by **non-shielding** {emphasis added}: coatings, repair coatings, and protective material used to protect the pipe from risk damage."[17] In setting this special condition that exceeds minimum federal pipeline safety regulations, PHMSA clearly understands the benefits of this advanced coating technology to increase safety by reducing the risks of pipeline failure from external corrosion. While not a pipe storage issue, the non-shielding coating requirement also applies to field joint coatings applied during construction after the girth welds joining pipe segments have been completed.[18]

4. Keystone XL Pipeline FBE coating degradation during storage

The possible threat to FBE pipeline coating degradation from transportation and long-term exposure to the elements has been well known in the industry for many decades. In an attempt to minimize the possible degradation from sunlight UV radiation on the Keystone XL pipe's FBE coating, the majority of the pipe stored in the outer layers of the stacked mainline pipe stockpiles exposed to the sun was coated with a whitewash acrylic resin coating ("Whitewash"). This Whitewash was applied approximately 18 to 24 months after the pipe was first stockpiled, with a reapplication of the Whitewash after about four to five years, as it was observed that even the Whitewash appeared to be impacted by UV radiation over time. It should be noted that the ends of the outer layer stockpiled pipe were not Whitewashed to avoid covering pipe stencil and manufacturing identifiers on the outside of the pipe utilized to fingerprint and track each pipe segment. The above referenced Corrosion Management article goes on to mention that, for the pipe stockpiled at the one storage location studied, it is estimated that at least 20% of the 24,000 pipe segments at that storage location, the pipe segments on the outer layers of the stacked pipe that were directly exposed to sunlight, had been Whitewashed for UV protection.[19] This article concludes that portions of the stored pipe that are exposed to UV radiation, could have degradation of the FBE external coating with regard to:

1) Embrittlement of the coating,
2) Loss of coating adhesion to the outer pipe wall, and
3) Reduction of coating flexibility.[20]

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[17] Final Environmental Impact Statement for the Keystone XL Pipeline, "PHMSA Special Conditions identified in Appendix U of FEIS," dated April 26, 2011, Condition # 9
[18] *Ibid*., Condition # 10.
[19] Technical Article by Keith Coulson, FI Corr, James Ferguson, TC Energy, Calgary, Canada, and David Milmine, DM Professional Services Ltd, Calgary, Canada, Journal of the Institute of Corrosion Management, "Study of stockpiled fusion bond epoxy coated pipe," Issue 153, January/February 2020, p. 17.
[20] *Ibid*.

It was also reported that exposed pipe has also undergone reduction of coating thickness that might render the FBE ineffective.[21] Clearly, many pipe segments have undergone FBE coating degradation to the point that the coating on much of the stored exposed Whitewashed pipe segments will not perform its intended purpose to reduce external corrosion.

5. The Keystone XL Pipeline's higher operating temperatures significantly increase the risk of external corrosion

The Keystone XL Pipeline is designed to move Canadian dilbit, also known as diluted bitumen. Dilbit is bitumen oil, a very heavy hydrocarbon, that is much heavier than conventional heavy crude oils, produced from various Canadian tar sand fields. Bitumen is diluted with a wide range of possible lighter oils that are blended to reduce the viscosity of the mixture to allow it to flow, usually at higher temperatures. Because of the extreme sensitivity of dilbit to rapidly increase viscosity by many orders of magnitude with a decrease in temperature, the Keystone XL Pipeline will be operated at elevated temperatures well above ambient of the soil in which it is buried. This temperature increase is not provided by external heaters heating the oil through heat exchangers, but from the significant pump horsepower utilized along the pipeline that introduces energy into the fluid raising the temperature. There are no upper operating temperature limitations imposed on the Keystone XL Pipeline, even above 150 ºF, a temperature that might cause some external coatings to degrade. There are, however, additional coating monitoring requirements imposed should pipeline temperatures exceed threshold triggers of 120 ºF or 150 ºF in the PHMSA conditions for the Keystone XL Pipeline.[22]

As the operating temperature increases, the viscosity of dilbit decreases significantly, increasing the operating efficiency of the pipeline. TC Energy therefore has an incentive to operate the Keystone XL Pipeline at more elevated temperatures than most conventional crude oil pipelines, even conventional heavy oil pipelines. However, increasing the pipeline operating temperature significantly increases the threat of corrosion attack, especially external corrosion. It is thus critical that the external coating and CP system be effective to counteract the increased risks from higher temperature operation on the Keystone XL Pipeline, as integrity management assessments (such as ILI tools) may not be effective at preventing an oil release on this system.

Based on my experience in pipeline corrosion as well as my chemical engineering background in reaction kinetics, it is my opinion (and I believe a general rule of thumb) that all other

[21] *Ibid.,* p. 16.

[22] Final Environmental Impact Statement for the Keystone XL Pipeline, "PHMSA Special Conditions identified in Appendix U of FEIS," dated April 26, 2011, Condition # 15.

factors being equal with certain caveats, at sites where corrosion occurs, corrosion rate will double for every 18 ºF (10 ºC) increase in temperature. A pipeline operating at 150 ºF will experience approximately thirty-two times (2^5) the corrosion rate of a pipeline operating at 60 ºF (the typical temperature of conventional crude oil pipelines), all other corrosion conditions being equal. It is therefore crucial that the CP system intended to mitigate potential external corrosion be effective on the Keystone XL Pipeline in order to prevent corrosion that would result in leaks and spills.

6. Options concerning the degraded FBE pipe

Given the physical degradation of the Keystone XL Pipeline FBE coating reported in the Corrosion Management article, I see three options for the Keystone XL Pipeline, explained below. Although the article evaluates Whitewashed pipe at only one storage site, TC Energy should also investigate the pipe segments stored at other locations that may have been exposed to the elements. Therefore, these recommendations also apply to pipe stored at those other locations, to the extent that the pipes have been similarly exposed to possible coating degradation.

6a.) Replace the degraded pipe segments with newly manufactured pipe with new coating meeting the non-shielded coating permit requirements.

This option may be the most costly given the number of pipe segments that would likely have to be replaced and the amount of new pipe steel that would be involved. The Corrosion Management article states that "In total, the whitewashed pipe was estimated to constitute at least 20% of the approximately 24,000 joints of 24 m pipe lengths."[23] Twenty percent of 24,000 joints of pipe calculates to about 70 miles of pipe that would have to be replaced of the approximately 350 miles of pipe stored at this one location. Note that this estimate only represents Whitewashed pipe at one storage site. Whitewashed pipe stored at other sites may have different percentages of degraded FBE coating from UV and weathering exposure.

While the most costly option, pipe replacement would have the advantage of replacing the exposed pipe segments that were not Whitewashed, which is necessary since "the last few feet at both ends were left bare {of Whitewash} so as not to overcoat the

[23] Technical Article by Keith Coulson, FI Corr, James Ferguson, TC Energy, Calgary, Canada, and David Milmine, DM Professional Services Ltd, Calgary, Canada, Journal of the Institute of Corrosion Management, "Study of stockpiled fusion bond epoxy coated pipe," Issue 153, January/February 2020, p. 17.

stencil and pipe identification markings on each pipe end."[24] Given the lack of Whitewash protection for these exposed pipe segments, it comes as no surprise that the Corrosion Management article concluded that "The CD {cathodic disbondment} results of the non-whitewashed pipe ends exposed to UV were deemed total failures (Figure 5)."[25]

6b.) Recoat the pipe segments containing major coating degradation.

This option is most likely significantly less expensive than the full pipe replacement option. A minimum standard for acceptable coating requirements needs to be agreed upon that sets minimum coating requirements such as thickness and minimum bonding/adhesion strength of the existing FBE pipe, as defined in the previous cited NACE standard. The existing degraded FBE that does not meet these minimum requirements would need to have the degraded coating fully removed and replaced with new FBE. The Corrosion Management article further indicates that all of the Whitewashed pipe, while meeting thickness and adhesion characteristics, exhibited flexibility deterioration to the point that all the Whitewashed FBE coating was no longer acceptable.[26] All these specific pipe sections should have the degraded FBE removed and the pipe recoated. In addition, all the pipe segments within the pipe stack and subsequently not Whitewashed, but whose pipe segment ends were the only FBE coating exposed to UV, would need to also have the few feet of exposed FBE removed and recoated, as these degraded FBE sites can easily become a site for external corrosion, even with CP. Special QA/QC procedures would also be needed to ensure a new quality FBE coating installation. I would expect, with the exception of the pipe ends exposed to UV, that the pipe stored within the pipe stack and not exposed to UV would pass FBE quality testing, but I recommend that testing for coating quality of these pipe segments be field verified before their use in construction.

6c.) Use the existing pipe as is with the degraded coating segments.

This last option, while the least costly, would fail to meet the PHMSA requirements imposed on the Keystone XL Pipeline as well as violate NACE SP0394 covering minimum standards for FBE installation to assure a FBE coating is effective. Using the stored Whitewashed pipe that fails to meet FBE coating standards is dangerous and should be rejected.

[24] *Ibid.*
[25] *Ibid.*, p. 19.
[26] *Ibid.*

I cannot rule out, however, that the pipeline operator might try to ignore/disregard the permit requirements and simply install the pipe with the deteriorated coating without repair. While I do not advise such an option, I see a need to recommend additional safety measures if the degraded coating is not replaced. These additional requirements would help temper, but not eliminate, the higher risks of an oil release on the Keystone XL Pipeline from degraded FBE coating associated with outside storage before installation, especially given the much greater risk of corrosion from the higher temperature operation.

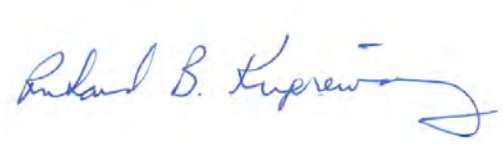
I recommend that the following need to be required if this last option were to occur:

1. For the life of the pipeline, track the location of each pipeline segment that does not meet coating specification by milepost to allow prudent integration of pipe integrity related data over the life of the pipeline to aid in monitoring and evaluating the condition of each segment that could become "hot spots" for external corrosion and possible pipeline failure with an oil release,
2. The CP system be operational before oil is pumped into the pipeline, superseding Special Condition # 35 Cathodic Protection that specifies six months, and minimum federal pipeline safety regulations allowing up to one year for CP operation, and

7. Conclusion

Given the unusually long time that the stored pipe for the Keystone XL Pipeline was exposed to the elements, it is not surprising that a significant percentage of the coated pipe segments studied was determined not to be fit for their intended purpose.[27] Before any of the long term stored pipe is utilized for the Keystone XL Pipeline construction, all such pipe segments must be retested to meet minimum NACE SP 0394 FBE application standards, especially as to minimum thickness, adhesion strength, and flexibility. TC Energy should also investigate the pipe stored at other locations to determine the extent of coating degradation from UV exposure. Pipe segments failing to meet such minimums should either be replaced or have the degraded FBE coating completely removed and recoated with new FBE. Otherwise, the risk of an oil release on the Keystone XL Pipeline goes up considerably, given the higher operating temperature and the unusual demands that large segments of deteriorated FBE coating would place on any CP system operation.

[27] *Ibid.*



Richard B. Kuprewicz,
President,
Accufacts Inc.

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EXHIBIT 61

February 21, 2023

NAPCA Bulletin 13-79-94

EXTERNAL APPLICATION PROCEDURES
FOR COAL TAR EPOXY PROTECTIVE COATINGS
TO STEEL PIPE

1. **General**
   a. These specifications may be used in whole or in part by anyone without prejudice, if recognition of the source is included. The National Association of Pipe Coating Applicators (NAPCA) assumes no responsibility for the interpretation or use of these specifications.
   b. The intended use of these coatings is to provide corrosion protection for buried pipelines. Above ground storage of coated pipe in excess of 6 months without additional Ultraviolet protection is not recommended.
   c. The following definitions apply:
      i. Applicator - The contractor who applies the coating to the pipe.
      ii. Company - The purchaser of the coated pipe or the entity for whom the Applicator coats the pipe.
      iii. SSPC - The Steel Structures Painting Council.
      iv. NACE - NACE International.
      v. Manufacturer - The company that makes the coating materials which are applied to the pipe.

2. **Scope**
   a. The Applicator shall furnish all labor, equipment and material required, shall prepare all surfaces to be coated and shall apply the coating to all surfaces to be coated.
   b. Corrosion protection, as provided under this specification, is furnished by the application of coal tar epoxy to the exterior of pipe to be placed underground.

3. **Pipe Conditions**
   a. Pipe delivered to the Applicator for coating shall be free of protective oils, lacquers, mill primer, dirt or any other deleterious surface contamination which may affect the application of the coating. The pipe surface shall be as free as possible from scabs, slivers and laminations.
   b. Any paint markings or stenciling of the pipe surface shall be of the type and thickness that can be removed easily during normal surface preparation.

4. **Handling of Bare Pipe**
   a. Proper equipment for unloading, handling, and temporary storage of bare pipe shall be used to avoid any damage to the pipe or pipe ends.
   b. If internally coated pipe is received at the Applicator's plant, care shall be taken to avoid damage to the internal coating or the obliteration of the internal pipe markings during any phases of work covered by this specification. Internal coatings must be capable of withstanding the processing conditions necessary for the application of the external coating.

c. The Applicator shall visibly inspect the pipe upon receipt for damage such as dents, flat ends, and bevel damage. Any damage observed at this point shall be noted on the inbound tally, and the Company shall be informed within 24 hours of receipt of the pipe. Any non-visible defects such as slivers, scabs, laminations, burrs, dents, etc. will be observed after the pipe is blast cleaned and at the Company's request, removed as an extra work item.

5. **Material and Workmanship**

All material furnished by the Applicator shall be of the specified quality. All work shall be done in a thorough workmanlike manner. The entire operation of pipe receiving, stockpiling, surface preparation, coating application, storage and loadout shall be performed under the supervision of and by experienced personnel skilled in the application of protective coating.

6. **Equipment**

The Applicator's equipment shall be in such condition as to permit the Applicator to follow the procedure and obtain results prescribed in these specifications.

7. **Coating Material**

a. All coating materials, including repair or patch materials, purchased or used under these specifications, shall be packaged in suitable and approved containers. The containers shall be plainly marked with the name of the Manufacturer, type of material and batch or lot number where applicable. Bulk shipments shall be allowed provided the above information is included in the bill of lading.

b. The coating material shall be packaged in containers suitable to keep the contents clean and dry during handling, shipping and storage. Storage and handling conditions shall be in accordance with the Manufacturer's recommendations.

c. Precautions shall be taken during the handling, shipping and storage of all materials to prevent damage to the containers that would result in contamination of the coating materials. All contaminated, or otherwise damaged materials shall be discarded.

8. **Surface Preparation**

a. Before blasting, all oil, grease, mill lacquer and other deleterious material on the surfaces of the metal to be coated shall be removed by suitable means.

b. In cold weather or any time when moisture tends to collect on the steel, the pipe shall be uniformly warmed for sufficient time to dry the pipe prior to cleaning. The pipe temperatures shall be maintained at least 5 degrees F above the dew point during the cleaning and coating operations. Pipe temperature shall not exceed 160 degrees F as a result of preheat.

c. Pipe surfaces shall be blast cleaned to a Commercial Blast metal finish in accordance with SSPC-SP-6 or NACE #3 requirements. Certain coating systems require a greater degree of cleanliness; in such cases, the degree of cleaning shall be as required by the coating system.

d. NACE, Swedish Pictorial, SSPC or other mutually agreed upon standards shall be used to judge the degree of cleaning.

e. A consistent abrasive working mix shall be maintained by frequent additions of small quantities of new abrasive commensurate with consumption. Infrequent large quantity additions of abrasive shall be avoided.

f. Following cleaning and prior to coating the pipe, abrasive remaining on the outside and loose contamination on the inside of the pipe shall be removed by air blast, vacuum or other suitable methods. If air is used, the air should be dry and free of contaminants, and all particles removed from the surface shall be collected in such a manner as not to contaminate clean pipe.

g. Following cleaning and prior to coating, the pipe surface shall be inspected for adequate cleaning and surface condition. Pipe not properly cleaned shall be rejected and recleaned.

h. Blast cleaned pipe surfaces shall be protected from conditions that would allow the pipe to flash rust before coating. If flash rusting occurs, affected pipe shall be recleaned.

9. **Coating Application**

a. After surface preparation and prior to coating, each pipe end shall be masked to allow for a cutback in accordance with the Company's specifications.

b. If system selected requires a primer, it shall be applied as soon after cleaning as possible to avoid surface cleanliness deterioration. All cleaned surfaces shall be primed the same work day.

c. Mixing shall be done with a powered mixing device to insure proper blending of the components.

d. Mixed material that has exceeded the Manufacturer's published pot life shall be discarded.

e. Application of the coating shall be by standard industrial spray equipment, airless or conventional, as per Manufacturer's recommendations.

f. Coal Tar Epoxies shall be applied in one or more coats to obtain the Manufacturer's recommended thickness. Manufacturer's recommendations for coating application shall be strictly followed.

g. Particular attention must be paid to the allowable time interval between coats so as to prevent coating delamination. If an Applicator has exceeded the allowable time interval between coats, then the first coat shall be "sweep blasted" or chemically treated prior to recoating so that a mechanical bond will develop between coats.

h. Cure conditions may vary widely depending on application parameters. Actual cure conditions shall be established after consultation with the Manufacturer.

10. **Inspection and Testing**

a. The entire procedure of applying the protective coating material as herein specified will be rigidly inspected from the time the bare pipe is received until the coated pipe is loaded on the carrier for shipment.

b. If the Company designates an Inspector, the Inspector shall be provided free access to the Applicator's plant at any time during any operation involving the pipe, with the right to inspect and to accept or reject work performed.

c. The Applicator's Quality Control Inspector shall be responsible for stopping

operations when conditions develop which could adversely affect the quality of the completed work.

d. Although the principal purpose of the coating inspection by the Company and Applicator is to insure compliance of the coating with these specifications, such inspection shall also include examination for previously undetected defects in the pipe, pipe surface or on the pipe ends. Pipe having such defects shall be set aside for subsequent repair or replacement by the pipe supplier and for any necessary coating repair. Recoating or coating repair that may be necessary by reason of these defects in the pipe which do not involve fault on the part of the Applicator shall be done at the Company's expense.

e. When Company's Representative exercises Company's right of approval at the Applicator's plant, the Company's Representative shall conduct final inspection on the Applicator's out-bound rack. Accepted pipe shall be presumed to be produced as specified unless test results indicate a discrepancy.

f. Coating Thickness Measurements
   i. An appropriate film thickness gauge, calibrated to the National Bureau of Standards' Certified Coating Thickness Calibration Standards shall be used to perform coating thickness measurement.
   ii. The coating thickness shall meet or exceed the agreed upon minimum coating thickness. All joints which fail to meet the minimum coating thickness test shall be recoated or repaired.

g. Electrical Inspection (when applicable)
   i. Holiday inspection of the entire coated surface shall be performed with an approved high voltage Holiday Detector to indicate any flaws, holes, breaks or conductive particles in the protective coating.
   ii. The Holiday Detector shall have sufficient D.C. voltage and be equipped with a positive signaling device. The search electrode shall be made of conductive rubber, or other applicable material. The Holiday Detector shall be operated in such a way as to audibly and/or visually detect the presence of all holidays.
   iii. The voltage to be used shall not exceed 125 volts per mil of nominal coating thickness. If a low voltage, wet sponge, type detector is used, the test voltage shall be 67.5 volts.

11. **Repair Procedures**

a. All defects disclosed by the Holiday Detector and other obvious defects shall be repaired by the Applicator.

b. Holidays which are the result of slivers, scabs, laminations, or other steel conditions beyond the control of the Applicator shall be repaired at the Company's expense.

c. Areas of repair to the coating shall be holiday inspected by the Applicator on a 100 percent basis. Holiday inspection of repairs is only required when also required for the coating.

d. The damaged coating shall be removed from the steel surface. The edge of the cured coating adjacent to the damaged area shall be "feathered" and coated with an appropriate surface conditioning solvent recommended by the coating

Manufacturer. This solvent shall be applied in accordance with the Manufacturer's recommendations.

e. The damaged area shall then be recoated.

12. **Coated Pipe Handling, Storage and Loading Requirements**

a. Pipe shall be stored, handled and transported in a manner to prevent damage to the pipe walls, beveled ends and the coating.

b. Storage racks shall be so designed as to protect the coated pipe from standing water, direct soil contact, and sharp or hard objects that might damage the coating.

c. The coated pipe shall be shipped using sufficient and proper dunnage to adequately protect the pipe and coating.

d. All pipe shipped by rail shall be loaded in accordance with API Specifications RP 5L1, Latest Edition.

13. **Supplementary Details Supplied by the Company**

When possible, the Company shall supply the following supplemental information:

a. Length and diameter of pipe.

b. Grade, wall thickness and/or weight per foot of pipe.

c. Source and approximate shipping date from the pipe mill.

d. Method of shipment from the mill.

e. Approximate shipping date to the destination.

f. If pipe is to be stored, the approximate length of time it is to be stored.

g. Length, style and post preparation of cutback.

h. Minimum weight per car or truck required to protect lowest outbound rate.

i. Name and type of carrier.

j. Stacking and/or loading instructions.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 62

February 21, 2023

Curriculum Vitae.

Richard B. Kuprewicz

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E-mail: kuprewicz@comcast.net

Profile:

As president of Accufacts Inc., I specialize in gas and liquid pipeline investigation, auditing, risk management, siting, construction, design, operation, maintenance, training, SCADA, leak detection, management review, emergency response, and regulatory development and compliance. I have consulted for various local, state and federal agencies, NGOs, the public, and pipeline industry members on pipeline regulation, operation and design, with particular emphasis on operation in unusually sensitive areas of high population density or environmental sensitivity.

Employment:

Accufacts Inc. **1999 – Present**

Pipeline regulatory advisor, incident investigator, and expert witness on all matters related to gas and liquid pipeline siting, design, operation, maintenance, risk analysis, and management.

Position: President
Duties:
> Full business responsibility
> Technical Expert

Alaska Anvil Inc. **1993 – 1999**

Engineering, procurement, and construction (EPC) oversight for various clients on oil production facilities, refining, and transportation pipeline design/operations in Alaska.

Position: Process Team Leader
Duties:
> Led process engineers group
> Review process designs
> Perform hazard analysis
> HAZOP Team leader
> Assure regulatory compliance in pipeline and process safety management

ARCO Transportation Alaska, Inc. **1991 - 1993**

Oversight of Trans Alaska Pipeline System (TAPS) and other Alaska pipeline assets for Arco after the Exxon Valdez event.

Position: Senior Technical Advisor
Duties:
> Access to all Alaska operations with partial Arco ownership
> Review, analysis of major Alaska pipeline projects

ARCO Transportation Co. **1989 – 1991**

Responsible for strategic planning, design, government interface, and construction of new gas pipeline projects, as well as gas pipeline acquisition/conversions.

Position: Manager Gas Pipeline Projects
Duties:
> Project management
> Oil pipeline conversion to gas transmission
> New distribution pipeline installation
> Full turnkey responsibility for new gas transmission pipeline, including FERC filing

Four Corners Pipeline Co. **1985 – 1989**

Managed operations of crude oil and product pipelines/terminals/berths/tank farms operating in western U.S., including regulatory compliance, emergency and spill response, and telecommunications and SCADA organizations supporting operations.

Position: Vice President and Manager of Operations
Duties:
> Full operational responsibility
> Major ship berth operations
> New acquisitions
> Several thousand miles of common carrier and private pipelines

Arco Product CQC Kiln **1985**

Operations manager of new plant acquisition, including major cogeneration power generation, with full profit center responsibility.

Position: Plant Manager
Duties:
> Team building of new facility that had been failing
> Plant design modifications and troubleshooting
> Setting expense and capital budgets, including key gas supply negotiations
> Modification of steam plant, power generation, and environmental controls

Arco Products Co. **1981 - 1985**

Operated Refined Product Blending, Storage and Handling Tank Farms, as well as Utility and Waste Water Treatment Operations for the third largest refinery on the west coast.

Position: Operations Manager of Process Services
Duties:
> Modernize refinery utilities and storage/blending operations
> Develop hydrocarbon product blends, including RFGs
> Modification of steam plants, power generation, and environmental controls
> Coordinate new major cogeneration installation, 400 MW plus

Arco Products Co. **1977 - 1981**

Coordinated short and long-range operational and capital planning, and major expansion for two west coast refineries.

Position: Manager of Refinery Planning and Evaluation
Duties:
> Establish monthly refinery volumetric plans
> Develop 5-year refinery long range plans
> Perform economic analysis for refinery enhancements
> Issue authorization for capital/expense major expenditures

Arco Products Co. **1973 - 1977**

Operating Supervisor and Process Engineer for various major refinery complexes.

Position: Operations Supervisor/Process Engineer
Duties:
> FCC Complex Supervisor
> Hydrocracker Complex Supervisor
> Process engineer throughout major integrated refinery improving process yield and energy efficiency

Qualifications:

Currently serving as a member representing the public on the federal Technical Hazardous Liquid Pipeline Safety Standards Committee (THLPSSC), a technical committee established by Congress to advise PHMSA on pipeline safety regulations.

Committee members are appointed by the Secretary of Transportation.

Served seven years, including position as its chairman, on the Washington State Citizens Committee on Pipeline Safety (CCOPS).

Positions are appointed by the governor of the state to advise federal, state, and local governments on regulatory matters related to pipeline safety, routing, construction, operation and maintenance.

Served on Executive subcommittee advising Congress and PHMSA on a report that culminated in new federal rules concerning Distribution Integrity Management Program (DIMP) gas distribution pipeline safety regulations.

As a representative of the public, advised the Office of Pipeline Safety on proposed new liquid and gas transmission pipeline integrity management rulemaking following the pipeline tragedies in Bellingham, Washington (1999) and Carlsbad, New Mexico (2000).

Member of Control Room Management committee assisting PHMSA on development of pipeline safety Control Room Management (CRM) regulations.

Certified and experienced HAZOP Team Leader associated with process safety management and application.

Education:

MBA (1976)	Pepperdine University, Los Angeles, CA
BS Chemical Engineering (1973)	University of California, Davis, CA
BS Chemistry (1973)	University of California, Davis, CA

Publications in the Public Domain:

1. "An Assessment of First Responder Readiness for Pipeline Emergencies in the State of Washington," prepared for the Office of the State Fire Marshall, by Hanson Engineers Inc., Elway Research Inc., and Accufacts Inc., and dated June 26, 2001.

2. "Preventing Pipeline Failures," prepared for the State of Washington Joint Legislative Audit and Review Committee ("JLARC"), by Richard B. Kuprewicz, President of Accufacts Inc., dated December 30, 2002.

3. "Pipelines - National Security and the Public's Right-to-Know," prepared for the Washington City and County Pipeline Safety Consortium, by Richard B. Kuprewicz, dated May 14, 2003.

4. "Preventing Pipeline Releases," prepared for the Washington City and County Pipeline Safety Consortium, by Richard B. Kuprewicz, dated July 22, 2003.

5. "Pipeline Integrity and Direct Assessment, A Layman's Perspective," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated November 18, 2004.

6. "Public Safety and FERC's LNG Spin, What Citizens Aren't Being Told," jointly authored by Richard B. Kuprewicz, President of Accufacts Inc., Clifford A. Goudey, Outreach Coordinator MIT Sea Grant College Program, and Carl M. Weimer, Executive Director Pipeline Safety Trust, dated May 14, 2005.

7. "A Simple Perspective on Excess Flow Valve Effectiveness in Gas Distribution System Service Lines," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated July 18, 2005.

8. "Observations on the Application of Smart Pigging on Transmission Pipelines," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated September 5, 2005.

9. "The Proposed Corrib Onshore System - An Independent Analysis," prepared for the Centre for Public Inquiry by Richard B. Kuprewicz, dated October 24, 2005.

10. "Observations on Sakhalin II Transmission Pipelines," prepared for The Wild Salmon Center by Richard B. Kuprewicz, dated February 24, 2006.

11. "Increasing MAOP on U.S. Gas Transmission Pipelines," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated March 31, 2006. This paper was also published in the June 26 and July 1, 2006 issues of the Oil & Gas Journal and in the December 2006 issue of the UK Global Pipeline Monthly magazines.

12. "An Independent Analysis of the Proposed Brunswick Pipeline Routes in Saint John, New Brunswick," prepared for the Friends of Rockwood Park, by Richard B. Kuprewicz, dated September 16, 2006.

13. "Commentary on the Risk Analysis for the Proposed Emera Brunswick Pipeline Through Saint John, NB," by Richard B. Kuprewicz, dated October 18, 2006.

14. "General Observations On the Myth of a Best International Pipeline Standard," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated March 31, 2007.

15. "Observations on Practical Leak Detection for Transmission Pipelines – An Experienced Perspective," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated August 30, 2007.

16. "Recommended Leak Detection Methods for the Keystone Pipeline in the Vicinity of the Fordville Aquifer," prepared for TransCanada Keystone L.P. by Richard B. Kuprewicz, President of Accufacts Inc., dated September 26, 2007.

17. "Increasing MOP on the Proposed Keystone XL 36-Inch Liquid Transmission Pipeline," prepared for the Pipeline Safety Trust by Richard B. Kuprewicz, dated February 6, 2009.

18. "Observations on Unified Command Drift River Fact Sheet No 1: Water Usage Options for the current Mt. Redoubt Volcano threat to the Drift River Oil Terminal," prepared for Cook Inletkeeper by Richard B. Kuprewicz, dated April 3, 2009.

19. “Observations on the Keystone XL Oil Pipeline DEIS,” prepared for Plains Justice by Richard B. Kuprewicz, dated April 10, 2010.

20. “PADD III & PADD II Refinery Options for Canadian Bitumen Oil and the Keystone XL Pipeline,” prepared for the Natural Resources Defense Council (NRDC), by Richard B. Kuprewicz, dated June 29, 2010.

21. “The State of Natural Gas Pipelines in Fort Worth,” prepared for the Fort Worth League of Neighborhoods by Richard B. Kuprewicz, President of Accufacts Inc., and Carl M. Weimer, Executive Director Pipeline Safety Trust, dated October, 2010.

22. “Accufacts’ Independent Observations on the Chevron No. 2 Crude Oil Pipeline,” prepared for the City of Salt Lake, Utah, by Richard B. Kuprewicz, dated January 30, 2011.

23. “Accufacts’ Independent Analysis of New Proposed School Sites and Risks Associated with a Nearby HVL Pipeline,” prepared for the Sylvania, Ohio School District, by Richard B. Kuprewicz, dated February 9, 2011.

24. “Accufacts’ Report Concerning Issues Related to the 36-inch Natural Gas Pipeline and the Application of Appleview, LLC Premises: 7009 and 7010 River Road, North Bergen, NJ,” prepared for the Galaxy Towers Condominium Association Inc., by Richard B. Kuprewicz, dated February 28, 2011.

25. “Prepared Testimony of Richard B. Kuprewicz Evaluating PG&E’s Pipeline Safety Enhancement Plan,” submitted on behalf of The Utility Reform Network (TURN), by Richard B. Kuprewicz, Accufacts Inc., dated January 31, 2012.

26. “Evaluation of the Valve Automation Component of PG&E’s Safety Enhancement Plan,” extracted from full testimony submitted on behalf of The Utility Reform Network (TURN), by Richard B.Kuprewicz, Accufacts Inc., dated January 31, 2012, Extracted Report issued February 20, 2012.

27. “Accufacts’ Perspective on Enbridge Filing to NEB for Modifications on Line 9 Reversal Phase I Project,” prepared for Equiterre Canada, by Richard B. Kuprewicz, Accufacts Inc., dated April 23, 2012.

28. “Accufacts’ Evaluation of Tennessee Gas Pipeline 300 Line Expansion Projects in PA & NJ,” prepared for the Delaware RiverKeeper Network, by Richard B. Kuprewicz, Accufacts Inc., dated June 27, 2012.

29. “Impact of an ONEOK NGL Pipeline Release in At-Risk Landslide and/or Sinkhole Karst Areas of Crook County, Wyoming,” prepared for landowners, by Richard B. Kuprewicz, Accufacts Inc., and submitted to Crook County Commissioners, dated July 16, 2012.

30. “Impact of Processing Dilbit on the Proposed NPDES Permit for the BP Cherry Point Washington Refinery,” prepared for the Puget Soundkeeper Alliance, by Richard B. Kuprewicz, Accufacts Inc., dated July 31, 2012.

31. “Analysis of SWG’s Proposed Accelerated EVPP and P70VSP Replacement Plans, Public Utilities Commission of Nevada Docket Nos. 12-02019 and 12-04005,” prepared for the State of Nevada Bureau of Consumer Protection, by Richard B. Kuprewicz, Accufacts Inc., dated August 17, 2012.

32. “Accufacts Inc. Most Probable Cause Findings of Three Oil Spills in Nigeria,” prepared for Bohler Advocaten, by Richard B. Kuprewicz, Accufacts Inc., dated September 3, 2012.

33. “Observations on Proposed 12-inch NGL ONEOK Pipeline Route in Crook County Sensitive or Unstable Land Areas,” prepared by Richard B. Kuprewicz, Accufacts Inc., dated September 13, 2012.

34. “Findings from Analysis of CEII Confidential Data Supplied to Accufacts Concerning the Millennium Pipeline Company L.L.C. Minisink Compressor Project Application to FERC, Docket No. CP11-515-000,” prepared by Richard B. Kuprewicz, Accufacts Inc., for Minisink Residents for Environmental Preservation and Safety (MREPS), dated November 25, 2012.

35. “Supplemental Observations from Analysis of CEII Confidential Data Supplied to Accufacts Concerning Tennessee Gas Pipeline’s Northeast Upgrade Project,” prepared by Richard B. Kuprewicz, Accufacts Inc., for Delaware RiverKeeper Network, dated December 19, 2012.

36. “Report on Pipeline Safety for Enbridge’s Line 9B Application to NEB,” prepared by Richard B. Kuprewicz, Accufacts Inc., for Equiterre, dated August 5, 2013.

37. “Accufacts’ Evaluation of Oil Spill Joint Investigation Visit Field Reporting Process for the Niger Delta Region of Nigeria,” prepared by Richard B. Kuprewicz for Amnesty International, September 30, 2013.

38. “Accufacts’ Expert Report on ExxonMobil Pipeline Company Silvertip Pipeline Rupture of July 1, 2011 into the Yellowstone River at the Laurel Crossing,” prepared by Richard B. Kuprewicz, November 25, 2013.

39. “Accufacts Inc. Evaluation of Transco’s 42-inch Skillman Loop submissions to FERC concerning the Princeton Ridge, NJ segment,” prepared by Richard B. Kuprewicz for the Princeton Ridge Coalition, dated June 26, 2014, and submitted to FERC Docket No. CP13-551.

40. Accufacts report “DTI Myersville Compressor Station and Dominion Cove Point Project Interlinks,” prepared by Richard B. Kuprewicz for Earthjustice, dated August 13, 2014, and submitted to FERC Docket No. CP13-113-000.

41. “Accufacts Inc. Report on EA Concerning the Princeton Ridge, NJ Segment of Transco’s Leidy Southeast Expansion Project,” prepared by Richard B. Kuprewicz for the Princeton Ridge Coalition, dated September 3, 2014, and submitted to FERC Docket No. CP13-551.

42. Accufacts’ “Evaluation of Actual Velocity Critical Issues Related to Transco’s Leidy Expansion Project,” prepared by Richard B. Kuprewicz for Delaware Riverkeeper Network, dated September 8, 2014, and submitted to FERC Docket No. CP13-551.

43. “Accufacts’ Report to Portland Water District on the Portland – Montreal Pipeline,” with Appendix, prepared by Richard B. Kuprewicz for the Portland, ME Water District, dated July 28, 1014.

44. “Accufacts Inc. Report on EA Concerning the Princeton Ridge, NJ Segment of Transco’s Leidy Southeast Expansion Project,” prepared by Richard B. Kuprewicz and submitted to FERC Docket No. CP13-551.

45. Review of Algonquin Gas Transmission LLC’s Algonquin Incremental Market (“AIM Project”), Impacting the Town of Cortlandt, NY, FERC Docket No. CP14-96-0000, Increasing System Capacity from 2.6 Billion Cubic Feet (Bcf/d) to 2.93 Bcf/d,” prepared by Richard B. Kuprewicz, and dated Nov. 3, 2014.

46. Accufacts’ Key Observations dated January 6, 2015 on Spectra’s Recent Responses to FERC Staff’s Data Request on the Algonquin Gas Transmission Proposal (aka “AIM Project”), FERC Docket No. CP 14-96-000) related to Accufacts’ Nov. 3, 2014 Report and prepared by Richard B. Kuprewicz.

47. Accufacts’ Report on Mariner East Project Affecting West Goshen Township, dated March 6, 2015, to Township Manager of West Goshen Township, PA, and prepared by Richard B. Kuprewicz.

48. Accufacts’ Report on Atmos Energy Corporation (“Atmos”) filing on the Proposed System Integrity Projects (“SIP”) to the Mississippi Public Service Commission (“MPSC”) under Docket No. 15-UN-049 (“Docket”), prepared by Richard B. Kuprewicz, dated June 12, 2015.

49. Accufacts’ Report to the Shwx’owhamel First Nations and the Peters Band (”First Nations”) on the Trans Mountain Expansion Project (“TMEP”) filing to the Canadian NEB, prepared by Richard B. Kuprewicz, dated April 24, 2015.

50. Accufacts Report Concerning Review of Siting of Transco New Compressor and Metering Station, and Possible New Jersey Intrastate Transmission Pipeline Within the Township of Chesterfield, NJ (“Township”), to the Township of Chesterfield, NJ, dated February 18, 2016.

51. Accufacts Report, “Accufacts Expert Analysis of Humberplex Developments Inc. v. TransCanada Pipelines Limited and Enbridge Gas Distribution Inc.; Application under Section 112 of the National Energy Board Act, R.S.C. 1985, c. N-7,” dated April 26, 2016, filed with the Canadian Nation Energy Board (NEB).

52. Accufacts Report, “ A Review, Analysis and Comments on Engineering Critical Assessments as proposed in

PHMSA's Proposed Rule on Safety of Gas Transmission and Gathering Pipelines," prepared for Pipeline Safety Trust by Richard B. Kuprewicz, dated May 16, 2016.

53. Accufacts' Report on Atmos Energy Corporation ("Atmos") filing to the Mississippi Public Utilities Staff, "Accufacts Review of Atmos Spending Proposal 2017 – 2021 (Docket N. 2015-UN-049)," prepared by Richard B. Kuprewicz, dated August 15, 2016.

54. Accufacts Report, "Accufacts Review of the U.S. Army Corps of Engineers (USACE) Environmental Assessment (EA) for the Dakota Access Pipeline ("DAPL")," prepared for Earthjustice by Richard B. Kuprewicz, dated October 28, 2016.

55. Accufacts' Report on Mariner East 2 Expansion Project Affecting West Goshen Township, dated January 6, 2017, to Township Manager of West Goshen Township, PA, and prepared by Richard B. Kuprewicz.

56. Accufacts Review of Puget Sound Energy's Energize Eastside Transmission project along Olympic Pipe Line's two petroleum pipelines crossing the City of Newcastle, for the City of Newcastle, WA, June 20, 2017.

57. Accufacts Review of the Draft Environmental Impact Statement for the Line 3 Pipeline Project Prepared for the Minnesota Department of Commerce, July 9, 2017, filed on behalf of Friends of the Headwaters, to Minnesota State Department of Commerce for Docket Nos. CN-14-916 & PPL-15-137.

58. Testimony of Richard B. Kuprewicz, president of Accufacts Inc., in the matter West Goshen Township and Concerned Citizens of West Goshen Township v. Sunoco Pipelines, L.P. before the Pennsylvania Public Utilities Commission, Docket No. C-2017-2589346, on July 18, 2017, on Behalf of West Goshen Township and Concerned Citizens of West Goshen Township.

59. Direct Testimony of Richard B. Kuprewicz, president of Accufacts Inc., on Behalf of Friends of the Headwaters regarding Enbridge Energy, Limited Partnership proposal to replace and reroute an existing Line 3 to the Minnesota Office of Administrative Hearings for the Minnesota Public Utilities Commission (MPUC PL-9/CN-14-916 and MPUC PL-9/PPL-15-137), September 11, 2017 and October 23, 2017.

60. Direct Testimony of Richard B. Kuprewicz On Behalf of The District of Columbia Government, before the Public Service Commission of the District of Columbia, in the matter of the merger of AltaGas Ltd. and WGL Holdings, Inc., Formal Case No. 1142, September 29, 2017.

61. Report to Mississippi Public Utilities Staff ("MPUS"), "Accufacts Review on Atmos Energy Corporation's Proposed Capital Budget for Fiscal Year 2018 related to System Integrity Program Spending (Docket N. 2015-UN-049)," prepared by Richard B. Kuprewicz, dated December 4, 2017.

62. Report to Hugh A. Donaghue, Esquire, Concord Township Solicitor, "Accufacts Comments on Adelphia Project Application to FERC (Docket No. CP18-46-000) as it might impact Concord Township," dated May 30, 2018.

63. Report to Mississippi Public Utilities Staff ("MPUS"), "Accufacts Review on Atmos Energy Corporation's Proposed Capital Budget for Fiscal Year 2019 related to System Integrity Program Spending (Docket N. 2015-UN-049)," prepared by Richard B. Kuprewicz, dated August 20, 2018.

64. Report to West Goshen Township Manager, PA, "Accufacts report on the repurposing of an existing 12-inch Sunoco pipeline segment to interconnect with the Mariner East 2 and Mariner East 2X crossing West Goshen Township," dated November 8, 2018.

65. Report to West Whiteland Township Manager, PA, "Accufacts Observations on Possible Pennsylvania State Pipeline Safety Regulations," prepared by Richard B. Kuprewicz, dated March 22, 2019.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 63

February 21, 2023

https://roanoke.com/news/local/as-mvp-construction-extended-concerns-about-pipes-integrity-grow/article_0f82436c-2a2d-11ed-9a3b-336c79988438.html

As MVP construction extended, concerns about pipe's integrity grow

Laurence Hammack
Sep 3, 2022

Preserve Bent Mountain advocate Robin Austin on the Mountain Valley Pipeline right of way off of Bottom Creek concerns the pipes remaining outside above ground is compromising their integrity.
SCOTT P. YATES photos, The Roanoke Times

Laurence Hammack

Advocates for preserving the natural resources of Bent Mountain walk the pipeline's right of way on Thursday, Aug. 25, 2022.

Scott P. Yates

Jan. 12, 2018: In a Roanoke courtroom packed with people whose land was being taken for the Mountain Valley Pipeline, a company executive explained why it was so important that construction begin as soon as possible.

One of the reasons was that sections of pipe already purchased by Mountain Valley needed to be buried promptly, before sunlight could break down an epoxy coating meant to safeguard the steel from corrosion.

“The coating needs to be protected,” Robert Cooper, the company’s vice president for engineering and construction, testified. “You have to do that very carefully.”

Aug. 25, 2022: Atop Bent Mountain, under a late-summer sun, sections of pipe were sitting along a linear construction zone like a giant, chopped-up garden hose. The pipe was supposed to have been buried in 2018, but lawsuits filed by environmentalists have slowed work to a crawl.

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Pipes like this should be stored above-ground for no longer than six months, unless additional coating is applied, according to industry standards. Otherwise, exposure to the elements could make the pipe more vulnerable, once it's buried, to a leak or rupture. And that could cause the highly pressurized natural gas being transported through the pipe to explode.

One of the pipe segments on Bent Mountain bore a stamp that read: "Date of coating: 8/25/2017" — exactly five years ago. Others had documented coating dates that fell in the same month.

That worries Mary Beth Coffey, who lives nearby and accompanied two other Bent Mountain residents on a recent hike along the pipeline's dormant right-of-way to view the pipes.

"I think there could be big ramifications," she said, "and a big boom."

At least a half-dozen individuals and organizations raised concerns about the exposed coating, and the effect it could have on the pipe's integrity, in public comments made this summer to the Federal Energy Regulatory Commission.

But in giving Mountain Valley another four years to complete the 303-mile pipeline — which traverses the New River and Roanoke valleys — FERC noted in an Aug. 23 order that the pipe would have to be inspected before installation. "And

therefore the concerns raised by commenters on this matter do not justify additional analysis," the order stated.

Critics say that does not address the majority of pipe already buried after lying outdoors for extended time periods. They also voiced concerns about the adequacy of pipe inspections.

And now that Mountain Valley has until Oct. 13, 2026, to put the $6.6 billion project into service, they worry that more time will only make things worse.

"Given what I've seen of this project, the public is raising valid concerns, and they need answers to those concerns," said Richard Kuprewicz, an independent pipeline safety expert who is president of Accufacts Inc., a consulting firm in Redmond, Washington.

Testing the pipe

In an emailed response to questions, a Mountain Valley spokesperson said: "First and foremost, the safe construction and operation of the MVP project remains our top priority."

The company understands that sunlight has changed the pipe's exterior from shiny green to a chalky and whitish-green appearance, Natalie Cox wrote, and has developed a plan to ensure that the coating is not compromised.

Before each section of pipe is placed in a trench and covered with dirt, the coating is inspected for any damage or deterioration, she said. This is done by scanning the pipe with a device called a "holiday detector," which uses an electrical current to detect flaws that might not be visible to the naked eye.

"Any damaged coating or coating thin spots are repaired prior to installation, or the pipe segment is not installed," Cox wrote.

That has yet to happen.

“All of the pipes shipped to the ROW [right of way] have continued to meet specification,” the email stated. “The pipes will continue to be checked to identify any issues that need to be addressed prior to the pipe being placed in the ditch and backfilled.”

In addition to inspecting the pipe immediately before it’s placed in the ground, Mountain Valley says it also “continuously surveys and monitors” sections of above-grade pipe that is either in storage yards or along the right of way.

The problem, according to Kuprewicz and others, is that the standards for inspections, which are enforced by the U.S. Pipeline and Hazardous Materials Safety Administration, do not include detailed specifications on how to gauge the coating’s condition.

“It’s probably in terrible shape,” Kuprewicz said. “But that in itself does not prevent the operator from putting it in service.”

Bill Caram, executive director of Pipeline Safety Trust, a nonprofit organization that promotes pipeline safety, agreed that government rules are not as precise as advocates say they should be.

“The regulations are written to largely allow the operator to determine if the coating is appropriate as opposed to prescribing exactly what would make a coating safe or unsafe,” Caram wrote in an email.

Spot checks are not enough, he said. “We would hope the operator would inspect each pipe’s coating, as it only takes one problem area to cause a failure once the pipeline is operating under pressure.”

The regulatory oversight

A spokesperson for PHMSA, the regulatory agency, said pipeline developers must inspect the coating for each section of pipe to ensure that it meets required specifications immediately before installation.

PHMSA oversees that process, the spokesperson said, and any violation of the rules is subject to enforcement action and an order for immediate corrective measures.

Data on PHMSA's website do not show any violations in Virginia involving coating inspections by Equitrans Midstream Corp., the lead partner in the Mountain Valley venture and considered by the agency to be its operator.

In West Virginia, where the pipeline starts, PHMSA issued in 2021 what's called a "notice of amendment" to Mountain Valley's written procedures for assessing the coating, finding that they lacked detail for certain sections of pipe..

Mountain Valley disputed the agency's finding. However, it agreed to make changes to language in its protocols to provide "further clarification" for future inspections.

"MVP takes pride in the comprehensive standards it maintains and welcomes suggested modifications," Gregg West, Equitrans' vice president for environment, safety and compliance, wrote in a Dec. 16, 2021, letter to PHSMA.

Two months later, the regulatory agency closed the case without taking further action.

Roberta Bondurant, a Bent Mountain resident who is co-chair of Protect Our Water, Heritage Rights, an anti-pipeline coalition, questioned both PHMSA's oversight and Mountain Valley's commitment to safety.

"We're going on five years now," she said of the time some of the pipe has remained above the ground. "And so my point is that, presumptively, that pipe is bad, and that's by MVP's own testimony."

Delays grow longer

Although there are differences of opinion on the issue, this much is undisputed:

Mountain Valley never planned for portions of the 42-inch diameter pipe to remain unconnected and above the ground for as long as they have.

Cooper, the lead company official overseeing construction, said in his January 2018 testimony that the plan was to have the project done by end of that year.

In Roanoke's federal court, he explained that Mountain Valley — which had filed a lawsuit to take land by eminent domain from opposing landowners in the pipeline's path — needed to start work by the following month.

U.S. District Judge Elizabeth Dillon granted the company's request for immediate possession, putting off until later decisions on how much money the company should pay landowners.

Later that year, other courts began to rule on lawsuits filed by national environmental groups and local opponents. Those legal challenges took aim at permits issued by the federal government, arguing among other things that the agencies did not adequately take into account the erosion to be caused by trenching across steep mountain slopes and through streams and wetlands.

Mountain Valley has been cited by environmental regulators in Virginia with violating erosion and sedimentation control regulations more than 300 times. And the 4th U.S. Circuit Court of Appeals has set aside about a dozen permits, forcing Mountain Valley back to the drawing board as it seeks new authorizations.

With the project already four years behind schedule, opponents wonder how exacting the company will be with coating inspections, should construction be allowed to continue.

"As soon as the permits are issued, my guess is that Mountain Valley is going to be in a hurry to get the pipeline completed, considering all the obstacles they have faced," said Carl Zipper, an environmental scientist in Blacksburg.

Zipper lives close to the pipeline's route, and joined other opponents in expressing

concerns to FERC about the pipe's condition. Those questions apply to both the pipe that has already been buried and what remains strung along the right of way — largely in the Jefferson National Forest and along streams and wetlands, areas where the suspension of permits has slowed construction the most.

In a status report filed with FERC July 15, Mountain Valley said 84% of the pipe has been laid in trenches and backfilled. Construction is currently stalled — except for erosion control maintenance — while the company seeks its latest round of new permits.

New standards approved

On Sept. 9, 2010, a natural gas pipeline ruptured and exploded in a residential neighborhood of San Bruno, California, killing eight people and injuring more than 60 in a fireball reported to be 1,000 feet high.

The blast was so powerful it left a crater 72 feet long and 26 feet wide. A 3,000-pound segment of the pipe where the rupture occurred was found about 100 feet from the crater.

Following the incident, which was blamed on faulty welds in the pipe, PHMSA began a lengthy review of its regulations. The process was completed last month, with the announcement of new rules that will take effect next May.

"This new rule will significantly improve safety and environmental protections for our nation's natural gas pipeline system," U.S. Transportation Secretary Pete Buttigieg said in a statement. PHMSA is part of the Transportation Department.

Among the changes are tougher standards that apply to monitoring pipes for corrosion.

While most pipeline operators conduct inspections before installation, using a holiday detector like the one described by Cox, the pipe's coating can be damaged later, when the pipe is lowered into a trench by pieces of heavy equipment, which

then dump dirt on top it.

The new regulations call for additional tests to be done after the pipe is underground, using high-voltage devices.

Mountain Valley is already planning to employ that technology to test the buried pipe before it goes into service and then regularly after that, Cox said, and the company is committed to meeting other standards announced by PHMSA.

According to the Pipeline Safety Trust, problems with corrosion have been increasing over the past four years and are now the second leading cause of pipeline failures.

As pipelines age, the risk grows higher. “If you’re looking for a perfect coating, you’re never going to find it,” Kuprewicz said.

The pipeline expert said pipe coatings should work hand in hand with cathodic protection, which uses electrochemical reactions that occur within the soil around the pipe to reduce the likelihood of corrosion. The pipe is coupled to buried anodes, which consist of magnesium or other reactive metals, and an electrical current shifts corrosion away from the pipe and to the anodes.

Some of the Mountain Valley pipe already has permanent cathodic protection in place, Cox said. In other areas where shorter segments are buried, more than 400 temporary systems have been installed to offer protection until the pipe can be connected to an overall network once it is completed.

“How do you forget?”

During their walk along the pipeline’s right of way in Southwest Roanoke County, Coffey, Grace Terry and Robin Austin pointed to sections of the pipe that will likely spend at least another winter exposed to the forces of nature.

Although Mountain Valley has another four years to complete the project, it says it

hopes to have reissued permits by early next year, which would allow a final stage of construction before the pipeline begins transporting natural gas by late 2023.

But in giving the company more time, FERC wrote: “We consider it likely that, should Mountain Valley receive the required permits, those permits will undergo judicial review, which will take time to resolve.”

For Coffey, whose Bent Mountain farm the pipeline will pass through, that means worries that started in 2016, when the pipeline was first proposed, will continue indefinitely.

“I think about it every day,” she said.

With the rural landscape already bearing the impact of tree-cutting and muddy runoff from construction sites, opponents say the risk of a pipe failure is a growing concern with each passing year.

“The scars will never go away,” Austin said. “How do you forget?”

By Laurence Hammack

Laurence Hammack covers environmental issues, including the Mountain Valley Pipeline, and business and enterprise stories. He has been a reporter for The Roanoke Times for more than three decades.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 64

February 21, 2023

SASKTODAY.ca

TransCanada is inspecting its pipe in anticipation of Keystone XL beginning second half 2019

Brian Zinchuk
Nov 1, 2018 8:18 AM

1 / 2 This map from Google Earth shows five stockpiles sites for pipe that had been destined for Keystone XL. The red arrows indicate stockpiled pile, painted white. The green pin indicates the EVRAZ Regina steel mill. To the left of the steel mill is fresh, green pipe, the usual colour after pipe has been coated | Google Earth

Regina – In July 2011, the stringing trucks were driving through Shaunavon, taking 36-inch pipe trucked from the coating plant in Camrose to a storage yard south of the Shaunavon. And there it sat, to the end of the first President Barrack Obama term. Then it sat throughout the entirety of the second Obama term, when he killed the project by denying a presidential permit. It continued to sit since the election of President Donald Trump, who, in the week following his inauguration in January 2017, invited TransCanada to reapply for a presidential permit, which he

then granted. This revived the project, but construction has not yet started.

The pipe sat even after that permit was granted, after Keystone XL legal odyssey continued. But finally, this past summer, the project started to gain some life to it. And it was then TransCanada started looking at its pipe stockpiles to see what it could use.

At the Saskatchewan Oil and Gas Supply Chain Forum in Regina on Oct. 4, representatives of TransCanada took part, explaining opportunities for businesses to become part of the company's supply chain. Among those present was Doug Brunning, pipeline manager, Canada, for the Keystone XL project. He had previously worked on the now-cancelled Energy East project in a similar capacity.

Earlier in the day, Andrea Korney, supplier diversity and stakeholder relations with TransCanada, told the conference that TransCanada had begun pipe refurbishment for the project.

"We're inspecting every piece of pipe," Brunning told *Pipeline News*. "We have a whole test plan, 11 steps. We look at coating, we look at interior, we look for corrosion. We look at everything – cleanliness, all that other stuff. It either passes or it fails. If it fails, then it's scrap. And there may be others where we may be able to remediate it."

"In other cases, if we find measurements of the coating thickness are too thin, we set them aside for a strip and recoat," Brunning said.

"At this point, all we're doing is inspecting the pipe. After we've done the inspection and see how much pipe we have, we will see If we, in fact, need the strip-and-recoat pipe for the project."

Asked why the amount in the stockpiles wouldn't match the amount needed, he explained, "Keystone XL doesn't own this pipe. TransCanada owns it. The asset gets transferred.

"TransCanada had 400 kilometres that was going to go to the U.S., that's not going to the U.S. now. We can use that pipe, here in Regina, for Canada."

He wouldn't say if that was related to recent steel and pipe tariffs imposed by the Donald Trump administration.

The industrial north end of Regina has had large stockpiles of pipe, painted white, tucked into numerous yards for many years. They've been there long enough to appear at five different sites on Google Earth, dating back to 2011. Imagery from October of that year showed the stockpiles in transition, from the common green coating, to a protective white paint.

“It’s still there,” he noted. “It’s TransCanada pipe that wasn’t used on other projects. It’s available for us to use.”

The largest stockpile, on Sherwood Road, covers an area of several city blocks.

“That pipe is for us to use. Some of the pipe, in the other stockpiles sites in Canada, was taken from those stockpile sites, to be used on other projects. So we can use the Regina stockpile to replenish.

“Whether or not we strip and recoat, we’re not sure yet. And if we did, it would be next year. For you to do that program, you have to be finished all your inspection first, before the coating mill has to change their whole process.”

It can’t be done on site, meaning the pipe to be recoated would have to be transported back to a plant, stripped, recoated, and sent back to the line again before usage.

“This would be in a plant environment,” he said, when asked if recoating could happen in the field.

Some of the pipe had been used on other projects, he noted, as 36-inch is the most popular size.

“We expect that after the inspection program, there will still be pipe left over that we will not need.”

Asked when is the soonest construction might start in Saskatchewan, such as topsoil stripping, he replied, “Our plan is to start mid-next year. We’ll do all the mitigation measures that we need to with regards to migratory birds to be able to start.”

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 65

February 21, 2023

ENERGY + ENVIRONMENT

COMMENTARY

Why the Mountain Valley Pipeline is uniquely risky

JACOB HILEMAN

AUGUST 22, 2019 11:18 PM

One of many steep grades the Mountain Valley Pipeline will traverse along its route through Virginia. (Ned Oliver/Virginia Mercury – July 26, 2018)

On Aug. 8, Mountain Valley Pipeline requested "emergency authorization" from the Federal Energy Regulatory Commission to repair an eight-acre landslide that "has progressed to the point

where a residence directly downslope is unsafe to be occupied."

Unfortunately, events like this are almost expected; MVP chose to route, and FERC chose to approve, this titanic 42-inch diameter, 303-mile pipeline across several hundred of miles of "high landslide potential" areas.

While MVP is not the first pipeline to cross unstable terrain, nor the first pipeline to be located in landslide-prone Appalachia, is MVP actually any different from previously built pipelines?

The answer is an unequivocal "yes."

In fact, it appears MVP has the notoriety of crossing more miles of high-risk terrain than any other major natural gas transmission pipeline in the past two decades. And perhaps ever.

Since 1997, FERC has approved no fewer than 46 new natural gas mega-pipelines, defined here as pipelines that are at least 24 inches in diameter, more than 100 miles long, and not installed along pre-existing utility corridors.

A review of the landslide hazard information contained in the environmental impact statements (EIS) for this set of pipelines reveals 22 of them – almost half – do not traverse any high landslide risk areas at all. The remaining 24 pipelines cross anywhere from 0.2 to more than 200 miles of high risk terrain.

Out of all these mega-pipeline projects, MVP finds itself infamously at the top of the list, having routed 225 miles of the pipeline – 74 percent of its total length – across high landslide risk terrain.

Considering its closest neighbors on this list, MVP is not in good company.

Just behind MVP, the 42-inch Rover Pipeline crosses 224 miles of high landslide risk areas. Yet it is a much longer pipeline; these high risk areas account for 44% of its 510-mile length. The Rover Pipeline is notoriously one of the most environmentally destructive pipelines in recent history. Last year, the pipeline was fined $430,000 for a litany of water quality violations in West Virginia due to failed sediment and erosion control devices.

Behind the Rover Pipeline comes the 42-inch Atlantic Coast Pipeline (ACP), with 187 miles crossing high landslide risk terrain. However, it is also considerably longer than MVP; these high risk

areas account for only 31 percent of its 604-mile length. The ACP has had so many permits invalidated by the courts that the project is all but dead, and the underlying legal logic for these decisions also affects MVP.

Another top contender on the list is the 36-inch Leach Xpress Pipeline, with 98 miles – 74 percent of its 132-mile length – crossing high risk terrain. Five months after being placed into service, on June 7, 2018, this "best-in-class pipeline" exploded as the result of a landslide that ruptured the line.

Two weeks ago, the 36-inch Mountaineer Xpress Pipeline also marked five months of being in service, thankfully without incident. However, this pipeline has the ominous distinction of being the only project on the list to have routed fully 100 percent of its 170 miles across areas of high landslide risk.

Not coincidentally, the five pipelines highlighted here were all approved by FERC in 2017. These projects illustrate the risks the natural gas industry is willing to take to access new fracked gas supplies in the Marcellus Shale. And the risks FERC is willing to place on the shoulders of all those who live, work, go to school, or recreate in the shadow of these combustible behemoths.

It is important to note this analysis is limited to those pipelines FERC lists on its "approved major pipeline projects" webpage, which only goes back as far as 1997. This analysis also only includes those pipelines with publicly accessible EIS documentation.

However, it is likely that obtaining more data would make MVP and these other mega-pipeline projects look even more anomalous, given the relatively recent expansion of gas infrastructure through Appalachia. Ultimately, compiling and analyzing this type of comprehensive dataset is a job for FERC and other regulatory authorities, not for concerned citizens.

MVP is not a normal pipeline project, but a frightening harbinger of a new class of unconscionably high-risk pipelines. Indeed, FERC has used its "regulatory" authority to reject fewer than 1 percent of all natural gas pipeline proposals in the past 20 years.

Given landslides will remain an existential threat along the MVP right-of-way for decades to come, it is imperative Virginia regulators immediately issue a statewide Stop Work Order.

Doing so may pressure FERC into actually regulating this dangerously unprecedented pipeline.

CORRECTION: *This post has been edited to correct the date of the Leach Xpress pipeline explosion.*

JACOB HILEMAN

Jacob Hileman is an environmental hydrologist with a doctorate from the University of California, Davis. He was raised in the Catawba Valley of Virginia, and is presently a researcher with the Centre of Natural Hazards and Disaster Science at Uppsala University.

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EXHIBIT 66

February 21, 2023

USDA United States Department of Agriculture
Forest Service
George Washington and Jefferson National Forests
5162 Valleypointe Parkway
Roanoke, VA 24019
540-265-5100

File Code: 1900; 2720
Date: October 24, 2016

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St., N.E., Room 1A
Washington, DC 20426

Dear Ms. Bose:

Subject: Request for Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Route of the proposed Mountain Valley Pipeline Project in the Jefferson National Forest
OEP/DG2E/Gas 3
Mountain Valley Pipeline, LLC
Docket No. CP16-10-000

The Forest Service submits an information request to Mountain Valley Pipeline, LLC to support the Forest Service's review of MVP's special use proposal for the proposed Mountain Valley Pipeline Project (MVP Project). The proposed project would affect 3.4 miles of National Forest System lands on the Jefferson National Forest.

In the attached document, we discuss the objectives of our request for the site-specific design of stabilization measures in selected high-hazard locations along the proposed MVP Project route. We also discuss the methods we followed and the criteria we used to select the representative sites.

For questions, please contact Jennifer Adams, Special Project Coordinator, at (540) 265-5114 or by email at jenniferpadams@fs.fed.us.

Sincerely,

JOBY P. TIMM
Forest Supervisor

cc: Mountain Valley Pipeline, LLC

U.S. Forest Service Request for Site-Specific Design of Stabilization Measures in Selected High-Hazard Portions of the Proposed Mountain Valley Pipeline Route

Introduction and Objectives

The route for the Mountain Valley Pipeline Project (MVP Project), proposed by Mountain Valley Pipeline, LLC (MVP) would cross some very challenging terrain in the central Appalachians. Potentially difficult situations include steep slopes, presence of headwater streams, geologic formations with high slippage potential, highly erodible soils, and the presence of high-value natural resources downslope of high hazard areas. These hazards are exacerbated by high annual rates of precipitation and the potential for extreme precipitation events.

Similar hazards on other smaller pipeline projects in the central Appalachians have led to slope failures, erosion and sedimentation incidents, and damage to aquatic resources. Therefore, the Forest Service (FS) is concerned that crossing such challenging terrain with a much larger pipeline could present a high risk of failures that lead to resource damage.

To address these hazards, MVP has proposed to implement slope stabilization and erosion/sedimentation control measures. MVP provided general descriptions and conceptual drawings of these methods in its resource reports and other filings. In comments on resource reports and in other communications, the FS has identified the need for more detailed information to document the effectiveness of the proposed techniques and measures.

The Jefferson National Forest contain Forest Plan standards that limit some activities on steep slopes. The FS is reviewing MVP's Special Use Permit application and expects MVP to submit an amended Special Use Permit application to address the FS's previous comments on the proposed MVP Project route. To facilitate the acceptance of MVP's amended Special Use Permit application for further processing, the Forest needs to be able to determine that the MVP project is consistent or can be made consistent with this Forest Plan direction.

To further clarify the likelihood that the MVP can be constructed through the Jefferson National Forest without undue risk of resource damage, the FS is requesting that MVP develop site-specific stabilization designs for selected areas of challenging terrain. FS specialists have selected several sites that appear to present a high risk for slope failure, slippage, and erosion/sedimentation. Note that these are merely representative sites that have been selected to demonstrate whether stability can be maintained for the purpose of making a preliminary determination of Forest Plan consistency. Should the MVP be permitted, multiple additional high hazard areas will need to be addressed on a site-specific basis.

MVP should present designs for the selected sites that clearly illustrate the following:

- Anticipated hazards at each site
- How the hazards will be minimized, to include specific techniques and materials tailored to the conditions of each site
- Plan and profiles (cross section(s) perpendicular to centerline, and a longitudinal cross section along the centerline) with dimensions (feet) showing 1) the original ground surface, 2) the maximum extent of the cut, fill and spoil during construction, 3) the post-construction reclaimed ground surface, showing reclamation backfill, reclaimed slopes, and the permanent right-of-way
- Short-term and long-term measures (i.e., construction vs. operation and maintenance periods)
- Provisions for ensuring that long-term stabilization features will remain in place and effective over the life of the project, without the need for continual maintenance
- Rationale and supporting documentation for the likelihood that the techniques and materials used at each site will be effective
- Potential resource impacts in the event of a failure, and how the potential for such impacts will be minimized

Methods Used to Select Representative Sites

- The Forest selected several locations along the right-of-way (ROW) where expert knowledge and resource data indicate a potential "worst case scenario" for 1) trying to maintain slope stability, 2) preventing potential significant indirect adverse effects to resources such as water quality, hydrology and aquatic ecosystems, and 3) ensure that long-term maintenance and stability can be accomplished if the project is implemented.
- JNF provided narratives to highlight representative site-specific Forest Service-administered areas of concern along the portion of the ROW that crosses this Forest in Virginia. The following data sources were used:
    - Topographic maps
    - surface ownership layer
    - ACP survey corridor and proposed centerline
    - Geologic formations and field survey data from the geohazard assessment

Selected Sites

JNF Priority site #1 of 6
From Station 10380+00 to 10390+00 on Drawing No. PA-GIVA-H600 -03 in Appendix A of MVP Plan of Development June 2016.
Lowest downslope NFS lands on south side of Peters Mountain.

JNF Priority site #2 of 6
The narrow ridge with steep slopes on north side of Brush Mountain from Station 11543+66 to the National Forest property line on crest of Brush Mountain on Drawing No. PA-MOVA-H600 -03 in Appendix A of MVP Plan of Development June 2016. MP 219.2-219.4. And the route variation to another ridge on north side of Brush Mountain presented by MVP to Forest Service at October 19, 2016 meeting in Roanoke VA.

JNF Priority site #3 of 6
The steepest slopes downslope from the bore pit (Station 10287+19) on south side of Peters Mountain to Station 10300+00 on Drawing No. PA-GIVA-H600 -01 in Appendix A of MVP Plan of Development June 2016. And the route variation for steepest slopes downslope from the bore pit on south side of Peters Mountain (Station 10287+19) presented by MVP to Forest Service at October 19, 2016 meeting in Roanoke VA.

JNF Priority site #4 of 6
From Station 10360+00 to 10367+47 on Drawing No. PA-GIVA-H600 -03 in Appendix A of MVP Plan of Development June 2016.
Steep slopes between MP 196.9 and MP 197 on south side of Peters Mountain.

JNF Priority site #5 of 6
MP 195.3-195.4
Steep slope north side of Peters Mountain

JNF Priority site #6 of 6
MP 217.2
Steep slope south side Sinking Creek Mountain

Document Content(s)

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 67

February 21, 2023

NEWS

Earthquake's epicenter just outside Giles County

Jeff Williamson, Digital Content Manager
Rachel Lucas, Anchor

Published: **September 13, 2017 at 1:56 PM**

Tags: **New River Valley, Local, News**

GILES COUNTY, Va. – An earthquake could be felt in Giles County on Wednesday afternoon.

The 3.1 magnitude earthquake's hit at 1:33 p.m. and its epicenter was about 8.5 miles NNE of Pearisburg, Virginia, according to the United States Geological Survey.

USGS says that an earthquake of that magnitude may cause vibrations similar to the passing of a truck.

The depth of the earthquake was about 13 miles deep, which is considered a shallow earthquake, according to the USGS.

The quake was felt in Pearisburg, Pembroke and Newport.

The USGS originally reported that it was a 3.2 earthquake. Some residents reported hearing a boom during the quake

that only lasted seconds.

Martin C. Chapman, Research Associate Professor at Virginia Tech Department of Geosciences said that is not an uncommon phenomenon.

"If they heard a noise, that's not uncommon with earthquakes in eastern North America. What you are hearing is the seismic waves that are converting into sound waves. If the earthquake is not too deep, you will hear a boom sound sort of like thunder," Chapman said.

Although the official magnitude from the USGS was recorded at a 3.1, Chapman says the quake was much stronger. He said data at Virginia Tech indicates the quake registered at a 3.7-4.0.

"If you would have been right at the epicenter, you would have probably felt shaking for just a few seconds. Most of the strongest shaking, as you get further away would only have lasted two the three seconds," Chapman said.

Chapman said to date, over 200 earthquakes have been recorded in Giles County.

The Giles County Sheriff's Department issued a Code Red to all residents in the county after the earthquake hit. The sheriff's office asks that only emergencies related to the earthquake be reported to dispatchers. If you need to report structural damage call Giles County Administration at 540-921-2525. For other emergencies such as utility damages contact the sheriff's office at 540-921-3842.

Maintenance workers have been asked to check for structural damage at all Giles County Public Schools. So far, no damage has been reported.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 68

February 21, 2023

44° 39° 48°

Small earthquake rattles Giles County

by Elizabeth Thomas
Thursday, July 15th 2021

A 2.7 magnitude temblor shook the ground near Narrows, Virginia, at 8:55 p.m. Wednesday, July 14, 2021. (Credit: USGS)

GILES COUNTY, Va. (WSET) — Did you feel it?

At least a dozen residents called in to report an earthquake Wednesday night in Giles County.

The United States Geological Survey reports a 2.7 magnitude earthquake shook the ground at 8:55 p.m.

The official location was 9 kilometers south-southwest of Narrows, Virginia. The temblor had a depth of 18.5 kilometers.

According to seismology data from Michigan Tech, a 2.7 magnitude earthquake is often felt but little damage is done. There are roughly 30,000 earthquakes each year between magnitudes 2.5 and 5.4.

The Wilderness Society et al. Comments on the U.S. Forest Service Mountain Valley Pipeline and Equitrans Expansion Project Draft Supplemental Environmental Impact Statement (#50036)

EXHIBIT 69

February 21, 2023

For additional reading:

Schultz, A.P., 1986, Ancient, Giant Rockslides, Sinking Creek Mountain, southern Appalachians, and Virginia: Geology, v. 14, p. 11-14.

Schultz, A.P., 1993, Geologic map of large rock block slides at Sinking Creek Mountain, Appalachian Valley and Ridge province, Southwestern Virginia, and comparison with the Colorado Front Range: U.S. Geological Survey Miscellaneous Investigations Series Map I-2370.

Schultz, A.P., and Southworth, C.S., 1989, Large bedrock landslides of the Appalachian Valley and Ridge province of Eastern North America: Geological Society of America Special Paper 236, p. 57-74.

Cover photograph: *View of ancient giant landslide from Brush Mountain.*

For more information

Visit the USGS web site at:
http://minerals.usgs.gov/landslides.html

Visit the Forest Service web site at:
http://www.fs.fed.us/gwjnf

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2000

Prehistoric, giant landslides in Montgomery and Craig Counties, Va., in the Blacksburg/Wythe Ranger Districts of the Jefferson National Forest, are the largest known landslides in eastern North America and are among the largest in the world. One of the landslides is more than 3 miles long! The ancient, giant landslides extend for more than 20 miles along the eastern slope of Sinking Creek Mountain. Enormous slabs of rock ranging from about 0.2 to more than 1.5 square miles in size broke loose and slid downslope under the influence of gravity. The movement of some slides may have been slow, but the movement of others was probably sudden and catastrophic.

These landslides are called rock-block slides and rockslides. In rock-block slides, a slab or block of bedrock moves down a slope intact. If the slab or block breaks up as it slides, it is called a rockslide.

How were the landslides discovered?

The landslides were discovered in the 1980's during geological mapping, which showed that rock layers were displaced (fig. 1). The landslides had not been recognized before because they are so large they are not easily seen. The zone of landslides was identified by geologists who noticed a combination of unusual hills and hollows, geologic structures, and unexpected vegetation patterns. These landslide features include cliffs where the rock has broken away, isolated flat areas or benches, and isolated knobs. The benches have springs, small streams, swamps, ponds, and circular to elliptical depressions from 30 to 300 feet across—features that are rare on slopes without landslides. The unusual landforms can be seen on topographic maps and aerial photographs.

Many of the rockslides have evergreen vegetation, while slopes below the slides have deciduous (hardwood) vegetation. Also, swamps and ponds on the slides contain ferns that do not normally grow on the steep eastern slopes, which are usually too dry for these plants. These changes in vegetation reflect the disruption of soils in the landslide zone.

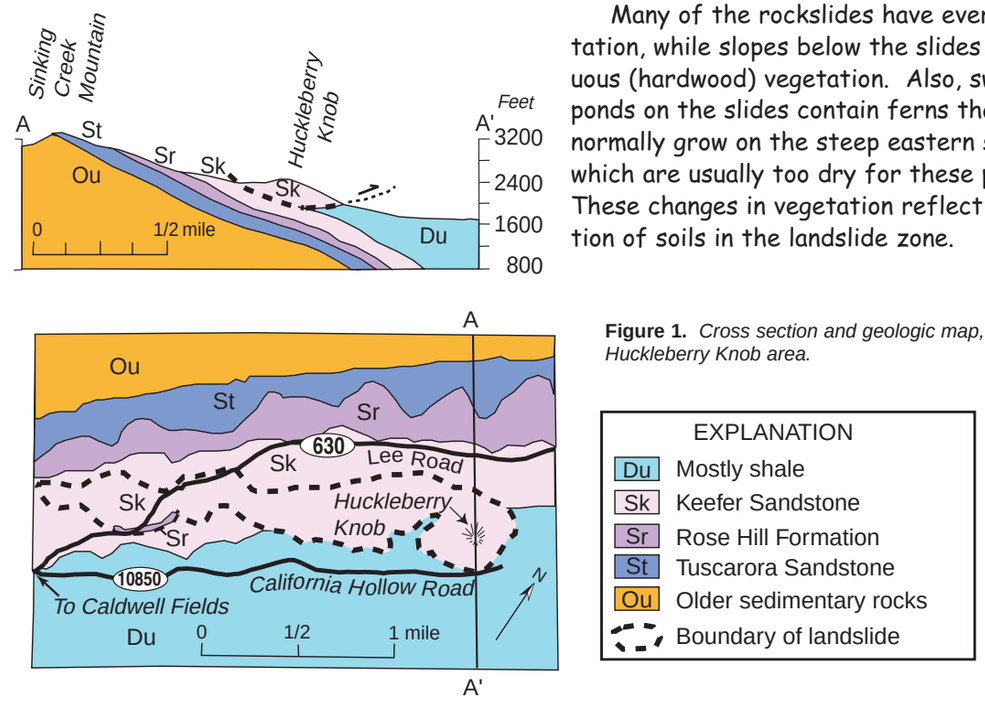

Figure 1. *Cross section and geologic map, Huckleberry Knob area.*

When did the landslides happen?

The exact time of movement is uncertain, but evidence suggests that the landslide movement was between about 10,000 and 25,000 years ago. This would be during the Pleistocene Ice Age, but before the arrival of humans in the area. Pollen and organic matter from a sag pond on one of the landslides show that sediments were deposited in the pond as early as 10,000 years ago. Native American artifacts of the Woodland period (about 1,000 B.C. to A.D. 1,000) were found on landslide slopes at three places. There is no evidence of recent movement of the landslides.

Where can you see them?

The large size of the landslides, dense vegetation, and deep erosion make them difficult to see. But, if you look carefully from certain locations, you can see the unusual landforms that are a result of these ancient landslides. They are seen best when the leaves are off the trees.

From Caldwell Fields and Lee Road. From the Caldwell Fields (fig. 2) parking area, look north along Lee Road (Rt. 630) (fig. 1). You will see the steep, straight "flat-irons" of

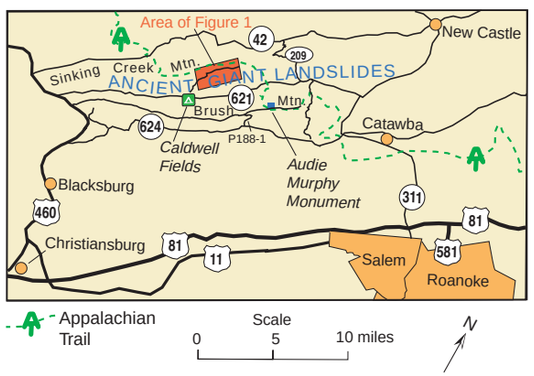

Figure 2. *Map showing location of ancient giant landslides.*

sandstone that are characteristic of the undisturbed parts of the east slope of Sinking Creek Mountain. Then look to your left, where the slope is broken by "lumpy" topography, and the lower bench of a large landslide can be seen below the crest of the mountain. If you look closely at the powerline at the top of the mountain, you can see a cliff where bedrock is exposed. This is the scarp from which the slab of rock in the slide broke away. If you drive up Lee Road from Caldwell Fields, you will cross one of the ancient landslides, but the changes in topography, geology, and vegetation are subtle and not readily recognized.

Huckleberry Knob. Huckleberry Knob (fig. 3) can be seen best when the leaves are off the trees from near the end of the Lee Road or by hiking on California Hollow Road (fig. 1). Huckleberry Knob is one of the best examples of an isolated landslide block sitting out in the valley. Notice the evergreens on the knob and the reversal in slope of the bench northwest of Huckleberry Knob. This is typical of the unusual landslide topography.

From Rt. 621 and Hall Road. Landslide benches can also be seen at some places from Rt. 621 on the slopes of Sinking Creek Mountain between Caldwell Fields and Rt. 209 (Hall Road). If you drive up Rt. 209, you get a good view of "lumpy" landslide ridges below the straight ridge at the skyline (fig. 4). As you continue on Hall Road to the top of Sinking Creek Mountain, you drive across an ancient giant landslide.

From Brush Mountain. Another viewpoint from which the landslide benches can be seen is the crest of Brush Mountain, looking north

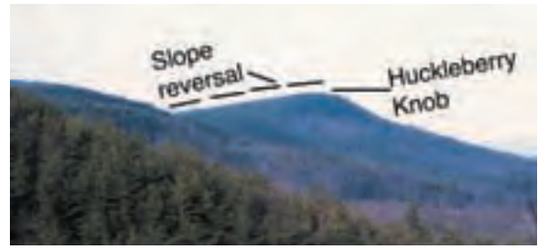

Figure 3. *View of Huckleberry Knob, which is an escarpment on the front of a landslide. Crest of the mountain and source of the slide are to the left.*

to Sinking Creek Mountain (cover photograph). You can drive to the crest of Brush Mountain on the gravel road (P188-1) off State Route 624.

From the Appalachian Trail. Hikers on the Appalachian Trail ascending from Rt. 621 to the top of Sinking Creek Mountain will walk across the benches of one of the ancient giant landslides. Along the crest of Sinking Creek Mountain, hikers can look down the eastern slope toward Huckleberry Knob and see benches on the ancient giant landslides.

Why did the mountains move?

Erosion that undercut the base of the slope or erosion related to heavy rainfall might have produced unstable slopes that resulted in landslides. Another possibility is that the landslides were triggered by earthquakes because the landslides border on the presently active Giles County earthquake zone.

Will there be more landslides?

Even though there is no evidence of recent movement of the ancient, giant landslides on the slope of Sinking Creek Mountain, other types of landslides (rockslides and debris flows) do occur during rainstorms on slopes in the Appalachian Mountains. In the past, most landslides occurred in uninhabited areas. Today, knowledge of the geologic setting of existing and planned development can help identify the potential for landslides. Research on how and where slope failures occur can help reduce the risk to human lives and property from landslides.

Have the rocks been useful?

Yes. The rocks that form the high ridge of Sinking Creek Mountain are composed of sandstone (Keefer Sandstone), sandstone and quartzite (Tuscarora Sandstone), and interbedded sandstone and shale (Rose Hill Formation). Rocks from these units, both in the landslides and in the intact parts of the ridges, have long been used for building stone. Sandstone of the Rose Hill Formation commonly forms one- to two-inch thick, grayish-red to reddish-black layers that make good flagstone. The layers of the Rose Hill Formation may have provided surfaces along which overlying blocks of rock slid. (Note: If you wish to remove stone from the national forest, first stop at the Blacksburg Ranger Station and get a permit.)

Figure 4. *"Lumpy" ridge line (accentuated by the dashed line) formed on a landslide. View from Hall Road near Craig Creek.*