Mountain Valley Pipeline, LLC
Mountain Valley Pipeline Project
FERC Docket No. CP16-10-000

Attachment 135
Landslide Mitigation Plan

Mountain Valley Pipeline Project

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Landslide Mitigation Plan

Rev. 3, December 2016

(Updates from previous reports highlighted in yellow.)

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1.0 INTRODUCTION

The Mountain Valley Pipeline (MVP) Project is a proposed 42-inch-diameter natural gas pipeline system that spans approximately 303 miles from northwestern West Virginia (Wetzel County) to southern Virginia (Pittsylvania County). The Project will be constructed and owned by Mountain Valley Pipeline LLC, which is a joint venture of EQT Corporation, NextEra Energy, Inc., Con Edison Gas Midstream, LLC, WGL Holdings, Inc., Vega Energy Partners, Ltd., and RGC Midstream, LLC.

Many portions of the proposed Mountain Valley Pipeline Project (Project) route are in landslide susceptible areas as mentioned in Section 6.6 of Resource Report 6 (Ref. 1) and as shown on Figure 6.4-3 of the same report. Slope information along the Project is provided in Resource Report 1, Appendix 1-I. Landslides in the Project area occur primarily in weathered bedrock or colluvial soil and within old landslide debris located on steep slopes. Numerous landslides on the Appalachian Plateau have developed in soils derived from sedimentary rocks. Shale, especially red beds and shale-limestone sequences, disintegrate rapidly into clayey soil upon exposure. Most landslides involving soil and weathered bedrock consist of smooth, integrated, thin earth-flow slabs that may be many square yards in area but generally are less than about eight feet thick. Commonly, the slabs move no faster than about three feet or six feet per year and are normally underlain by material containing water with a hydrostatic head of as much as seven feet. In both the folded Appalachians and the Blue Ridge Mountains, numerous slow-moving debris slides form in colluvial soil and scree that are particularly abundant on slopes underlain by sandstone and metamorphic rocks.

MVP has performed a review of potential areas of landslide or rockfall concern along the pipeline alignment. This was completed through review of available historic aerial photographs, soils data, and topographic maps to identify indications of potential landslide hazards. Areas investigated as part of this report are shown on the project alignment sheets and erosion and sediment control plans.

MVP has developed this Landslide Mitigation Plan to outline the special procedures and best management practices (BMPs) that will be implemented during the pipeline installation and post-construction periods to mitigate landslide occurrence.

All mileposts (MP) reference herein refer to the October 2016 Proposed Route unless otherwise specified.

2.0 FIELD INSPECTION

MVP has completed field observations of the steep sidehill slope sites where potential stability issues were identified, as summarized Table 1 of this document. The field observations for these sites included slope characteristics, GPS mapping of observed slides, slumps, rockfalls, scarp locations, and the presence of geotropically affected trees, drainage features, and gullying. In 2015, investigations were conducted by a consulting geotechnical engineer with experience in landslide evaluation, whose resume is attached. In 2016, additional site visits were conducted by MVP personnel with experience in landslide evaluation.

3.0 SLOPE EVALUATIONS

The occurrence of a landslide is dependent on a combination of site-specific conditions and influencing factors. Common factors that contribute to landslides principally fall into four broad categories (WSDOT 2014):

- Climatic/hydrologic (rainfall or precipitation)

- Geomorphic (slope form and conditions)
- Geologic/geotechnical/hydrogeological (material type and groundwater)
- Human activity

Climatic factors that influence landslides include the duration of rainfall events, intensity of rainfall, type of precipitation (rain or snow), and rainfall conditions over a period of time (antecedent conditions). It is common for landslides to occur after intense or prolonged periods of rain. Some episodes of widespread landslide occurrences correspond to storms that involve the rapid melting of previously accumulated snow by wind and warm rain. The most disastrous landslide events in the Appalachian Plateau region have been associated with persistent rainfall followed by a heavy downpour along steep slopes which causes debris flows and debris avalanches. Debris flows develop on steep slopes as a result of heavy rainfall that saturates the soil, which under the extra weight and lubrication breaks loose and becomes slurry that pulls surface vegetation and large trees downslope. Infiltration of precipitation into surface soils was considered in the mitigation measures presented in this report.

Geomorphic factors that affect slope stability include height and steepness, as well as vegetation and underlying geology. Increased steepness, concave topographic slopes and slope height generally correlate with reduced stability. A lack of vegetative cover will also increase the amount of rainfall that can infiltrate the slope surface. Vegetation generally inhibits surface soil erosion with erosion occurring much more rapidly on bare slopes. Whether water infiltrates into the ground or runs off is influenced by both surface vegetation and the permeability of the geologic substrate, its degree of saturation, and precipitation intensity. Either shallow bedrock conditions or a compact and fine-grained soil unit at depth will tend to cause a saturation and weakening of the near-surface, loosened soil. The approximate depth to bedrock along the pipeline is indicated in Resource Report 6, Appendix 6-B.

As mentioned in Section 1.0, the geologic and geotechnical characteristics of the region contribute to slope instability. Landslides along the project route will occur primarily in weathered bedrock or loose colluvial soil and within old landslide debris located on steep slopes. Exposed sedimentary rock formations can erode rapidly and create soils prone to landslides. Most landslides along the route are expected to be thin earth-flow type slabs rather than deep-seated circular failures. Rockfalls are also a potential hazard below bedrock outcroppings at or near the top of steep slopes associated with the cliff-forming formations such as sandstones, granite, and gneiss. These outcrops may be weathered by wind or rainfall and become loosened, leading to a violent cascade downhill, often triggering a larger landslide. Landslides also commonly recur in the same areas, thus evidence of previous events is important to the slope evaluations. Areas of high groundwater table and surface drainage paths can also contribute to the instability of slopes. Drainage paths or streams can over-steepen slopes from erosion. If known, the Hydrologic Soil Group for the surface soils is indicated in the site description. Hydrologic soil groupings are used to describe the minimum rate of infiltration obtained for bare soils after prolonged wetting.

Human activities are a common contributor to landslide events. Large excavations and fills located in mountainous areas related to rural development have increased the number of and potential for landslides. Development of this type tends to create over-steepened slopes and drainage alteration that leads to the potential for many landslides. The removal of surface vegetation during land development can affect slope stability through increased infiltration of rainfall.

Table 1 contains descriptive notes for each of the 37 slope areas of concern along the pipeline. These descriptions were obtained from Table 6.4-6 and augmented with notes from the field surveys, where possible. In addition, three areas within Jefferson National Forest (JNF), at the request of JNF personnel,

and several areas identified in realigned areas of the route were also investigated and included in Table 1. Six additional areas were investigated at the request of the JNF and are discussed in detail in the *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*.

	Table 1 - Landslide Concern Areas Crossed by the MVP Pipeline					
Designation	**Beginning MP**	**Ending MP**	**Length Crossed (feet)**	**Slope (%) [a]**	**Signs of Recent Movement [b]**	**Notes [c]**
MVP-LMP-WE-01	3.3	3.8	2147	33	No*	Dormant slide and/or soil prone to movement. Intersects at least three natural drains.
MVP-LMP-HA-02	28.0	28.2	967	29	No*	Near well appurtenances. Side cut would run across at least three natural drains.
MVP-LMP-DO-03	32.4	32.6	749	32	No*	Dormant slide and/or soil prone to movement. Located at toe of slope. Hillside previously cleared.
MVP-LMP-HA-04	33.4	33.6	570	42	No*	Dormant slide and/or soil prone to movement. Located at toe of slope. Hillside previously cleared.
MVP-LMP-DO-05	34.2	34.4	377	28	No*	Moderate side slope, includes slight pipe bend. Cuts across at least one natural drain.
MVP-LMP-DO-06	34.4	34.6	907	28	No*	Downslope of ridge. Cuts across at least three, possibly four or five natural drains and one or two four-wheeler paths.
MVP-LMP-DO-07	35.1	35.4	869	40	No*	Construction equipment may need to be staged on sidehill here. Southeastern side less steep, may be better to stage.
MVP-LMP-LE-08	43.3	43.5	494	30	No*	Steep side slope, but ridge within right-of-way.
MVP-LMP-LE-09	46.2	46.5	1113	15-33	Yes*	Gravitropism and natural drains on a moderate side slope.
MVP-LMP-LE-10	46.6	46.8	448	36	Yes*	Existing dormant slide possibly upslope, and active within past twenty years. Cuts across at least one natural drain, possibly two.
MVP-LMP-LE-11	53.0	53.3	872	22	No*	Adjacent slopes composed of dormant slides. Moderate side slope directly below cemetery. Cuts across some kind of existing right-of-way or road, and at least two natural drains.
MVP-LMP-LE-12	55.1	55.2	224	35	No*	Moderate side slope, cuts across toe of slope. No signs of recent movement.
MVP-LMP-LE-13	57.2	57.7	806	18 - 40	No*	Right-of-way will run alongside hill with 32% grade and a 40% grade directly below it.
MVP-LMP-BR-14	66.8	67.0	826	15-34	No*	Moderate side slope subjacent to Weston and Gauley Bridge Turnpike Trail.
MVP-LMP-BR-15	69.2	69.5	1128	29	No*	Cuts across one large natural drainage. No signs of recent movement.

	Table 1 - Landslide Concern Areas Crossed by the MVP Pipeline					
Designation	**Beginning MP**	**Ending MP**	**Length Crossed (feet)**	**Slope (%) [a]**	**Signs of Recent Movement [b]**	**Notes [c]**
MVP-LMP-WB-16	81.8	82.1	1462	35	No*	Route crosses dormant slide area. Moderate side slope. No natural drains, but is directly above house or farm structure. Landowner issues may force it to be on the east side below the road, intersecting at least three natural drains.
MVP-LMP-WB-17	82.5	82.6	602	45	No*	Route cuts through a colluvial slope which is very prone to sliding. Very steep side slope, right above ravine, possibly crossing one natural drain.
MVP-LMP-NI-18	111.7†	111.8†	231	12 – 39	No	Moderately steep slope. Pipeline cuts through either dormant slide or slide-prone material. Not included in October 2016 Proposed Route.
MVP-LMP-NI-19	122.5	123.0	2547	7 – 43	No*	Crosses at least 5 streams or natural drains. Cuts through dormant slide or material prone to sliding.
MVP-LMP-NI-20	123.1	123.2	362	22	No*	Route crosses soil prone to movement. Mild side slope directly below power line right-of-way. Cuts across one natural drain.
MVP-LMP-NI-21	124.3	124.8	648	15 - 20	Yes*	Possible recent landslides, and this portion of route crosses through soil prone to movement.
MVP-LMP-NI-22	127.2	127.4	631	12 – 39	No*	Moderately steep slope below ridge. Cuts through dormant slide or material prone to sliding. Crosses an existing logging road.
MVP-LMP-NI-23	127.9	128.0	423	10 – 60	No*	Moderately steep slope below point. Cuts through dormant slide or material prone to sliding.
MVP-LMP-NI-24	132.0	132.1	646	25	No*	Portion of route is adjacent to soil prone to movement to the west and a dormant slide to the east. Moderate side slope. Cuts across at least one natural drain.
MVP-LMP-GB-25	145.3	146.1	8000	30 - 35	No*	Steep and very long side slope. Cuts across at least 3 natural drains. Two hard 90s one after the other in route.
MVP-LMP-SU-26	164.6	165.15	1320	33 - 43	No*	Steep side slopes outside of construction right-of-way. Two gullies at saddles are outside of the construction right-of-way.
MVP-LMP-MO-27	182.4	182.8	808	18 - 28	Yes*	Some slope movement is indicated on historical imagery within the past 20 years.
MVP-LMP-GI-28	197.4	197.6	1800	18 - 26	No*	Jefferson National Forest:
MVP-LMP-GI-29	198.4	199.1	2300	18 - 35	No*	Jefferson National Forest:
MVP-LMP-GI-30	204.4	204.8	1120	39	No	Lateral slope side cut, paralleling transmission power line.
MVP-LMP-GI-31	211.5	211.8	1184	32 – 53	No*	Very steep slope, centerline may or may not be on ridge. Directly above U.S. 460.

	Table 1 - Landslide Concern Areas Crossed by the MVP Pipeline					
Designation	**Beginning MP**	**Ending MP**	**Length Crossed (feet)**	**Slope (%) [a]**	**Signs of Recent Movement [b]**	**Notes [c]**
MVP-LMP-MN-32	219.6	220.9	1200	25 - 40	No*	Jefferson National Forest:
MVP-LMP-MN-33	220.6†	220.7†	310	59	No	Very steep slope where route makes a 90 degree turn off the ridge. Very short section, but because of the severity of slope, could be prone to slippage. Cuts across one stream. Not included in October 2016 Proposed Route.
MVP-LMP-MN-34	221.8†	221.9†	380	46	No*	Steep slope runs alongside of knoll, directly above substation. Not included in October 2016 Proposed Route.
MVP-LMP-MN-35	229.2	229.3	640	28	No*	Slight sidehill. Crosses stream.
MVP-LMP-FR-36	261.2	261.2	179	40	No*	Steep side slope, but just for small section. Running just below ridge line through a gulley. Crosses one natural drain.
MVP-LMP-FR-37	263.9†	264.0†	368	34	No*	Steep side slope. Running just below ridge line through a gulley. Crosses one natural drain. Not included in MVP Route 5.0.
	[a] Design slope is based on desktop and field review, or range from map analysis of alignment. [b] Based on historical imagery. [c] Based on available landslide mapping and field survey. * A field review of this site was performed. † Refers to MVP Route 4.0.0 mileposts.					

4.0 STEEP SLOPES AND RED SHALE

The MVP route will cross numerous bedrock strata, including the Conemaugh, Monongahela, and Dunkard Formations and Mauch Chunk Group. These groups contain landslide-prone shale formations that are sometimes referred to as "red beds" and are frequently associated with landslides that occur in the project area. Detailed descriptions of each formation/group are presented below. Figure 1 illustrates areas where the aforementioned shale formations are present along the pipeline route.

Landslides are documented to be associated with red beds that form in the Conemaugh Formation, Monongahela Formation, Dunkard Group, and Mauch Chunk Formation. Red beds refer to shale or siltstone layers that can appear red, reddish-gray, or greenish-gray due to the presence of iron bearing minerals. These shales are generally slightly fissile, jointed, and slickensided. As these shales are exposed to water and oxygen near the surface they weather very easily into a thick mud. In addition, impervious layers located beneath the shale may trap water and cause the weathered shale to become saturated. Steep slopes, that are often present in these areas, along with the weathered shale and mud, produce conditions that increase the likelihood for landslides.

Two common types of landslides include rotational slump, and earthflow. Rotational slump is characterized by the movement of a large mass of weak rock or sediment as a block unit along a curved slip plane. These slumps are large, slow moving and produce several distinctive topographic features. The upper section

(crown or head) is characterized by transversely oriented rupture scarps that can form terraces of displaced blocks. Depressions and pools of water may form and trees may become inclined upslope. The lower section (toe) is characterized by a fan-shaped, bulging mass, and radial ridges and cracks. Vegetation on the toe slopes may be seen leaning in strange directions. Earthflow landslides are smaller in size and result in weathered rock or sediment that flows downslope as a jumbled mass, forming a hummocky topography of ridges and swales.

Conemaugh Formation (Upper Pennsylvanian)

The Upper Pennsylvanian-aged Conemaugh Formation consists of cyclic sequences of shale, siltstone, sandstone, red beds, thin impure limestone, thin nonpersistent coal, and underclay, semi-flint clay, and flint clay. The Conemaugh Formation is formally divided into two members, the upper Casselman Formation and the lower Glenshaw Formation, however, several informal members exist as well. The lower member, the Sandy Grove Sandstone Member, is overlain by the Pittsburgh red shale. Sandstone in the Conemaugh Formation is described as medium-light-gray, very fine- to course grained, locally conglomeratic with well-rounded quartz pebbles and subangular limestone and shale fragments, thin bedded to massive. The shales and siltstones in the Formation are generally described as medium and greenish-gray to grayish-red, slightly fissile to poorly bedded, soft, clayey to silty; includes hematite nodules and discontinuous beds of limestone. The red beds and shales of the Conemaugh Formation are associated with landslides. Coal beds are also found in the Conemaugh Formation and are often underlain by underclay, flint clay, or semi-flint clay. These clays are described as medium-gray to grayish-red, poorly bedded with conchoidal fracture and containing fossil root prints. Coal and limestone beds in the Formation are generally thin bedded (around four feet). Limestones consists of medium-gray to light-grayish brown, nodular paleokarst surfaces, mudstone to packstone, and containing fossils.

Monongahela Formation (Upper Pennsylvanian)

The Upper Pennsylvanian-aged Monongahela Formation consists of non-marine cyclic sequences of sandstone, siltstone, red and gray shale, limestone, and coal. The Formation extends from the top of the Waynesburg coal to the base of the Pittsburgh coal and also includes the Uniontown, Sewickley, and Redstone coals. In West Virginia, the thickness of the Formation generally ranges from 170 feet to 300 feet. Sandstone in the Formation is described as medium-light-gray, very fine- to coarse-grained, conglomeratic with rounded quartz pebbles; thin-bedded to massive. Siltstone and shale in the Formation are described as medium- dark-gray to grayish-red, thin to poorly bedded, slightly fissile, silty, carbonaceous, and slightly calcareous. The shales and siltstones of the Formation, commonly known as red beds, are associated with landslides. Coal beds are also found in the Monongahela Formation and are often underlain by underclay, flint clay, or semi-flint clay. These clays are described as medium-gray, grayish-yellow, grayish-red, poorly bedded and brecciated with conchoidal fracture and containing fossil root prints.

Dunkard Group (Upper Pennsylvanian/Permian)

The Upper Pennsylvanian/Permian-aged Dunkard Group consists of non-marine cyclic sequences of sandstone, siltstone, red and gray shale, limestone, and coal. The Dunkard Group contains the Greene, Washington, and Waynesburg Formations. The maximum thickness of the Group, in Wetzel County, West Virginia, is estimated to be about 1,190 feet. Thin coal beds are often underlain with underclay, flint clay, or semi-flint clay that may contain fossil root prints. The coal beds are often overlain with multi-story, thick channel-form sandstone bodies with undulating, erosive bases and roof shale. Sandstones may grade

upward back into siltstone, and gray, green, or red shale. Calcarious nodules and slickensides are also present in the shales. Red, green, or gray, mudstone or claystone paleosols may also develop indicating periods of wetting and drying. These paleosols are typically overlain by nonmarine lacustrine limestone beds. Individual limestone beds are generally less than five feet thick and display evidence of subaerial exposure. Limestone beds are frequently interbedded with argillaceous limestone, calcareous mudstone, and calcareous shale. Red facies of red colored shale, siltstone, and paleosols are prevalent throughout the Dunkard Group and are associated with landslides.

Mauch Chunk Group (Mississippian)

The Mississippian-aged Mauch Chunk Group consists of red, green, and medium-gray shale, siltstone, sandstone, and some conglomerate with a few thin limestones. The Mauch Chunk Group contains the Bluestone and Princeton, Hinton, and Bluefield Formations. In West Virginia, the thickness of the Group ranges from 970 feet to 4150 feet.

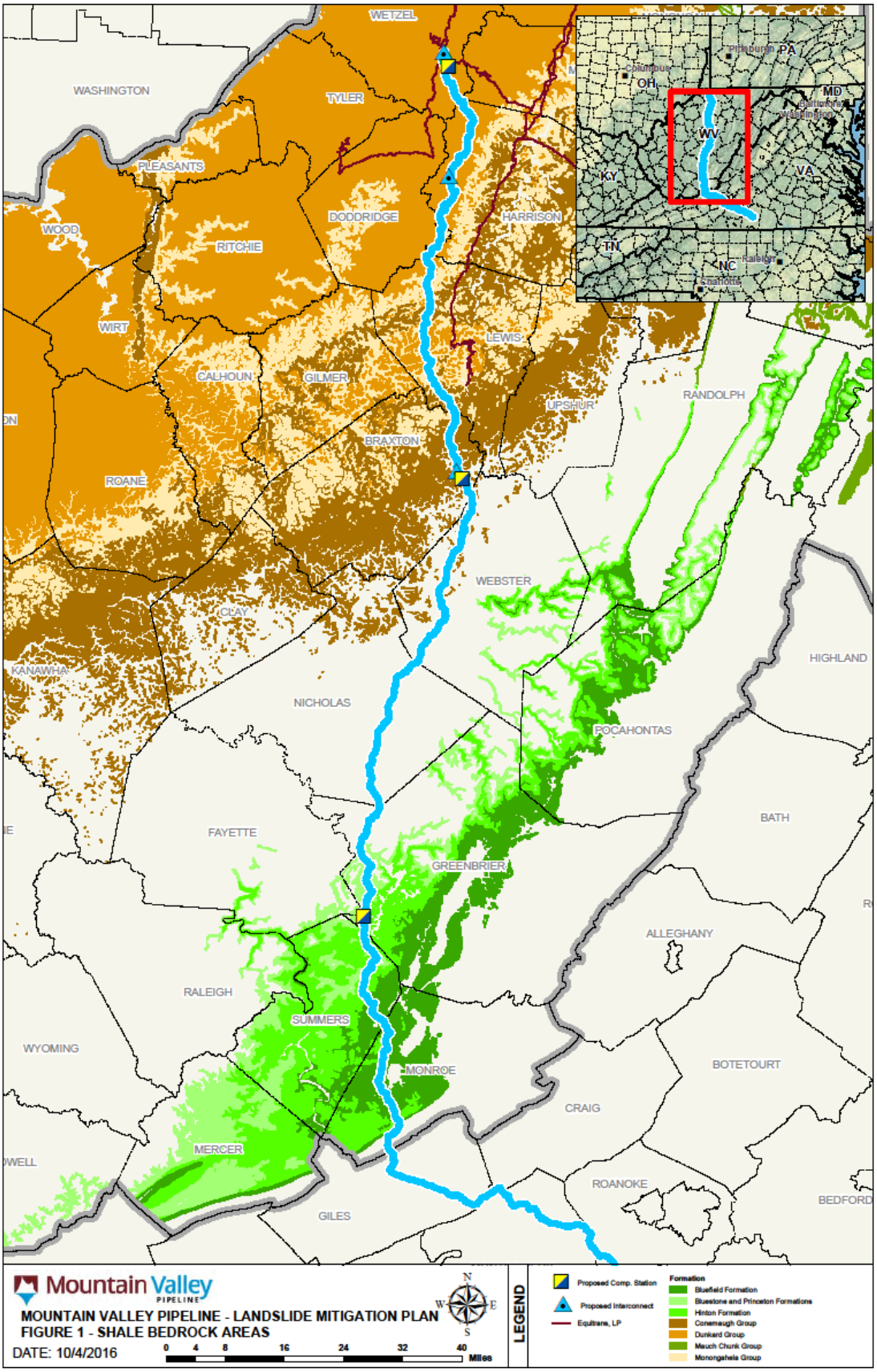
The Bluefield Formation of the Mauch Chunk Group consists of Limestone, siltstone, and shale. Limestone is light-grayish-brown, dolomitic, cherty, and fossiliferous. Shale is medium-gray to light-grayish-red, silty, thin and evenly bedded, very calcareous.

The Hinton Formation overlies the Bluefield Formation and consists of red shale and siltstone; sandstone, limestone, and dolomite are also present. The sandstone member at the base of the Formation is light-gray to white, very fine- to coarse-grained, cross-bedded quartzose with few scattered rounded quartz pebbles. The middle member of the Formation, the red member, consists of red silty shale that is locally calcareous and interbedded with thin beds of sandstone, siltstone and impure limestone, and dolomite. The limestone member of the Hinton Formation consists of dark calcareous shale or gray to brownish-gray, fossiliferous, impure shaly limestone. The upper member of the Hinton Formation consists of red, greenish-gray, and gray shale which is locally calcareous and contains several nonpersistent lenticular beds of sandstone and siltstone.

The Princeton Sandstone consists of white quartzose cross-bedded massive sandstone with rounded medium grains and some fine- to coarse-grained and conglomeratic zones. The sandstone is cemented with calcium carbonate or silica. Some gray to red shale, limestone, and coal are also present.

The Bluestone Formation consists of mostly interbedded shale, mudstone, siltstone, sandstone, limestone, and thin, impure coal seams. The lower member of the Bluestone Formation, the gray shale member, consists of gray and black shale which contains some beds of siltstone, sandstone, red shale, and limestone. The shale is calcareous and locally carbonaceous. The upper half of the member is mostly conglomeratic sandstone. The middle member, the red member, is composed of calcareous red shale with some siltstone, small amounts of calcareous sandstone and lenticular beds of limestone. The upper member of the Bluestone Formation consists of white, gray and greenish-gray sandstone. The sandstone is medium- to coarse-grained and locally conglomeratic and contains cross-bedding. The sandstone is interbedded with gray, green, black, and red shale and siltstone.

The Mauch Chunk consists of red and green shales, similar to the red beds found in the Conemaugh and Monongahela Formations. The shales are moderately high in clay minerals, are highly susceptible to weathering, and are prone to mass wasting. The residual soils have a moderate shrink-swell potential and are susceptible to gully erosion.


WETZEL
WASHINGTON
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PLEASANTS
WOOD
RITCHIE
DODDRIDGE
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WIRT
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RANDOLPH
BRAXTON
ROANE
WEBSTER
CLAY
KANAWHA
HIGHLAND
NICHOLAS
POCAHONTAS
BATH
FAYETTE
GREENBRIER
ALLEGHANY
RALEIGH
SUMMERS
WYOMING
MONROE
BOTETOURT
CRAIG
MERCER
ROANOKE
BEDFORD
GILES
OH
PA
MD
WV
VA
KY
TN
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Mountain Valley PIPELINE
MOUNTAIN VALLEY PIPELINE - LANDSLIDE MITIGATION PLAN
FIGURE 1 - SHALE BEDROCK AREAS
DATE: 10/4/2016
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LEGEND
Proposed Comp. Station
Proposed Interconnect
Equitrans, LP
Formation
Bluefield Formation
Bluestone and Princeton Formations
Hinton Formation
Conemaugh Group
Dunkard Group
Mauch Chunk Group
Monongahela Group

5.0 POTENTIAL MITIGATION MEASURES

The basic strategies to protect against landslides and slope instability along the pipeline corridor during construction are stabilization, drainage improvement, and erosion and runoff control. Mitigation measures that may be used on MVP are outlined below and prescribed to specific project areas in Section 8.0. Construction typical drawings for selected mitigation measures are shown in the Appendix.

- Excavation and/or Regrading of Upgradient Head Soils: Regrading to a flatter slope upgradient of the pipeline excavation will increase the slope stability factor of safety by reducing the weight of soil at the top of the slope.
- Bedrock Embedment: Installing the pipeline completely within a bedrock trench will protect the pipeline integrity in the event of a surficial landslide.
- Dewatering: Dewatering a slope is often the most cost effective means to stabilize a slope and prevent future landslides. Saturated soil has an increased unit weight and higher pore water pressure, both of which negatively affect the slope stability factor of safety. To prevent soil from becoming saturated, runoff will be directed away from the potentially unstable slope and drains will daylight subsurface water.
- Erosion and Runoff Control: Typical erosion and sediment control BMPs will be implemented during pipeline construction and will be detailed in the Project plans. Installing additional erosion and sediment control measures will increase slope stability by minimizing soil saturation, as in dewatering. BMPs that are recommended for slope stabilization are summarized below.
    - Berms: Diversion berms will be used to intercept, divert, and convey surface runoff from steep slopes to decrease the chance of rill or gully erosion to occur which could weaken the stability of steep slopes. The outlet of all diversion berms will be armored with riprap to act as an energy dissipater and prevent localized erosion.
    - Rock Outlet Protection (Riprap): Rock outlet protection (riprap) will be used at the outlets of trench drains, sidehill low-point drains, berms, culverts, etc., to control the velocity and potential for erosion of the storm water runoff.
    - Sidehill Low-Point Drain: Sidehill low-point drains will be installed from the main pipeline trench at the upgradient side of a trench breaker to drain water out of the trench and outlet it to an area with rock outlet protection.
    - Trench Drain: Trench drains will be installed on side slopes and steep slopes in order to dewater the uphill slope.
    - Water Bar (Broad-Based Dip): Water bars will be used across the right-of-way, sloped to drain water off of the pipeline right-of-way.
    - Trench breakers (Trench Plugs): Trench breakers constructed of sandbags will be used in trenches along pipes to control water flowing through the pipeline trench. Excessive amounts of water will saturate the slope and destabilize it.
    - Hard Armor: Hard armoring existing drainage channels with riprap or articulated concrete block (ACB) will minimize slope saturation and erosion by stormwater. Areas susceptible

to future erosion, especially above the pipeline, may be armored with articulated concrete block (ACB) or riprap, as necessary.

- Rerouting: Minor route adjustments may be made to avoid landslide-prone areas identified during construction.

Construction operations will be staffed with geotechnical personnel who will prescribe additional mitigation measures as needed when subsurface conditions are revealed. The following measures are not currently anticipated but may be implemented during construction, as needed.

- Buttressing: An earth, rock, or riprap fill buttress in front of an unstable slope will increase the weight of the material at the toe of the slope, thereby increasing the slope stability factor of safety.
- Reinforced Soil Slope: Incorporating multiple layers of geogrid or other geosynthetics between compacted lifts of soil or crushed stone will increase the shear strength of the fill, decreasing the risk of a slope movement.
- Rockfall Protection (Fencing): Protection measures such as rock fences, placement of concrete barriers, or creating catchment areas may be added where excavation is planned at the top of steep slopes to limit loose debris and protect downslope property or roadways.
- Soil-Nail Stabilization: Soil-Nail Stabilization is used to stabilize unstable soil slopes or allow for safe over-steepening (if required) of new or existing soil slopes. Tension-resisting steel elements will be inserted into holes in the soil surface and grouted or directly driven into the ground surface to anchor a steel cable or net system at the surface of the ground.

6.0 MAINTENANCE AND MONITORING

Maintenance and monitoring measures will be implemented to confirm the pipeline integrity in areas susceptible to landslides.

In all of the areas where there was evidence of a previous landslide in close proximity to the pipeline, or there remains some uncertainty, slope monitoring will be conducted. In some cases, this may be limited to periodic visual evaluation, but in others, more robust monitoring may be appropriate. The need for future monitoring will be field determined by an engineering geologist or geotechnical engineer during construction. If monitoring is necessary, specific requirements will be established for each location following construction.

7.0 SIDEHILL CONSTRUCTION

In sidehill construction areas (as defined on the project alignment sheets), the following construction practices shall be observed (in addition to landslide mitigations prescribed for locations specified in this document):

- Seeps or springs encountered in the excavation shall be intercepted by transverse trench drains, cutoff drains, or similar, and directed out of the pipeline ditch to an energy dissipating structure (such as a riprap apron).
- Backfill material shall exclude organic material, vegetation, stumps, root systems, frozen material, and rocks larger than three inches in diameter.

- Backfill operations shall be performed when soil moisture content is suitable for compaction, at or near optimum moisture content (i.e., not immediately following a large precipitation event or when soil is excessively dry).
- Backfill material shall be placed in compacted lifts no greater than 12 inches thick.
- Backfill compaction shall be accomplished using the back of an excavator bucket, sheep's foot roller, or similar.
- Where a temporary cut and fill surface is required, any ground fractures forming near the cut/fill line or the pipeline ditch shall be repaired to prevent water infiltration.
- All streams, gullies, natural drains, field roads or trails, and other water conveying features shall be properly recontoured such that the permanent right-of-way is protected from preferential water accumulation and infiltration.

8.0 SITE SPECIFIC MITIGATION

Recommendations for landslide mitigation at each of the 37 areas identified in Table 1 are described below. Landslide mitigation typical detail drawings are appended.

Generally, landslide mitigation will depend heavily on the installation of appropriate drainage and erosion control measures during pipeline construction (as described in Resource Report 6.6.1.2) and proper right-of-way reclamation. Backfilling operations in the areas discussed below and all sidehill construction areas identified on the alignment sheets (as discussed in Section 7.0) will be accomplished by following specific guidelines. Fill material will exclude organic material, vegetation, stumps, root systems, and rocks larger than three inches in diameter. When placed in the trench, this select material will be placed in compacted lifts of no greater than 12 inches thick. Compaction may be accomplished using the back of an excavator bucket, a sheep's foot roller, or similar. Where a cut and fill surface is required, contractors will ensure that any ground fractures that form at the interface of that surface and the pipeline ditch are repaired. Finally, inspectors or on-site engineers/geologists will ensure that all identified streams, gullies, natural drains, field roads or trails, and any other water conveying features are properly recontoured such that the permanent right-of-way is protected from preferential water accumulation and infiltration.

Additional mitigation measures beyond these may be required depending on site specific conditions. These are described below based on the results of the field investigations.

- **MVP-LMP-WE-01 (MP 3.3 to 3.8):**

  The pipeline in this area runs along the crest of a ridge between MP 3.3 to 3.5, drops down along a steep side slope between MP 3.5 and 3.8, and continues along the ridgeline beyond MP 3.8. The primary area of concern falls between MP 3.55 and 3.77. The side slope in this area varies from 41.5 % to 51.2% below and above the pipeline, respectively.

  Although the field survey found no evidence of recent slides in this area, the state landslide topographic maps indicate dormant slides are located in this vicinity. The field survey did observe three primary gullies draining to the east down this bowl-shaped slope.

  As this area may be prone to landslides, the right-of-way will be kept drained by installing transverse trench drains along the right-of-way. The trench drain will convey water out of the

pipeline trench. The gullies noted during the site visit will be restored to original contours to facilitate surface water drainage. The ultimate protective measure for the pipeline in this area will be embedment of the pipe within the local bedrock.

- **MVP-LMP-HA-02 (MP 28.0 to 28.2):**

The pipeline in this area runs entirely along the crest of a ridge with steep side slopes ranging from 31.2% to 54%. This location is near well appurtenances at MP 28.25 located approximately 40 feet east of the pipeline.

A 10-foot wide slump was noted in the field survey approximately 75 feet west of the pipe centerline at MP 27.95 on the side slope. A large rock outcrop was also noted on the east side near the pipe centerline at MP 28.0. Multiple gullies were observed outside of the right-of-way from MP 28.1 to 28.2.

As the pipeline follows the ridge and the existing slump will not be affected by construction operations, no additional mitigation is required at this location. Where practical, the pipe trench will be located in bedrock to protect the pipe in the event that the subjacent slope fails.

- **MVP-LMP-DO-03 (MP 32.4 to 32.6):**

The pipeline in this area runs downslope from a crest at a slope of 30% to 35% before crossing a stream and cutting across the toe of a side slope between MP 32.3 and MP 32.55. Although historical imagery shows no signs of recent movement, the hillside was previously cleared and landslide topographic maps show this portion of the route crossing through dormant slides and/or soil prone to movement. The soils in this region were classified as a Gilpin-Peabody Complex or Vandalia Silty Loam (NRCS Hydrologic Soil Group C).

The lower section of the slope was recently cleared and is mainly vegetated with grasses and/or small shrubs. The upper portion is vegetated with trees and overgrown with shrubs. Along the toe of the slope, the existing three-foot-wide stream is actively eroding the toe as indicated by the steep cut bank and slumping of material into the stream. A scarp was indicated in the field report at MP 32.4 that was approximately 12-feet tall and 50-feet long with evidence of gravitropism.

The area with visible scarp and steep side slopes following it may be prone to landslides. In this area, a trench drain will be installed on the high side of the right-of-way, daylighting to the low side. It should also be buttressed with a riprap fill at the edge of the right-of-way, if needed during construction. At the steep downslope before the stream crossing, water bars in conjunction with trench breakers and trench breaker daylight drains will be installed.

- **MVP-LMP-HA-04 (MP 33.45 to 33.6):**

The pipeline in this area runs entirely along the crest of a ridge with steep side slopes ranging from 34% to 48%. The primary area of concern falls between MP 33.45 to MP 33.6. As the pipeline excavation runs along the crest it crosses an existing right-of-way with an underground pipe near MP 33.55.

During the field observation no evidence of mass movement was observed on the vegetated slopes or existing cleared right-of-way. Soils in this section were classified as Gilpin-Peabody Complex or Gilpin-Upshur Complex (NRCS Hydrologic Soil Group C).

No additional mitigation measures are necessary in this area.

- **MVP-LMP-DO-05 (MP 34.2 to 34.4):**

The pipeline in this area runs along a side slope and crosses a number of gullies between MP 34.25 and MP 34.35 with side slopes ranging from 25% to 48%. The primary area of concern lies between MP 34.25 and MP 34.35. Historical imagery shows no recent signs of landslide movement in the area, and the soils were classified as Gilpin-Peabody Complex (Very Stony, NRC Hydrologic Soil Group C).

Rock armoring (or ACB) will be used between MP 34.25 to MP 34.32 after backfill of the pipeline excavation to help stabilize the gully crossings, which will be restored to their original contours. A trench breaker, in conjunction with a sidehill low-point drain which will outlet to a rock outfall protection location, will be used at the low point near MP 34.35. Where practical, the pipe trench will be located in bedrock to protect the pipe from shallow soil movements.

- **MVP-LMP-DO-06 (MP 34.4 to 34.6):**

The pipeline in this area runs along steep side slopes and crosses a number of gullies as well as an area that is a cut slope adjacent to an existing road with visible slumps and associated scarps. The slopes in this area range from 17% to 42%.

The most critical area is a 150-foot-long, 300-foot-wide section next to an existing cut slope with multiple large slumps and scarps. The field reports also noted a long coal seam with standing water and saturated slopes below the seam. The soils in this region were noted as Gilpin-Peabody Complex, very stony (NRCS Hydrologic Soil Group C).

The area exhibiting slumps and scarps must be stabilized by removing and replacing the slumping soils prior to placing additional material in that area. Transverse trench drains will be installed uphill of the pipeline to cut off water ponding near the coal seam outcrop. Gullies will be restored to their natural contours to facilitate drainage across the right-of-way. Where practical, the pipe trench will be located in bedrock to protect the pipe in the event that the subjacent slope fails.

- **MVP-LMP-DO-07 (MP 35.15 to 35.35):**

The pipeline in this area runs along the crest of a ridge between MP 35.15 to MP 35.35 with steep side slopes ranging from 27% to 69%. Historical imagery shows no signs of recent landslide movement and the soils in the area were classified as Gilpin-Peabody Complex, very stony (NRCS Hydrologic Soil Group C).

A trench breaker should be used in the trench in conjunction with a sidehill low-point drain that outlets to a rock outfall protection location at the low point near MP 35.25. Where practical, the pipe trench will be located in bedrock to protect the pipe in the event that the subjacent slope fails.

- **MVP-LMP-LE-08 (MP 43.35 to 43.45):**

The pipeline in this area will be constructed along the ridgeline between MP 43.15 to 43.2, then at the local peak turns slightly eastward and runs approximately 100 to 200 feet from the top of the adjacent ridgeline to the west between MP 43.2 to 43.45. The remainder of the pipeline in this area follows the existing saddles and ridgeline to the southwest between MP 43.45 through 43.65. The primary area of concern falls between MP 43.25 and 43.45.

The side slopes in this area vary from approximately 58% above the pipeline and 53% below the pipeline. The pipeline right-of-way in this area is crossed by an existing gas pipeline at approximately MP 43.35. During the field survey, multiple rock outcrops were observed along the top of the slope/ridgeline that were undercut at the base up to five feet. In addition, large boulders located downslope of these outcrops indicate that future rockfall in the area is possible. Some evidence of gravitropism was noted at the top of slope above the pipeline centerline, which indicates that soil movement has occurred in the past. Although the field survey found little to no evidence of recent slides in this area, the state landslide topographic maps indicate dormant slides are located in this vicinity. The NRCS soil classification for this area is Hydrologic Soil Group C soil that represents a sandy clay loam.

Transverse trench drains will be installed in the pipeline trench. Water bars in conjunction with trench breakers with drains will be installed in the steeper downhill sections of the pipeline. Where practical, the pipe trench will be located in bedrock to protect the pipe in the event that the subjacent slope fails.

- **MVP-LMP-LE-09 (MP 46.2 to 46.5):**

In this area, the pipeline right of way is aligned to the eastern side of a knoll from about MP 46.25 to 46.4 where it follows a saddle to about MP 46.5. Side slopes in the area range from approximately 15% to 33%. Soils in the area are classified as Gilpin-Upshur silt loams, corresponding to NRCS Hydrologic Soil Group C.

The site visit revealed numerous rock outcrops about the knoll between MP 46.25 and 46.4. Several swales and evidence of gravitropism were observed between MP 46.4 and 46.5. The area is forested.

Transverse trench drains will be installed in sidehill portions of the alignment and the ground surface will be restored to existing contours. Where practical, the pipeline trench will be located in bedrock to protect the pipe from shallow soil movements.

- **MVP-LMP-LE-10 (MP 46.6 to 46.8):**

The pipeline in this area has been rerouted since the initial field visit to be constructed generally along the ridgeline in this area. The primary area of concern falls between MP 46.5 and 46.8 on the western slope. The western side slopes in this area have an approximate 18 to 25% grade and the eastern side slope (located over the uphill ridgeline) have varying range of slopes (20 to 40%) with an average slope of approximately 25%.

During the field survey, one scarp and one gully were located on the eastern slope area and two gullies and two scarps were observed on the western side slope. The gullies have been delineated as streams. Some evidence of gravitropism was noted along the top of the western slope above the pipeline centerline, which indicates that soil movement has occurred in the past. Although the field survey found little to no evidence of recent slides in this area, the state landslide topographic maps indicate dormant slides are located in this vicinity and historical scarps were present. The NRCS soil classification for this area is Hydrologic Soil Group C soil that represents a sandy clay loam.

Transverse trench drains will be installed in the pipeline trench through the sidehill portion of the alignment. Water bars in conjunction with trench breakers will be installed in the steeper downhill

sections of the right-of-way. Gullies will be restored to original contours to facilitate drainage across the right-of-way. Where practical, the pipe trench will be located in bedrock to protect the pipe from shallow soil movements.

- **MVP-LMP-LE-11 (MP 53.0 to 53.3):**

A majority of the pipeline in this area is to be constructed along the existing ridgeline on the western side slope between MP 52.9 to 53.35. An existing cemetery is located at the top of the slope approximately 100 feet east of MP 53.1 and creates a gently sloping ridgeline. A gated roadway located just south of the cemetery also parallels the proposed gas pipeline to the east along the ridgeline at a distance/offset of approximately 50 feet between MP 53.05 through 53.2. An abandoned road right-of-way located on the western slope crosses the gas pipeline at MP 53.1.

During the field survey, multiple road failures were identified along this abandoned right-of-way. An existing gas line that runs northwest to southeast intersects the new pipeline at MP 53.2. The primary area of concern falls between MP 53.0 and 53.15; the western side slopes in this area have an approximate 25% to 30% grade.

Seven gullies, some of which were delineated as streams, were identified on the western slope. Although the field survey found no evidence of recent slides in this area, the state landslide topographic maps indicate dormant slides are located in this vicinity. The NRCS soil classification for this area is Hydrologic Soil Group C soil that represents a sandy clay loam.

In areas where the pipeline crosses gullies and natural drains, the grade will be restored to original contours to facilitate drainage. Water bars in conjunction with trench breakers will be installed in the steeper downhill sections of the right-of-way. Transverse trench drains will be installed in sidehill sections of the right-of-way to prevent saturation of the trench backfill. Where practical, the pipe trench will be located in bedrock to protect the pipe from shallow soil movements.

- **MVP-LMP-LE-012 (MP 55.1 to 55.2):**

The pipeline in this area will be constructed perpendicular to a valley. The northwestern slope section of the pipeline starts at MP 54.9 (top of slope) and runs down slope to MP 55.1 at Copley Road located at the toe of slope. The pipeline will then cross under an existing drainage ditch, Copley Road, and stream. The pipeline then ascends the adjacent slope from MP 55.1 (Copley Road at toe of slope) to MP 55.25 (top of slope). The primary areas of concern are the two aforementioned side slopes that fall between MP 54.95 and 55.25.

The northwestern side slope in this area is well vegetated with trees and shrubs and has an approximate grade that ranges from 35% to 45%. A 20-foot high rock outcrop is located at the toe of slope on the northwestern side of Copley Road. A “Falling Rocks” warning sign is also located along this section road. Many of the trees located throughout this slope show signs of gravitropism that indicates soil movement on the slope has occurred in the past. The southeastern side slope is also well vegetated with trees and shrubs and has an approximate grade that ranges from 43% to 53%. The NRCS soil classification for this area is Hydrologic Soil Group C soil that represents a sandy clay loam.

Water bars in conjunction with trench breakers will be installed along the pipeline in this area. Trench breaker daylight drains will be installed at the base of some trench breakers to allow for

discharge of infiltrated water from the trench to areas outside or downstream of the area of concern. At this time, stabilization measures for the very steep slope superjacent to Copley Road have not been finalized as the work will require approval from the owner of the road, but MVP anticipates that a highwall revetment may be required.

- **MVP-LMP-LE-13 (MP 57.2 to 57.7):**

The pipeline in this area runs along the crest of a ridge, then at a local peak runs along steep side slopes on the west side of the ridgeline between MP 57.3 and 57.6. The slope below this area of concern also has two gullies with one associated seep located down gradient to the northwest, off of the right-of-way. The gullies lead to a creek at the toe of the slope that is approximately 10 feet wide. The creek did not form significant cut slopes or show signs of significant toe erosion. Across the side slopes, signs of gravitropism were observed. Tree deformation was more significant at the steep section and was present down to the toe of the slope. The corridor in this area also crosses two abandoned roads. The forest floor has little to no vegetative cover, occupied by small shrubs and ferns with silty clayey sand and sandstone cobbles and boulders scattered across the slope. Historical imagery shows no recent signs of movement.

Transverse trench drains will be installed in the pipeline trench through the sidehill area of the alignment. Where practical, the pipe trench will be located in bedrock to protect the pipe from shallow soil movements.

- **MVP-LMP-BR-14 (MP 66.8 to 66.95):**

The pipeline in this area is to be constructed subjacent to the Weston and Gauley Bridge Turnpike Trail, sidehill along a moderate side slope. The trail follows the ridgeline with moderate side slopes in the vicinity. The pipeline crosses the trail at approximately MP 66.95. Soils in this area are classified as Gilpin-Upshur silt loam (NRCS hydrologic soil group C).

The area is generally wooded but is a vegetated open field in the vicinity of MP 66.9 to 66.95. No evidence of recent or historic slope movement was observed at this location.

Transverse trench drains will be installed in the sidehill portion of this area.

- **MVP-LMP-BR-15 (MP 69.2 to 69.5):**

The pipeline in this area is to be constructed along the ridgeline between MP 69.0 to 69.2, then runs approximately 500 feet downslope from the adjacent ridgeline to the west between MP 69.2 to 69.45. The remainder of the pipeline in this area follows the existing saddles and ridgeline to the southwest of MP 69.45. The primary area of concern falls between MP 69.2 and 69.45.

As the property could not be accessed due to landowner restrictions, no field survey or report was prepared for this sidehill area, and the preliminary evaluation was prepared based on summary descriptions provided by routing engineers and publically available imagery and information for the area. The side slopes upgradient (west) of the pipeline right-of-way range from approximately 41% to 67% and downgradient (east) from 28% to 36%. The area is well vegetated with trees. Historical imagery does not suggest recent landslide/soil movement in the area, nor does it cross an existing or dormant slide. The NRCS soil classification for this area is Hydrologic Soil Group C soil that represents a sandy clay loam.

Transverse trench drains will be installed on the upgradient edge of the right-of-way, conveying the water out of the area of concern. Water bars in conjunction with trench breakers will be installed at the steep downhill sections of the right-of-way. Sidehill low point drains will be installed at selected trench breakers.

- **MVP-LMP-WB-16 (MP 81.8 to 82.1):**

The pipeline in this area will be constructed along the upgradient edge of an existing, ephemeral drainage between MP 81.8 and 82.0 with moderately steep side slopes. Dave Cowger Hill Road is located upgradient of this pipeline segment. The upgradient slopes between the road and the pipeline range from 40% to 45% and 150 to 250 feet in length. The pipeline then runs up the moderately steep slope to the south (approximately 52% grade) to the top of a saddle at MP 82.05. From the top of the saddle, the pipeline runs at an angle across a relatively steep slope (slope grade ranges from 28% to 63% with angled pipeline grade ranging from 18% to 35% in the trench) to the toe of slope in a valley at MP 82.3.

All of the slopes appear to be heavily vegetated with trees and the forest floor is comprised of scattered shrubs and sparse vegetation. During the field survey, five significant gullies were identified between MP 81.9 and MP 82.0. These gullies range in width from three feet to 20 feet; four of them are delineated as streams. Although the field survey found no evidence of recent slides in this area, the state landslide topographic maps indicate dormant slides are located in this vicinity. The NRCS soil classification at MP 81.8 is Hydrologic Soil Group B soil that represents a silt loam or loam and MP 81.9 to 82.1 is Hydrologic Soil Group C soil that represents a sandy clay loam.

Water bars in conjunction with trench breakers will be installed at the steep downhill sections of the pipeline in this area. Transverse trench drains will be installed in the pipeline trench. Gullies will be restored to their natural contours to facilitate drainage across the right-of-way; the gully not delineated as a stream will be armored with rock or ACB to minimize erosion. Where practical, the pipe trench will be located in bedrock to protect the pipe from shallow soil movements.

- **MVP-LMP-WB-17 (MP 82.5 to 82.6):**

The pipeline runs up a moderate side slope to the south, across a natural drain, and up a steep ridge. The side slopes vary from 37% to 70%. However, the pipeline alignment avoids the steepest sections. At MP 82.6 the pipeline crosses a significant natural drain. From MP 82.6 to 82.9 the pipeline runs directly up a steep slope (44% to 55%).

Both the historical imagery and the field survey indicated no signs of recent slope movement or gravitropism. The soil type in this area has been identified as sandy clay loam, but colluvial material may be present near the drain paths which could be unstable.

In areas where the pipeline crosses gullies and natural drains, the grade will be restored to original contours to facilitate drainage. Transverse trench drains will be installed in the sidehill portion of the alignment in this area. Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-NI-18 (MP 111.7 to 111.8 -MVP Route 4.0.0):**

The area of concern runs between MP 111.7 and 111.85 (MVP Route 4.0.0) where the pipeline corridor goes down a ridge with side slopes between 35% and 47%. At MP 111.85, the pipeline

corridor makes a 90-degree bend and continues normal to the slope, reaching a significant drainage crossing at MP 111.92.

Historical imagery shows no signs of recent landslide movement However, the landslide topographic maps show the pipeline running through dormant slides and/or material prone to landslide movement. No field survey or report was completed in this area as the property could not be accessed due to landowner restrictions. The soil in this area was classified as Clifftop Channery Silt Loam, very stony (NRCS Hydrologic Soil Group C).

The pipeline in this area has been re-routed and this area is no longer of concern.

- **MVP-LMP-NI-19 (MP 122.5 to 123.0):**

The pipeline in this section traverses side slopes ranging from 28% to 43% and crosses four drainages and under a transmission line and road.

Although historical imagery reveals no signs of recent landslide movement, this section cuts through an area with dormant slides and/or material prone to sliding. Soils in the region were classified as a variety of different soil groups (NRCS Hydrologic Soil Groups A, C and D). The field survey revealed numerous natural drains and several large boulders along and adjacent to the route. Some areas showed evidence of gravitropism and hummocky terrain.

Transverse trench drains will be installed in the pipeline trench throughout the sidehill area. Numerous boulders and rock outcrops suggest that bedrock will be relatively shallow in the area and that the pipeline trench will be located in bedrock, minimizing the potential for damage due to earth movement.

- **MVP-LMP-NI-20 (MP 123.1 to 123.2):**

The pipeline in this area crosses an existing gully and seep at MP 123.1, crosses a sidehill parallel to a cleared existing power line right-of-way at a slope of 12.5% between MP 121.13 to 123.2, and then runs normal and downhill on a well-vegetated steep slope with slopes ranging from 30% to 60% between MP 123.13 to 123.2.

The field survey noted one seep near MP 123.2 that was actively flowing to a gully that crosses the corridor just to the north. The gully becomes up to 10 feet wide and three feet deep near the corridor centerline and has been delineated as a stream. Although the historical imagery shows no signs of recent movement, the landslide topographic map shows this portion of route crosses through soil prone to movement. The field survey defined the soil as decomposed plant material, silt loam, and silty clay loam.

In areas where the pipeline crosses gullies and natural drains, the grade will be restored to original contours to facilitate drainage. Water bars in conjunction with trench breakers will be installed in the steeper downhill sections of the right-of-way. Transverse trench drains will be installed in the sidehill portions of the alignment.

- **MVP-LMP-NI-21 (MP 124.35 to 124.75):**

The pipeline in this area runs along the crest of a moderately sloping ridge then continues to run south downslope off the ridge though a valley with steep slopes. The valley located between MP 124.5 and 124.6 has a seasonal stream located at the toe of the slope. The steep slopes around the

valley are mostly vegetated by trees. The forest floor has little to no vegetative cover and was covered in fallen leaves at the time of the site visit. No signs of erosion were observed from the seasonal stream at the toe of the slope but erosion around the base of trees was observed.

Historical imagery shows possible signs of recent movement and the landslide topographic map shows this portion of the route crosses through soil prone to movement.

Trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-NI-22 (MP 127.2 to 127.4)**:

The pipeline in this area runs northwesterly upslope along a crest of a ridge then turns southerly downslope between MP 127.2 to MP 127.0. The primary area of concern runs from MP 127.2 to MP 127.5. The steep slopes off the side of the crest where the pipeline runs along the slope vary from 30% to 40%.

Historical imagery and the site visit revealed no signs of recent landslide movement. However, landslide topographic maps show materials that are prone to landslide movement. Rock outcrops were observed along the pipeline right of way during the site visit. An existing logging road with steep high-side cut, approximately three feet high, is located at the southern end of the segment.

Transverse trench drains will be installed at low points along the pipeline alignment to facilitate drainage of the pipeline trench and prevent slope saturation.

- **MVP-LMP-NI-23 (MP 127.9 to 128.0):**

The pipeline in this area runs along the crest of a ridge between MP 127.8 to 127.92, then drops down along a steep side slope between MP 127.92 to MP 128.0. The primary area of concern falls between MP 127.92 and MP 128.0. The side slope in this area varies from 30% to 40% along the pipeline.

The site visit revealed that the sidehill area of the pipeline route contained numerous rock outcrops. Historical imagery shows no sign of recent landslide movement. However, landslide topographic maps show slide prone material. NRCS data show the soils in this area to be a sandy loam and silt loam.

If possible, the pipeline alignment should be rerouted to traverse directly uphill to the peak of the knoll and back downhill, eliminating the sidehill portion. If this is not possible, transverse trench drains will be installed in the sidehill portion of this area. Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-NI-24 (MP 132.0 to 132.1):**

The pipeline in this area runs along a side slope and crosses a gully with two contributing seeps west of the pipeline between MP 132.0 to MP 132.1 and then continues southeasterly down a moderately steep slope.

Although the field survey and historical imagery show no signs of recent landslide movement, the landslide topographic maps show soil prone to movement uphill (west) of the pipeline excavation and a dormant slide downhill (east) of the pipeline excavation. The soil type in this area has been defined as a Clifftop Channery silt loam, very stony, Hydrologic Soil Group C.

The primary area of concern lies between MP 131.9 and MP 132.1 with side slopes ranging from 25% to 35% below and above the pipeline. Transverse trench drains will be installed along the pipeline trench and will outlet the water away from the area of concern.

A second area of concern lies between MP 131.8 to MP 132.0, where steep slopes and a drainage way are present. Where the pipeline crosses a gully, the grade will be restored to original contours to facilitate drainage. Water bars in conjunction with trench breakers will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-GB-025 (MP 145.3 to 146.1):**

This pipeline section starts along the broad crest, and crosses a number of drainage ways and small access roads, with some minor turns and two 90-degree bends. The area of concern falls between MP 145.8 and MP 146.1. After a 90-degree bend, the pipeline runs downhill normal to the slope, then crosses a paved road and river.

The steep slopes to the west of the corridor were noted as densely vegetated and overgrown with abandoned logging roads remaining. There will be some gully and road crossing in this area but no mitigation measures are recommended for potential landslides in this area. The soils in the area of concern include sandy loam and silty loam from NRCS soil groups A and C, respectively.

Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-SU-26 (MP 164.6 to 165.15):**

The pipeline in this section begins running perpendicular to a steep upslope (MP 164.6 to MP 164.75), runs across three rounded peaks and follows the crest of the ridge between the peaks. From MP 165.0 to MP 165.15, the route runs normal to a moderately steep downslope with a gully at the bottom.

The field report noted the soils in this area as silty clayey sand with scattered sandstone cobbles. The field report also noted that the pipeline crosses two significant gullies located near MP 164.93 and MP 165.15. The NRCS soil type is this section is silt loam from Soil Group C.

Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-MO-27 (MP 182.4 to 182.8):**

The pipeline in this area runs along the toe of a steep side slope then crosses Slate Run Creek, a local road, and a cleared transmission right-of-way, and State Route 122 between MP 182.4 to 182.8. The area traverses grassed clearings interrupted by dense vegetation of trees and shrubs.

Exposed bedrock (sandstone/siltstone outcrop) was observed in the field down gradient from the pipeline corridor along State Route 122. No signs of movement were observed along the cleared area but signs of gravitropism were noted during the field report on the well-vegetated steep slope up gradient of the corridor. Historical imagery shows movement within the past twenty years, but no slumps were noticeable during the field investigation. The soils in this section are silt loam according to the NRCS classification and of Soil Group D.

Water bars in conjunction with trench breakers and drains will be installed superjacent to State Route 122.

- **MVP-LMP-GI-28 (MP 197.4 to 197.6 - Jefferson National Forest)**:

The pipeline in this area runs across a moderately sloped knob before following a moderately steep ridgeline downgradient. The adjacent side slopes are steep. The pipeline parallels Mystery Ridge Road in this area.

The field report noted that slopes were mostly silty sand with sandstone cobbles and boulders scattered throughout, and the soil type in the area was defined as Lily-Bailegap Complex or Nolichucky Very Stony Sandy Loam (NRCS Hydrologic Soil Group B). Some of the side slopes off the ridge were observed to have minor signs of gravitropism. Water bars in conjunction with trench breakers will be installed in the steeper downhill sections of the right-of-way and transverse trench drains will be installed throughout the sidehill portion of the alignment.

- **MVP-LMP-GI-29 (MP 198.4 to 199.1 - Jefferson National Forest)**:

The pipeline in this area runs along moderate slopes thoroughly vegetated by grasses and used as a cow pasture from MP 198.4 to 198.8. The pipeline then crosses through dense forest and cleared pasture while crossing a smaller two-track road and two streams. The intermittent stream near MP 198.83 has very steep slopes with little to no vegetative cover on the forest floor. The soil is a very loose organic soil with active surficial erosion across the slope. No failures were observed during the field visit. The corridor intersects a perennial stream near MP 198.93 with moderate slopes and dense vegetation. From this stream the corridor traverses a moderately steep sidehill to a broad, relatively flat ridge.

The soils in the area were noted as Nolichucky Loam (NRC Hydrologic Soil Group B). Overall the slopes are well vegetated with no signs of mass movement except for the steep short slopes leading to the stream near MP 198.93.

In areas where the pipeline crosses the intermittent streams, the grade will be restored to original contours to facilitate drainage. Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-GI-30 (MP 204.4 to 204.8):**

The pipeline in this area runs diagonally upslope from MP 204.4 to MP 204.6, then transitions to upslope on a broad ridge to MP 204.7. The slopes along this section vary between 30% and 45%. This section parallels an existing cleared right-of-way for transmission lines. A gully near MP 204.6 is indicated on the topographic mapping.

No field report was completed for this area as the property cannot be accessed due to landowner restrictions. Historical imagery shows no signs of recent landslide movement. NRCS classifies soil in this region as silt loam (NRCS Hydrologic Soil Group C) or Carbo-Rock outcrop complex (NRCS Hydrologic Soil Group D).

Where the right-of-way crosses the gully shown on the topographic map, the grade will be restored to original contours to facilitate drainage. Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

- **MVP-LMP-GI-31 (MP 211.55 to 211.8):**

  The pipeline in this area runs across an existing access drive and alongside moderate slopes just south of a crest before heading downslope between MP 211.55 and MP 211.8. The primary area of concern falls between MP 211.55 and MP 211.7 where the pipeline right-of-way comes within approximately 15 feet of a nearly vertical slope. US Route 460 is located directly below this steep slope. The remainder of the area of concern crosses drainages with side slopes ranging from 30% to 47%.

  Historical imagery and site reconnaisance show no signs of landslide movement or slope instability. Soils in this area were classified as Carbo-Rock outcrop complex (NRCS Hydrologic Soil Group D) or Gilpin silty loam (NRCS Hydrologic Soil Group C).

  Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill section of the right-of-way. Where practical, the pipe trench will be located in bedrock to protect the pipe from shallow soil movements. A transverse trench drain will be installed at the low point near MP 211.65.

- **MVP-LMP-MN-32 (MP 219.6 to 220.9 - Jefferson National Forest):**

  From MP 219.6 to MP 219.8, the pipeline corridor follows a generally flat profile along the toe of a slope, then swings south and climbs a steep ridge to MP 220.7. The section of pipeline running up the ridge has an average slope of 30% with side slopes ranging from 40% to 80% downslope to drainage ways. From MP 220.65 to 220.95, the pipeline corridor follows relatively flat or gently up sloping terrain with a gravel road crossing at MP 220.7.

  This section was mostly vegetated by trees and shrubs but has occasional sandstone outcrops along the ridgeline. The topsoil was thin and underlying soil was gravelly with gravels composed of fragments of sandstone. Drainage areas from the ridge drain west into Craig Creek. The soil was classified as either Berks and Weikert or Berks and Weikert very stony (NRCS Hydrologic Soil Group B).

  Due to the relatively shallow depth of bedrock in this area (approximately 2.75 feet bgs), it is anticipated that the pipe will be installed/embedded within the bedrock from MP 220 to the end of this area of concern. Water bars in conjunction with trench breakers and drains will be installed in the steeper downhill sections of the right-of-way.

  Refer to *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*, JNF Priority Site #6 for more information.

- **MVP-LMP-MN-33 (MP 220.6 to 220.7 – MVP Route 4.0.0)**:

  The pipeline in this area runs down the crest of a broad ridge between MP 220.5 to MP 220.65 (MVP Route 4.0.0), then turns 90-degrees down at a slope of approximately 30% for 150 feet before the pipeline corridor crosses a drainage way near MP 220.66 (MVP Route 4.0.0). The primary area of concern is from MP 220.6 to MP 220.7 (MVP Route 4.0.0). Two additional significant drainage crossings were encountered at MP 220.8 and MP 220.98 (MVP Route 4.0.0), which have been delineated as streams

No field survey or report was completed for this area due to landowner restrictions, but soils in this region are classified as either Berks-Weikert Complex or Berks and Weikert Soils (NRCS hydrologic Soil Group B).

In areas where the pipeline crosses gullies and natural drains, the grade will be restored to original contours to facilitate drainage. Rock armoring or ACB will be utilized to minimize erosion across the pipeline right-of-way at gullies not delineated as streams. A sidehill low-point drain will be installed in the trench at the drainage crossings.

- **MVP-LMP-MN-34 (MP 221.8 to 221.9 -MVP Route 4.0.0):**

The pipeline in this area runs along relatively flat terrain but, while avoiding a substation to the south, cuts through a knoll for a short 400-foot section between MP 221.8 to MP 221.9 (MVP Route 4.0.0).

The area is located at the edge of a pasture and a wooded area adjacent to an existing powerline right-of-way. It does not appear that construction will impact the slope subjacent to the substation. During the field visit, a sinkhole was observed between the edge of the proposed right-of-way and the substation. Soils in this area were classified as either Frederick and Vertrees gravelly silt loam or Duffield-Ernest Complex (NRCS Hydrologic Soil Group B).

No landslide mitigation measures are required in this area and the sinkhole was delineated in MVP's karst study. This area will no longer affect the pipeline alignment following acceptance of the Mount Tabor Alternative.

- **MVP-LMP-MN-35 (MP 229.2 to 229.3):**

The pipeline in this section runs adjacent to and crosses a power line right-of-way and intermittent stream. After crossing the stream near MP 229.3, the pipeline follows a slight sidehill trajectory above the stream to the power line right-of-way. The forest floor is mostly bare with leaves and some small shrubs, but the area is forested. Soils in the area correspond to NRCS Hydrologic Soil Class A and B and were observed to be very stony.

No landslide mitigation measures are recommended in this area.

- **MVP-LMP-FR-36 (MP 261.2 to 261.2):**

The pipeline in this area crosses State Route 697 and then turns downslope before crossing moderately steep side slopes for approximately 600 feet. The area of concern is in the vicinity of MP 261.2. Houses are located within 200 feet or less of the pipeline corridor but both are uphill from the corridor.

The area is gently sloping with a dense forest of young trees with sparse low-growing vegetation. No evidence of prior slope movement was observed. Soils in the area were classified as Clifford-Hickoryknob Complex (NRCS Hydrologic Soil Group B).

No landslide mitigation measures are required in this area.

- **MVP-LMP-FR-37 (MP 263.9 to 264.0 -MVP Route 4.0.0):**

The pipeline in this section runs across two existing gravel roads and a cleared right-of-way for transmission lines before turning across a moderate side slope just south of a substation. The primary concern is the steep side slope adjacent to the substation between MP 264.05 to MP 264.1 (MVP Route 4.0.0).

The right-of-way is brush- and tree-covered in this vicinity. Several boulders were visible at the ground surface, but soil along the right-of-way may have been disturbed during construction of the substation or associated power lines. Just south of the substation, an existing drainage culvert runs downhill to a catch basin on the north side of Energy Boulevard. It appears that this culvert drains to the south side of Energy Boulevard. This drainage should be restored following pipeline construction. The soil type in this section is Clifford fine sandy loam of NRCS soil group B.

No landslide mitigation measures are required in this area.

This area will no longer affect the pipeline alignment following acceptance of the Blackwater Alternative.

9.0 ADDITIONAL AREAS OF CONCERN

9.1 Peters Mountain, Sinking Creek Mountain, Brush Mountain, and Giles County Seismic Zone

Potential landslide hazards in the areas of the Giles County Seismic Zone (GCSZ), Peters Mountain, Sinking Creek Mountain and Brush Mountain in southern West Virginia and Southwestern Virginia along the proposed route for the Mountain Valley Pipeline are summarized below. It should be noted that the GCSZ is not a specifically mapped geographic area, but corresponds to a generalized area that is relatively seismically active.

Landslide, debris flow, debris avalanche, earthflow and creep, rockfall (Wieczorek and Snyder, 2009), and rock slump and rock block slides (Schultz and Southworth;1989) are the general categories of mass wasting hazards that may be observed in southern West Virginia and southwestern Virginia. Landslides, flow, avalanche and creep are characteristic of failure in unconsolidated overburden or highly weathered shallow bedrock.

Rock block failure involves gravity-induced movement of massive and intact blocks of bedrock. Schultz and Southworth (1989) identify rock slumps and rock block slides as a specific mass wasting hazard somewhat unique to Peters Mountain, Sinking Creek Mountain and Brush Mountain.

According to Schultz and Southworth (1987, 1989): *Rock block slides tend to occur on the southeast slopes of anticlinal folds composed of sandstone, siltstone and shale. Where these folded beds dip steeply (45 degrees or more) rock slides are relatively small and confined to the uppermost parts of the slope. Where dips are less than 30 degrees, slides show more movement and are areally extensive. Most of the rock block slides are relict features from the Pleistocene Epoch. Dip-slope rock block failure occurs over an extended period of time, and no evidence of recent movement in these areas have been found.*

Trigger events for rock block failure are thought to be primarily associated with pore pressure effects from sustained long-duration or short duration intense precipitation events (Schultz and Southworth, 1987, 1989; Wieczorek and Snyder, 2009). Some researchers postulate that seismic shaking may trigger slope failure, but no direct evidence is available to support this suggestion. D.G. Honegger Consulting (2015) presents an analysis and recommendations for mitigating seismic-induced risks to MVP.

Rock block failure progresses from an initial stage of downslope sagging and bulging to downslope slumping to brittle fracture along lateral break-away scarps (Schultz and Southworth, 1987). This typified behavior presents an opportunity to establish a monitoring program along the southeast slopes of Peters Mountain, Sinking Creek Mountain and Brush Mountain to provide advanced warning of potential rock block failure, as summarized below.

Mountain Valley Pipeline will monitor for potential rock block slides on the southeast slopes of Peters Mountain, Sinking Creek Mountain and Brush Mountain. As discussed above, rock block slides in these areas of concern are relict features, and if further sliding or slumping is occurring it is a very slow process. The pace of such failures is conducive to establishing a monitoring program and if future observations dictate, establishing an evaluation and mitigation program for the pipeline in areas observed to be at risk. On a five-year basis, MVP will conduct aerial inspection of these slopes with LIDAR, and evaluate the slope characteristics for notable bulging or bowing, and other observations of possible slope movement. If this monitoring program suggests evidence for rock block slumping or incipient failure, Mountain Valley will deploy a field inspection team to the area of concern and establish a mitigation program commensurate with the results of an incipient slope failure study.

It is noted that there is no direct evidence that seismic shaking presents significant risk for acute or catastrophic rock block slides in the relatively seismically active southern West Virginia and southwestern Virginia. This further supports the efficacy of a surveillance program described above.

9.2 Debris Flow Potential along Kimballton Branch

Debris flows are a type of mass movement comprised of soil and rock moving along a shallow sliding surface within soil or weathered, foliated and jointed rock materials. Debris flows are often associated with steep gullies and may be triggered by significant precipitation events.

The pipeline crosses the headwaters of Kimballton Branch (which flows to Big Stoney Creek) between MP 195.7 and 195.8. During construction, an engineering geologist or geotechnical engineer familiar with debris flows will evaluate the area and will be present during pipeline construction to observe the trench and earth materials. Based on the results of these observations, MVP will determine if minor adjustments to the proposed alignment are warranted to mitigate the potential for a debris flow or avoid an existing debris flow. If this area appears to be prone to debris flow recurrence but an alignment adjustment is not practical, mitigation measures, which may include drains and soil reinforcement or other measures depending on subsurface conditions encountered, will be implemented.

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Mountain Valley Pipeline, LLC
Mountain Valley Pipeline Project
FERC Docket No. CP16-10-000

Attachment 136
Draft Restoration Plan

Draft
Restoration Plan

Mountain Valley Pipeline Project

Prepared by:

Mountain Valley PIPELINE LLC

December 2016

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1.0 INTRODUCTION

Mountain Valley Pipeline, LLC (MVP), a joint venture between EQT Midstream Partners, LP and affiliates of NextEra Energy, Inc., Con Edison Gas Midstream LLC, WGL Holdings, Inc., Vega Energy Partners, Ltd., and RGC Midstream, LLC (collectively referred to as MVP), is seeking a Certificate of Public Convenience and Necessity (Certificate) from the Federal Energy Regulatory Commission (FERC) pursuant to Section 7(c) of the Natural Gas Act authorizing it to construct and operate the proposed Mountain Valley Pipeline Project (Project) located in 17 counties in West Virginia and Virginia. MVP plans to construct an approximately 303-mile, 42-inch-diameter natural gas pipeline to provide timely, cost-effective access to the growing demand for natural gas for use by local distribution companies (LDCs), industrial users and power generation in the Mid-Atlantic and southeastern markets, as well as potential markets in the Appalachian region. Construction is anticipated to begin in 2017 and conclude in the fourth quarter of 2018. Construction on National Forest System lands will occur in 2018.

The proposed pipeline will extend from the existing Equitrans, L.P. 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 will include approximately 171,600 horsepower of compression at three compressor stations currently planned 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.

A 3.4-mile long segment of the Project will cross portions of the Jefferson National Forest (JNF) in Monroe County in southern West Virginia and in Giles, Craig, and Montgomery Counties in southwestern Virginia. The JNF is managed by the Forest Service of the U.S. Department of Agriculture (USFS). Another 60-foot segment, (i.e., the Weston Gauley Bridge Turnpike Trail [Weston Gauley Turnpike] in Braxton County, West Virginia, administered by the U.S. Army Corps of Engineers [USACE]), will be crossed by the pipeline. Approval to cross land managed by two or more federal agencies is the responsibility of the U.S. Department of the Interior, Bureau of Land Management (BLM) through issuance of a Right-of-Way Grant. Project-wide construction environmental compliance will be the responsibility of the FERC. The USFS and USACE will also ensure compliance across lands managed or administered by those agencies. Because the majority of federal lands crossed are managed by the USFS and MVP intends to bore under USACE property, this plan focuses on the JNF. Where USACE measures would substantively differ for the crossing of the Weston Gauley Turnpike, they are pointed out. If BLM requirements differ, they are pointed out.

The USFS will be responsible for enforcement of the terms and conditions of the BLM's Right-of-Way Grant and the USFS Special Use Authorization (SUA) on National Forest System lands during the term of the Right-of-Way Grant/SUA, respectively. On the JNF, compliance will be monitored by the USFS Project Manager and compliance monitors designated by the Authorized Officer. The Authorized Officer's designated compliance monitors will have stop-work authority if any safety violations of the Right-of-Way Grant/SUA or the POD occur.

The FERC will utilize a third-party Compliance Inspection Contractor (CIC) contracted to MVP to act on behalf of the agency to provide Project-wide construction oversight and monitor compliance. The CIC will inspect and monitor preconstruction and construction activities and enforce requirements related to the National Historic Preservation Act (NHPA), the Endangered Species Act (ESA), and other applicable laws and regulations. The Project will adhere to all federal, state, and local permits. The CIC will coordinate with the USFS Project Manager and designated compliance monitors.

The Project has potential to impact sensitive environmental resources and, as a result, environmental protection measures have been developed to minimize potential impacts on these resources and will be applied, as applicable, to the Project (see the Plan of Development [POD], Section 6 – Environmental Protection Plans and Documents). The purpose of this Draft Restoration Plan is to provide measures to be utilized by the construction contractor, the USFS compliance monitors, and the CIC to ensure that proper restoration is achieved on lands disturbed during construction and operation on the JNF.

2.0 RESTORATION GOALS AND OBJECTIVES

This Restoration Plan focuses on the stabilization and protection of existing vegetation and soils; minimizing disturbance of the environment to the extent practical; and establishing vegetation communities that are consistent and compatible with adjacent land uses. The goal of this draft plan is to provide a structure for developing and implementing the Project's restoration process on the JNF, which will be designed to restore impacted areas to meet the following objectives:

- Topsoil segregation and stockpiling,
- Right-of-way stabilization and restoration,
- Seedbed preparation and re-seeding,
- Noxious- and invasive-weed control, and
- Road reclamation.

Restoration of disturbed habitats can be achieved through short- and long-term objectives. The short-term objectives are to stabilize disturbed areas to minimize potential erosion and sedimentation, establish temporary vegetation cover, prevent or minimize the introduction and spread of noxious- and invasive-weed species, and conserve suitable topsoil for long-term reclamation activities. The long-term objective is to establish permanent vegetation cover that is suitable for the land-use, is self-sustaining, and, where

applicable, is resistant to the introduction or spread of noxious- and invasive-weed species.

Measures to achieve these goals include the following:

- Use proper soil-management techniques, including stripping, stockpiling, and re-applying topsoil material at temporarily disturbed areas to restore soil horizons, use appropriate seed mixes, and establish surface conditions that would allow for the rapid re-establishment of vegetative cover;
- Establish stable soil surface and drainage conditions and use applicable best-management practices (BMPs) that would minimize surface erosion and sedimentation as well as facilitate plant establishment;
- Re-establishing topography to pre-construction conditions to the extent practical;
- Conduct appropriate weed treatment methods: pre-construction weed surveys; pre-construction weed-control treatments at locations identified by pre construction weed surveys (areas with large weed infestations within or adjacent to the Project right-of-way); post-construction weed treatment (e.g., re-seeding and/or site restoration) to pre-disturbance conditions as documented by pre-construction surveys;
- Conduct post-construction monitoring; and
- Ensure that all restoration measures and the final Restoration Plan complies with the USFS needs and requirements on the JNF and incorporates all requirements found in the federal Right-of-Way Grant/SUA if approved.

3.0 DEVELOPMENT AND IMPLEMENTATION OF THE PLAN

In general, MVP will follow the directions and requirements in FERC's *Upland Erosion Control Revegetation and Maintenance Plan* (Plan) as well as FERC's *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) during restoration efforts. However, MVP will also follow any requirements of the USFS that exceed those of the FERC Plan and Procedures when conducting restoration efforts on the JNF. The additional USFS requirements and measures that have been identified to-date have been incorporated into this plan. Any additional measures that are identified by the USFS at a later date will be incorporated into the final Restoration Plan (see Section 5). FERC's Plan and Procedures can be found in Attachments D-1 and D-2 of this document and the USFS recommendations for seeding techniques and seed mixes can be found in Attachment D-3.

If any variances from FERC's Plan and Procedures or the USFS's restoration requirements are necessary on the JNF, MVP would be required to file for a variance request and this request would need to be approved by the FERC and USFS before it could be implemented. These variance requests would need to be filed for and approved on a case-by-case basis.

3.1 Topsoil and Spoil Treatment

There will still be areas of soil disturbance due to the nature of the proposed work. Project-related disturbances will be limited to areas identified and approved in the FERC Order and the USFS Right-of-Way Grant/SUA.

As requested by the USFS, MVP will prevent the mixing of topsoil and subsoil during construction by stripping topsoil from the permanent and temporary ROW during construction on the JNF. The stockpiled topsoil and subsoil will be stored separately, and will be replaced in the proper order during backfilling and final grading in order to prevent mixing of the soil horizons. MVP will identify and segregate the topsoil layer from the subsoil layer as described in FERC's Plan and Procedure (Attachments D-1 and D-2). All stockpiled spoils will be stored at least 10 feet from waterbodies, and within approved construction areas (as required by FERC's Plan and Procedures). Erosion controls will be installed around stockpiled spoils to ensure that they do not erode and impact adjacent areas (see the following section for more details regarding erosion controls).

3.2 Installation of Erosion Controls

Temporary erosion controls will be installed prior to or concurrently with construction activities that can disturb soils, and these controls will be inspected and maintained throughout the construction process. These erosion controls will be inspected on a daily basis in areas that are currently experiencing active construction or equipment operation, on a weekly basis in areas where no active construction is currently occurring, and within 24 hours in areas that have just received a rainfall event of at least 0.5 inch. Any necessary repairs that are identified during these inspections will be conducted within 24 hours. Inspection and repair of temporary erosion controls will continue until they are replaced by permanent erosion controls or until restoration efforts are completed. Temporary erosion control devices include temporary slope breakers, sediment barriers, trench plugs, and mulch. As requested by the USFS for implementation on the JNF, erosion control and sediment control products will be promptly removed after soils are stable and vegetative cover is established.

Temporary slope breakers are intended to reduce runoff velocities and divert water to vegetated areas off the construction right-of-way. Temporary sediment barriers are installed to stop the movement of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive areas. As indicated in FERC's Plan, these structures can be constructed of materials such as soil (e.g., diversion ditches), sand bags, silt-fences (which are only applicable for sediment barriers, not slope breakers), or other approved materials. As requested by the USFS, silt fences reinforced with metal or plastic mesh will be avoided if possible. In the case of the temporary slope breaker, water will be directed to a stable well-vegetated area or to an energy-dissipating device. The required spacing for these controls is outlined in the erosion and sedimentation control sheets.

Temporary trench plugs are intended to segment a continuous open trench prior to backfilling in order to prevent pooling and movement of water along the open trench. These plugs will consist of unexcavated portions of the trench (i.e., undisturbed soils), compacted subsoils, sandbags, or some functional equivalent.

Mulch will be applied to all disturbed slopes that have the potential to erode in order to stabilize the soil and to reduce wind and water erosion. FERC's Plan requires that mulch be spread uniformly over an affected area to at least 75 percent coverage at a rate of 2 tons/acre. In wetland areas FERC's Plan requires that mulch applications will be increased to 3 tons/acre. This rate can be increased or decreased on the JNF based on USFS requirements. The following describes the USFS requirements regarding mulch applications, which would be followed on the JNF:

- Materials will be certified weed free or be accompanied by vendor's test results for noxious weed content. Hay will not be used on the JNF.
- Weed free straw will be hand spread or blown at a rate of 1 to 2 tons/acre. Fiber mulch, using a hydraulic application machine (i.e., hydro seeder) will be applied at a rate of 0.75 to 1 tons/acre.
- Natural biodegradable products will be used and materials will be demonstrated to be free of invasive species, including but not limited to plants, pests, and pathogens.
- If the use of stabilization netting is required/permitted, wildlife friendly geotextiles will be used. These products must either not contain netting, or netting must be made of 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber. Plastic netting (such as polypropylene, nylon, polyethylene, and polyester), even if advertised as biodegradable, is not an acceptable alternative. Any netting used must also have a loose-weave design with movable joints between horizontal and vertical twines to reduce the chance for wildlife entanglement, injury, or death. (CA Coastal Commission, 2012)
- Water used for any products that require mixing with water will come from USFS-approved water source. The source of water must not be contaminated with non-native invasive organisms that could spread into streams.

Permanent erosion controls will be installed following completion of construction. Permanent erosion controls consist of permanent trench breakers and slope breakers. The placement, number, and composition of these permanent erosion controls will be determined by the Environmental Inspector as directed by the applicable land management agency (i.e., the USFS) and the FERC Plan and Procedures (Attachments D-1 and D-2).

3.3 Re-contouring

All disturbed areas will be regraded and re-contoured to blend into the surrounding landscape and to reestablish natural drainage patterns to the extent feasible. The emphasis during re-contouring will be to return the entire ROW to its approximate original contours, to stabilize slopes, control surface drainage, and to aesthetically blend the area with the contours of adjacent lands. The re-contouring of disturbed wetland to their original grade is especially critical so that the wetland hydrology is not altered. If existing culverts are damaged or removed during construction, they will be replaced to their original or better condition in order to maintain the original hydrology.

3.4 Construction Debris Removal

During final cleanup, all construction debris (e.g., mats, garbage, etc.) will be cleared from the construction area and disposed of in accordance with state and local regulations. Excess rock and spoil materials will be distributed along the construction right-of-way or disposed of in existing quarries or in permanent disposal sites. Hazardous materials will be handled and disposed of as described in the Project's Hazardous Materials Management Plan (i.e., Appendix L in the POD).

All non-merchantable brush and slash will be windrowed to the edge of the right-of-way, utilized in downslope areas of the right of-way and access roads, or removed from the area in accordance with USFS requirements. Windrowing of non-merchantable brush and slash along the right-of-way will result in habitat for many types of wildlife including: rabbits and other small mammals, ruffed grouse, song birds and reptiles. Over time the windrows will provide food for wildlife as insects will establish residence in the materials. The windrows can serve as escape cover from predators, locations for nesting and shelter from inclement weather. The windrows will generally range from 10 to 20 feet in width and 6 to 8 feet in height. Breaks will be left in the windrows at approximately 100 feet in order to provide for fire breaks and wildlife crossings.

Non-merchantable brush and slash can be utilized in downslope areas of the right-of-way and access roads to aide in soil stabilization and erosion control. Layering the brush and slash at the toe of a low-side slope along an access road provides for physical protection in the form of soil stabilization, and erosion and sediment control. Layering of brush and slash can promote physical protection to the downslope areas of the right-of-way. Additionally, the layering can provide long-term support for revegetation in downslope areas of the right-of-way.

3.5 Seedbed Preparation

Areas targeted for restoration will be prepared for reseeding prior to the implementation of revegetation efforts in order to create a seedbed that is conductive to proper seed placement and moisture retention (as described in FERC's Plan and Procedures). Permanent erosion control devices will be installed to minimize the risk of erosion and mulch will be used to prevent soils from eroding or desiccating (as described above).

Compaction of soils can reduce the likelihood of disturbed areas being successfully revegetated following disturbance. In order to minimize soil compaction, construction activities will be timed to dry periods to the extent possible, and construction mats will be used in wetland habitats. Per the JNF Goal and Objective FW-8, no heavy equipment will be used on plastic soils when the water table is within 12 inches of the surface, or when soil moisture exceeds the plastic limit. Also, per the JNF Goal and Objective FW-118, heavy equipment will not be used during site preparation on sustained slopes over 35 percent, or on sustained slopes over 20 percent when soils have a high erosion hazard or are failure-prone. If compacted soils are identified by the Environmental Inspector or the USFS within areas targeted for restoration, the compacted soils will be ripped to a depth of at least 6 to 8 inches.

As stated in Section 3.1, stockpiled topsoil and subsoil will be stored separately, and will be replaced in the proper order during backfilling and final grading, and prior to seeding. Following topsoil placement, dry fertilizer and lime will be incorporated into the top 2-5 inches of soil by disking or other means. The following are guidelines for fertilizer and lime application rates recommended by the USFS:

- Fertilizer:
  - 600 – 800 lbs/acre of 10-20-10 (Nitrogen [N], Phosphorous [P], Potassium [K]) fertilizer;
  - 400 lbs/acre of 15-30-15 (N-P-K) fertilizer; or
  - 800-1000 lbs/acre of 10-10-10 (N-P-K)
- Lime:
  - 1500-4000 lbs/acre (pelletized or dust); or
  - 4000 lbs/ac of Hydro Lime (2.5 gal container is equivalent to 1000 lbs limestone; 5-10 containers /acre.

Soil chemistry tests will be conducted during construction and the fertilizer and liming rates described above will be adjusted accordingly based on the results of site-specific soil tests. Soil chemistry data will be submitted to the USFS following testing and any modifications to the fertilizer or lime application rates described above will be provided to the USFS for approval prior to use.

3.6 Streambank Stabilization

The stabilization of streambanks and areas adjacent to waterbodies is critical to minimize the risk of erosion and slope failure. The methods that would be implemented to stabilize and restore streambanks can be found in the POD, and are summarized here. Stream banks will be restored by vegetative stabilization where site conditions warrant or by riprap where banks slope of 3:1 or more exist. Vegetative stabilization generally includes planting a temporary erosion control seed mix, followed by a native perennial seed mix (for slopes less than 3:1) or a permanent erosion control seed mix (for slopes 3:1 or greater; see Section 3.6 for more details). If grubbing has not been extensive, then native shrub and tree species are expected to sprout and regenerate naturally. Stream banks will be treated with lime and fertilizer, based on the results of soil chemistry tests, then the seed will be applied and lightly covered with soil before mulch is added to the area. Rock, soil imported from outside the wetland, tree stumps, or brush riprap will not be used to stabilize the right-of-way in wetlands. A sediment barrier will be maintained at the edge of the water until revegetation is successful (see Section 3.2 for a description of erosion control devises).

3.7 Seed Mixes

MVP consulted with the USFS regarding appropriate seed mixtures for use within the JNF. The USFS indicated that the initial goal of seeding on the JNF is to establish vegetative cover to minimize surface erosion and sedimentation, while the secondary goal

is to establish an assortment of native species congruent with local ecological communities and beneficial for wildlife and pollinators (see Attachment D-3). Native plants that provide structural diversity and wildlife/pollinator benefits often do not germinate or grow fast enough to provide initial erosion control (see Attachment D-3); therefore, these goals will be accomplished through the use of seed mixes that include both fast growing, annual/short-lived perennial non-native grass species approved by the USFS, as well as some perennial native species.

The following USFS recommendations regarding seeds and seed mixes will be implemented:

- Seeds shall be Virginia or West Virginia certified seed (i.e., seed certification shall meet each state's standards for certified seed classification and bag tags will be attached) or alternative seed sourced from USFS approved distributers.
- For native species, local ecotypes for native seeds shall be used, in the following order of preference:
    - From within the state
    - From the mountain regions of an adjoining state
    - From within 100 miles, as long as it is within the Appalachian mountain ecosystem
- All leguminous seeds shall be either pre-inoculated, or mixed with inoculant[1] specified for use on that particular seed according to manufacturer's directions. Inoculants shall be manually applied at double the manufacturer's rate and inoculant shall be mixed with legume seed prior to mixing with other seeds. For hydroseeding, a minimum of five times the dry seeding rate of inoculant will be used (Flynn, 2015; Monsanto 2015)

For areas that will be seeded through drill seeding or mechanical broadcast seeding, two different seed mixes will be developed, one for use in upland areas and one mix for riparian areas. These two seed mixes are described in Tables 3.7-1 (for upland areas) and 3.7-2 (for riparian areas). Areas that are too steep or inaccessible for drill seeding or mechanical broadcast seeding will be treated with a third seed mix. This seed mix is described in Table 3.7-3, and will be applied concurrently with a temporary erosion control seed mix when possible.

Although soil chemistry tests for the Project have not yet been completed, low pH levels were often encountered during soil profile surveys conducted for the Project within the JNF (MVP 2016); therefore, Tables 3.7-1 through 3.7.3 provide the pH preference for each plant species, if known (also see Section 3.5 regarding proposed applications of lime during seed bed preparation). The final species chosen for each seed mix will be based on results of soil chemistry tests that will be conducted during construction, as well as the availability of seeds.

[1] Microbial inoculants are amendments that use beneficial endophytes (i.e., microbes) to promote plant health.

At least two of the non-native species for erosion control and five of the native species listed in Table 3.7-1 will be included in the final upland seed mix. At least two of the non-native species for erosion control and five of the native species listed in Table 3.7-2 will be included in the final riparian seed mix.

Table 3.7-1

Species for Upland Seed Mix

Scientific Name	**Common Name**	**Growth Habit**	**pH Preference**
Non-native Species for Erosion Control			
Lolium perenne subsp. *multiflorum*	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
Urochloa ramosa (*Panicum ramosum*)	Browntop millett	Graminoid	5.5 – 6.9
Secale cereale	Cereal rye	Graminoid	5.2 – 8.0
Setaria italica	Foxtail millet	Graminoid	5.3 – 6.9
Native Species			
Chasmanthium laxum[a]	Slender woodoats	Graminoid	4.5 – 7.0
Eragrostis spectabilis[a]	Purple lovegrass	Graminoid	4.0 – 7.5
Panicum virgatum	Switchgrass	Graminoid	4.5 – 8.0
Sorghastrum nutans	Indiangrass	Graminoid	5.0 – 7.8
Tridens flavus[a]	Purpletop	Graminoid	4.5 – 6.5
Apocynum cannabinum[a]	Indian hemp	Forb	4.5 – 7.0
Chamaecrista fasciculata	Partridge pea	Forb	5.5 – 7.5
Desmodium canadense	Showy ticktrefoil	Forb	wide tolerance
Desmodium paniculatum	Panicledleaf ticktrefoil	Forb	6.0 – 7.0
Elymus virginicus[b]	Virginia wildrye	Graminoid	5.0 – 7.4
Geum canadense[a]	White avens	Forb	4.5 – 7.5
Heliopsis helianthoides	Oxeye sunflower; Smooth oxeye	Forb	unknown
Monarda fistulosa[b]	Wild bergamot	Forb	6.0 – 8.0
Pycnanthemum spp.[b]	Mountain mint	Forb	unknown
Rubus allegheniensis[a]	Common blackberry; Allegheny blackberry	Forb/ Subshrub	4.6 – 7.5
Rudbeckia hirta	Blackeyed Susan	Forb	6.0 – 7.0
Solidago canadensis[a]	Canada goldenrod	Forb	4.8 – 7.5
Tradescantia virginiana[a]	Virginia spiderwort	Forb	4.0 – 8.0

a/ This species is more tolerant of low pH soils

b/ Species is a good choice for higher elevation (i.e., areas higher than 3,000 feet or lower sites where the presence of red spruce indicates cold conditions) areas.

Table 3.7-2

Species for Riparian Seed Mix

Scientific Name	**Common Name**	**Habit**	**pH Preference**
Non-native Species for Erosion Control			
Lolium perenne subsp. *multiflorum*	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
Urochloa ramosa (*Panicum ramosum*)	Browntop millett	Graminoid	5.5 – 6.9
Secale cereale	Cereal rye	Graminoid	5.2 – 8.0

Table 3.7-2 Species for Riparian Seed Mix			
Scientific Name	**Common Name**	**Habit**	**pH Preference**
Setaria italica	Foxtail millet	Graminoid	5.3 – 6.9
Native Species			
Agrostis perennans	Autumn bentgrass; upland bentgrass	Graminoid	5.5 – 7.5
Elymus virginicus	Virginia Wildrye	Graminoid	5.0 - 7.4
Sorghastrum nutans	Indiangrass	Graminoid	5.0 – 7.8
Asclepias incarnata	Swamp milkweed	Forb	5.0 – 8.0
Chamaecrista fasciculata	Partridge pea	Forb	5.5 – 7.5
Eutrochium fistulosum (*Eupatorium fistulosum*)	Joe pye weed	Forb	4.5 – 7.0
Eupatorium maculatum	Spotted joe pye weed	Forb	5.5 – 7.0
Eupatorium perfoliatum	Boneset	Forb	unknown
Helenium autumnale	Common sneezeweed	Forb	4.0 – 7.5
Senna hebecarpa	Wild senna; American senna	Forb	unknown
Senna marilandica	Maryland senna	Forb / Subshrub	4.0 – 7.0
Vernonia noveboracensis	New York ironweed	Forb	4.5 -8.0

For areas that will be hydroseeded, at least one of the non-native species for temporary erosion control and five of the native species listed in Table 3.7-3 will be included in the final seed mix. A minimum of 100 pounds per acre of the hydroseed seed mix will be applied unless otherwise specified by the seed mix provider.

Table 3.7-3 Hydroseed Seed Mix			
Scientific Name	**Common Name**	**Growth Habit**	**pH Preference**
Non-native Species for Temporary Erosion Control			
Lolium perenne subsp. *multiflorum*	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
Urochloa ramosa (*Panicum ramosum*)	Browntop millett	Graminoid	5.5 – 6.9
Secale cereale	Cereal rye	Graminoid	5.2 – 8.0
Setaria italica	Foxtail millet	Graminoid	5.3 – 6.9
Native – Highly Preferred			
Sorghastrum nutans	Indiangrass	Graminoid	5.0 – 7.8
Tridens flavus	Purpletop	Graminoid	4.5 – 6.5
Native – Preferred			
Agrostis perennans	Autumn bentgrass; Upland bentgrass	Graminoid	5.5 – 7.5
Dichanthelium clandestinum	Deertongue	Graminoid	4.0 – 7.5
Elymus canadensis	Canada wildrye	Graminoid	5.0 – 7.9
Desmodium canadense	Showy ticktrefoil	Forb	wide tolerance
Heliopsis helianthoides	Oxeye sunflower; Smooth oxeye	Forb	unknown

Lespedeza virginica	Slender bushclover; Slender lespedeza	Forb	acid tolerant
Liatris spicata	Dense blazing star; Spiked gayfeather	Forb	5.6 - 7.5
Senna hebecarpa	Wild senna; American senna	Forb	unknown
Native – Moderately Preferred			
Panicum virgatum	Switchgrass	Graminoid	4.5 – 8.0
Chamaecrista fasciculata	Partridge pea	Forb	5.5 – 7.5
Rudbeckia hirta	Blackeyed Susan	Forb	6.0 – 7.0

Seeding with the seed mixes listed in Tables 3.7-1 through 3.7-3 must occur only during the normal seeding season (i.e., spring or fall). If this is not possible, a temporary erosion control seed mix will be applied, followed by seeding with one of the permanent seed mixes, as described above and in Tables 3.7-1 through 3.7.3, during the next normal seeding season. A temporary erosion control seed mix will consist of at least two of the non-native species for temporary erosion control listed in the tables above.

Table 3.7-4 below provides recommendations for seed mixes and application methods, by milepost, within the JNF. These recommendations are based on the approximate slope and habitat type that may be found within these locations; however, the final decision for seed mix and application method will be based on site-specific conditions as well as accessibility of an area for planting equipment.

Table 3.7-4

Suggested Seed Mixes and Seeding Methods for the Jefferson National Forest[a]

Approximate Milepost	Slope	Habitat	Seed Mix(es)	Application Method(s)[a]	Minimum Seeding Rate[b] (lbs/acre)
196.2 - 196.3	>50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
196.4 – 196.65	20-50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
196.65[c]	10 - 20	Riparian	Riparian Seed Mix – see Table 3.7-2	Drill Seed	30
196.65[c] – 197.0	0-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
197.0 – 197.05	30-50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
197.05 – 197.7[d]	0-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30

Table 3.7-4

Suggested Seed Mixes and Seeding Methods for the Jefferson National Forest[a]

Approximate Milepost	Slope	Habitat	Seed Mix(es)	Application Method(s)[a]	Minimum Seeding Rate[b] (lbs/acre)
197.7 – 197.9	20-40%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
198.1-198.2	10-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
198.4-198.5	20-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
218.6 – 218.7	30- >50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
218.7 – 218.75	10-20%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
218.75 – 218.9	20-50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
218.9	30-40%	Riparian	Riparian Seed Mix – see Table 3.7-2	Drill Seed or Mechanical Broadcast	30 or 60
218.9 – 219.1[d]	10-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
219.1 – 219.2	30-50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
219.2 – 219.25	0-20%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
219.25	0-20%	Riparian	Riparian Seed Mix – see Table 3.7-2	Drill Seed	30
219.25 – 219.3	0-10%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
219.3	0-30%	Riparian	Riparian Seed Mix – see Table 3.7-2	Drill Seed	30
219.3 – 219.45	0-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30
219.9 – 220.0	20-50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100
220.0 – 220.25	10-30%	Riparian	Riparian Seed Mix – see Table 3.7-2	Drill Seed	30
220.25 – 220.8[e]	10- >50%	Upland Forest	Upland Seed Mix – see Table 3.7-1 or Hydroseed Seed Mix– see Table 3.7-3	Mechanical Broadcast or Hydroseed	60 or 100

Table 3.7-4

Suggested Seed Mixes and Seeding Methods for the Jefferson National Forest[a]

Approximate Milepost	Slope	Habitat	Seed Mix(es)	Application Method(s)[a]	Minimum Seeding Rate[b] (lbs/acre)
220.8 – 220.85	0-30%	Upland Forest	Upland Seed Mix – see Table 3.7-1	Drill Seed	30

a/ These are estimated slopes and suggested seed mixes and application methods. Conditions on the ground may result in modifications to recommendations in this table.

b/ This is the minimum pounds per acre of seed to be applied unless otherwise specified by the seed mix provider and approved by the USFS.

c/ Only a portion of the ROW in this area may be a riparian area; both a riparian seed mix and upland seed mix will likely be required in this area.

d/ Some areas may exceed 30% slopes and may require mechanical broadcast or hydroseeding.

e/ Slopes in this area are generally greater than 30% and will likely require mechanical broadcast or hydroseeding; however, portions of this area may be less than 30% and drill seeding may be possible in these areas.

3.8 Seeding Methods

Seeding will occur promptly after construction is complete; however, if ground conditions delay restoration until the following spring, the ground will be mulched and seeding will take place during the next growing season. A Winter Construction Plan has been prepared to address how restoration and revegetation would proceed if seeding could not be completed before the onset of winter. Additionally, if seeding must occur outside the normal seeding season (approximately March 15 – June 1 or August 15 – October 15, depending on elevation), a temporary erosion control seed mix will be applied, and either a permanent erosion control seed mix or native seed mix will be applied during the next normal seeding season.

Seeding will be conducted using drill seeding, mechanical broadcast seeding, or hydroseeding according to the guidelines in FERC's Plan and/or specifications made by the USFS. These methods are described in more detail below.

Drill seeding, is a mechanical seeding method which places seed directly into the soil which allows seeds to be directly in contact with the soil. Due to the equipment required; however, drill seeding is generally limited to areas with slopes less than 3:1 (USDA-NRCS 2005). Because native seed mixes need to be drilled or otherwise covered, to enhance germination success (see Attachment D-3), drill seeding is the preferred option to be used in areas where a native seed mix will be applied (see Section 3.7).

Broadcast seeding will be the preferred seeding method used on steep slopes (i.e., slopes greater than 3:1) or other areas that cannot be accessed with other seeding equipment; areas that will be covered with erosion control fabric; or other areas determined to be appropriate for broadcast seeding by the Environmental Inspector and USFS. Seeds will be broadcast with a mechanical seeder immediately after the seedbed has been prepared and the soil is loose. This will allow the seeds to be lightly covered as the soil settles. The seeded area may also be disrupted by lightly dragging the area with chains or other

appropriate harrows to lightly cover the seed. Broadcast seeding will occur immediately prior to installation of erosion control fabric or the application of mulch.

Hydroseeding will be used in upland areas that can be safely accessed with hydroseeding equipment, on slopes where drill seeding is not feasible (i.e., slopes greater than 3:1), and in areas determined to be appropriate for this method by the Environmental Inspector and USFS. Hydroseeding equipment shall be equipped with sufficient tanks, pumps, nozzles, and other devices required for mixing and hydraulically applying the seed, wood fiber mulch, and tackifier mix in slurry form onto the prepared ground. The hydroseeding equipment shall have built-in agitators, which will keep the seed, mulch, tackifier, and water mixed homogeneously until pumped from the tank. Hydroseeding and hydromulching will be done from two directions (e.g., left and right or up and down), where feasible, to ensure maximum coverage of the soil. The amount of tackifier will be adjusted based on the slope of area being hydroseeded. For example, typical application rates for guar (a plant based tackifier) range from 40 lbs/acre for flat areas to 50 lbs/acre for 33 percent (3:1) slopes (California Stormwater Quality Association 2003). In addition, the following USFS recommendations will be implemented in areas that are hydroseeded:

- Hydroseeding will occur during a periods of dry weather, whenever possible, as wood-fiber hydraulic mulches are generally short-lived and require a 24-hour period to dry before rainfall occurs.
- Materials or additives used as binders or emulsifiers will not be toxic to soil organisms or otherwise prevent or inhibit seed germination.
- Only products suitable for wildlife will be used.
- Tackifiers will be non-toxic and organic based (e.g., guar, psyllium, or pitch and rosin emulsions).
- Tackifiers to be used, as well as, application rates, and methods of application will be submitted to the USFS for approval prior to use.

Following application of seed mix, mulch will be applied as described in Section 3.2.

3.9 Weed Management

Management and control of invasive species is critical if disturbed areas are to be successfully revegetated and restored, as invasive species can outcompete and exclude native species. MVP will utilize techniques approved by the FERC and USFS to control invasive species along the construction areas, which will include mechanical methods (e.g., pulling, mowing, disking, etc.) as well as chemical treatments (e.g., herbicides) on the JNF, as requested by the USFS. MVP will comply with all local, state, and federal requirements related to the use of herbicides, including any requirements specified by the USFS on the JNF. Herbicides to be used on the JNF will be approved by the USFS prior to use. See the Herbicide Use Plan for more details regarding the use of herbicides on the JNF.

The Project's Exotic and Invasive Species Control Plan also contains details regarding the methods that will be implemented to manage and control invasive species. MVP and its construction contractor will comply with BMPs and requirements outlined in the

Project's Exotic and Invasive Species Control Plan to manage and control invasive species. Implementation of the measures outlined in that plan will minimize the risk of introducing or spreading invasive plant species.

3.10 Road Reclamation

All roads developed as part of the Project on the JNF will be reclaimed after completion of the Project's construction. No permanent Project related roads, beyond the existing Forest Service roads that would be used for the Project, will remain on the JNF following completion of the Project's construction and restoration. Existing Forest Service roads that are used during construction will be upgraded to support the Project's needs as applicable, and will remain intact following construction, or as otherwise specified by the Forest Service. MVP will request ingress/egress rights on these existing Forest Service roads for pipeline maintenance following construction.

3.11 Post-Construction Monitoring and Reporting

3.11.1 Maintenance

All areas disturbed by construction on the JNF will be restored. However, a 50-foot-wide permanent right-of-way will be maintained in a grassland/low-shrub state above the pipeline (see the Project's Operations, Maintenance, and Emergency Response Plan,). This permanent right-of-way will maintain MVP's access to the pipeline's routes for terrestrial patrols, visibility of the pipeline's route for aerial patrols, and maintaining access in the event of emergency repairs. In upland areas, trees or deep-rooted shrubs will not be allowed to grow within the 15 feet of either side of the centerline in order to maintain the integrity of the pipe. The maintained permanent right-of-way will be subjected to mowing and will result in permanent conversion of the existing forested vegetation to herbaceous or scrub vegetation. Within wetlands or adjacent to waterbodies, MVP will maintain vegetation in a 10-foot corridor centered over the pipeline by mechanical means.

3.11.2 Monitoring

Along portion of the Project that are allowed to restore to pre-construction conditions (e.g., in areas outside of the permanent right-of-way), successful restoration will be determined by monitoring reclaimed areas and comparing them to adjacent undisturbed areas and targeted conditions. Restoration in these areas will be determined successful if the seeded areas have germinated and are demonstrating that they will, over time, achieve a distribution and diversity comparable to the pre-established targeted conditions. The targeted conditions of each area will be established by the goals of the Special Use Authorization and determined by the USFS Authorized Representative.

Success criterial will differ within the permanently maintained right-of-way on the JNF, as these areas will not be allowed to achieve a distribution and diversity similar to adjacent undisturbed areas (e.g., they will be maintained in a grassland/low-shrub condition). The permanently maintained right-of-way will be considered successful restored when the soils have been stabilized, and a native vegetation community is established that is consistent and compatible with the pipeline's permanent right-of-way (i.e., native low grasses and shallow-rooted shrubs).

MVP will conduct post-construction monitoring for a 2-year period on the JNF following the conclusion of ground-disturbing activities. If after the second growing season problem areas have been identified (e.g., seed germination is lower than expected or there is a prevalence of invasive plant species), the area will be re-treated and re-seeded. Treatments may include additional seedbed preparation, control of noxious weeds, use of soil amendments, and/or use of another appropriate seed mix (which would have to be approved by the USFS prior to its use). Revegetation efforts will continue until the targeted areas are determined to be successfully revegetated, as defined above.

Monitoring will also be conducted in waterbodies and riparian areas that were crossed by the pipeline. Monitors will compare the waterbodies' level of aggradation, scour over the trench, lateral migration of the channel, bank erosion, and turbidity levels against the baseline condition established following the initial stream restoration. Monitoring of riparian restoration activities will be conducted for two years.

3.11.3 Reporting

MVP will document pre-construction observations, construction reclamation activities, and post construction monitoring on the JNF in a report that will be filed with the USFS and FERC two years after implementation of the restoration actions, as required by FERC's Plan and Procedures. This report will provide the agencies with a summary of Project reclamation activities and observations, and include recommendations for additional corrective actions if monitoring determines that these actions may be necessary. In addition, MVP will alert the USFS and FERC in an annual report (prior to the second year report) if after the second growing season problem areas have been identified and corrective actions may be necessary (in order to solicit recommendations from the USFS regarding potential corrective actions that could be implemented).

4.0 NATIONAL FOREST SYSTEM LANDS AFFECTED

Several forest community types will be crossed and impacted along this proposed 3.4-mile crossing, including mixed mesophytic forests, conifer-northern hardwood forests, dry-mesic oak forests, dry and dry-mesic oak-pine forests, dry and xeric oak forests, woodlands, savanna, and xeric pine and pine-oak forests and woodlands.

The following USFS Management Prescriptions will be crossed by the Project: 1B (Recommended Wilderness Study Area); 4A (Appalachian National Scenic Trail Corridor); 6C (Old-Growth Forest Communities Associated with Disturbance); 8A1 (Mix of successional Habitats in Forested Landscapes); and Riparian Corridors. In addition, the Project will cross the following USFS Management Areas: MA2 (Upper James River) and MA3 (New River).

Although the Forest Plan does not specifically establish restoration measures applicable to each of these areas, MVP anticipates that the USFS may provide the Project with specific recommendations or requirements related to restoration in these affected Management Prescriptions and Management Areas (e.g., modifications to the proposed seeding mixes for each area). MVP will continue to work with the USFS on any potential site-specific measures applicable to these affected areas, and will incorporate these site-specific measures into the final Restoration Plan as applicable.

5.0 PLAN UPDATES

This draft Restoration Plan contains restoration measures required by FERC's Plan and Procedures (Attachment D-1 and D-2), and recommendations that have been expressed by the USFS to date regarding restoration activities. However, communications with the USFS are ongoing, and it is anticipated that the USFS may provide comments and recommendations for additional measures that will be required on lands they manage. This plan will be updated based on input from the USFS, and the Final Restoration Plan will contain the measures required by the USFS for implementation during restoration efforts on the JNF.

6.0 REFERENCES

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ATTACHMENT D-1
FERC UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

Federal Energy Regulatory Commission

Office of
Energy Projects

May 2013

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

Washington, DC 20426

MAY 2013 VERSION

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

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UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN (PLAN)

I. APPLICABILITY

A. The intent of this Plan is to assist project sponsors by identifying baseline mitigation measures for minimizing erosion and enhancing revegetation. Project sponsors shall specify in their applications for a new FERC authorization and in prior notice and advance notice filings, any individual measures in this Plan they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in this Plan (or the applicant's approved plan). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of this Plan is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on wetland and waterbody systems are addressed in the staff's Wetland and Waterbody Construction and Mitigation Procedures (Procedures).

II. SUPERVISION AND INSPECTION

A. ENVIRONMENTAL INSPECTION

1. At least one Environmental Inspector is required for each construction spread during construction and restoration (as defined by section V). The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

2. Environmental Inspectors shall have peer status with all other activity inspectors.

3. Environmental Inspectors shall have the authority to stop activities that violate the environmental conditions of the FERC's Orders, stipulations of other environmental permits or approvals, or landowner easement agreements; and to order appropriate corrective action.

B. RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

At a minimum, the Environmental Inspector(s) shall be responsible for:

1. Inspecting construction activities for compliance with the requirements of this Plan, the Procedures, the environmental conditions of the FERC's Orders, the mitigation measures proposed by the project sponsor (as approved and/or modified by the Order), other environmental permits and approvals, and environmental requirements in landowner easement agreements.

2. Identifying, documenting, and overseeing corrective actions, as necessary to bring an activity back into compliance;

3. Verifying that the limits of authorized construction work areas and locations of access roads are visibly marked before clearing, and maintained throughout construction;

4. Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;

5. Identifying erosion/sediment control and soil stabilization needs in all areas;

6. Ensuring that the design of slope breakers will not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetlands, waterbodies, and sensitive species habitats;

7. Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats; stopping dewatering activities if such deposition is occurring and ensuring the design of the discharge is changed to prevent reoccurrence; and verifying that dewatering structures are removed after completion of dewatering activities;

8. Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;

9. Advising the Chief Construction Inspector when environmental conditions (such as wet weather or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing or excessive compaction;

10. Ensuring restoration of contours and topsoil;

11. Verifying that the soils imported for agricultural or residential use are certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;

12. Ensuring that erosion control devices are properly installed to prevent sediment flow into sensitive environmental resource areas (e.g., wetlands, waterbodies, cultural resource sites, and sensitive species habitats) and onto roads, and determining the need for additional erosion control devices;

13. Inspecting and ensuring the maintenance of temporary erosion control measures at least:

    a. on a daily basis in areas of active construction or equipment operation;

    b. on a weekly basis in areas with no construction or equipment operation; and

    c. within 24 hours of each 0.5 inch of rainfall;

14. Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts;

15. Keeping records of compliance with the environmental conditions of the FERC's Orders, and the mitigation measures proposed by the project sponsor in the application submitted to the FERC, and other federal or state environmental permits during active construction and restoration;

16. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase; and

17. Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with section III.E.

III. PRECONSTRUCTION PLANNING

The project sponsor shall do the following before construction:

A. CONSTRUCTION WORK AREAS

1. Identify all construction work areas (e.g., construction right-of-way, extra work space areas, pipe storage and contractor yards, borrow and disposal areas, access roads) that would be needed for safe construction. The project sponsor must ensure that appropriate cultural resources and biological surveys are conducted, as determined necessary by the appropriate federal and state agencies.

2. Project sponsors are encouraged to consider expanding any required cultural resources and endangered species surveys in anticipation of the need for activities outside of authorized work areas.

3. Plan construction sequencing to limit the amount and duration of open trench sections, as necessary, to prevent excessive erosion or sediment flow into sensitive environmental resource areas.

B. DRAIN TILE AND IRRIGATION SYSTEMS

1. Attempt to locate existing drain tiles and irrigation systems.

2. Contact landowners and local soil conservation authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of the authorized construction.

3. Develop procedures for constructing through drain-tiled areas, maintaining irrigation systems during construction, and repairing drain tiles and irrigation systems after construction.

4. Engage qualified drain tile specialists, as needed to conduct or monitor repairs to drain tile systems affected by construction. Use drain tile specialists from the project area, if available.

C. GRAZING DEFERMENT

Develop grazing deferment plans with willing landowners, grazing permittees, and land management agencies to minimize grazing disturbance of revegetation efforts.

D. ROAD CROSSINGS AND ACCESS POINTS

Plan for safe and accessible conditions at all roadway crossings and access points during construction and restoration.

E. DISPOSAL PLANNING

Determine methods and locations for the regular collection, containment, and disposal of excess construction materials and debris (e.g., timber, slash, mats, garbage, drill cuttings and fluids, excess rock) throughout the construction process. Disposal of materials for beneficial reuse must not result in adverse environmental impact and is subject to compliance with all applicable survey, landowner or land management agency approval, and permit requirements.

F. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in this Plan and/or required by the FERC's Orders.

1. Obtain written recommendations from the local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specifications.

2. Develop specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities.

3. Develop specific procedures in coordination with the appropriate agencies and landowners, as necessary, to allow for livestock and wildlife movement and protection during construction.

4. Develop specific blasting procedures in coordination with the appropriate agencies that address pre- and post-blast inspections; advanced public notification; and mitigation measures for building foundations, groundwater wells, and springs. Use appropriate methods (e.g., blasting mats) to prevent damage to nearby structures and to prevent debris from entering sensitive environmental resource areas.

G. SPILL PREVENTION AND RESPONSE PROCEDURES

The project sponsor shall develop project-specific Spill Prevention and Response Procedures, as specified in section IV of the staff's Procedures. A copy must be filed with the Secretary of the FERC (Secretary) prior to construction and made available in the field on each construction spread. The filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

H. RESIDENTIAL CONSTRUCTION

For all properties with residences located within 50 feet of construction work areas, project sponsors shall: avoid removal of mature trees and landscaping within the construction work area unless necessary for safe operation of construction equipment, or as specified in landowner agreements; fence the edge of the construction work area for a distance of 100 feet on either side of the residence; and restore all lawn areas and landscaping immediately following clean up operations, or as specified in landowner agreements. If seasonal or other weather conditions prevent compliance with these time frames, maintain and monitor temporary erosion controls (sediment barriers and mulch) until conditions allow completion of restoration.

I. WINTER CONSTRUCTION PLANS

If construction is planned to occur during winter weather conditions, project sponsors shall develop and file a project-specific winter construction plan with the FERC application. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The plan shall address:

1. winter construction procedures (e.g., snow handling and removal, access road construction and maintenance, soil handling under saturated or frozen conditions, topsoil stripping);

2. stabilization and monitoring procedures if ground conditions will delay restoration until the following spring (e.g., mulching and erosion controls, inspection and reporting, stormwater control during spring thaw conditions); and

3. final restoration procedures (e.g., subsidence and compaction repair, topsoil replacement, seeding).

IV. INSTALLATION

A. APPROVED AREAS OF DISTURBANCE

1. Project-related ground disturbance shall be limited to the construction right-of-way, extra work space areas, pipe storage yards, borrow and disposal areas, access roads, and other areas approved in the FERC's Orders. Any project-related ground disturbing activities outside these areas will require prior Director approval. This requirement does not apply to activities needed to comply with the Plan and Procedures (i.e., slope breakers, energy-dissipating devices, dewatering structures, drain tile system repairs) or minor field realignments and workspace shifts per landowner needs and requirements that do not affect other landowners or sensitive environmental resource areas. All construction or restoration activities outside of authorized areas are subject to all applicable survey and permit requirements, and landowner easement agreements.

2. The construction right-of-way width for a project shall not exceed 75 feet or that described in the FERC application unless otherwise modified by a FERC Order. However, in limited, non-wetland areas, this construction right-of-way width may be expanded by up to 25 feet without Director approval to accommodate full construction right-of-way topsoil segregation and to ensure safe construction where topographic conditions (e.g., side-slopes) or soil limitations require it. Twenty-five feet of extra construction right-of-way width may also be used in limited, non-wetland or non-forested areas for truck turn-arounds where no reasonable alternative access exists.

   Project use of these additional limited areas is subject to landowner or land management agency approval and compliance with all applicable survey and permit requirements. When additional areas are used, each one shall be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material shall be included in the reports:

   a. the location of each additional area by station number and reference to previously filed alignment sheets, or updated alignment sheets showing the additional areas;

   b. identification of the filing at FERC containing evidence that the additional areas were previously surveyed; and

c. a statement that landowner approval has been obtained and is available in project files.

Prior written approval of the Director is required when the authorized construction right-of-way width would be expanded by more than 25 feet.

B. TOPSOIL SEGREGATION

1. Unless the landowner or land management agency specifically approves otherwise, prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or from the trench and subsoil storage area (ditch plus spoil side method) in:

   a. cultivated or rotated croplands, and managed pastures;

   b. residential areas;

   c. hayfields; and

   d. other areas at the landowner's or land managing agency's request.

2. In residential areas, importation of topsoil is an acceptable alternative to topsoil segregation.

3. Where topsoil segregation is required, the project sponsor must:

   a. segregate at least 12 inches of topsoil in deep soils (more than 12 inches of topsoil); and

   b. make every effort to segregate the entire topsoil layer in soils with less than 12 inches of topsoil.

4. Maintain separation of salvaged topsoil and subsoil throughout all construction activities.

5. Segregated topsoil may not be used for padding the pipe, constructing temporary slope breakers or trench plugs, improving or maintaining roads, or as a fill material.

6. Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary.

C. DRAIN TILES

1. Mark locations of drain tiles damaged during construction.

2. Probe all drainage tile systems within the area of disturbance to check for damage.

3. Repair damaged drain tiles to their original or better condition. Do not use filter-covered drain tiles unless the local soil conservation authorities and the landowner agree. Use qualified specialists for testing and repairs.

4. For new pipelines in areas where drain tiles exist or are planned, ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems. For adjacent pipeline loops in agricultural areas, install the new pipeline with at least the same depth of cover as the existing pipeline(s).

D. IRRIGATION

Maintain water flow in crop irrigation systems, unless shutoff is coordinated with affected parties.

E. ROAD CROSSINGS AND ACCESS POINTS

1. Maintain safe and accessible conditions at all road crossings and access points during construction.

2. If crushed stone access pads are used in residential or agricultural areas, place the stone on synthetic fabric to facilitate removal.

3. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions. Repair any damages to roadway surfaces, shoulders, and bar ditches.

F. TEMPORARY EROSION CONTROL

Install temporary erosion controls immediately after initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration is complete.

1. Temporary Slope Breakers

a. Temporary slope breakers are intended to reduce runoff velocity and divert water off the construction right-of-way. Temporary slope

breakers may be constructed of materials such as soil, silt fence, staked hay or straw bales, or sand bags.

b. Install temporary slope breakers on all disturbed areas, as necessary to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings at the following spacing (closer spacing shall be used if necessary):

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way.

d. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive environmental resource areas.

2. Temporary Trench Plugs

Temporary trench plugs are intended to segment a continuous open trench prior to backfill.

a. Temporary trench plugs may consist of unexcavated portions of the trench, compacted subsoil, sandbags, or some functional equivalent.

b. Position temporary trench plugs, as necessary, to reduce trenchline erosion and minimize the volume and velocity of trench water flow at the base of slopes.

3. Sediment Barriers

Sediment barriers are intended to stop the flow of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive resources.

a. Sediment barriers may be constructed of materials such as silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travelways), sand bags, or other appropriate materials.

b. At a minimum, install and maintain temporary sediment barriers across the entire construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until revegetation is successful as defined in this Plan. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition.

c. Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as necessary to prevent sediment flow into the wetland or waterbody.

4. Mulch

a. Apply mulch on all slopes (except in cultivated cropland) concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion. Spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or its equivalent, unless the local soil conservation authority, landowner, or land managing agency approves otherwise in writing.

b. Mulch can consist of weed-free straw or hay, wood fiber hydromulch, erosion control fabric, or some functional equivalent.

c. Mulch all disturbed upland areas (except cultivated cropland) <u>before</u> seeding if:

(1) final grading and installation of permanent erosion control measures will not be completed in an area within 20 days after the trench in that area is backfilled (10 days in residential areas), as required in section V.A.1; or

(2) construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions.

d. If mulching <u>before</u> seeding, increase mulch application on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre of straw or equivalent.

e. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50 percent of which is slow release).

f. Ensure that mulch is adequately anchored to minimize loss due to wind and water.

g. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies, except where the product is certified environmentally non-toxic by the appropriate state or federal agency or independent standards-setting organization.

h. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

V. RESTORATION

A. CLEANUP

1. Commence cleanup operations immediately following backfill operations. Complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench (10 days in residential areas). If seasonal or other weather conditions prevent compliance with these time frames, maintain temporary erosion controls (i.e., temporary slope breakers, sediment barriers, and mulch) until conditions allow completion of cleanup.

   If construction or restoration unexpectedly continues into the winter season when conditions could delay successful decompaction, topsoil replacement, or seeding until the following spring, file with the Secretary for the review and written approval of the Director, a winter construction plan (as specified in section III.I). This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

2. A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed as specified in section IV.F. and inspected and maintained as specified in sections II.B.12 through 14. When access is no longer required the travel lane must be removed and the right-of-way restored.

3. Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile. Rock that is not returned to the trench shall be considered construction debris, unless approved for use as mulch or for some other use on the construction work areas by the landowner or land managing agency.

4. Remove excess rock from at least the top 12 inches of soil in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing.

5. Grade the construction right-of-way to restore pre-construction contours and leave the soil in the proper condition for planting.

6. Remove construction debris from all construction work areas unless the landowner or land managing agency approves leaving materials onsite for beneficial reuse, stabilization, or habitat restoration.

7. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers

a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.

b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.

c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.

d. At a minimum, install a trench breaker at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland. Install trench breakers at wetland boundaries, as specified in the Procedures. Do not install trench breakers within a wetland.

2. Permanent Slope Breakers

a. Permanent slope breakers are intended to reduce runoff velocity, divert water off the construction right-of-way, and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, stone, or some functional equivalent.

b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, unless requested by the landowner, using spacing recommendations obtained from the local soil conservation authority or land managing agency.

In the absence of written recommendations, use the following spacing unless closer spacing is necessary to avoid excessive erosion on the construction right-of-way:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Construct slope breakers to divert surface flow to a stable area without causing water to pool or erode behind the breaker. In the absence of a stable area, construct appropriate energy-dissipating devices at the end of the breaker.

d. Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction right-of-way to effectively drain water off the disturbed area. Where slope breakers extend beyond the edge of the construction right-of-way, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to approximate preconstruction conditions. Use penetrometers or other appropriate devices to conduct tests.

2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil.

If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.

3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General

a. The project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities, except as noted in section V.D.1.b.

b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives

Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority, land management agencies, or landowner. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as practicable after application.

3. Seeding Requirements

a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.

b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or the request of the landowner or land management agency. Seeding is not required in cultivated croplands unless requested by the landowner.

c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in section IV.F and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Dormant seeding or temporary

seeding of annual species may also be used, if necessary, to establish cover, as approved by the Environmental Inspector. Lawns may be seeded on a schedule established with the landowner.

d. In the absence of written recommendations from the local soil conservation authorities, seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in section V.D.3.a through V.D.3.c.

e. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.

f. Treat legume seed with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).

g. In the absence of written recommendations from the local soil conservation authorities, landowner, or land managing agency to the contrary, a seed drill equipped with a cultipacker is preferred for seed application.

Broadcast or hydroseeding can be used in lieu of drilling at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or roller after seeding. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover seed after application, as approved by the Environmental Inspector.

VI. OFF-ROAD VEHICLE CONTROL

To each owner or manager of forested lands, offer to install and maintain measures to control unauthorized vehicle access to the right-of-way. These measures may include:

A. signs;

B. fences with locking gates;

C. slash and timber barriers, pipe barriers, or a line of boulders across the right-of-way; and

D. conifers or other appropriate trees or shrubs across the right-of-way.

VII. POST-CONSTRUCTION ACTIVITIES AND REPORTING

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation and address landowner concerns. At a minimum, conduct inspections after the first and second growing seasons.

2. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation shall be considered successful when upon visual survey, crop growth and vigor are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise.

   Continue revegetation efforts until revegetation is successful.

3. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in agricultural areas until restoration is successful.

4. Restoration shall be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless otherwise approved by the landowner or land managing agency per section V.A.6), revegetation is successful, and proper drainage has been restored.

5. Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In no case shall routine vegetation mowing or clearing occur during the migratory bird nesting season between April 15 and August 1 of any year unless specifically approved in writing by the responsible land management agency or the U.S. Fish and Wildlife Service.

6. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Maintain signs, gates, and permanent access roads as necessary.

B. REPORTING

1. The project sponsor shall maintain records that identify by milepost:

   a. method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;

   b. acreage treated;

   c. dates of backfilling and seeding;

   d. names of landowners requesting special seeding treatment and a description of the follow-up actions;

   e. the location of any subsurface drainage repairs or improvements made during restoration; and

   f. any problem areas and how they were addressed.

2. The project sponsor shall file with the Secretary quarterly activity reports documenting the results of follow-up inspections required by section VII.A.1; any problem areas, including those identified by the landowner; and corrective actions taken for at least 2 years following construction.

   The requirement to file quarterly activity reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advanced notice provisions in the FERC's regulations.

ATTACHMENT D-2
FERC WATERBODY AND WETLAND CONSTRUCTION AND MITIGATION PROCEDURES

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

Washington, DC 20426

MAY 2013 VERSION

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

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WETLAND AND WATERBODY
CONSTRUCTION AND MITIGATION PROCEDURES (PROCEDURES)

I. APPLICABILITY

A. The intent of these Procedures is to assist project sponsors by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetlands and waterbodies. Project sponsors shall specify in their applications for a new FERC authorization, and in prior notice and advance notice filings, any individual measures in these Procedures they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in these Procedures (or the applicant's approved procedures). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of these Procedures is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on non-wetland areas are addressed in the staff's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

B. DEFINITIONS

1. "Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;

   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and

   c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

2. "Wetland" includes any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. The following information must be filed with the Secretary of the FERC (Secretary) prior to the beginning of construction, for the review and written approval by the Director:

1. site-specific justifications for extra work areas that would be closer than 50 feet from a waterbody or wetland; and

2. site-specific justifications for the use of a construction right-of-way greater than 75-feet-wide in wetlands.

B. The following information must be filed with the Secretary prior to the beginning of construction. These filing requirements do not apply to projects constructed under the automatic authorization provisions in the FERC's regulations:

1. Spill Prevention and Response Procedures specified in section IV.A;

2. a schedule identifying when trenching or blasting will occur within each waterbody greater than 10 feet wide, within any designated coldwater fishery, and within any waterbody identified as habitat for federally-listed threatened or endangered species. The project sponsor will revise the schedule as necessary to provide FERC staff at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice;

3. plans for horizontal directional drills (HDD) under wetlands or waterbodies, specified in section V.B.6.d;

4. site-specific plans for major waterbody crossings, described in section V.B.9;

5. a wetland delineation report as described in section VI.A.1, if applicable; and

6. the hydrostatic testing information specified in section VII.B.3.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread. The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

B. The Environmental Inspector's responsibilities are outlined in the Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

IV. PRECONSTRUCTION PLANNING

A. The project sponsor shall develop project-specific Spill Prevention and Response Procedures that meet applicable requirements of state and federal agencies. A copy must be filed with the Secretary prior to construction and made available in the field on each construction spread. This filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

1. It shall be the responsibility of the project sponsor and its contractors to structure their operations in a manner that reduces the risk of spills or the accidental exposure of fuels or hazardous materials to waterbodies or wetlands. The project sponsor and its contractors must, at a minimum, ensure that:

a. all employees handling fuels and other hazardous materials are properly trained;

b. all equipment is in good operating order and inspected on a regular basis;

c. fuel trucks transporting fuel to on-site equipment travel only on approved access roads;

d. all equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the

project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

e. hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas;

f. concrete coating activities are not performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

g. pumps operating within 100 feet of a waterbody or wetland boundary utilize appropriate secondary containment systems to prevent spills; and

h. bulk storage of hazardous materials, including chemicals, fuels, and lubricating oils have appropriate secondary containment systems to prevent spills.

2. The project sponsor and its contractors must structure their operations in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. At a minimum, the project sponsor and its contractors must:

a. ensure that each construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills and unanticipated discoveries of contamination;

b. ensure that each construction crew has on hand sufficient tools and material to stop leaks;

c. know the contact names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U. S. Coast Guard and the National Response Center) that must be notified of a spill; and

d. follow the requirements of those agencies in cleaning up the spill, in excavating and disposing of soils or other materials contaminated by a spill, and in collecting and disposing of waste generated during spill cleanup.

B. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in these Procedures and in the FERC's Orders.

V. WATERBODY CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply to the U.S. Army Corps of Engineers (COE), or its delegated agency, for the appropriate wetland and waterbody crossing permits.

2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody, or as otherwise specified by that authority.

3. Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.

4. Notify appropriate federal and state authorities at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in applicable permits.

B. INSTALLATION

1. Time Window for Construction

Unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis, instream work, except that required to install or remove equipment bridges, must occur during the following time windows:

a. coldwater fisheries - June 1 through September 30; and

b. coolwater and warmwater fisheries - June 1 through November 30.

2. Extra Work Areas

a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, except where

the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from the water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the conditions that will not permit a 50-foot setback and measures to ensure the waterbody is adequately protected.

c. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures

a. Comply with the COE, or its delegated agency, permit terms and conditions.

b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.

c. Where pipelines parallel a waterbody, maintain at least 15 feet of undisturbed vegetation between the waterbody (and any adjacent wetland) and the construction right-of-way, except where maintaining this offset will result in greater environmental impact.

d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.

e. Maintain adequate waterbody flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.

f. Waterbody buffers (e.g., extra work area setbacks, refueling restrictions) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

g. Crossing of waterbodies when they are dry or frozen and not flowing may proceed using standard upland construction techniques in accordance with the Plan, provided that the Environmental Inspector verifies that water is unlikely to flow between initial disturbance and final stabilization of the feature. In the event of perceptible flow, the project sponsor must comply with all applicable Procedure requirements for "waterbodies" as defined in section I.B.1.

4. Spoil Pile Placement and Control

a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas as described in section V.B.2.

b. Use sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody.

5. Equipment Bridges

a. Only clearing equipment and equipment necessary for installation of equipment bridges may cross waterbodies prior to bridge installation. Limit the number of such crossings of each waterbody to one per piece of clearing equipment.

b. Construct and maintain equipment bridges to allow unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:

(1) equipment pads and culvert(s);
(2) equipment pads or railroad car bridges without culverts;
(3) clean rock fill and culvert(s); and
(4) flexi-float or portable bridges.

Additional options for equipment bridges may be utilized that achieve the performance objectives noted above. Do not use soil to construct or stabilize equipment bridges.

c. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy dissipating devices downstream of the culverts.

d. Design and maintain equipment bridges to prevent soil from entering the waterbody.

e. Remove temporary equipment bridges as soon as practicable after permanent seeding.

f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the right-of-way is available, remove temporary equipment bridges as soon as practicable after final cleanup.

g. Obtain any necessary approval from the COE, or the appropriate state agency for permanent bridges.

6. Dry-Ditch Crossing Methods

a. Unless approved otherwise by the appropriate federal or state agency, install the pipeline using one of the dry-ditch methods outlined below for crossings of waterbodies up to 30 feet wide (at the water's edge at the time of construction) that are state-designated as either coldwater or significant coolwater or warmwater fisheries, or federally-designated as critical habitat.

b. Dam and Pump

(1) The dam-and-pump method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and there are no concerns about sensitive species passage.

(2) Implementation of the dam-and-pump crossing method must meet the following performance criteria:

(i) use sufficient pumps, including on-site backup pumps, to maintain downstream flows;
(ii) construct dams with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
(iii) screen pump intakes to minimize entrainment of fish;
(iv) prevent streambed scour at pump discharge; and
(v) continuously monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.

c. Flume Crossing

The flume crossing method requires implementation of the following steps:

(1) install flume pipe after blasting (if necessary), but before any trenching;

(2) use sand bag or sand bag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal);

(3) properly align flume pipe(s) to prevent bank erosion and streambed scour;

(4) do not remove flume pipe during trenching, pipelaying, or backfilling activities, or initial streambed restoration efforts; and

(5) remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the stream bed and bank is complete.

d. Horizontal Directional Drill

For each waterbody or wetland that would be crossed using the HDD method, file with the Secretary for the review and written approval by the Director, a plan that includes:

(1) site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;

(2) justification that disturbed areas are limited to the minimum needed to construct the crossing;

(3) identification of any aboveground disturbance or clearing between the HDD entry and exit workspaces during construction;

(4) a description of how an inadvertent release of drilling mud would be contained and cleaned up; and

(5) a contingency plan for crossing the waterbody or wetland in the event the HDD is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

The requirement to file HDD plans does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

7. Crossings of Minor Waterbodies

Where a dry-ditch crossing is not required, minor waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours.

Streambanks and unconsolidated streambeds may require additional restoration after this period;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification or protected status (e.g., agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in section V.B.5.

8. Crossings of Intermediate Waterbodies

Where a dry-ditch crossing is not required, intermediate waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. complete instream construction activities (not including blasting and other rock breaking measures) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. all other construction equipment must cross on an equipment bridge as specified in section V.B.5.

9. Crossings of Major Waterbodies

Before construction, the project sponsor shall file with the Secretary for the review and written approval by the Director a detailed, site-specific construction plan and scaled drawings identifying all areas to be disturbed by construction for each major waterbody crossing (the scaled drawings are not required for any offshore portions of pipeline projects). This plan must be developed in consultation with the appropriate state and federal agencies and shall include extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. The requirement to file major waterbody crossing plans does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The Environmental Inspector may adjust the final placement of the erosion and sediment control structures in the field to maximize effectiveness.

10. Temporary Erosion and Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the waterbody or adjacent upland.

Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan; however, the following specific measures must be implemented at stream crossings:

a. install sediment barriers across the entire construction right-of-way at all waterbody crossings, where necessary to prevent the flow of sediments into the waterbody. Removable sediment barriers (or driveable berms) must be installed across the travel lane. These removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;

b. where waterbodies are adjacent to the construction right-of-way and the right-of-way slopes toward the waterbody, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the waterbody; and

c. use temporary trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody.

11. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.

2. For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.

3. Return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the Environmental Inspector.

4. Install erosion control fabric or a functional equivalent on waterbody banks at the time of final bank recontouring. Do not use synthetic monofilament

mesh/netted erosion control materials in areas designated as sensitive wildlife habitat unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

5. Application of riprap for bank stabilization must comply with COE, or its delegated agency, permit terms and conditions.

6. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric.

7. Revegetate disturbed riparian areas with native species of conservation grasses, legumes, and woody species, similar in density to adjacent undisturbed lands.

8. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody. In addition, install sediment barriers as outlined in the Plan.

   In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

9. Sections V.C.3 through V.C.7 above also apply to those perennial or intermittent streams not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit routine vegetation mowing or clearing adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction right-of-way. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating may be cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in riparian areas that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of riparian areas.

VI. WETLAND CROSSINGS

A. GENERAL

1. The project sponsor shall conduct a wetland delineation using the current federal methodology and file a wetland delineation report with the Secretary before construction. The requirement to file a wetland delineation report does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

   This report shall identify:

   a. by milepost all wetlands that would be affected;

   b. the National Wetlands Inventory (NWI) classification for each wetland;

   c. the crossing length of each wetland in feet; and

   d. the area of permanent and temporary disturbance that would occur in each wetland by NWI classification type.

   The requirements outlined in this section do not apply to wetlands in actively cultivated or rotated cropland. Standard upland protective measures, including workspace and topsoiling requirements, apply to these agricultural wetlands.

2. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing right-of-way, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing pipeline right-of-way with the new construction right-of-way. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

3. Limit the width of the construction right-of-way to 75 feet or less. Prior written approval of the Director is required where topographic conditions or soil limitations require that the construction right-of-way width within the boundaries of a federally delineated wetland be expanded beyond 75 feet. Early in the planning process the project sponsor is encouraged to identify site-specific areas where excessively wide trenches could occur and/or where spoil piles could be difficult to maintain because existing soils lack adequate unconfined compressive strength.

4. Wetland boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

5. Implement the measures of sections V and VI in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all measures of sections V and VI cannot be met, the project sponsor must file with the Secretary a site-specific crossing plan for review and written approval by the Director before construction. This crossing plan shall address at a minimum:

   a. spoil control;

   b. equipment bridges;

   c. restoration of waterbody banks and wetland hydrology;

   d. timing of the waterbody crossing;

   e. method of crossing; and

   f. size and location of all extra work areas.

6. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

B. INSTALLATION

1. Extra Work Areas and Access Roads

   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

   b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from wetland boundaries, except where adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the site-specific conditions that will not permit a 50-foot setback and measures to ensure the wetland is adequately protected.

   c. The construction right-of-way may be used for access when the wetland soil is firm enough to avoid rutting or the construction right-of-way has been appropriately stabilized to avoid rutting (e.g., with timber riprap, prefabricated equipment mats, or terra mats).

      In wetlands that cannot be appropriately stabilized, all construction equipment other than that needed to install the wetland crossing shall

use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the construction right-of-way.

d. The only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair, and no impact on the wetland.

2. Crossing Procedures

a. Comply with COE, or its delegated agency, permit terms and conditions.

b. Assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe.

c. Use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow.

d. Minimize the length of time that topsoil is segregated and the trench is open. Do not trench the wetland until the pipeline is assembled and ready for lowering in.

e. Limit construction equipment operating in wetland areas to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

f. Cut vegetation just above ground level, leaving existing root systems in place, and remove it from the wetland for disposal.

The project sponsor can burn woody debris in wetlands, if approved by the COE and in accordance with state and local regulations, ensuring that all remaining woody debris is removed for disposal.

g. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the construction right-of-way in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require grading or the removal of tree stumps from under the working side of the construction right-of-way.

h. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are

saturated. Immediately after backfilling is complete, restore the segregated topsoil to its original location.

i. Do not use rock, soil imported from outside the wetland, tree stumps, or brush riprap to support equipment on the construction right-of-way.

j. If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or terra mats.

k. Remove all project-related material used to support equipment on the construction right-of-way upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in section VI.B.3.c, maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all wetland crossings where necessary to prevent sediment flow into the wetland.

b. Where wetlands are adjacent to the construction right-of-way and the right-of-way slopes toward the wetland, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the wetland.

c. Install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way through wetlands. Remove these sediment barriers during right-of-way cleanup.

4. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any wetland. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers at the wetland boundaries and/or seal the trench bottom as necessary to maintain the original wetland hydrology.

2. Restore pre-construction wetland contours to maintain the original wetland hydrology.

3. For each wetland crossed, install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. In addition, install sediment barriers as outlined in the Plan. In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

4. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate federal or state agency.

5. Consult with the appropriate federal or state agencies to develop a project-specific wetland restoration plan. The restoration plan shall include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of invasive species and noxious weeds (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Provide this plan to the FERC staff upon request.

6. Until a project-specific wetland restoration plan is developed and/or implemented, temporarily revegetate the construction right-of-way with annual ryegrass at a rate of 40 pounds/acre (unless standing water is present).

7. Ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.

8. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after revegetation and stabilization of adjacent upland areas are judged to be successful as specified in section VII.A.4 of the Plan.

D. POST-CONSTRUCTION MAINTENANCE AND REPORTING

1. Do not conduct routine vegetation mowing or clearing over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as allowed by the appropriate federal or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of wetland areas.

4. Monitor and record the success of wetland revegetation annually until wetland revegetation is successful.

5. Wetland revegetation shall be considered successful if all of the following criteria are satisfied:

    a. the affected wetland satisfies the current federal definition for a wetland (i.e., soils, hydrology, and vegetation);

    b. vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction;

    c. if natural rather than active revegetation was used, the plant species composition is consistent with early successional wetland plant communities in the affected ecoregion; and

    d. invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

6. Within 3 years after construction, file a report with the Secretary identifying the status of the wetland revegetation efforts and documenting success as defined in section VI.D.5, above. The requirement to file wetland restoration reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advance notice provisions in the FERC's regulations.

    For any wetland where revegetation is not successful at the end of 3 years after construction, develop and implement (in consultation with a

professional wetland ecologist) a remedial revegetation plan to actively revegetate wetlands. Continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued water withdrawal permits, as required.

2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.

3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless they waive this requirement in writing.

B. GENERAL

1. Perform 100 percent radiographic inspection of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.

2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, address secondary containment and refueling of these pumps in the project's Spill Prevention and Response Procedures.

3. The project sponsor shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to minimize the potential for entrainment of fish.

2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and/or local permitting agencies grant written permission.

3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

4. Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.

D. DISCHARGE LOCATION, METHOD, AND RATE

1. Regulate discharge rate, use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

2. Do not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission.

ATTACHMENT D-3
USFS RECOMMENDATIONS FOR SEED MIXES AND SEEDING TECHNIQUES

SUGGESTED SEEDING TECHNIQUES FOR PIPELINE RIGHTS-OF-WAYS AND ASSOCIATED DISTURBANCES ON THE MONONGAHELA AND GEORGE WASHINGTON-JEFFERSON NATIONAL FORESTS

November 2016

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Introduction

This document provides guidelines for erosion control seeding techniques in the reclamation and restoration of disturbed soils associated with pipeline installations and repairs/maintenance on National Forest lands. Erosion is an expected consequence of any soil disturbing activity that crosses variable and severe terrain. Therefore, a variety of short term and long term erosion control measures must be implemented. These include but are not limited to physical measures such as contouring; revegetation measures such as re-seeding and mulching; and follow up monitoring. This document specifically addresses seeding and mulching techniques.

The goal of this document is to assist contractors with designing projects so that projects are consistent with Forest Plan goals and objectives. Because every site is unique, guidelines are meant to be descriptive, not prescriptive. Specific proposals still need Forest Service approval. However, ensuring from the start that project designs are consistent with Forest Plan direction will facilitate both the review and implementation process.

Restoration objectives

The initial goal of seeding is to establish a vegetative cover to minimize surface erosion and sedimentation. The secondary goal of seeding is to assist with establishing an assortment of native species beneficial for wildlife and pollinators. Because native species often do not establish as easily nor spread as readily as species typically used for erosion control, it is important to use them in conjunction with erosion control species, and also to use techniques that maximize germination rates and likelihood of survival. This includes proper initial site stabilization, choosing appropriate site specific seed mixes, and using appropriate seeding techniques once the site has been stabilized. Follow-up monitoring and maintenance are also required so that site problems are dealt with immediately and treatments adjusted as needed.

This document includes guidelines for the following:

1) General erosion control and seeding
2) Seeding seasons
3) Nutrient additions
4) Mulch and binders

GENERAL DIRECTION FOR EROSION CONTROL AND SEEDING

Project plans must specify how each of these guidelines will be met.

- Placement of sequestered topsoil prior to seeding.
- Seed shall be Virginia or West Virginia certified seed (bag tags attached; seed certification shall meet each state's standards for their certified seed classification) or alternative seed sourced from approved distributers.
- USFS approval of treatments outside normal seeding seasons.
- All leguminous seed shall be either be pre-inoculated from a supplier, or mixed with inoculant specified for use on that particular seed according to manufacturer's directions. Inoculants shall be manually applied at double the manufacturer's rate. Inoculant shall be mixed with legume seed prior to mixing with other seeds. For hydro-seeding, use a minimum of five times the dry seeding rate of inoculant. (Flynn, 2015; Monsanto 2015)
- A minimum of 100 lbs/ac of seed will be applied when seeding for permanent erosion control (VA BMP) unless otherwise specified by the seed mix provider.
- A success standard/threshold, such as 70-85% ground cover, must be delineated, and provisions to monitor and report on site conditions. Please describe plans for implementing mitigation measures (in case of planting failures) to ensure planting success.
- Describe how subsoil will be tested for compaction, and loosened prior to topsoil replacement if necessary.
- Dry fertilizer and lime may need to be incorporated into the top 2-5 inches of soil after application, at rates indicated by the results of site-specific soil tests. Please describe plans for doing so. (FERC 2013, Virginia DEQ)
- All seeding must occur promptly after construction halts, either temporarily or permanently. Erosion control seed mixtures must be sufficient to stabilize sites for varying lengths of time, and seed mixes may need to vary depending on that timeframe. Please describe how quickly seeding will occur, and the decision thresholds for applying temporary versus permanent erosion control seed mixtures.
- Areas to be planted with species beneficial for wildlife after pipeline installation will be treated with temporary erosion control mix during a normal seeding season.
- Areas not to be treated with wildlife seed species will be treated with permanent erosion control seeding during a normal seeding season.
- Seeding rates should be doubled when hydroseeding (Steinfeld et. al., 2007)

NORMAL SEEDING SEASONS

Appropriate seasons for seeding can vary dramatically depending on elevation. Spring seeding can be conducted from March 15th – June 1st, and fall seeding can be done from August 15th – October 15th, but neither timeframe is appropriate in its entirety at all elevations.
Please describe the timeframe in which seeding is proposed according to site specific elevations. Seeding windows should allow time for application, germination, and survival.

NUTRIENT ADDITIONS

In the absence of soil chemistry tests, the following guidelines can be used to develop fertilizer and liming rates**. Whenever possible, nutrient additions should be based on soil chemistry data in the interpretations provided with the order 1 soil survey.**

Fertilizer: 600-800 lbs/ac, 10-20-10 (Nitrogen, Phosphorous, Potassium), 400 lbs/ac 15-30-15, 800-1000 lbs/ac 10-10-10.

Lime: 1500-4000 lbs/ac (pelletized or dust), 4000 lbs/ac, Hydro Lime (2.5 gal container is equivalent to 1000 lbs limestone)—5-10 containers /ac.

MULCH AND BINDERS

Use of mulch materials and binders will be needed. Use of hay is prohibited on National Forest land due to invasive species concerns. Below are some guidelines that apply when selecting these materials for various sections of the ROW. Please describe how each of these issues will be addressed. All techniques must be appropriate for the % slope on which they will be applied. Please describe how mulching, seeding, and binding techniques will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.).

- Materials must be certified weed free or be accompanied by vendor's test results for noxious weed content.
- Seeded areas can be mulched with weed free straw at a rate of 2-4K lbs/ac, hand spread or blown, fiber mulch hydro-seeded at 1500-2000 lbs/ac., or other appropriate material.
- Natural biodegradable products are preferred. Materials must be demonstrated to be free of invasive species, including but not limited to plants, pests, and pathogens.
- Hydraulic erosion control products (HEPC) must be suitable for wildlife.
- If the use of stabilization netting is required/permitted, wildlife friendly geotextiles must be used. These products must either not contain netting, or netting must be made of 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber. Plastic netting (such as polypropylene, nylon, polyethylene, and polyester), even if advertised as biodegradable, is not an acceptable alternative. Any netting used must also have a loose-weave design with movable joints between horizontal and vertical twines to reduce the chance for wildlife entanglement, injury, or death. (CA Coastal Commission, 2012)
- Avoid the use of silt fences reinforced with metal or plastic mesh.
- When no longer required, (after soils are stable and the vegetative cover is established), temporary erosion control and sediment control products should be promptly removed.
- Any products that require mixing with water need to have a Forest Service-approved water source. The source of water must not be contaminated with non-native invasive organisms that could spread into streams.

Hydroseeding

- Wood-fiber hydraulic mulches are generally short-lived and require a 24-hour period to dry before rainfall occurs.

- Wood fiber naturally has tackifying properties, but fiber alone may not be sufficient on steep slopes. In those cases the addition of a tackifier will help keep the seeds in contact with the soil. Describe plans to assess when this will be necessary, and describe the tackifier and application methods to be used.
- As wood chips, shredded woody materials, and other high-carbon materials decompose, they remove plant nutrients such as nitrogen from the soil. This can reduce soil fertility and make it difficult for grasses to grow. This should be taken into account when planning restoration seeding.

Binders

- The use of hydroseeding with binders will most likely be required in many areas on FS lands due to the steep terrain. Please describe site conditions where this will be used.
- The success of soil binders are somewhat dependent on the soil type present. If soil is compacted or high in clay and silt, soil binders may not penetrate soil surfaces.
- Whether short-life or long-life, soil binders should be non-toxic and organic based, such as guar, psyllium, or pitch and rosin emulsions. Please describe type of binder to be used under what circumstances, and specific application rates and methods.
- Materials or additives used as binders or emulsifiers cannot be toxic to soil organisms or otherwise prevent or inhibit seed germination.

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SUGGESTED SEED MIXES FOR PIPELINE RIGHTS-OF-WAYS AND ASSOCIATED DISTURBANCES ON THE MONONGAHELA AND GEORGE WASHINGTON-JEFFERSON NATIONAL FORESTS

November 2016

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Introduction

This document is meant to provide direction for assembling seed mixes to be used in reclamation and restoration of disturbed soils associated with pipeline installations and repairs/maintenance on the MNF and GW-Jefferson National Forests. All recommended species are commercially available. This document is intended to help restoration achieve two goals: 1) the initial goal of establishing a vegetative cover to minimize surface erosion and sedimentation resulting from precipitation and surface flow, and 2) the secondary goal of establishing an assortment of native species congruent with local ecological communities, and beneficial for wildlife and pollinators.

Because this area possesses such diverse landscapes and microclimates, it is critical to deploy appropriate seed mixes in appropriate habitats. However, native plants that provide diverse wildlife benefits and structural diversity on the landscape often do not germinate or grow fast enough to provide initial erosion control. Therefore, fast-germinating, non-invasive, annual cover crops are recommended for the first round of seeding to stabilize exposed soil. Once those have established and erosion is no longer an immediate threat, native seed mixes tailored to site-specific conditions should be installed among the erosion control species where possible.

When using native seed, use as local an ecotype as is available, in the following order of preference:

- from within state
- from the mountain regions of an adjoining state
- from within 100 miles, as long as it is within the Appalachian mountain ecosystem

This document contains:

- Species recommendations for both temporary and permanent erosion control mixes
- Species recommendations for native mixes beneficial for wildlife and pollinators
- Site specific species recommendations for special site conditions (upland/high elevation, riparian, wetland, and dry low pH soils). Wetland indicator status codes are used to indicate species' soil moisture preferences. (USDA NRCS)

SPECIES FOR EROSION CONTROL

Temporary erosion control species:

To be applied

- wherever erosion control is needed outside of normal seeding seasons
- concurrent with permanent erosion control, and
- prior to permanent seeding with wildlife mixes, where such follow-up is appropriate.

Select at least two of the following species for temporary mixes, or suggest an existing erosion control seed mix containing at least some of these species but not containing anything that would act invasive at the site. Please describe how seed mixes will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.)

Table 1: Temporary erosion control species

Name	**pH preference**	**Wetland Indicator Status**
Annual Ryegrass (Lolium multiflorum (L. perenne var. italicum))	5.0-7.9	NI/moderate
German/Foxtail Millet (Setaria italica)	5.3-6.9	FACU
Cereal Rye (Secale cereale)	52-8.0	NI/damp
Browntop Millet (Panicum ramosum) (introduced in VA & south; possibly ok for WV?)	5.5-6.9	FACU

Permanent erosion control species:

To be applied

- only during normal seeding season in spring and fall
- on slopes too steep or inaccessible for planting equipment, or
- on areas planned to be left not in final grade for more than 1 year.

Select 5 or more of the following species for permanent mixes, and/or suggest an existing restoration seed mix composed primarily of these species and not containing anything that would act invasive at the site. Please include at least one species from Table 1 or one non-native from Table 2 to provide quick cover and mulching/organic matter. Please describe how seed mixes will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.).

Table 2: Permanent erosion control species

Name (sorted first by *Native status* and then by *Preference*)	**pH preference**	**Wetland Indicator Status**
Non-native		
Hard Fescue (Festuca ovina var. duriuscula (F. longifolia))	4.5-8.5	NI/dry
Creeping Red Fescue (Festuca rubra)	5.8-8.0	FACU

Chewings Fescue (Festuca rubra ssp. commutata)	acid tol.	FACU
Redtop (Agrostis alba)	4.5-8.0	FACW
Native		
Highly Preferred		
Indiangrass, (Sorghastrum nutans)	5.0-7.8	UPL
Purpletop (Tridens flavus)	4.5-6.5	FACU
Preferred		
Autumn Bentgrass, (Agrostis perennans)	5.5-7.5	FACU
Canada Wildrye (Elymus canadensis)	5.0-7.9	FACU+
Creeping Red Fescue (Festuca rubra)	5.8-8.0	FACU
Deertongue (Dichanthelium clandestinum)	4.0-7.5	FAC+
Marsh (Dense) Blazing Star (Spiked Gayfeather), (Liatris spicata)	5.6-7.5	FAC+
New England Aster, (Aster novae-angliae (Symphyotrichum)	?	FACW
Oxeye Sunflower, (Heliopsis helianthoides)	?	FACU
Panicledleaf Ticktrefoil, (Desmodium paniculatum)	6.0-7.0	FACU
Showy Ticktrefoil, (Desmodium canadense)	wide tol	FAC
Slender Bushclover, (Lespedeza virginica)	acid tol	NI/dry
Slender Mountainmint (Pycnanthemum tenuifolium)	?	FAC-FACW
Virginia Wildrye, (Elymus virginicus)	5.0-7.4	FACW-
Wild Bergamot, (Monarda fistulosa)	6.0-8.0	UPL
Wild Senna (Senna hebecarpa (Cassia h.))	circumn.	FAC
Moderately preferred		
Partridge pea (Chamaecrista fasciculate)	5.5-7.5	FACU
Blackeyed Susan, (Rudbeckia hirta)	6.0-7.0	FACU-
Grain Rye (Secale cereale)	5.2-8.0	NI
Switchgrass (Panicum virgatum)	4.5-8.0	FAC
Ticklegrass (Rough Bentgrass), (Agrostis scabra)	6.0-8.0	FAC

NATIVE SPECIES FOR WILDLIFE AND POLLINATORS

These should be installed as permanent vegetation in areas accessible to drills or other necessary planting equipment. (Because native seed mixes need to be drilled or otherwise covered to enhance germination success, only areas accessible to the necessary equipment should be designated for follow-up native seeding.)

For **each** habitat type (dry, high, riparian, wet): select 5 or more of the following species, and/or suggest an existing restoration seed mix composed primarily of local genotypes (as described above) and not containing anything that would act invasive at the site. A temporary cover crop (Table 1) will also likely be necessary to stabilize the site and protect overwintering seeds.

"High elevation" species should be included in mixes on sites higher than 3,000 feet, or lower sites where the presence of red spruce indicates cold conditions. Please work with your FS contacts if you have suggestions for other appropriate species that are tolerant of short growing seasons and cold temperatures.

Ensure seed mixes are appropriate for local soil pH; see Table 4 for species to include in dry, acidic conditions. To ensure restoration success in a landscape with varying pH, more than one seed mix per habitat may be needed.

As with erosion control mixes, please describe how native seed mixes will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.).

Table 3: Native species for wildlife and pollinators

Name (sorted by *Habitat Type*)	**pH preference**	**Wetland Indicator Status**
Dry Soils/Upland		
Blackeyed Susan, (Rudbeckia hirta)	6.0-7.0	FACU-
Common Milkweed, (Asclepias syriaca)	calcareous	FACU
Indiangrass, (Sorghastrum nutans)	5.0-7.8	UPL
Oxeye Sunflower, (Heliopsis helianthoides)	?	FACU
Panicledleaf Ticktrefoil, (Desmodium paniculatum)	6.0-7.0	FACU
Partridge Pea, (Chamaecrista fasciculata (Cassia f.))	5.5-7.5	FACU
Showy Ticktrefoil, (Desmodium canadense)	wide tol	FAC
Switchgrass, (Panicum virgatum)	4.5-8.0	FAC
Virginia Wildrye, (Elymus virginicus)	5.0-7.4	FACW-
High Elevation		
Mountain Mint, Pycnanthemum spp.	?	FAC-FACW
Wild Bergamot, (Monarda fistulosa)	6.0-8.0	UPL
Virginia Wildrye, (Elymus virginicus)	5.0-7.4	FACW-
Riparian		
Autumn Bentgrass, (Agrostis perennans)	5.5-7.5	FACU
Big Bluestem, 'Niagara' (Andropogon gerardii, 'Niagara')	6.0-7.5	FAC
Boneset, (Eupatorium perfoliatum)	?	FACW+
Common Sneezeweed, (Helenium autumnale)	4.0-7.5	FACW+
Indiangrass, (Sorghastrum nutans)	5.0-7.8	UPL
Joe Pye Weed, (Eupatorium fistulosum)	4.5-7.0	FAC+
Maryland Senna (Senna marilandica (Cassia m.))	4.0-7.0	FAC+
New York Ironweed, (Vernonia noveboracensis)	4.5-8.0	FACW+
Partridge Pea, (Chamaecrista fasciculata (Cassia f.))	5.5-7.5	FACU
Spotted Joe Pye Weed, (Eupatorium maculatum (Eupatoriadelphus maculatus))	5.5-7.0	FACW
Swamp Milkweed (Asclepias incarnata)	5.0-8.0	OBL
Virginia Wildrye, (Elymus virginicus)	5.0-7.4	FACW-
Wild Senna (Senna hebecarpa (Cassia h.))	circumn.	FAC
Wetland/Wet Soils *(pH indicators not included in this section because the majority of "problem" acid soil sites on these Forests are dry uplands. Wetland indicators not included because all plants are appropriate for wetlands)*		
Blue False Indigo, (Baptisia australis)		

Bottlebrush Grass, (Elymus hystrix (Hystrix patula))
Canadian Anemone, (Anemone canadensis)
Canadian Burnet, (Sanguisorba canadensis)
Deertongue, 'Tioga' (Panicum clandestinum (Dichanthelium c.), 'Tioga')
Fringed (Nodding) Sedge, (Carex crinita)
Great Blue Lobelia, (Lobelia siphilitica)
New York Ironweed, (Vernonia noveboracensis)
Path Rush, (Juncus tenuis,)
Purple Node Joe Pye Weed, (Eupatorium purpureum)
Redtop Panicgrass, (Panicum rigidulum (P. stipitatum))
Soft Rush (Juncus effusus)
Spotted Joe Pye Weed, (Eupatorium maculatum (Eupatoriadelphus maculatus))
Squarrose Sedge, (Carex squarrosa)
Swamp Milkweed (Asclepias incarnata)
Switchgrass, 'Cave-In-Rock' (Panicum virgatum, 'Cave-In-Rock')
Tussock Sedge, (Carex stricta)
Wild Senna (Senna hebecarpa (Cassia h.))
Woolgrass, (Scirpus cyperinus)

Low pH (acidic) soils

Few of the species listed above would naturally grow well in acidic soils as defined in this project (pH less than 4.8), though many would survive for several years if initial seeding was accompanied by a lime addition. For permanent cover, blackberries and goldenrods do well in sunny, acid, dry soils; and ferns, lycopodiums, and mosses persist as vegetative cover in more shaded areas. Table 4 lists perennial species native to WV and VA that should be included in permanent vegetation mixes for dry, acidic sites.

Table 4: Species for dry, acidic sites

Name	**pH preference**	**Wetland Indicator Status**
Purpletop (Tridens flavus)	4.5-6.5	FACU
Purple lovegrass (Eragrostis spectabilis (Pursh) Steud.)	4.0-7.5	UPL
Virginia spiderwort (Tradescantia virginiana)	4.0-8.0	FACU
Common blackberry (Rubus allegheniensis)	4.6-7.5	FACU-
Canada goldenrod, (Solidago Canadensis)	4.8-7.5	FACU
Indian hemp (Apocynum cannabinum)	4.5-7.0	FACU
White avens, (Geum canadense)	4.5-7.5	FACU
Splitbeard bluestem (Andropogon ternarius var. Michx.) (native to VA & KY, & south; a warm season bunchgrass.)	4.0-7.5	FACU
Slender woodoats ((Chasmanthium laxum (Uniola laxa))	4.5-7.0	FAC

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Mountain Valley Pipeline, LLC
Mountain Valley Pipeline Project
FERC Docket No. CP16-10-000

Attachment 179
Brush Mountain Alternative

Brush Mountain Alternative (MPs 218.3-219.4)

The Forest Service requested that MVP evaluate an alternative between MPs 218.3 and 219.4 of the October 2016 Proposed Route (Brush Mountain Alternative) to reduce the length of construction work space near Craig Creek and avoid crossing a tributary to Craig Creek. This section of the October 2016 Proposed Route follows a ridge generally north-south, and the alternative would move the pipeline to another ridge about 0.1 mile to the west of the October 2016 Proposed Route. The alternative would be about 0.1 mile longer than the Proposed Route, and both routes would cross forested areas. About 0.2 mile of the proposed route would be adjacent to an existing pipeline right-of-way along the south side of Craig Creek Road, while about 0.3 mile of the alternative would be collocated with FS Road 188/Brush Mountain Road temporarily disturbing regular recreational and Forest Service vehicle access in that location. The general location of the alternative is shown on the attached figure. The table below includes a comparison of environmental features crossed by the Brush Mountain Alternative and the corresponding segment of the Proposed Route.

Comparison of the Brush Mountain Alternative and the October 2016 Proposed Route

Feature	Brush Mountain Alternative	October 2016 Proposed Route
General		
Total length (miles)	1.1	1.0
Length adjacent to existing right-of-way (miles)	0.2	0.3
Land disturbed within construction right-of-way (acres) a/	16.4	15.5
Land Use		
Populated areas within 0.5 mile (number)	0	0
NRHP designated or eligible historic districts crossed (miles)	0	0
National Forest System lands crossed (miles)	1.0	0.9
National Forest Wilderness Area crossed (miles)	0	0
Proximity to Brush Mountain Wilderness (feet)	1,450	850
Length adjacent to Brush Mountain Wilderness (miles)	0.7	0.7
Residences within 50 feet of construction workspace (number)	0	0
Landowner parcels crossed (number)	5	3
Resources		
Forested land crossed (miles)	1.1	1.0
Forested land affected during construction (acres)	16.4	15.6
Forested land affected during operation (acres)	6.5	6.2
Interior forest crossed (acres)	0.9	0.7
Forested wetlands crossed (feet)	0	0
Wetlands (NWI) crossed (feet) b/	0	0
Perennial waterbody crossings (number) b/	0	1
All streams crossed (number)	0	1
Shallow bedrock crossed (miles)	1.1	1.0
Steep slope (> 20 percent) crossed (miles)	0.5	0.7
Side slope crossed (miles)	0.7	0.9
Landslide potential crossed (miles)	0.5	0.4

Comparison of the Brush Mountain Alternative and the October 2016 Proposed Route		
Feature	**Brush Mountain Alternative**	**October 2016 Proposed Route**
Karst area crossed (miles)	0	0

a/ Assuming 125-foot-wide construction right-of-way.
b/ NWI and NHD data used in order to provide a common comparison between the variations and proposed route since field surveys were not conducted along the variations.

The alternative would move about 0.3 mile of the pipeline away from the immediate vicinity of Craig Creek and avoid crossing one tributary to Craig Creek that would be crossed by the proposed route. The alternative would be slightly longer and result in more disturbance, including forest habitat, during construction and operation, and would cross two additional private landowner parcels, than the corresponding segment of October 2016 Proposed Route. The alternative would parallel slightly less (0.2 mile) of existing road or right-of-way (FS Road 188/Brush Mountain Road) compared to 0.3 mile of existing pipeline right-of-way that would be paralleled by the October 2016 Proposed Route. The alternative would move the pipeline approximately 600 feet further west from the western boundary of the Brush Mountain Wilderness.

Constructability of the Brush Mountain Alternative is similar to the October 2016 Proposed Route with the exception of the area depicted on the map as “winch area start” and “winch area end”. Due to the steep terrain in this area, Mountain Valley’s contractors will not be able to travel this area with vehicles. Also, due to the inability to construct an access road to gain access to this area, Mountain Valley would have to limited to no access to the area at “winch area end” without using Forest Service Road #188. Finally, due to the winch construction, Mountain Valley would have to add additional temporary work space at the “winch area end” location creating more disturbance to the private landowner and the Forest Service.

Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N 1:12,000

0 500 1,000 2,000 Feet

Mountain Valley PIPELINE

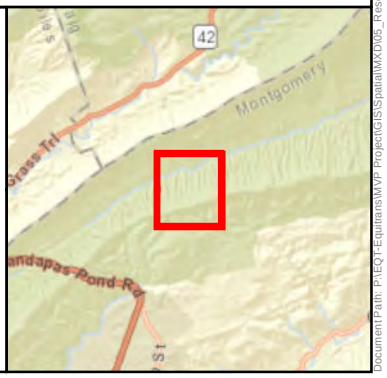
Brush Mountain Alternative

December 2016

Data Sources: ESRI Streaming Data, 2014, Ventyx 2014, Virginia Department of Recreation and Conservation, 2015, Protected Areas Database, 2015.

Legend

- October 2016 Proposed Route
- Brush Mountain Alternative
- Milepost
- Brush Mountain Wilderness
- US National Forest Service Boundary



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