APPENDIX G

DRAFT CONSTRUCTION, OPERATIONS,
AND MAINTENANCE PLANS

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket Nos. CP15-554-000
CP15-554-001

Construction, Operations, and Maintenance Plans

DRAFT

Prepared by

ERM

August 2016

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The attachments to Atlantic's draft COM Plan can be viewed on the FERC Internet website at http://www.ferc.gov. Using the eLibrary link, select "Advanced Search" from the eLibrary menu and enter 20160824-5160 in the "Accession Number" field.

LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
AO	Authorized Officer
Atlantic	Atlantic Coast Pipeline, LLC
ATWS	Additional Temporary Workspace
BA	biological assessment
BFM	bonded fiber matrix
BIC	Best in Class
Blocking Plan	OHV Blocking Plan
BMP	best management practice
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CM	Compliance Monitors
COE	United States Army Corps of Engineers
COM	Construction, Operation and Maintenance
CP	cathodic protection
CPCN	Certificate of Public Convenience and Necessity
DEQ	Department of Environmental Quality
DTI	Dominion Transmission, Inc.
EACG	Eastern Area Coordination Group
ECC	Environmental Construction Coordinator
EI	Environmental Inspector
EIS	environmental impact statement
EM	Environmental Manager
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
ERS	electronic reporting system
ESCP	Erosion and Sedimentation Control Plan
FERC PM	FERC Environmental Project Manager
FERC	Federal Energy Regulatory Commission
Fire Plan	Fire Prevention and Suppression Plan
FSO	Field Safety Officer
FWS	U.S. Fish and Wildlife Service
GPS	global positioning system
GWNF	George Washington National Forest
HCA	High Consequence Areas
HDD	horizontal directional drill
ICS	Incident Command System
LOD	limits of disturbance
LRMP	Land and Resource Management Plans
LUST	Leaking Underground Storage Tank
M&R	metering and regulating
MLRA	Major Land Resource Areas
MNF	Monongahela National Forest
MP	Milepost
NFS	National Forest Service
NIMS	National Incident Management System
NPS	National Park Service
NRCS	Natural Resources Conservation Service

NTP	Notice to Proceed
OHV	off-highway vehicle
OPS	Office of Pipeline Safety
Plan	Upland Erosion Control, Revegetation, and Maintenance Plan
PPV	peak particle velocity
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
Projects	Atlantic Coast Pipeline and Supply Header Project
RECP	Rolled Erosion Control Product
RFP	request for proposal
RQ	Reportable Quantity
SACC	Southern Area Coordination Center
SAIPR	Slip Avoidance, Identification, Prevention, and Remediation - Policy and Procedure
SAMACG	Southern Area Multi-Agency Coordination Group
SHPO	State Historic Preservation Officer
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SSURGO	Soil Survey Geographic Database
SWPPP	Storm Water Pollution Prevention Plan
Transportation Plan	Traffic and Transportation Plan
UDP	Unanticipated Discoveries Plan
USDA	United States Department of Agriculture
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
VDOF	Virginia Department of Forestry
VDOT	Virginia Department of Transportation
VESCH	Virginia Erosion and Sediment Control Handbook
WVDOT	West Virginia Department of Transportation

1.0 INTRODUCTION

1.1 BACKGROUND

Atlantic Coast Pipeline, LLC (Atlantic) - a company formed by four major U.S. energy companies - Dominion Resources, Inc., Duke Energy Corporation, Piedmont Natural Gas Co., Inc., and AGL Resources, Inc. - is proposing to construct and operate approximately 600 miles of interstate natural gas transmission pipeline and associated laterals in West Virginia, Virginia, and North Carolina. This project, referred to as the Atlantic Coast Pipeline (ACP or Project), will deliver natural gas from supply areas in the Appalachian region to demand areas in Virginia and North Carolina. Dominion Transmission, Inc. (DTI) will build and operate the ACP on behalf of Atlantic.

The ACP will serve the growing energy needs of multiple public utilities and local distribution companies in Virginia and North Carolina. Based on current customer commitments, approximately 79.2 percent of the natural gas transported by the ACP will be used as a fuel to generate electricity for industrial, commercial, and residential uses. The remainder of the natural gas will be used directly for residential (9.1 percent), industrial (8.9 percent), and commercial and other uses such as vehicle fuel (2.8 percent). By providing access to low-cost natural gas supplies, the ACP will increase the reliability and security of natural gas supplies in Virginia and North Carolina.

An environmental impact statement (EIS) is being prepared for the project by the Federal Energy Regulatory Commission (FERC), which has jurisdiction over the project under Section 7 of the Natural Gas Act. The FERC is responsible for the preparation of the Project's EIS in compliance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (40 Code of Federal Regulations [CFR] Parts 1500-1508), and FERC's National Environmental Policy Act implementing regulations (18 CFR Part 380). The FERC will use the EIS to aid in deciding whether to issue the ACP a Certificate of Public Convenience and Necessity (CPCN). The U.S. Forest Service (USFS), along with several other Federal agencies, is cooperating with the FERC in preparing the EIS for the Project, and will use the EIS to aid in its own decision-making process, as discussed below.

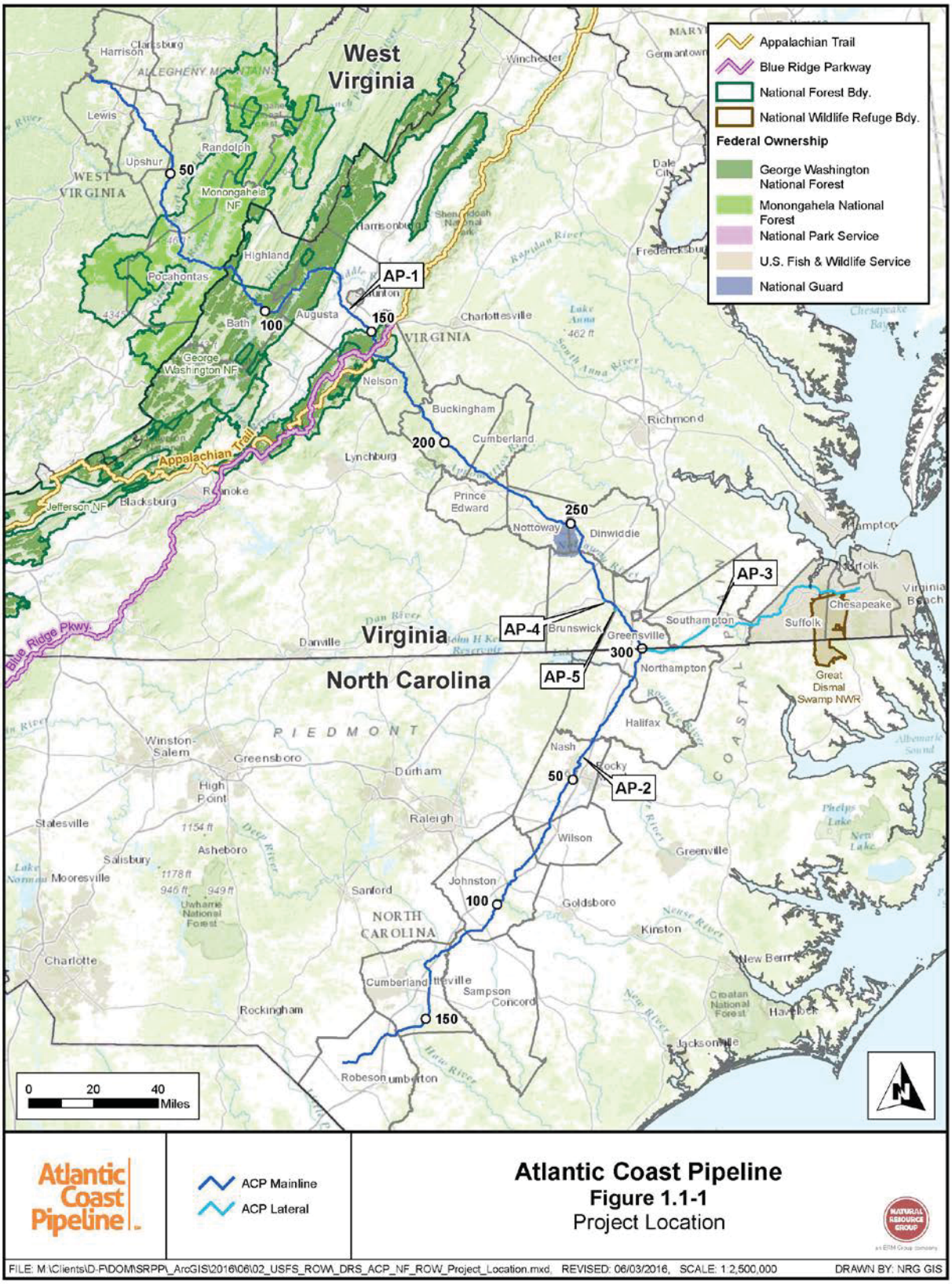
FERC, in consultation with the State Historic Preservation Officers (SHPO), is also responsible for compliance with Section 106 of the National Historic Preservation Act (16 U.S. Code § 470f) and its implementing regulations (36 CFR Part 800) promulgated by the Advisory Council on Historic Preservation.

FERC, in consultation with the US Fish and Wildlife Service (FWS), is also the lead federal agency responsible for compliance with Sections 7(a)(2) and 7(c) of the Endangered Species Act (16 U.S. Code. §§ 1536(a)(2), 1536(c)). FERC will prepare a biological assessment (BA) consistent with the requirements of 50 CFR § 402.12(f). The BA will identify conservation measures to avoid or minimize any adverse effects the Project may have on federally listed species and their critical habitat.

Portions of the Project would cross National Forest Service (NFS) lands administered by the USFS' Monongahela National Forest (MNF) and George Washington National Forest (GWNF)[1] (see Figure 1.1-1). Accordingly, Atlantic submitted an Application for Transportation and Utility Systems and Facilities on USFS Lands (Form SF-299) on November 12, 2015, and amended its application to incorporate various route changes on July 29, 2016.[2]

[1] Since 1995, the GWNF and the adjacent Jefferson National Forest have been managed under a single Forest Supervisor.

[2] Atlantic submitted a separate application to the NPS for a right-of-way across NPS-administered land.


West Virginia
Virginia
North Carolina
Appalachian Trail
Blue Ridge Parkway
National Forest Bdy.
National Wildlife Refuge Bdy.
Federal Ownership
George Washington National Forest
Monongahela National Forest
National Park Service
U.S. Fish & Wildlife Service
National Guard
AP-1
AP-2
AP-3
AP-4
AP-5
50
100
150
200
250
300
0 20 40 Miles
ACP Mainline
ACP Lateral
Atlantic Coast Pipeline
Figure 1.1-1
Project Location
FILE: M:\Clients\D-F\DOM\SRPP_ArcGIS\2016\06\02_USFS_ROW_DRS_ACP_NF_ROW_Project_Location.mxd REVISED: 06/03/2016 SCALE: 1:2,500,000 DRAWN BY: NRG GIS

The ACP's proposed route does not lie within a GWNF-designated utility corridor. The GWNF's Land and Resource Management Plan (LRMP) requires that decisions for new authorizations outside designated utility corridors include an amendment to the LRMP to change the management prescription of the corridor area. The GWNF must therefore decide whether to amend its LRMP, and the USFS must decide whether to authorize granting a right-of-way/use permit to construct and operate the pipeline facilities on NFS lands. This Construction, Operation, and Maintenance (COM) Plan specifies the terms under which a right-of-way across NFS lands would be granted. The COM Plan is intended to be appended to the right-of-way grant.

The COM Plan consists of a number of individual topical plans and appendices applicable to construction and operation of the ACP on NFS lands. During the planning and building of the ACP, changes to the COM Plan may be warranted. The COM Plan is the repository and reference for new and amended permits, approvals, clearances, and plans that may be issued during that time frame.

It should be noted that this COM Plan was prepared based on the proposed project schedule prior to the FERC's August 12, 2016 issuance of a Notice of Schedule for preparation of an EIS for the ACP. The ACP construction schedule, as well as any associated impact assessments, will be refined in a subsequent version of the COM Plan to reflect the anticipated milestone dates contained in the FERC's Notice of Schedule.

2.0 PROJECT DESCRIPTION

The ACP consists of the following:

Mainline Pipeline Facilities:

- AP-1: approximately 333 miles of underground 42-inch outside diameter natural gas transmission pipeline in Harrison, Lewis, Upshur, Randolph, and Pocahontas Counties, West Virginia; Highland, Bath, Augusta, Nelson, Buckingham, Cumberland, Prince Edward, Nottoway, Dinwiddie, Brunswick, and Greensville Counties, Virginia; and Northampton County, North Carolina.
- AP-2: approximately 186 miles of underground 36-inch outside diameter natural gas transmission pipeline in Northampton, Halifax, Nash, Wilson, Johnston, Sampson, Cumberland, and Robeson Counties, North Carolina.

Lateral Pipeline Facilities:

- AP-3: approximately 83 miles of underground 20-inch outside diameter natural gas lateral pipeline in Northampton County, North Carolina; and Greensville and Southampton Counties and the Cities of Suffolk and Chesapeake, Virginia.
- AP-4: approximately 0.4 mile of underground 16-inch outside diameter natural gas lateral pipeline in Brunswick County, Virginia.

  AP-5: approximately 1 mile of underground 16-inch outside diameter natural gas lateral pipeline in Greensville County, Virginia.

Compressor Station Facilities:

- Compressor Station 1 (Marts Compressor Station): a new, natural gas-fired compressor station at approximately Milepost [3] (MP) 7.5 of the AP-1 mainline in Lewis County, West Virginia.

- Compressor Station 2 (Buckingham Compressor Station): a new, natural gas-fired compressor station at approximately MP 191.5 of the AP-1 mainline in Buckingham County, Virginia.

- Compressor Station 3 (Northampton Compressor Station): a new natural gas-fired compressor station at approximately MP 300.1 of the AP-1 mainline and MP 0.0 of the AP-2 mainline and 0.0 of the AP-3 lateral in Northampton County, North Carolina.

Other Aboveground Facilities:

- Nine new metering and regulating (M&R) stations at receipt and/or delivery points along the new pipelines (including one at Compressor Station 1 and one at Compressor Station 2).

- Forty-one valve sites at select points along the new pipelines at intervals specified by U.S. Department of Transportation (USDOT) regulations at Title 49 CFR Part 192.

- Nine sets of pig launcher and/or receiver sites at 10 sites along the new pipelines (including launcher/receiver sites at Compressor Stations 2 and 3).

2.1.1.1 Facilities on National Forest Service Lands

On NFS lands, the ACP consists of a 42-inch, buried steel pipe across portions of the MNF and GWNF. The pipeline route crosses the MNF for a total of 5.2 miles, all within the Marlinton Ranger District. It crosses the GWNF for a total of 15.9 miles in the Warm Springs, North River, and Glenwood-Pedlar Ranger Districts, in Virginia. No compressor stations, meter and regulating stations, pig launcher/receivers, mainline valves or other major above-ground facilities are proposed on NFS lands. Minor appurtenant facilities on NFS lands include pipeline markers and cathodic protection (CP) test stations.

Pipeline markers will be installed at road and rail crossings, and at other areas as deemed necessary to alert the public to the line's presence. Larger aerial markers will be installed in the permanent right-of-way at periodic intervals to facilitate aerial surveillance during operation of the pipeline system.

Installation of a CP system is necessary to protect the pipe from corrosion, and is required by USDOT pipeline safety regulations. The CP system for the ACP utilizes a number anode beds installed perpendicular to the right-of-way; none of these are located on NFS lands. The CP system does require

[3] The mileposts used in the initial FERC Application, which was filed on September 18, 2015 (FERC Accession Number 20150918-5212), were based on three-dimensional changes in topography along the proposed pipeline routes. In areas where a pipeline route has changed due to the adoption of an alternative, the mileposts in the affected area have been scaled to account for the resulting difference in the length of the route. For these reasons, the straight-line distance between consecutive mileposts as indicated or depicted in tables and figures in this updated Resource Report may be greater than or less than 5,280 feet. The mileposts should be considered as reference points only.

periodic CP test stations, which comprise a small-diameter plastic stand-pipe holding wires attached to the pipe, usually installed at road crossings next to the pipeline marker.

Construction of the ACP requires the use of existing USFS roads for access to the right-of-way. Some of these roads will require improvements, ranging from light grading and graveling of existing road prisms, to widening at certain locations to accommodate pipe and log trucks. A small number of new roads will be required, principally short spurs to connect existing roads with the right-of-way. Once the pipeline is installed, these same roads will be used to access the right-of-way for operations and maintenance purposes. Roads to be used for ACP purposes, including new roads and roads that will require improvements, are shown in Table 2.1.1-1.

2.1.1.2 Land Requirements

The ACP proposes to utilize a nominal 125-foot-wide construction right-of-way for installation of a 42-inch pipeline, with a 40-foot-wide spoil side and an 85-foot-wide working side. For most pipeline construction activities, this right-of-way width would accommodate large equipment, pipe stringing and set up, welding, the trench, and the temporary storage of topsoil and trench spoil.

Additional temporary workspace (ATWS) is proposed at certain locations, such as road crossings, and where additional spoil storage, log landings or equipment staging is needed. Conversely, the nominal 125-foot construction right-of-way width is proposed to be reduced to 75 feet in wetlands and certain other ecologically sensitive areas. Typical right-of-way configurations are provided in Attachment A. The alignment sheets (Attachment B) provide exact dimensions of the proposed construction right-of-way widths on NFS lands.

The ACP proposes to utilize a 53.5-foot-wide permanent right-of-way for operating purposes. The permanent right-of-way will be maintained in an herbaceous state to allow for maintenance access along the right-of-way, although no permanent access road will be established on or along the right-of-way. All temporary construction work areas outside the permanent right-of-way will be restored in accordance with the Restoration and Rehabilitation Plan.

The ACP will mostly use existing USFS roads to access the pipeline right-of-way, with the exception of a three new roads that would connect existing roads with the right-of-way. Section 2.1.1.4 provides more details about access roads proposed to construct and operate the pipeline. **[Note – Atlantic is in the process of preparing a detailed Haul Plan, which may identify additional Forest Service roads that could be used. These are expected to be identified by the end of October.]**

TABLE 2.1.1-1

Atlantic Coast Pipeline Access Roads on NFS Lands

Forest Service Road No.	Project Access Road Name	Milepost	County	State	New/ Existing	Improve-ments	National Forest	Area Affected by Construction and Operations (acres)	Length (miles)
N/A	05-001-C009.AR2	71.5	Pocahontas County	WV	New	Yes	MNF	0.0	0.1
MNF Road 1026	05-001-C009.AR1	71.7	Pocahontas County	WV	Exist	Yes	MNF	13.9	3.8
MNF Road 1012 and an unnumbered connector road between MNF Road 1012 and right-of-way	05-001-E064.AR1	81.8	Pocahontas County	WV	Exist	Yes	MNF	6.3	1.7
MNF Road 1017	05-001-E064.AR3	83.3	Pocahontas County	WV	Exist	Yes	MNF	0.1	0.0
GWNF un-numbered road between Highway 84 and right-of-way	06-001-B001.AR3	85.0	Highland County	VA	Exist	Yes	GWNF	0.6	0.2
GWNF un-numbered road between Highway 84 and right-of-way	06-001-B001.AR4	85.4	Highland County	VA	Exist	Yes	GWNF	0.4	0.1
GWNF Road 124	36-014.AR2	93.6	Bath County	VA	Exist	Yes	GWNF	19.1	5.3
GWNF un-numbered road between GWNF Road 614 and right-of-way	36-014.AR3	94.1	Bath County	VA	New	Yes	GWNF	4.7	1.2
GWNF Road 281	36-016.AR1	96.3	Bath County	VA	Exist	Yes	GWNF	10.1	2.8
GWNF Road 309	36-016.AR2	99.6	Bath County	VA	Exist	Yes	GWNF	2.0	0.6
GWNF Roads 449 and 449A	07-001.AR1-AR 3	116.8	Augusta County	VA	Exist	Yes	GWNF	9.2	3.0
N/A	07-001.AR1-AR 4	117.2	Augusta County	VA	New	Yes	GWNF	0.1	0.1
GWNF un-numbered road between GWNF Road 449A and right-of-way	07-001.AR1-AR 6	118.0	Augusta County	VA	Exist	Yes	GWNF	0.9	0.8
GWNF Road 466A	07-001.AR1-AR 8	120.2	Augusta County	VA	Exist	Yes	GWNF	1.1	0.3
GWNF Road 466	07-001.AR1-AR 9	120.4	Augusta County	VA	Exist	Yes	GWNF	2.0	0.6
GWNF Road 1755	07-001.AR1-AR 7	121.1	Augusta County	VA	New	Yes	GWNF	1.4	0.4

Some existing roads require minor grading and graveling and/or widening to accommodate construction vehicles. All roads utilized for construction would also be used to access the permanent right-of-way for operation and maintenance purposes. Further information regarding access roads can be found in Section 7.0.

Table 2.1.1-2 below shows the acreage affected on the MNF and GWNF for the construction right-of-way, the permanent right-of-way, and access roads.

TABLE 2.1.1-2

Summary of National Forest Lands Affected by the Atlantic Coast Pipeline Project (acres)

National Forest	Permanent right-of-way	Temporary Workspace	Access Roads (as is or with improvements)	Access Roads (new)
Monongahela National Forest	33.07	46.97	20.36	0.04
George Washington National Forest	105.21	144.36	45.45	6.27
Total	**138.28**	**191.33**	**65.81**	**6.31**

2.1.1.3 Construction Schedule

Overall Construction Schedule

This COM Plan was prepared based on the proposed project schedule prior to the FERC's August 12, 2016 issuance of a Notice of Schedule for preparation of an EIS for the ACP. The ACP construction schedule, as well as any associated impact assessments, will be refined in a subsequent version of the COM Plan to reflect the anticipated milestone dates contained in the FERC's Notice of Schedule.

Subject to receipt of the required permits and regulatory approvals, initial construction activities (e.g., timber removal, preparation of contractor yards and access roads) are expected to begin in April 2017. Atlantic anticipates that pipeline construction will commence in the summer of 2017. The ACP pipeline will be built along 14 spreads. Construction of aboveground facilities will begin in June 2017. It is anticipated that all facilities will be placed in service by the fourth quarter of 2018. Key milestone dates for the construction schedule are summarized in Table 2.1.1-3.

Construction on the MNF will span two spreads. Spread 3 crosses the MNF for about 0.8 mile, north of Cloverlick Mountain. Spread 3A crosses the MNF for about 4.3 miles between Michael Mountain and the Virginia border. Timber removal on both spreads is scheduled for November, 2017. Pipeline construction is scheduled to commence in March, 2018.

Construction on the GWNF will span three spreads. Spread 4A crosses the GWNF for about 4 miles just east of the West Virginia-Virginia border, where the GWNF abuts the MNF. As indicated above, timber removal on this spread is scheduled for November, 2017 and pipeline construction is scheduled to commence in March, 2018.

Spread 4A crosses the GWNF for about 4.2 miles in Highland, Bath and Augusta counties, Virginia. Spread 4B crosses the GWNF for about 6.5 miles in Augusta County. Spread 5 crosses the GWNF for about 1.2 miles in the vicinity of the Mt. Torrey Furnace and the Appalachian Trail in Augusta County. Timber removal on Spreads 4A and 5 are scheduled to begin in April 2017 with pipeline construction schedule commencing in June 2017.

Figure 2.1-1 shows the construction spreads and scheduled start dates with respect to NFS lands.

TABLE 2.1.1-3

Construction Schedule by Spread for the Atlantic Coast Pipeline [a]

Spread	Approximate Mileposts	Counties/Cities and States/Commonwealths	Begin Construction	Finish Construction [d]
ATLANTIC COAST PIPELINE				
INITIAL CONSTRUCTION ACTIVITIES				
Initial Site Preparation (2017 spreads)	By spread	See below	April 2017	3Q 2017
Tree Clearing (2017 spreads) [b, c]	By spread	See below	April 2017	4Q 2017
Initial Site Preparation (2018 spreads)	By spread	See below	September 2017	1Q 2018
Tree Clearing (2018 spreads) [b, c]	By spread	See below	November 2017	2Q 2018
CONSTRUCTION OF PIPELINE				
Spread 1 (AP-1)	0.0–29.1	Harrison, Lewis, and Upshur Counties, WV	June 2017	4Q 2017
Spread 2 (AP-1)	29.1–50.6	Upshur and Randolph Counties, WV	June 2017	4Q 2017
Spread 2A (AP-1)	50.6–65.3	Randolph County, WV	March 2018	4Q 2018
Spread 3 (AP-1)	65.3–79.2	Randolph and Pocahontas Counties, WV	March 2018	4Q 2018
Spread 3A (AP-1)	79.2–91.3	Pocahontas County, WV and Highland County, VA	March 2018	4Q 2018
Spread 4a (AP-1)	91.3–108.2	Highland, Bath, and Augusta Counties, VA	June 2017	4Q 2018
Spread 4b (AP-1)	108.2-125.9	Augusta County, VA	June 2017	4Q 2017
Spread 5 (AP-1)	125.9–183.3	Augusta and Nelson Counties, VA	June 2017	4Q 2018
Spread 6 (AP-1)	183.3–239.6	Nelson, Buckingham, Cumberland, Prince Edward, and Nottoway Counties, VA	March 2018	4Q 2018
Spread 7 (AP-1)	239.6–300.1	Nottoway, Dinwiddie, Brunswick, and Greensville Counties, VA, and Northampton County, NC	February 2018	4Q 2018
Spread 8 (AP-2)	0.0–61.6	Northampton, Halifax, and Nash Counties, NC	February 2018	4Q 2018
Spread 9 (AP-2)	61.6–125.0	Nash, Wilson, Johnston, Sampson, and Cumberland Counties, NC	June 2017	1Q 2018
Spread 10 (AP-2)	61.5–183.0	Cumberland and Robeson Counties, NC	June 2017	1Q 2018
Spread 11 (AP-3)	0.0–83.0	Northampton County, NC, Greensville and Southampton Counties, VA, and the Cities of Suffolk and Chesapeake, VA	February 2018	4Q 2018
Spread 12 (AP-4; AP-5) [e]	0.0–0.4; 0.0-1.1	Brunswick County, VA; Greensville County, VA	February 2018	4Q 2018
CONSTRUCTION OF COMPRESSOR STATIONS				
Compressor Station 1	7.6	Lewis County, WV	June 2017	4Q 2018
Compressor Station 2	191.5	Buckingham County, VA	June 2017	4Q 2018
Compressor Station 3	300.1	Northampton County, NC	June 2017	4Q 2018
CONSTRUCTION OF METERING AND REGULATING STATIONS				
Kincheloe	7.6	Lewis County, WV	July 2017	4Q 2018
Long Run	47.2	Randolph County, WV	April 2018	4Q 2018
Woods Corner	191.5	Buckingham County, VA	July 2017	4Q 2018
Smithfield	92.7	Johnston County, NC	July 2017	3Q 2018
Fayetteville	132.9	Johnston County, NC	August 2017	3Q 2018
Pembroke	183.0	Robeson County, NC	July 2017	3Q 2018
Elizabeth River	83.0	City of Chesapeake, VA	January 2018	3Q 2018

TABLE 2.1.1-3

Construction Schedule by Spread for the Atlantic Coast Pipeline [a] (cont'd)

Spread	Approximate Mileposts	Counties/Cities and States/Commonwealths	Begin Construction	Finish Construction [d]
CONSTRUCTION OF METERING AND REGULATING STATIONS				
Brunswick	0.4	Brunswick County, VA	July 2017	1Q 2018
Greensville	1.1	Greensville County, VA	October 2017	2Q 2018

[a] The number and timing of the construction spreads are subject to change dependent upon construction and permit requirements.

[b] The start of tree clearing is dependent upon the results of the environmental surveys and agency consultations.

[c] Including tree clearing for aboveground facilities, access roads, and contractor yards.

[d] The finish construction date refers to the end of mechanical construction; additional restoration and post construction activity is expected to occur in the Project area beyond the timeframe reflected here. 1Q = first quarter; 2Q = second quarter; 3Q = third quarter; 4Q = fourth quarter.

[e] Spread 12 will be completed with spread 11 and is counted as one spread.

Seasonal Restrictions

Timber Removal/Clearing

Based on agency consultations to date, timing restrictions for tree clearing in West Virginia and Virginia are as follows:

- West Virginia:
  - migratory birds: April 1 – August 31
  - bats: April 1 to November 15
- Virginia:
  - migratory birds: March 15 – August 15
  - bats: April 1 – November 15

While Atlantic will comply with these time-of-year restrictions to the extent practicable, tree clearing on portions of the GWNF will be required in the Spring and Summer of 2017, for constructability and safety reasons. Atlantic will consult with the USFS, FWS, and State/Commonwealth wildlife agencies regarding additional or special requirements or mitigation for tree clearing in this period.

Timber removal on the MNF and the westernmost portion of the GWNF, i.e. Spreads 3 and 3A, is scheduled to take place between November 15, 2017 and March 15 (April 1 for the MNF), 2018. This schedule avoids the sensitive bat and migratory bird periods on these spreads.

Timber removal on the central and easternmost portions of the GWNF (.i.e. Spreads 4A, 4B and 5) cannot practically avoid the sensitive period, and is scheduled to begin April 1, 2017. The Migratory Bird Protection Plan and the Bat Habitat Protection and Habitat Mitigation Plan provide details about measures to minimize and mitigate impacts to these biological resources.

Stream and Wetland Crossings

At streams containing sensitive fisheries, crossings utilizing dry crossing methods will be scheduled to occur during the least sensitive periods, determined in consultation with Federal and State/Commonwealth agencies, including the USFS. Streams on NFS lands where timing restrictions have been adopted are shown in Tables 2.1.1-4 and 2.1.1-5.

Table 2.1.1-4

Waterbodies Crossed and Crossing Methods for the Atlantic Coast Pipeline in the Monongahela National Forest

Waterbody			Crossing		Special Designations		
Feature ID	Waterbody Name	Flow Regime	Approximate Crossing Width (feet) [a]	Construction Method/ Access Road Type [b]	State Water Quality Classification [c]	Fishery [d] Type	Time Restrictions [e]
AP-1 MAINLINE							
spoa402	UNT to Sugar Camp Run	Intermittent	4	1) Dam and Pump 2) Flume	UNT to B1	Warmwater	April 1 to June 30
spoa400	UNT to Shock Run	Perennial	12	1) Dam and Pump 2) Flume	Unclassified	Warmwater	April 1 to June 30

[a] Waterbodies with a Feature ID starting with nhd represent waterbodies that are based on desktop data from the National Hydrography Dataset, and widths have been assumed as 10 feet wide for perennial and 5 feet wide for intermittent waterbodies in this dataset.

[b] Construction methods are provided for features that intersect the centerline. For features that are crossed by access roads the access road type is indicated as permanent (Perm AR) or temporary (Temp AR).

[c] Abbreviations for West Virginia State Water Quality Classifications are listed below:

West Virginia Stream Water Use Categories:

Category A - Public Water; Category B - Propagation and Maintenance of Fish and Other Aquatic Life; Category B1 - Warm Water Fishery; Category B2 - Trout Waters; Category B4 – Wetlands; Category C - Water Contact Recreation (Category C); Category D - Agricultural and Wildlife Uses; Category D1 –Irrigation; Category D2 - Livestock; Category D3 - Wildlife; Category E - Water Supply Industrial, Water Transport, Cooling and Power ; Category E1 - Water Transport; Category E2 - Cooling Water; Category E3 -Power Production; Category E4 - Industrial (West Virginia CSR, 2014).

State Water Quality Classifications were determined using West Virginia Code of State Regulations, Title 47, Series 2 and communication with West Virginia Department of Environmental Protection (WVDEP) staff (Peterson, 2015). WVDEP considers all waters of the state Category A, B, and C waters. Waterbodies are assumed to be capable of supporting public water use. Those waterbodies listed in the table as Category A waters are waterbodies listed in appendices to West Virginia CSR, Title 47.

High Quality Streams (HQS) are based on the Sixth Edition of the West Virginia High Quality Streams prepared by the Wildlife Resources Section of the West Virginia Division of Natural Resources.

State regulations require the classification to extend into adjacent tributaries, indicated by UNT (unnamed tributary) to [Stream Class] to indicate connected tributaries to classified waters.

[d] Fisheries type is based on readily available data from agency consultation letters or online data. Additional consultation with state and federal agencies will be on-going to further refine these waterbody designations.

[e] Timing restrictions are based on readily available data from agency consultation letters or online data. Additional consultations with state and federal agencies, as well as field survey data for protected species will be necessary to further refine timing restrictions.

TABLE 2.1.1-5

Waterbodies Crossed and Crossing Methods for the Atlantic Coast Pipeline in the George Washington National Forest

State/ Facility/ Milepost	Waterbody			Crossing		Special Designations		
	Feature ID	Waterbody Name	Flow Regime	Approximate Crossing Width (feet) [a]	Construction Method/ Access Road Type [b]	State Water Quality Classification [c]	Fishery Type [d]	Time Restrictions [e]
AP-1 MAINLINE								
85.0	shia407	UNT to Warwick Run	Perennial	45	1) Dam and Pump 2) Flume	Unclassified	Unclassified	--
85.1	shia410	UNT to Warwick Run	Perennial	10	1) Dam and Pump 2) Flume	Unclassified	Unclassified	--
85.4	shia409	UNT to Lick Draft	Perennial	10	1) Dam and Pump 2) Flume	Unclassified	Unclassified	--
85.5	shia408	Lick Draft	Perennial	8	1) Dam and Pump 2) Flume	Unclassified	Unclassified	--
94.1	nhd_va_e_024	Laurel Run	Intermittent	5	Dam and Pump	Aquatic Life, I-IV	Wild Brook Trout	October 1 to March 31
98.3	nhd_va_j_007	UNT to Cowpasture River	Intermittent	5	Dam and Pump	UNT to Aquatic Life	Unclassified	--
115.8	saub108	Barn Lick Branch	Perennial	Not Crossed By Centerline	Not Crossed by Centerline	Unclassified	Unclassified	--
117.1	sauc002	Dowell's Draft	Perennial	10	1) Flume 2) Dam and Pump	Unclassified	Unclassified	--
117.2	sauc004	UNT to Dowell's Draft	Perennial	9	Dam and Pump	Unclassified	Unclassified	--
117.7	sauc005	UNT to Dowell's Draft	Intermittent	7	Dam and Pump	Unclassified	Unclassified	--
120.2	sauc007	UNT to White Oak Draft	Ephemeral	2	1) Dam and Pump 2) Flume	UNT to Aquatic Life, I-IV	UNT to Wild Brook Trout	October 1 to March 31
120.2	sauc006	White Oak Draft	Perennial	25	Dam and Pump	Aquatic Life, I-IV	Wild Brook Trout	October 1 to March 31
120.4	sauc008	White Oak Draft	Perennial	29	1) Flume 2) Dam and Pump	Aquatic Life, I-IV	Wild Brook Trout	October 1 to March 31
120.6	sauc009	UNT to White Oak Draft	Intermittent	Not Crossed By Centerline	Not Crossed by Centerline	UNT to Aquatic Life, I-IV	UNT to Wild Brook Trout	October 1 to March 31
121.1	nhd_va_030	Stoutameyer Branch	Perennial	1	1) Dam and Pump 2) Flume	Unclassified	Coldwater	--
122.5	sauc010	UNT to Jennings Branch	Intermittent	3	Dam and Pump	UNT to Aquatic Life, I-IV	UNT to Wild Brook Trout	October 1 to March 31
122.8	sauc011	UNT to Jennings Branch	Perennial	6	1) Dam and Pump 2) Flume	UNT to Aquatic Life, I-IV	UNT to Wild Brook Trout	October 1 to March 31
123.0	sauc012	UNT to Jennings Branch	Intermittent	3	1) Dam and Pump 2) Flume	UNT to Aquatic Life, I-IV	UNT to Wild Brook Trout	October 1 to March 31

TABLE 2.1.1-5

Waterbodies Crossed and Crossing Methods for the Atlantic Coast Pipeline in the George Washington National Forest (cont'd)

State/ Facility/ Milepost	Waterbody			Crossing		Special Designations		
	Feature ID	Waterbody Name	Flow Regime	Approximate Crossing Width (feet) [a]	Construction Method/ Access Road Type [b]	State Water Quality Classification [c]	Fishery Type [d]	Time Restrictions [e]
AP-1 MAINLINE								
154.2	saua072	UNT to Back Creek	Intermittent	5	1) Flume 2) Dam and Pump	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--
154.4	sauc104	UNT to Back Creek	Intermittent	8	Dam and Pump	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--
154.5	saua071	UNT to Back Creek	Intermittent	4	1) Flume 2) Dam and Pump	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--
154.8	sauc103	UNT to Back Creek	Intermittent	10	Dam and Pump	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--
154.9	sauc102	UNT to Back Creek	Ephemeral	6.	Dam and Pump	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--
155.0	sauc101	UNT to Back Creek	Intermittent	Not Crossed By Centerline	Not Crossed by Centerline	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--
155.1	sauc100	UNT to Back Creek	Ephemeral	11	Dam and Pump	UNT to Aquatic Life, V-VIII	UNT to Stockable Trout Stream	--

[a] Waterbodies with a Feature ID starting with nhd represent waterbodies that are based on desktop data from the National Hydrography Dataset, and widths have been assumed as 10 feet wide for perennial and 5 feet wide for intermittent waterbodies in this dataset.

[b] Construction methods are provided for features that intersect the centerline. For features that are crossed by access roads the access road type is indicated as permanent (Perm AR) or temporary (Temp AR).

[c] Abbreviations for Virginia State Water Quality Classifications are listed below:

Virginia Trout Waters Classes:

Classes I, II, III, IV are wild natural trout streams ranking from highest to lowest quality

Classes V, VI, VII, VIII are stockable trout streams ranking from highest to lowest quality

State Water Quality Classifications were determined using Virginia Department of Environmental Quality GIS dataset, 2012 Integrated WQ Report Rivers, January 27, 2014 available for download from the Virginia Environmental Geographic Information System (VEGIS) website at: http://www.deq.virginia.gov/ConnectWithDEQ/VEGIS/VEGISDatasets.aspx. State regulations require the classification to extend into adjacent tributaries, indicated by UNT (unnamed tributary) to [Stream Class] to indicate connected tributaries to classified waters.

Unclassified – waters that do not have an assigned classification, or are not unnamed tributaries to classified waters.

[d] Fisheries type is based on readily available data from agency consultation letters or online data. Additional consultation with state and federal agencies will be on-going to further refine these waterbody designations.

[e] Timing restrictions are based on readily available data from agency consultation letters or online data. Additional consultations with state and federal agencies, as well as field survey data for protected species will be necessary to further refine timing restrictions.

2.1.1.4 Access

The ACP will mostly use existing NFS roads to access the pipeline right-of-way. However, four new access roads are proposed (Table 2.1.1-1). Two of the four new roads utilize the routes of existing roadways, but are considered new roads because they would require substantial re-construction.

New Access Road 05-001-C009.AR2 would consist of about 100 feet of new road on the MNF between Forest Service Road 1026 (Buzzard Ridge Road) and the pipeline right-of-way near MP 71.1. The pipeline right-of-way itself does not lie on NFS lands at this location. Dominion will provide the GWNF proposed design details for the road after civil surveys have been completed. The road and its drainage structures will be designed and constructed in accordance with MNF requirements. Methods and locations for disposal of any excess fill created by the road construction will also be identified.

New Access Road 36-014.AR3 would follow an un-numbered jeep trail for 1.2 miles on the GWNF between Highway 614 (Muddy Run Road) and the pipeline right-of-way near MP 94.1. The jeep trail, which runs along Laurel Run and crosses the creek several times, would require substantial new construction. Dominion will provide the GWNF proposed design details for the road after civil surveys have been completed. The access road and associated stream crossing structures will be designed to withstand a stream discharge that represents the 100-year return interval. The road and its drainage structures will be designed and constructed in accordance with GWNF requirements. Methods and locations for disposal of any excess fill created by the road construction will also be identified.

New Access Road 07-001.AR1-AR4 is a short (approximately 200 feet) new road at MP 117.2, connecting Forest Road 449 with the ROW.

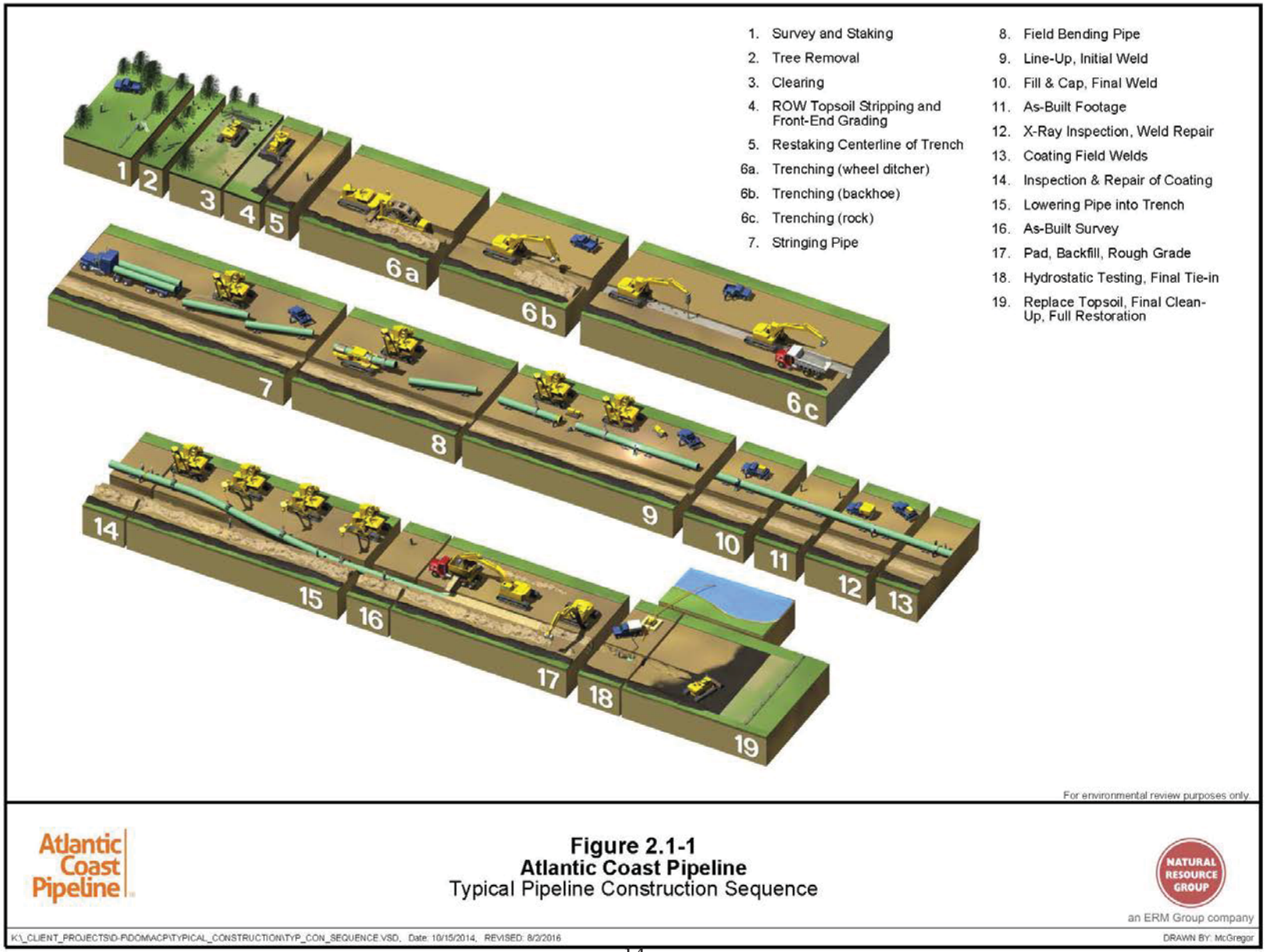
New Access Road 07-001.AR1-AR 7 would follow GWNF Road 1755 for about 0.4 mile between Stover Shop Road and the pipeline right-of-way at about MP 121.1. GWNF Road 1755 would require substantial improvements along its entire length to accommodate construction equipment, and so has been considered a new road for purposes of the COM Plan. This segment of GWNF Road 1755 would be closed to the public during road construction. Dominion will provide the GWNF proposed design details for the road after civil surveys have been completed. The road and its drainage structures will be designed and constructed in accordance with GWNF requirements. Methods and locations for disposal of any excess fill created by the road construction will also be identified.

Most of the existing NFS roads to be used for pipeline construction will require minor grading and graveling and/or widening to accommodate construction vehicles. Improvements to existing roads, as well as new road construction, will be done according to USFS specifications. NOTE: Applicable road construction specifications will be attached pending additional discussion with USFS.

All roads utilized for construction would also be used to access the permanent right-of-way for operation and maintenance purposes. Use of NFS access roads not identified in the COM Plan, or the undertaking of improvements to existing NFS roads not identified in the COM Plan, will not occur unless approved in writing by the USFS Authorized Officer (AO) and FERC.

2.1.1.5 General Pipeline Construction Procedures

Construction of the proposed pipelines will follow industry-standard practices and procedures as described below. In a typical scenario, construction involves a series of discrete activities conducted in a linear sequence. These include survey and staking; clearing and grading; trenching; pipe stringing, bending, and welding; lowering-in and backfilling; hydrostatic testing; final tie-in; commissioning; and right-of-way cleanup and restoration. Figure 2.1-1 illustrates each of the steps in a typical construction sequence. A description of each step in the process is provided below.


1. Survey and Staking
2. Tree Removal
3. Clearing
4. ROW Topsoil Stripping and Front-End Grading
5. Restaking Centerline of Trench
6a. Trenching (wheel ditcher)
6b. Trenching (backhoe)
6c. Trenching (rock)
7. Stringing Pipe
8. Field Bending Pipe
9. Line-Up, Initial Weld
10. Fill & Cap, Final Weld
11. As-Built Footage
12. X-Ray Inspection, Weld Repair
13. Coating Field Welds
14. Inspection & Repair of Coating
15. Lowering Pipe into Trench
16. As-Built Survey
17. Pad, Backfill, Rough Grade
18. Hydrostatic Testing, Final Tie-in
19. Replace Topsoil, Final Clean-Up, Full Restoration
1
2
3
4
5
6a
6b
6c
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For environmental review purposes only.
Atlantic Coast Pipeline
Figure 2.1-1
Atlantic Coast Pipeline
Typical Pipeline Construction Sequence
NATURAL RESOURCE GROUP
an ERM Group company
K:_CLIENT_PROJECTS\D-PDOM\ACP\TYPICAL_CONSTRUCTION\TYP_CON_SEQUENCE.VSD; Date: 10/15/2014; REVISED: 8/2/2016
DRAWN BY: McGregor

2.1.2 Survey and Staking

Atlantic's survey contractor will stake the pipeline centerlines and limits of the construction right-of-way and ATWS areas. Wetland boundaries and other environmentally sensitive areas will also be marked at this time.

2.1.3 Clearing and Grading

Prior to beginning ground-disturbing activities, Atlantic's construction contractors will coordinate with the One-Call systems in West Virginia and Virginia to have existing underground utilities (e.g., cables, conduits, and pipelines) identified and flagged. Once this process is complete, the clearing crew will mobilize to the construction areas. Fences along the rights-of-way will be cut and braced, and temporary gates and fences will be installed to contain livestock, if present. The clearing crew will then clear the work area of vegetation and other obstacles, including trees, stumps that lie within the trenchline, logs, brush, and rocks.

Cleared vegetation and stumps will either be burned, chipped (except in wetlands), or hauled offsite to a commercial disposal facility or for beneficial reuse, as specified in the Restoration and Rehabilitation Plan or otherwise directed by the AO. No chips, mulch, or mechanically cut woody debris will be stockpiled in wetlands, and no upland woody debris will be disposed of in wetlands.

Burning of slash or non-merchantable wood is not currently anticipated. If burning is deemed necessary, it will be done only after Atlantic has acquired all applicable permits and approvals, including specific authorization from the AO. In addition, any such burning will be conducted in accordance with the *Fire Prevention and Suppression Plan* (Fire Plan).

Following clearing, the construction right-of-way and ATWS will be graded where necessary to provide a level work surface to allow safe passage of construction equipment and emergency vehicles. More extensive grading will be required in steep side slope or vertical areas and where necessary to prevent excessive bending of the pipelines. Graded topsoil will be segregated in accordance with the Upland Erosion Control Plan. Typically, topsoil will be segregated from subsoil in non-saturated wetlands, and in other areas as specified in the Upland Erosion Control Plan.

In accordance with the Upland Erosion Control Plan, in areas where topsoil segregation is required Atlantic will segregate at least 12 inches of topsoil in deep soils (more than 12 inches of topsoil) and the entire topsoil layer in shallow soils (less than 12 inches of topsoil). Excavated topsoil will be placed on the edge or edges of the construction right-of-way as shown in the typical drawings provided in Attachment A.

If the ground is relatively flat and does not require topsoil segregation or grading, the existing vegetative mat will be peeled and removed similar to topsoil and stockpiled along the right-of-way for use in restoration. In areas disturbed by grading, and as required by the Upland Erosion Control Plan, temporary erosion and sediment controls will be installed immediately after initial disturbance within the right-of-way to minimize erosion. All materials used for erosion and sediment control (e.g., hay bales or straw mulch) will be certified as weed free. The erosion and sediment control materials will be inspected and maintained throughout the construction and restoration phases of the Project, as appropriate, and as required by the Upland Erosion Control Plan.

2.1.4 Trenching

Pipe trench will be excavated by rotary trenching machines, track-mounted backhoes, or other similar equipment. Trench spoil will be deposited adjacent to the trench within the construction right-of-way. The trench for each pipeline will be excavated to a depth that provides sufficient cover over the pipeline after backfilling. The typical dimensions of each pipeline trench will vary depending on a number of factors, such as the substrate in the vicinity of the trench (see Table 2.1.4-1). The bottom width of the trench will accommodate the diameter of the pipeline and sufficient pad material around it (typically approximately one foot on either side of the pipeline). The top width will vary to allow the sides of the trench to be adapted to local soil conditions at the time of construction. If trench dewatering is required, it will be conducted in accordance with the Upland Erosion Control Plan and applicable permits in a manner that will not cause additional erosion or result in heavily silt-laden water flowing into a wetland or waterbody.

Atlantic will conduct topsoil segregation in accordance with the FERC Upland Erosion Control, Revegetation and Maintenance Plan. In areas where topsoil segregation is conducted, subsoil from trench excavations will be placed adjacent to the topsoil in a separate pile to allow for proper restoration of the soil during backfilling and restoration. Gaps will be left between the topsoil and subsoil piles to prevent stormwater runoff from backing up or flooding. Mixing of topsoil and subsoil piles will be prevented by separating them physically or with a mulch or silt fence barrier, where necessary and dictated by site conditions, to accommodate reduced workspace.

When rock or rocky formations are encountered, hydraulic hammers, tractor-mounted mechanical rippers or rock trenchers will be used for breaking up the rock prior to excavation. In areas where mechanical equipment or other means cannot be used to break up or loosen boulders or shallow bedrock, blasting will be required. Locations where blasting may be required on NFS lands are identified in the Blasting Plan.

TABLE 2.1.4-1

Typical Trench Dimensions for the Atlantic Coast Pipeline Project

Pipeline	Outside Diameter	Cover	Top Width (feet)	Depth (feet)	Typical Depth of Cover (feet)
Atlantic Coast Pipeline					
AP-1	42-inch	Non-agricultural upland	10–15	7.5	3
		Agricultural	10–15	8.5	4
		Wetland	15–20	7.5	3
		Road, railroad, and waterbody crossings	15–20	9.5	5

2.1.5 Pipe Stringing, Bending, and Welding

Individual joints of pipe (up to approximately 80 feet long) will be transported to the construction right-of-way and strung along the trenchline in a single, continuous line. Individual sections of pipe will be bent, where necessary, to allow for a uniform fit with the contours at the bottom of the trench and horizontal points of inflection. Typically, a track-mounted, hydraulic pipe-bending machine will tailor the shape of the pipe to conform to the contours of the trench. After the pipe sections are bent, they will be welded together into long sections and placed on temporary supports along the trench.

Welding is a crucial phase of pipeline construction because the integrity of the pipeline depends on this process. Each weld must exhibit the same structural integrity with respect to strength and ductility. Welding will be conducted in compliance with 49 CFR 192 and API Standard 1104, Welding of Pipelines and Related Facilities. Completed welds will be visually and radiographically inspected.

Welds that do not meet established specifications will be repaired or removed. Following welding and after inspection, pipe weld joints will be coated with an epoxy coating in accordance with required specifications. If the coating is sprayed on, it will be contained within a flocking ring as it is sprayed onto the weld joint; this will result in little to no overspray of coating into the environment. The coating will be inspected for defects, and repaired, if necessary, prior to lowering the pipe into the trench.

2.1.6 Lowering-in and Backfilling

Prior to lowering-in, the trench will be inspected for rocks and other debris that could damage the pipe or its protective coating, and where necessary, the pipe will be protected with rock-shield. Dewatering may be necessary to inspect the bottom of the trench in areas where water has accumulated. If dewatering is required, it will be conducted in accordance with the Upland Erosion Control Plan and applicable permits in a manner that will not cause erosion or result in silt-laden water flowing into a wetland or waterbody.

The pipe will be lifted from the temporary supports and lowered into the trench using side-boom tractors. Sand bags or sifted spoil (not topsoil) will be placed in the bottom of the ditch to support the pipe. As necessary, trench breakers (stacked sand bags, sacrete or foam) will be installed in the trench around the pipe where necessary to prevent movement of subsurface water along the pipeline.

After lowering-in, the pipe will be padded and the trench will be backfilled with previously excavated materials using bladed equipment or backhoes. If the material excavated from the trench is rocky, the pipeline will be protected with a rock shield or covered with other suitable fill (i.e., crushed limestone rock or screened sand). Additionally, excavated rock may be buried within the limits of the construction right-of-way, crushed with a rock pulverizer and incorporated into fill, or used as gravel to upgrade access roads. Excavated material not required for backfill will be removed and disposed of at approved upland disposal sites. Atlantic will not remove excess soil or rock material from NFS lands without authorization from the AO.

If soils containing hazardous materials are encountered during excavation, Atlantic will implement the procedures identified in the Contaminated Media Plan to isolate and contain the suspected soil contamination, collect and test samples of the soil to identify the contaminants, and develop a response plan for crossing or avoiding the site. With the exception of soils classified as hazardous material, all native soils can be used as backfill.

2.1.7 Hydrostatic Testing

After backfilling and all other construction activities that could affect the pipeline are complete, each pipeline will be hydrostatically tested in sections to verify that each system is free from leaks and will provide the required margin of safety at operating pressures. Individual sections of pipeline to be tested will be determined by water availability, terrain conditions and class location. No water will be withdrawn from sources on either the MNF or the GWNF. As practicable, water will be transferred from one test section to another to reduce the amount of water that is required for testing. No hydrostatic discharge locations are anticipated to be required on either the MNF or the GWNF.

During hydrostatic testing, internal pressures and durations will be in accordance with 49 CFR 192 and applicable permit conditions. If leaks are found during testing, the leaks will be repaired and the section of pipe retested until the required specifications are met.

Water Impoundment Structures

No water impoundment structures are proposed to be located on NFS lands.

Final Tie-in and Commissioning

After hydrostatic testing, the pipeline will first be cleaned and dried utilizing compressed air and dry foam pig(s). The pig(s) will be continuously ran through the pipeline, at designated controlled launching and receiving points located within the construction limits of disturbance (LOD), until a desired moisture content is achieved. After the pipeline has been dried and verified through Atlantic inspection, in-line inspection tools (telemetry pigs) are utilized to detect anomalies within the pipe that may have been introduced during construction. In the event that any anomalies are identified, they will first be located and excavated for field verification, and then cut out and replaced with pre-tested pipe, in accordance with all project environmental permits and guidelines. Once all anomaly repairs (if any are identified) have been completed, then final-tie(s) will be completed and commissioning of the line will begin. During the commissioning of the line, operational equipment associated with the pipeline (ex. mainline valves) are inspected and verified for proper installment and functionally working controls, including communication systems, and the initial start-up of compressor facilities begin. The line and associated facilities are slowly purged and loaded with natural gas until brought into actual operation.

2.1.8 Clean-Up and Restoration

Final cleanup will begin after backfilling and as soon as weather and site conditions permit. Final cleanup (including final grading and installation of permanent erosion control devices) will be completed within timeframes specified in the Upland Erosion Control Plan and Restoration and Rehabilitation Plan. Construction debris will be collected and taken to an approved disposal facility. Preconstruction contours will be restored as closely as practicable. Segregated topsoil will be spread over the surface of the right-of-way, and permanent erosion controls will be installed.

Revegetation measures will be implemented in accordance with the Restoration and Rehabilitation Plan. Work areas will be stabilized and seeded as soon as possible after final grading, weather and soil conditions permitting, subject to the recommended seeding dates for the seed mixes used to revegetate different areas along the pipelines. Seeding will stabilize the soil, improve the appearance of the area disturbed by construction, and in some cases, restore native flora.

As-built drawings of the pipeline segments crossing NFS lands will be provided to the USFS following construction. Any USFS boundary markers or monuments disturbed or damaged within the ACP Project area will be re-established following construction.

Markers showing the location of the pipeline will be installed intermittently along the pipeline rights-of-way according to ACP specifications as well as at fence, road, and railroad crossings. The markers will convey emergency information in accordance with applicable government regulations, including USDOT safety requirements. Special “line of sight” markers providing information and guidance to aerial patrol pilots also will be installed.

Aerial markers, used for identifying the pipeline from the air, are orange spheres approximately 12 to 16 inches in diameter mounted on a pole located over the line. This is an object easily seen from the air. In addition, the markers identify a number that coincides with a gate assembly number. This allows the observer to easily identify a gate assembly and confirm their location from the air. In the event there is an issue noted, it may be referenced back to a particular gate assembly.

The pipeline "line-of-sight" markers will be flat fiberglass stakes with markings on both sides of the marker. The pipeline markers at road and railroad crossings will be round posts (3 inches in diameter and 5 feet in height) with wording on at least one side facing the roadway. The markers will contain markings required by law, including the following:

- the marker must state the word "Warning";
- the marker must identify what product is being carried in the pipeline;
- the marker must identify the pipeline operator;
- the marker must include a telephone number that can be reached 24 hours per day, 365 days per year in case of an emergency; and
- the marker must include "call before you dig" labeling and the telephone of the State/Commonwealth One-Call system.

Although line markers are only required to be in the immediate vicinity of the pipeline, DTI's standard operating procedure is to install the marker directly over the pipeline if possible.

2.1.8.1 Specialized Pipeline Construction Procedures

In addition to standard pipeline construction methods, Atlantic will use special construction techniques where warranted by site-specific conditions, e.g., when constructing across waterbodies, wetlands, roads, highways, railroads, steep terrain, karst areas, agricultural areas, and residential areas; when blasting through rock; or when working in winter conditions. Each of these specialized measures is described below. Illustrations of select crossing methods are provided in Attachment A.

2.1.9 Waterbody Crossings

Atlantic will cross all waterbodies on NFS lands using open cut construction methods. Specifically, Atlantic will employ the "dry" open cut methods discussed below. Other stream crossing methods, including the open cut wet crossing method, coffer dam method, conventional bore method, or horizontal directional drilling (HDD) method, are therefore not discussed. It should be noted that while HDD will not be employed to cross waterbodies on the NFS, it will be utilized to cross the Appalachian National Scenic Trail and Blue Ridge Parkway.

Atlantic will adhere to the measures specified in the Stream and Wetland Crossing Procedures and any additional requirements contained in Federal or State/Commonwealth waterbody crossing permits, including applicable permits and approvals from the U.S. Army Corps of Engineers (COE) and various State/Commonwealth agencies. A complete list of the waterbodies crossed on NFS lands and the construction method proposed for each crossing is provided in Tables 2.1.1-4 and 2.1.1-5.

During the clearing and grading phase of construction, temporary bridges will be installed across waterbodies in accordance with the Procedures to allow construction equipment and personnel to cross. The bridges may include clean rock fill over culverts, timber mats supported by flumes, railcar flatbeds, flexi-float apparatuses, or other types of spans. Construction equipment will be required to use the bridges, except that the clearing and bridge installation crews will be allowed one pass through waterbodies before bridges are installed. The temporary bridges will be removed when construction and restoration activities are complete.

ATWS will be required on both sides of waterbody crossings to stage construction equipment, fabricate the pipeline, and store construction materials. Except as authorized by the FERC and the AO, the ATWS will be located at least 100 feet away from the water's edge at each waterbody on NFS lands.

Clearing adjacent to waterbodies will involve the removal of trees and brush from the construction right-of-way and ATWS areas. Woody vegetation within the construction right-of-way will be cleared to the edge of each waterbody. Sediment barriers will be installed at the top of the bank if no herbaceous strip exists. Initial grading of the herbaceous strip will be limited to the extent needed to create a safe approach to the waterbody and to install temporary bridges.

Following clearing, sediment barriers will be installed and maintained across the right-of-way adjacent to waterbodies and within ATWS to minimize the potential for sediment runoff. Silt fence, coir logs and/or straw bales (weed-free)[4] located across the working side of the right-of-way will be removed during periods of active construction when vehicle traffic is present, and will be replaced each night. Alternatively, drivable berms may be installed and maintained across the right-of-way in lieu of silt fences and/or straw bales (weed-free).

Typically, equipment refueling and lubricating at waterbodies will take place in upland areas that are 100 feet or more from the edge of the waterbody and adjacent wetlands. However, there will be certain instances where equipment refueling and lubricating may be necessary in or near waterbodies. For example, stationary equipment such as water pumps for use during stream crossing construction may need to be operated continuously on the banks of waterbodies and may require refueling in place. The Spill Prevention, Control and Countermeasure (SPCC) Plan addresses the handling of fuel and other materials associated with the Projects. The SPCC Plan will be available on each construction spread.

After the pipeline is installed across a waterbody using one of the methods described below, the trench will be backfilled with native material excavated from the trench. If present and moved prior to construction, larger rocks or boulders will be replaced in the stream channel within the construction area following backfill of the trench. The streambed profile will be restored to pre-existing contours and grade conditions to prevent scouring. The stream banks will then be restored as near as practicable to pre-existing conditions and stabilized. Stabilization measures could include seeding, plantings, installation of erosion control blankets, or installation of riprap materials, as appropriate. Jute thatching or bonded fiber blankets will be installed on banks of waterbodies or road crossings to stabilize seeded areas. Temporary erosion controls will be installed immediately following bank restoration. The waterbody crossing area will be inspected and maintained until restoration of vegetation is complete.

2.1.9.1 Flume Method Dry Crossing

The flume crossing method consists of isolating and temporarily diverting the flow of water across the trenching area through one or more large-diameter, smooth steel flume pipes placed in the waterbody. This method allows for trenching activities to occur within a relatively dry stream or riverbed (i.e., beneath the flume pipes containing the water flow) thereby avoiding sedimentation and turbidity in the waterbody. The flume method is typically used to cross small to intermediate flowing waterbodies that support coldwater or other significant fisheries.

For each waterbody where the flume method is implemented, a sufficient number of adequately sized flume pipes will be installed in the waterbody to accommodate the highest anticipated flows during construction. Atlantic will use stream gauge data from the U.S. Geological Survey to determine the

[4] While straw bales are not allowed by the State of West Virginia for a primary form of erosion control, Atlantic proposes to use them in West Virginia as a secondary form of erosion control, in some instances or as directed by the MNF.

highest anticipated flows during the time the flume crossing is in effect. As noted above, the duration of in-stream construction activities (excluding blasting, if required) will be limited to 24 hours across minor waterbodies and 48 hours across intermediate waterbodies. In the absence of stream gauge data, Atlantic's engineers and Environmental Inspectors (EI) will estimate the highest anticipated flows based on the width of the waterbody at the ordinary high water mark, the depth of the waterbody, existing flows at the time of the crossing, and the weather forecast at the time of the crossing. As a contingency, Atlantic will stage additional flume pipes at the crossing in the event that the volume of flow increases due to a precipitation event.

Prior to installation, EIs will visually verify the flume pipes are free of dirt, grease, oil, or other pollutants. After placing the pipes in the waterbody, sand- or pea gravel-filled bags, water bladders, or metal wing deflectors will be placed in the waterbody around the flume pipes upstream and downstream of the proposed trench. These devices will serve to dam the stream and divert the water flow through the flume pipes thereby isolating the water flow from the construction work area between the dams.

After installation of the flume pipes, the remaining standing water between the dams will be pumped out. Pump intakes will be appropriately screened to prevent entrainment of aquatic species. Additionally, fish trapped in the dewatered area will be removed and returned to the flowing waterbody. Leakage from the dams or subsurface flow from below the waterbody bed may cause water to accumulate in the trench once trenching has begun. If water accumulates in this area, it may be periodically pumped out and discharged into energy dissipation/sediment filtration devices as required by the Procedures. Such devices include geotextile filter bags or straw bale (weed-free) structures. Alternatively, the water will be discharged into well-vegetated areas away from the edge of the waterbody, to prevent heavily silt-laden water from entering the waterbody.

Backhoe-type excavators located on the banks of the waterbody will be used to excavate a trench under the flume pipe across the dewatered streambed. Spoil excavated from the waterbody trench will be placed and stored on the bank above the high water mark and a minimum of 10 feet from the edge of the waterbody. Once the trench is excavated, a prefabricated segment of pipe will be installed beneath the flume pipes. The trench will then be backfilled with the native material excavated from the trench across the waterbody bed. The banks will be stabilized before removing the dams and flume pipes and returning flow to the waterbody channel.

The flume method has proven to be an effective technique for constructing pipelines across sensitive waterbodies. The potential for the introduction of turbidity or suspended sediments is limited because sediment generated during trench excavation and backfilling operations is isolated to the dewatered area between dams. When flumes are installed properly, the operation of the flume is generally stable and can be left in place for periods prior to and following the installation of the waterbody pipeline crossing. The flume method also provides for continued fish passage through the construction work area via the flume pipes during the crossing.

2.1.9.2 Dam-and-Pump Dry Crossing Method

The dam-and-pump method may be used as an alternative to the flume method. It generally is preferred for waterbodies where hard bedrock occurs and in-stream blasting is required. The dam-and-pump method is similar to the flume method except that pumps and hoses are used instead of flume pipes to isolate and transport the stream flow around the construction work area. Similar to the flume method, the objective of the dam-and-pump method is to create a relatively dry work area to avoid or minimize the transportation of sediment and turbidity downstream of the crossing during in-stream work.

As the first step in implementing the dam-and-pump method, one or more pumps and hoses of sufficient size to transport anticipated flows around the construction work area will be installed in the waterbody. Additional back-up pumps will be on site at all times in case of pump failure. Once the pumps are operational, the waterbody upstream and downstream of the construction area will be dammed with sandbags and/or steel plates. Prior to dewatering the streambed, a fish relocation procedure will be implemented to remove fish from the section of the waterbody to be dewatered. As the dams are installed, the pumps will be started to maintain continuous flow in the waterbody.

Following the installation of the dams, the pumps will be run continuously until the pipeline is installed across the waterbody and the streambed and banks are restored. Pump intakes above the upstream dam will be appropriately screened to prevent entrainment of aquatic species. Energy-dissipation devices will be used to prevent scouring of the streambed at the discharge location. Water flow will be maintained through all but a short reach of the waterbody at the actual crossing location.

Backhoe-type excavators located on the banks of the waterbody will be used to excavate a trench across the waterbody. Spoil removed from the trench will be placed and stored on the bank above the high water mark at a minimum of 10 feet from the edge of the waterbody. Trench plugs will be maintained between the upland trench and the waterbody crossing. After backfilling, the dams will be removed and the banks restored and stabilized as described above.

2.1.9.3 Wetland Crossings

No wetlands are crossed by the pipeline in the MNF and two are crossed in the GWNF. The crossed wetlands are located at MPs 117.0 and 85.4 and are categorized as palustrine forested. The combined length of the crossing of both wetlands is 61 feet, comprising approximately 0.01 acre of temporary impacts and 0.06 acres of permanent potential wetland impacts. Construction across wetlands will be conducted in accordance with the Procedures and additional requirements identified in Federal or State/Commonwealth wetland crossing permits. Typical methods for construction across wetlands are described below.

In accordance with the Procedures, the width of the construction right-of-way will be limited to 75 feet through wetlands, with ATWS on both sides of wetland crossings to stage construction equipment and materials, fabricate the pipeline, and store materials and excavated spoil. ATWS will be located in upland areas a minimum of 50 feet from the wetland edge (with the exception of site-specific modifications as approved by the FERC and the AO).

Wetland boundaries will be clearly marked in the field prior to the start of construction with signs and flagging. Construction equipment working in wetlands will be limited to what is essential for right-of-way clearing, excavating the trench, fabricating and installing the pipeline, backfilling the trench, and restoring the right-of-way. In areas where there is no reasonable access to the right-of-way except through wetlands, non-essential equipment will be allowed to travel through wetlands once, unless the ground is firm enough or has been stabilized to avoid rutting.

Clearing of vegetation in wetlands will be limited to trees and shrubs, which will be cut flush with the surface of the ground and removed from the wetland. To avoid excessive disruption of wetland soils and the native seed and rootstock within the topsoil, stump removal, grading, topsoil segregation, and excavation will be limited to the area immediately over the trenchline, except a limited amount of stump removal and grading may be conducted in other areas if required by safety-related issues. Topsoil segregation over the trenchline will only occur if the wetland soils are not saturated at the time of construction.

Following clearing, sediment barriers, such as silt fences, straw bales (weed-free), or other approved sediment barriers, will be installed and maintained adjacent to wetlands and within ATWS areas as necessary to minimize the potential for sediment runoff. Sediment barriers will be installed across the full width of the construction right-of-way at the base of slopes adjacent to wetland boundaries. Silt fences, coir logs and/or straw bales (weed-free) installed across the working side of the right-of-way will be removed during active construction when vehicle traffic is present, and will be replaced each night. Alternatively, drivable berms may be installed and maintained across the right-of-way in lieu of silt fences or straw bales (weed-free). Sediment barriers will also be installed adjacent to or within wetlands along the edge of the right-of-way, where necessary, to minimize the potential for sediment to run off the construction right-of-way and into wetlands outside the work area. If trench dewatering is necessary, it will be conducted in accordance with the Procedures and applicable permits. Silt-laden trench water will be discharged into an energy dissipation/sediment filtration device, such as a geotextile filter bag or straw bale (weed-free) structure or a well-vegetated upland area, to minimize the potential for erosion and sedimentation.

The method of pipeline construction used in wetlands will depend on site-specific weather conditions, soil saturation, and soil stability at the time of construction. If wetland soils are not excessively saturated at the time of construction and can support construction equipment on equipment mats, they will be crossed using conventional open-trench construction. This will occur in a manner similar to conventional upland cross-country construction techniques. In unsaturated wetlands, topsoil from the trenchline will be stripped and stored separately from subsoil.

Where wetland soils are saturated or in inundated lowlands areas where soils cannot support conventional pipe-laying equipment, the pipeline may be installed using the push-pull method. This method will involve stringing and welding the pipeline outside of the wetland and excavating and backfilling the trench using a backhoe supported by equipment mats or pontoons. A prefabricated section of pipeline will be installed in the wetland by equipping it with buoys and pushing or pulling it across the water-filled trench. After the pipeline is floated into place, the floats will be removed and the pipeline will sink into place. In most cases, the pipeline will be coated with concrete or equipped with bag weights to provide negative buoyancy. Once the pipeline is in place, the trench will be backfilled. The push-pull construction method minimizes the number of equipment passes, reducing wetland impacts and soil compaction in lowland areas.

Because little or no grading will occur in wetlands, restoration of contours will be accomplished during backfilling. Prior to backfilling, trench breakers will be installed, where necessary, to prevent subsurface drainage of water from wetlands. Where topsoil is segregated, the subsoil will be backfilled first followed by the topsoil. Topsoil will be replaced to the original ground level leaving no crown over the trenchline. In areas where wetlands overlie rocky soils, the pipe will be padded with rock-free soil or sand before backfilling with native bedrock and soil. Equipment mats, gravel fill, and/or geotextile fabric will be removed from wetlands following backfilling.

Where wetlands are located at the base of slopes, permanent slope breakers will be constructed across the right-of-way in upland areas adjacent to the wetland boundary. Temporary sediment barriers will be installed where necessary until revegetation of adjacent upland areas is successful. Once revegetation is successful, sediment barriers will be removed from the right-of-way and disposed of at an approved disposal facility.

2.1.9.4 Road Crossings

The *Traffic and Transportation Plan* (Transportation Plan) identifies NFS roads crossed by the ACP Project on FS lands, with crossing methods[5]. Paved NFS roads will be crossed by conventional boring beneath the roadbed, which will avoid impacts on the surface of the roadbed. Boring activities will consist of the following: excavating a pit on each side of the road; placing boring equipment within the pits; boring a hole under the roadbed that is greater than or equal to the diameter of the pipe; and pulling a section of pipe through the hole. For long crossings, sections of pipe may be welded into a pipe string before being pulled through the borehole. Typically, there is little or no disruption to traffic during boring operations.

Unpaved roads, two-tracks, trails, and driveways, as well as roads in areas with a high water table, will be crossed using the open-cut method and then restored to preconstruction condition. This method could require temporary closure of the road, two-track, or trail to traffic and establishment of detours. For roads, if no reasonable detour is feasible, at least one lane of the road being crossed will be kept open to traffic, except during brief periods when it is essential to close the road to install the pipeline in the trench. Most open-cut road crossings will be completed and the road restored in a few days using the same type of sub-bed and surface material as the original construction. Atlantic will take measures such as posting signs and implementing necessary traffic control measures at open-cut road crossings for safety and to minimize traffic disruptions. Specific measures associated with the timing of any road closures, detours to avoid active construction areas, and mitigation measures for maintaining access across the road, such plating across the road, are provided in the Transportation Plan. Debris from road construction (e.g., remnants of concrete) will be recycled or disposed of at an approved disposal facility.

Details regarding construction across designated NFS trails, including the timing of any closures, detours to avoid active construction areas, and measures for maintaining access across particular trails, are discussed in the Public Access Plan. For certain high-use trails, Atlantic will install the pipeline using construction methods to be determined in consultation with the Forests. This would allow trail access across the right-of-way to continue until the trail crossing segment is ready to be excavated, installed, and backfilled, and would reduce the trail closure time to two days or less in most instances. At all trail crossings crossed by the open-cut method, the trail will be restored to its preconstruction condition.

2.1.9.5 Steep Terrain

Steep slope hazards are one of numerous geologic hazards and processes that could adversely impact environmental resources; or affect the routing, design, construction, and operation or the integrity of the Projects. In accordance with Atlantic's commitment to safety and the environment, Atlantic developed and implemented for all new construction Projects, the Slip Avoidance, Identification, Prevention, and Remediation - Policy and Procedure (SAIPR) in August of 2015 to avoid, minimize, and mitigate potential landslide issues in slip prone areas prior to, during, and after construction (see Attachment B). The SAIPR includes considerations for slips associated with pipeline construction during routing, engineering design, preconstruction planning, construction, and post construction.

In addition, Atlantic is committed to identifying mitigation measures beyond standard practices targeted to prevent slips on steep slopes through a Best in Class (BIC) Program. The focus of the BIC Program is to proactively address steep slopes (defined as slopes greater than 30 percent) and landslide hazards related to pipeline construction, compressor station, and metering and regulation facilities that could potentially impact environmental resources, in particular streams, wetlands, and waterbodies. The BIC program is intended to incorporate the permit requirements from West Virginia, Virginia, and North

[5] The ACP Project does not cross any State highways or railroads on NFS lands.

Carolina, and then go above and beyond all these regulatory standards, in order to mitigate for potential erosion and sediment discharges related to steep slope and landslide hazards.

The ultimate goal of the BIC Program is to develop Project-specific engineering mitigation recommendations targeting un-authorized discharges to water bodies resulting from steep slope, landslide and erosion hazards; and thereby support preparation of the project-specific Erosion & Sediment Control (E&SC) Plan and corresponding Storm Water Pollution Prevention Plans (SWPPPs) that will be used to secure the construction stormwater permits for the project. The BIC Program will achieve this by pulling together a team of internal Dominion stakeholders along with supporting external subject matter experts (SMEs) to develop project specific mitigation recommendations; by using a process based approach that includes: hazard identification and assessment (i.e. find and then understand the hazard), engineering mitigation design (i.e. targeted design measures that mitigate the hazard), monitoring (i.e. track performance to know if additional mitigation is needed), and operational measures (i.e. monitor and maintain and operate the system, as needed).

The BIC Program Team will convene in a series of design workshops to examine the identified hazards and supporting information along the pipeline alignment. The hazards will be initially identified by studies such as the "Geohazards Assessment" (may include geotechnical or hydrotechnical investigations) or the karst study, and/or from other targeted studies such as the soil survey. These studies identify and assess or support the review of the hazard, and provide a basis to select the most applicable and robust BIC mitigation response to minimize or eliminate the hazard, and then monitor the hazard through ongoing operations.

2.1.9.6 Karst Areas

Based on review of maps from the U.S. Geological Survey, West Virginia Department of Environmental Protection, and Virginia Department of Mines, Minerals, and Energy, portions of the AP-1 mainline route across NFS lands have the potential to contain karst features (Dicken et al., 2005; Hubbard, 1983; Nicholson et al., 2005; West Virginia Department of Environmental Protection, 1998). A detailed desktop assessment and field survey was conducted by a geotechnical expert to identify sinkholes and other karst features (e.g., cave entrances, closed depressions, and sinking streams) along the proposed pipeline route in these areas. The Karst Monitoring and Mitigation Plan (Attachment H) identifies construction and restoration practices in karst areas. In accordance with this plan, erosion and sediment controls will be installed prior to construction along the edge of the right-of-way and in other work areas upslope of known sinkholes or other karst features with a direct connection to the phreatic zone of the karst (i.e., groundwater). Refueling activities and the handling of fuel and other materials in the vicinity of these features will be conducted in accordance with the SPCC Plan. Additionally, Atlantic will monitor clearing, grading, and trenching activities to identify potential karst features that may have been unidentifiable on the surface during the preconstruction survey. If features are uncovered, they will be evaluated by a geotechnical contractor, in conjunction with the construction/environmental team members, to determine the need for mitigation measures, such as stabilization. Additionally, Atlantic will monitor karst features as described in the Karst Monitoring and Mitigation Plan.

2.1.9.7 Blasting

It is anticipated that blasting will be required in areas where hard shallow bedrock or boulders are encountered that cannot be removed by conventional excavation with a backhoe trencher, by ripping with a bulldozer followed by backhoe excavation, or by hammering with a backhoe-attached device followed by backhoe excavation. The Blasting Plan identifies areas on NFS lands where hard shallow bedrock is anticipated and blasting could be necessary. The Blasting Plan also provides blasting procedures,

including safety, use, storage, and transportation of explosives, consistent with safety requirements as defined by Federal and State/Commonwealth regulations.

2.1.9.8 Winter Construction/Snow Removal

Atlantic does not expect that construction activities will occur in frozen ground conditions, but construction could occur during times of snowfall in West Virginia and Virginia, particularly at higher elevations. Atlantic filed a Winter Construction Plan with the FERC (Attachment D), which identifies best management practices (BMPs) for winter construction activities.

As necessary, snow will be removed from construction work areas to expose soils for grading and excavation. Snow removal will be limited to active construction areas and areas needed to maintain access to the construction rights-of-way. Snow will be bladed or pushed to the edges of the right-of-way with a motor-grader, snowplow, or bulldozer fitted with a "shoe" to minimize impacts on underlying soils and vegetation, and stockpiled within the right-of-way or in approved ATWS areas. Snow will not be bladed off the right-of-way. Alternatively, in the event of extreme snow events or significant snowdrifts, snow may be blown off the right-of-way using industrial blowers mounted to construction vehicles. Snow that is blown off the construction right-of-way will be directed away from existing roads and driveways, parking areas, residences, and other landowner structures. Regardless of the method used, snow removal equipment will access the ACP Project area from approved access roads, and will operate from within the construction right-of-way or approved ATWS areas.

Snow will be removed from both the working and spoil sides of the construction right-of-way prior to topsoil segregation and grading to prevent mixing of snow with excavated spoil. Snow which accumulates on the right-of-way during construction will be removed and stockpiled along the edges of the construction right-of-way or in approved ATWS areas, or blown off the right-of-way, as described above. Large accumulations of snow on excavated spoil piles will be removed as practicable prior to backfilling. Snow will not be mixed with spoil during backfilling to the extent practicable.

Snow also will be removed, as necessary, from approved access roads by plowing to the edges of the road or blowing off the road to allow safe access to the construction right-of-way. The access roads will be maintained in accordance with applicable permit requirements and landowner agreements.

Gaps will be left in stockpiled snow piles based on an assessment of drainage patterns to allow water to drain off of the right-of-way during thaw. Gaps will also be left in stockpiled snow at drainage crossings. Atlantic's EIs will work with the construction contractors to identify sites where large accumulations of melting snow could flow away from the right-of-way causing erosion. Erosion control devices and diversion berms will be installed in these areas, as appropriate, in accordance with the Upland Erosion Control Plan.

2.1.9.9 Concrete Coating

As noted above, concrete coating or bag weights will be used to provide negative buoyancy for the pipelines where they are installed across wetlands and waterbodies. Concrete coating, where required, will be applied to pipe joints at the contractor yards or on the construction right-of-way. The pipe will either be coated at contractor yards, in the construction right-of-way or in approved ATWS areas. All applications of concrete coating will be conducted in accordance with the SPCC Plan. Concrete coating activities will not be conducted within 100 feet of wetlands, waterbodies, or springs, or within 300 feet of karst features, unless the location is an existing industrial site designated for such use.

2.1.9.10 Construction Safety & Security

Day-to-day security of the work sites (contractor yards, material yards, work sites, etc.) will be the responsibility of the respective contractors assigned to the site. Contractors will likely use private security contractors and/or local off-duty police officers to maintain security. Contractors' security personnel will coordinate with Atlantic corporate security and will provide briefings on known or potential security risks as necessary. Atlantic will coordinate all security and safety activities at work sites on Forest Service lands with the designated USFS staff.

Each contractor will have a full-time safety representative assigned to each active construction site. This representative will work closely with Atlantic safety personnel, both field and managerial, to maintain and enforce project safety guidelines. Each contractor will develop site-specific safety plans that will address the safety concerns associated with each work site (steep terrain, urban work areas, etc.).

The contractors' safety plans will be submitted to Dominion for approval and will address a broad range of project safety guidelines and procedures, including but not limited to:

- Accident investigation
- Substance abuse policy
- Emergency action plans (fire reporting, site evacuation procedures, etc.)
- Local emergency contacts (police, fire, hospitals, etc.)
- Safety training requirements and procedures
- Safe operation of equipment
- Traffic control procedures

General security and safety plans will be reviewed daily, during morning meetings with all construction personnel, prior to leaving the yard. Once on the ROW or associated job site, specific safety and security risks associated with the day's work will be addressed with job hazard analysis conducted by crew foremen. The job hazard analysis will be narrower in scope and will address specific hazards associated with the work to be completed that day.

2.1.9.11 Operation and Maintenance

Routine Maintenance

DTI will operate and maintain the ACP facilities in accordance with all applicable Federal and State/Commonwealth requirements, including the minimum Federal safety standards identified in Transportation of Natural and Other Gas by Pipeline, 49 CFR 192. Operation and maintenance of the ACP facilities will be performed by or at the direction of DTI in its capacity as operator of the ACP pursuant to a Construction, Operation, and Maintenance Agreement with Atlantic.

The USDOT's Pipeline and Hazardous Materials Safety Administration regulates the operation and maintenance of natural gas pipeline facilities. The regulations found at 49 CFR 192.613, 192.703, 192.705, and 192.709 address aerial and ground patrols of pipeline facilities. DTI will conduct regular aerial and ground patrols of the pipeline facilities in accordance with these regulations. The frequency of

patrols is determined by class location unit (i.e., population density) and the location of the pipeline. DTI has Standard Operating Procedures for its facilities that define patrol frequency and methods and identify reporting requirements for abnormal or unusual conditions. All patrols are documented in an Inspection Monitoring System Compliance Database.

The pipeline facilities will be inspected by qualified personnel from the air (quarterly) and on foot (yearly) in accordance with the applicable regulations. This will allow for adequate viewing of the right-of-way and use of forward looking infrared technology for leak detection. Foot patrols are conducted by staff trained to identify potential issues such as erosion, slips, and leaks. These surveillance activities will provide information on possible encroachments and nearby construction activities, exposed pipe, and other potential concerns that may affect the safety and operation of the pipelines. Field personnel will advise the appropriate operations personnel of new construction along or near the pipeline system. Line patrol of highway and railroad crossings will be completed as required by the USDOT. Valves will be inspected annually and the results documented.

Pipeline markers and signs will be inspected to assure that pipeline locations are clearly identified. The condition of pipeline markers will be noted during line patrols as well as during road crossing, One-Call, and other inspections. Damaged or missing line markers will be noted and repaired or replaced as necessary.

In order to maintain accessibility of the rights-of-way and accommodate pipeline integrity surveys, vegetation along the rights-of-way will be cleared periodically, and as necessary, in accordance with the Upland Erosion Control Plan and Stream and Wetland Crossing Procedures (except in areas crossed by HDD where vegetation maintenance will not be required). The permanent pipeline right-of-way will be maintained in an herbaceous state. In wetlands, the Procedures allow for a 10-foot-wide corridor centered over the pipeline to be permanently maintained in an herbaceous state. Additionally, the Stream and Wetland Crossing Procedures allow trees greater than 15 feet in height within 15 feet of the pipeline to be cut and removed from wetlands along the right-of-way. Where necessary and when required, DTI will use mechanical mowing or cutting along the right-of-way for normal vegetation maintenance. No herbicides will be utilized for normal vegetation maintenance. DTI will monitor the right-of-way for infestations of non-native invasive species that may have been created or exacerbated by its construction activities, and may utilize USFS-approved herbicides to treat such infestations, in accordance with the Non-Native Invasive Plant Species Management Plan.

Operations and maintenance procedures, including record keeping, will be performed in accordance with USDOT requirements.

Pipeline integrity surveys and vegetation maintenance may identify areas along the rights-of-way where permanent erosion control devices need to be repaired or additional erosion control devices may be needed. If problem areas are evident, erosion control devices will be repaired or installed, as necessary, and the right-of-way will be stabilized to prevent future degradation.

Major Maintenance Work

During the operating life of the pipeline, it may be necessary on occasion to excavate the pipe for inspection, repair or replacement purposes. Atlantic will notify the appropriate Forest in advance of such work to review the work plan, to ensure the work is carried out in compliance with the terms of the right-of-way grant, and to address any other issues regarding the work. In many cases the work would be able to be performed within the permanent right-of-way boundaries. However, in some instances additional workspace may be needed outside the permanent right-of-way, depending on terrain, the extent of the

excavation or repairs, etc. In such instances, Atlantic anticipates that the work would be able to be carried out within the ACP construction footprint.

Emergency Repairs

49 CFR Part 192 describes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under Section 192.615, each pipeline operator must establish an emergency plan that provides written procedures to minimize the hazards from a gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, such as gas leaks, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- protecting people first and then property, and making safe from actual or potential hazards; and
- emergency shutdown of systems and safe restoration of service.

DTI has an Emergency Response Plan (ERP) for its existing pipeline system in accordance with the USDOT regulations. DTI will update the ERP to incorporate the proposed Projects based on feedback from local emergency service providers (e.g., police, fire, medical, and emergency response). The updates to the ERP will identify the appropriate contacts for emergency service providers (including names and telephone numbers) in the event of an emergency during operation of the Project. The updated ERP will be available prior to construction.

The USDOT requires that pipeline operators establish and maintain liaisons with local fire, police, and other emergency responders to plan for and coordinate emergency response efforts in the event of an incident during construction or operation of the proposed facilities. Additionally, each operator must establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a natural gas pipeline emergency and report it to the appropriate public officials. Accordingly, DTI will establish and maintain liaisons with local public officials and emergency responders, and provide appropriate training to responders before the proposed ACP is placed in service.

Regular meetings will be held with emergency response agencies (including local fire departments) where the role of the agencies with regard to pipeline fires will be discussed, along with issues related to potential compressor station incidents. The information exchanged between DTI and the emergency response agencies that participate in these meetings will familiarize each organization with the resources, including personnel and equipment, which can be utilized in the unlikely event that an incident occurs. Police and fire departments will also receive emergency telephone numbers to contact DTI 24 hours a day.

In the unlikely event of an incident, DTI will work with emergency response agencies to maintain access to and from residences and businesses during potential emergency situations. DTI will implement its ERP to bring the incident under control, and work with local responders to maintain access to residences and businesses via existing roads. If a road is damaged by an incident, or access to residences

and business is otherwise restricted, DTI responders will cut a new road for access or make an old road passable, to reach the affected residences and businesses. Additionally, in an emergency situation, DTI could use air lift services to reach affected residences and businesses.

Pipeline Operations/Safety and Security

The USDOT is the Federal agency responsible for pipeline safety under Title 49, United States Code Chapter 601. Within the USDOT, Pipeline and Hazardous Materials Safety Administration's Office of Pipeline Safety (OPS) administers a national regulatory program to facilitate the safe transportation of natural gas and other hazardous materials by pipeline. The OPS has developed safety regulations and other approaches to risk management that promote safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve the required safety standards.

The pipeline facilities associated with the ACP will be designed, constructed, operated, and maintained to meet or exceed the USDOT Minimum Federal Safety Standards in Title 49 CFR Part 192. These regulations, which are intended to protect the public and to prevent natural gas facility accidents and failures, include specifications for material selection and qualification; minimum design requirements; and protection of the pipeline from internal, external, and atmospheric corrosion.

In addition, Part 192 of the regulations specifies safety standards for the design and operation of compressor stations and other aboveground facilities, such as valves and meter stations. The aboveground facilities constructed as part of the ACP will be designed, constructed, and operated to meet or exceed these standards.

Integrity Management Plan

The Gas Transmission Integrity Management Rule (49 CFR Part 192, Subpart O) specifies how pipeline operators must identify, prioritize, assess, evaluate, repair, and validate the integrity of gas transmission pipelines that could, in the event of a leak or failure, affect High Consequence Areas (HCA). This rule requires that operators develop a written integrity management plan that includes:

- identification of all covered segments;
- a Baseline Assessment Plan to assure the integrity of all covered segments;
- a framework that contains all required elements of the Integrity Management Program;
- a process to assure continual improvement to the program;
- provisions to implement industry standards invoked by reference; and
- a process to document changes to the program (and notify OPS as required).

DTI has implemented a comprehensive Integrity Management Program that meets or exceeds these regulations. DTI's Integrity Management Program addresses the following:

- HCAs – see Section 11.2.2.
- Threat Identification/Risk Assessment – DTI has adopted a threat-based methodology for managing pipeline risk.

- Baseline/Continuous Assessment Plans – Risk assessment provides a rational and consistent method to assess the integrity of a pipeline segment. This method allows for prioritization, which more effectively uses resources in identifying and mitigating threats.
- Remediation/Prevention – Remediation is defined as action taken by the operator to mitigate the danger of a potential integrity concern. Remediation includes pressure reduction and/or timely repair and preventive measures that halt a potential integrity problem so it does not proceed to failure.
- Record-Keeping Provisions – DTI maintains a complete history of all major integrity components within integrated databases.
- Performance and Quality Assurance – DTI's Integrity Management Program is evaluated to confirm that the program effectively assesses integrity and protects HCAs. A Quality Assurance Plan provides documented proof that the operator meets all requirements of its Integrity Management Plan.
- Management of Change – Management of change procedures identify changes to pipeline systems and consider the impact of those changes on the integrity of the pipeline system.
- Communications – DTI has developed and implemented a communications plan to inform company personnel, jurisdictional authorities, and the public about its integrity management efforts and the results of its integrity management activities.

2.2 FACILITIES SECURITY

DTI maintains a Critical Gas Facilities Security Plan that addresses the assessment of risks to DTI facilities. DTI will update this plan to incorporate the proposed Project. The risk assessment process includes sabotage, terrorism, theft and diversion, cyber threats, security breaches, and security incidents. DTI Corporate Security, working with DTI Management, conducts ongoing risk assessment of DTI facilities utilizing the continual risk management methodology. This methodology assesses historical and projected risks.

The security plan implements a strategy that includes the development of close working relationships with the local, State/Commonwealth, and Federal law enforcement agencies that are responsible for DTI sites throughout the DTI footprint. These relationships include the sharing of risk/threat information pertaining to DTI facilities. The security strategy also includes an ongoing training program for DTI personnel on the security topics of the signs of terrorism, sabotage, and suspicious incidents, to include the reporting of such incidents to DTI Management, DTI Corporate Security, law enforcement, and the appropriate State/Commonwealth and Federal regulatory agencies.

2.2.1.1 Abandonment

While Atlantic has no plans for abandonment of its pipeline facilities, if abandonment is necessary, Atlantic will either remove its pipeline facilities from NFS lands or abandon them in place as authorized or directed by the AO.

2.3 KEY CONTACTS

Key contacts during the period of ACP construction are as follows:

Names of person(s) to contact:

Dominion Transmission, Inc.: _____

U.S. Forest Service Authorized Officer: _____

Key Contacts

U.S. Forest Service:

- Authorized Officer(s): _____
- Forest Supervisor, Monongahela National Forest _____
- Forest Supervisor, George Washington National Forest _____

Dominion Transmission, Inc.

- Title: _____
- Field Compliance/Monitoring Officers _____

Federal Energy Regulatory Commission (FERC)

- FERC Environmental Project Manager _____
- Third-Party Monitors _____

Dominion Transmission, Inc. (Grant/Permit Holder)

- Project Manager _____
- Construction Site Supervisor _____
- Environmental Construction Coordinator _____
- Environmental Inspectors/Environmental Monitors _____

3.0 ENVIRONMENTAL COMPLIANCE

3.1 PURPOSE

The purpose of this Environmental Compliance Plan is to identify processes to ensure compliance with conditions attached to ACP authorizations, for the portion of the Project that lies on NFS lands, as well as other applicable regulatory requirements. This Environmental Compliance Plan is consistent with and will be referenced in the broader *Implementation Plan*, which is required by the FERC to address environmental compliance across the entire Project. The Environmental Compliance Plan establishes processes and procedures for environmental training, environmental inspection and monitoring, and reporting. It also identifies the roles and responsibilities of Project and agency staff or their representatives, in assuring environmental compliance.

3.2 FERC IMPLEMENTATION PLAN

Among the standard conditions included by the FERC in any issuance of a CPCN, is that the certificate holder submit an Implementation Plan. The Implementation Plan will describe how Atlantic will comply with the construction procedures and mitigation measures described in their application, supplemental filings (including responses to staff data requests), the final EIS, and conditions required by the CPCN. The Implementation Plan will demonstrate to the FERC, regulatory agencies, and federal/state land management agencies that Atlantic has considered all environmental requirements related to the project, and has a plan to ensure they are implemented during construction. The Implementation Plan will include, among other items, the following:

- updated alignment sheets;
- any changes, route realignments, facility relocations and staging area changes or additions shown on alignment sheets along with a written description of the change, existing land use/cover type, documentation of landowner approval, and a statement of any cultural or federally listed threatened or endangered species will be affected;
- a statement that Atlantic will inform contractor personnel of the EIs authority and commitment to provide environmental training to contractor personnel;
- a description of how Atlantic will implement the construction procedures and mitigation measures described in their application, supplemental filings (including responses to staff data requests), the final EIS, and required by the CPCN; how Atlantic will incorporate these requirements into the contract bid documents, construction contracts and construction drawings so that the mitigation required at each site is clear to onsite construction and inspection personnel;
- a schedule or Gantt Chart that includes dates for the completion of all required surveys and reports; the environmental training of construction personnel; the start of construction; and the start and completion of restoration;
- a list number of EIs assigned per construction spread, and how Atlantic will ensure that sufficient personnel are available to implement the environmental mitigation measures; company personnel, including EIs and contractors; who will receive copies of the appropriate material; the location and dates of the environmental compliance training; the procedures (including use of contract penalties) Atlantic will follow if noncompliance occurs;

- a discussion of the EIs roles and responsibilities;
- a commitment by Atlantic to file weekly or biweekly construction status reports;
- a description of Atlantics environmental complaint resolution procedure, that provides landowners with clear and simple directions for identifying and resolving their environmental mitigation problems/concerns during construction and restoration of the ACP Project.

Atlantic's Implementation Plan will need to be filed within 60 days of acceptance of the CPCN.

3.3 CONTRACTOR BID DOCUMENTS

Atlantic will develop contractor bid documents, construction alignment sheets with environmental features and notes are accurately presented. Atlantic will include copies of all approved environmental construction and mitigation plans and permits for incorporation into the contractor bid documents. The contractor bid documents will include contractor penalties for noncompliance with the project's environmental requirements.

3.4 PREPARATION OF REQUEST FOR PROPOSAL FOR THIRD-PARTY COMPLIANCE CONTRACTOR

Following receipt of the CPCN from the FERC, Atlantic will prepare a request for proposal (RFP) to provide third-party compliance oversight on behalf of the FERC and other agencies, including, pending their concurrence, the MNF and GWNF. The RFP will be sent to multiple environmental firms with a demonstrated track record of providing these services to the FERC. The environmental contractor assisting FERC with the environmental document is typically included on the list assuming they are qualified to provide these services. Atlantic will choose its preferred proposals (typically three) and submit them to FERC. The FERC will choose its preferred provider of the proposals submitted by Atlantic.

3.5 NOTICES TO PROCEED

Atlantic will not commence construction anywhere on the Project until the FERC has issued the Project a Notice to Proceed (NTP). FERC's NTP is typically issued once the certificate holder has satisfactorily demonstrated compliance with pre-construction conditions contained in the CPCN. Similarly, Atlantic will not commence construction (including timber removal) on NFS lands unless and until the USFS AO has issued the Project an NTP.

Due to the two-season construction schedule, as well as the need to complete certain surveys, conduct treatment at cultural resource sites, etc., Atlantic anticipates requesting from both the FERC and the USFS partial NTPs covering those segments of the Project that are ready to commence construction and for which pre-construction conditions have been satisfied. Any such requests will document the reasons for the request of a partial NTP, as well as documentation that pre-construction conditions have been satisfied for the requested segment(s).

3.6 ENVIRONMENTAL COMPLIANCE ROLES AND RESPONSIBILITIES

3.6.1 US Forest Service

The USFS has authority over all activities that occur on NFS lands.

3.6.2 USFS Authorized Officer

The USFS AO is responsible for determining overall environmental compliance with the COM Plan, Record of Decision, and terms of the right-of-way grant. The AO has stop work authority on all NFS lands. The AO manages the Field Compliance/Monitoring Officers. The AO is responsible for issuing NTPs and for approving requested project changes on NFS lands using the variance request process described below.6

3.6.3 Field Compliance/Monitoring Officers

The Field Compliance/Monitoring Officers will conduct compliance oversight inspections on all NFS lands. The Field Compliance/Monitoring Officers will be responsible to the AO to verify and document Atlantic's compliance with the COM Plan, the Record of Decision , and terms of the right-of-way grant. The Field Compliance/Monitoring Officers will not interact directly with the contractor but will coordinate and communicate with Atlantic's EIs. The Field Compliance/Monitoring Officers will conduct field review of potential project changes and report findings to the AO to support approval or denial of variance requests. The Field Compliance/Monitoring Officers will have Stop Work authority for discrete activities on NFS lands that pose an immediate threat to a sensitive environmental resource.

3.6.4 Federal Energy Regulatory Commission

3.6.5 FERC Environmental Project Manager

The FERC Environmental Project Manager (FERC PM) will have environmental compliance oversight over the entire Project. The FERC PM will direct the activities of the Third-Party Compliance Monitoring Team. The FERC PM will have Stop Work authority for all project-related activities.

3.6.6 Third-Party Compliance Monitoring Team

The FERC Third-Party Compliance Monitoring Team will consist of an office-based Compliance Manager and multiple field-based Compliance Monitors (CM). The Third-Party Compliance Manager will manage the Third-Party Compliance Monitoring Program and be responsible for directing the day to day activities of the Third-Party CMs, reporting compliance results to FERC, and managing the variance approval process. The Third-Party Compliance Manager will be responsible to ensure that corrective actions documented in relation to all noncompliance activities. The Third-Party Compliance Manager will be responsible to approve or deny Level 2 variance requests. The Compliance Manager will coordinate with Atlantic, the AO, and the FERC PM to ensure compliance.

The CMs will conduct daily inspections of all construction activities and document their observations and levels of compliance in daily reports. The CM will assist in the review of variance requests and be responsible to approve or deny Level 1 variance requests. The CMs' primary responsibilities will be monitoring environmental compliance on all non-NFS lands; however, because the FERC has responsibility for environmental compliance over the entire Project, the CMs will conduct limited monitoring on NFS lands and will coordinate with the Field Compliance/Monitoring Officers. The CMs will not interact directly with the contractor but will coordinate and communicate with Atlantic's EIs. The CMs will have Stop Work authority for discrete activities that pose an immediate threat to a sensitive environmental resource.

[6] Variances approved by the US Forest Service still require FERC approval prior to implementation unless FERC agrees to an alternative arrangement.

3.6.7 Project Manager

Atlantic's Project Manager will be responsible to Atlantic and is responsible for overall management of construction activities.

3.6.8 Construction Site Supervisor

The Construction Site Supervisor will have direct oversight of all personnel that prepare, construct, maintain and rehabilitate the Project. The Supervisor also has control over site-specific construction plans, including the ability to make modifications to those plans, pending any necessary agency approvals. This person must ensure compliance with the FERC Order, COM Plan, ESC, SWPPP, and West Virginia and Virginia Stormwater Management Program requirements. The Construction Site Supervisor is authorized to direct workers at a site to carry out activities in accordance with these and other permit conditions. The Supervisor will ensure compliance with all applicable safety requirements.

3.6.9 Environmental Construction Coordinator

The Environmental Construction Coordinator (ECC) will serve as part of the environmental team relative to environmental compliance within Atlantic. The ECC has the responsibility of ensuring full compliance with applicable laws, environmental rules, regulations, permits, and company policies that pertain to their Project. The ECC's roles and responsibilities may include:

- Ensure compliance with applicable federal, state, and local environmental regulations, permits, company standards, and procedures, and facility procedures at the Project;
- Promote environmental stewardship;
- Coordinate with EI's and contractors to ensure site environmental compliance;
- Serve as primary site coordinator with Dominion Environmental Services, internal departments, and external agencies regarding environmental issues;
- Serve as contact with community or local public to resolve environmental emergencies, complaints, or problems;
- Maintain environmental permits, plans, and various compliance records; and
- Assist with environmental emergency response activities.

3.6.10 Environmental Inspector

EIs will have the authority to stop activities that violate the environmental conditions of the FERC Order, the COM Plan, stipulations of other environmental permits or approvals, or landowner easement agreements, as well as order appropriate corrective action.

The EI will have peer status with all other activity inspectors and will report directly to the Environmental Compliance Coordinator (ECC) who has overall authority on the construction spread or Project.

The number and experience of EIs assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected. The person designated as the EI will typically be a dedicated role for each construction spread.

At a minimum, the EI shall be responsible for:

- Inspecting construction activities for compliance with the requirements of this COM Plan, the Erosion and Sediment Control Plan (ESCP), the Construction Alignment Sheets, the environmental conditions of the FERC Order, proposed mitigation measures, other federal or state and local environmental permits and approvals, and environmental requirements in landowner easement agreements;

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

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

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

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

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

- Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitat; 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;

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

- Advising the Construction Site Supervisor when environmental conditions (such as wet weather, severe storm events or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing or excessive compaction;

- Ensuring restoration of contours and topsoil;

- Verifying that the soils imported for agricultural or residential use have been certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner, and is considered clean and free of hazardous materials;

- Ensuring that the appropriate erosion/sediment control and stabilization needs are implemented in all areas, including ensuring that erosion and sediment controls are properly installed and maintained daily to prevent sediment flow into sensitive 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;

- Inspecting and ensuring the maintenance of temporary erosion and sediment control measures at least:
  - On a daily basis in areas of active construction or equipment operation;
  - On a bi-weekly basis in areas with no construction or equipment operation;
  - Within 24 hours of each stormwater event (runoff from precipitation, snowmelt, surface runoff and drainage, including rainfall events resulting in 0.5 inches or more);
- Ensuring the repair of all ineffective temporary erosion and sediment 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;
- Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase;
- Ensuring proper seed mixes, rates and restoration methods are used, and obtaining documentation;
- Ensuring that the Contractor implements and complies with Atlantic's *Preparedness, Prevention and Contingency Plan*, Atlantic's *Waste Management Plan*, and other Company environmental documents and standard operating procedures;
- Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with this COM Plan, the ESCP and any applicable permits / clearances; and;
- Keeping records of compliance with the environmental conditions of the FERC Order and the mitigation measures proposed by Atlantic in the application submitted to the FERC, the COM Plan, and other federal or state environmental permits during active construction and restoration. Records should include photo documentation.

3.6.11 Environmental Monitors

In addition to EIs, Environmental Monitors will be deployed as required. Environmental Monitors are resource specialists and include for example cultural and biological resource monitors. Depending on the Project requirements, the biological monitors may be general biological monitors, avian or fisheries monitors, or other species-specific monitors with certifications for handling sensitive species. These monitors will be provided on an as needed basis in compliance with construction monitoring plans and permit conditions. For example, certain monitors may only be required when construction activities are in the vicinity of a specific site (e.g., a known cultural resource site or habitat for a threatened endangered species). Depending on the timing of construction, avian monitors may be required during tree clearing operations.

3.7 ENVIRONMENTAL TRAINING

Environmental training will be given to both Atlantic personnel and contractor personnel whose activities have the potential to impact the environment during pipeline construction. All construction personnel from the ECC, EI, ESC/SWM inspectors, craft inspectors, contractor job superintendent to loggers, welders, equipment operators, and laborers will be given some form of environmental training. The level of training will be commensurate with the type of duties of the personnel. At the discretion of Atlantic, environmental training for personnel may also be required on Project where it is not required by FERC.

Training will be given prior to the start of construction and throughout the construction process, as needed, and will cover the following issues:

- Specifics of this COM Plan, the ESCP and other Atlantic plans;
- Job or activity specific permit requirements;
- Atlantic policies and commitments;
- Cultural resource procedures and restrictions;
- Threatened and endangered species procedures and restrictions; and
- Any other pertinent information related to the job.

In addition to the EI, all other construction personnel are expected to play an important role in maintaining strict compliance with all permit conditions, and to promptly report any conditions that are perceived as having the potential to threaten environmental protection to the appropriate inspector during construction.

3.8 REPORTING

All EIs and Environmental Monitors will document their daily inspection activities in a daily report using an electronic reporting system (ERS). All information for the daily inspection reports will be entered into an electronic daily report template that transfers the information to a Project-specific database. The daily report will have required reporting fields such as date, location information, and compliance level and will be capable of handling photographic documentation. The ERS will be used to generate information for the Atlantic's weekly report to be submitted to FERC.

Section 8.11 discusses reporting requirements specific to the Erosion Control and Sedimentation Plan.

3.9 VARIANCE PROCEDURES

Project changes will require approval through the variance request process. A dedicated Variance Coordinator may be required to coordinate variance requests from the contractor, ensure approvals are received from Atlantic, ensure any necessary landowner approvals are in place, appropriate documentation is provided (e.g., photos, maps, biological/ cultural survey), and other agency approval as necessary. Levels of variance approvals are as follows:

- Level 1 variance requests include the approval of like-use roads (assuming the Project has received blanket concurrences from the FWS and SHPO for like-use roads); shifting extra workspace along the construction right-of-way for a short distance within the previously surveyed corridor (without increasing land use disturbance in type or acreage or impacting cultural or environmental resources); and performance based changes to mitigation measures. On NFS lands, Level 1 variances must be approved in writing by

the USFS Field Compliance/Monitoring Officer, unless the USFS delegates this authority to the FERC Compliance Monitor. Any such approvals will be documented by the FERC Compliance Monitor.

- Level 2 variance requests typically include additional workspace within the area surveyed for cultural and biological resources. On NFS lands, Level 2 variance requests must be approved in writing by the USFS Field Compliance/Monitoring Officer. Any such approvals will be documented by the FERC Compliance Monitor.

- Level 3 variance requests typically include workspace for which additional cultural and biological survey is required or other agency (e.g., FWS,COE, SHPO), certain changes to permanent facility locations and Project-wide changes. On NFS lands, Level 3 variance requests must be approved in writing by the AO. Level 3 variance request must also be formally filed with the FERC for review and approval by the FERC PM.

4.0 TIMBER REMOVAL PLAN

4.1 PURPOSE

The purpose of this plan is to describe how timber removal activities will be conducted on NFS lands, and identify measures for reducing impacts and stabilizing areas where timber is removed. For purposes of this plan, timber removal is defined as completely removing merchantable timber logs, chipping merchantable and non-merchantable timber, the permanent stacking of logs at the edge of the right-of-way, and/or the burning of non-merchantable timber. This plan augments the other construction, restoration, and mitigation plans prepared for the Projects. All applicable provisions of other plans apply to timber removal activities (e.g., the equipment refueling procedures described in the SPCC Plan).

The MNF and GWNF each have standards and guidelines applicable to timber removal practices within the National Forests. This Timber Removal Plan has been written to conform to the standards and guidelines contained within the LRMPs of both National Forests.

The ACP will cross NFS lands administered by the GWNF at the Appalachian Trail Scenic Corridor. Atlantic is planning to cross the Appalachian National Scenic Trail, as well as the nearby Blue Ridge Parkway corridor on National Park Service (NPS) land, with a HDD, eliminating the need to clear trees at these sensitive crossing locations.

4.2 TRAINING

Prior to the start of timber removal, Atlantic will conduct environmental and safety training for Atlantic and Contractor personnel. The training program will focus on this *Timber Removal Plan,* the FERC Plan and Procedures, and other applicable elements of the COM Plans and permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

4.3 COMPENSATION

Timber located on NFS lands will be paid for and disposed of at the discretion of the AO. The value of merchantable timber removed for pipeline construction will be determined by a timber cruise. The cruise will evaluate forests within the Project's footprint and provide a current market value estimate for merchantable timber, and the Project will reimburse the Federal government based on that valuation, prior to any cutting taking place.

4.4 TIMBER CRUISE AND EXTRACTION PLANS

Timber cruises will be conducted prior to construction to determine timber volumes, values, and species composition. Atlantic will employ timber specialists to cruise, mark and appraise timber in accordance with a Cruise Plan provided by the MNF and GWNF. For areas containing merchantable timber, the Project will prepare Timber Extraction Plans (a.k.a. Logging Plans) in consultation with the MNF and GWNF after timber cruises are complete. These Plans will be appended to the COM Plan and will identify:

- the timber volume to be cleared;
- tree sizes;
- log grades;
- the dollar value of the timber;
- the logging system(s) to be used for each harvest segment;

- yarding methods and landing locations and decks;
- the volume of timber that will be yarded at each landing;
- the locations of any landings and decks not previously identified; and
- the roads that will be used to haul logs.

4.5 TIMBER REMOVAL METHODS

The Project is considering two timber-clearing methods for the Projects: mechanical harvesting and high line yarder logging. Helicopter logging is not currently being considered, but could be used in steep areas. If mechanical harvesting is used on slopes greater than 35 percent, Project-specific plan amendments to both Forests' LRMPs may be required to allow logs to be skidded to their landings. All three methods are described below.

4.5.1 Mechanical Harvesting

Wherever possible, mechanical harvesting will be employed. "Feller bunchers," which are mechanized tree harvesters that can cut and gather several trees at once, can be used to cut trees on slopes with up to 50 percent grade. The feller bunchers will pile the felled trees, allowing them to be transported (yarded) to larger collection areas (landings) by "skidders" or "forwarders," which are other specialized machines for moving trees. Skidders drag logs, while forwarders carry logs clear of the ground. Log cranes and logging shovels will load trucks, feed grinders, handle stumps, place environmental mats, build bridges, and aid in the overall safe handling of materials and rigging on the landing and in the woods.

4.5.2 Yarder Logging

Cable yarding systems remove felled timber with the use of cables and blocks using a tower (the "yarder") and an anchor line. Yarding systems may drag logs up or down hill, or in the case of skyline systems, partially or entirely lift the logs above the ground. Skyline logging will be implemented in some areas because of steep terrain, limited access, and the alignment of the route. Alignment is critical in all cable systems. Where there are slight changes in alignment, skyline yarder logging can be effectively used.

Yarder work using a skyline system could be used in some places on the rights-of-way. This system requires a tailhold, which is the point of anchorage of the skyline. In many cases, a right-of-way alignment does not lend itself to be "in line" for a good tailhold. Loggers typically seek permission to place their tailhold outside the cutting area to create better alignment. Consequently, the tailhold is typically placed off the construction area and on an opposing slope. The tailhold could also be a tree that is rigged off the main cutting area. The Project will seek extra workspace authorization, if necessary to locate any tailholds beyond the construction rights-of-way.

Yarders will be used to assist excavators, skidders, stump grinders, and dozers to remove brush and stumps on the rights-of-way. With long cable capabilities and good rigging, many machines can be aided by a yarder using stump holds, blocks, and "dead men" as a safety anchor on a steep slope.

A yoder is a combination yarder/loader that can accomplish many of the same tasks as a yarding system on a smaller scale. Yoders can fill the gap for log removal in areas where alignment problems pose major inefficiencies to big yarders. These smaller yarding machines can effectively remove logs in tight, steep areas, such as those encountered in parts of the Appalachian Range.

4.5.3 Helicopter Logging

Helicopter logging is typically employed in remote areas with rough terrain. Timber is generally felled by hand cutters with chain saws. One advantage of helicopter logging is the ability to safely remove timber on remote slopes where no roads exist. Flying logs to existing roadway systems creates less soil disturbance and requires fewer man-hours on the hills. Logs are flown to the nearest timber landing for truck transport to a mill.

During log transportation, helicopter flight paths typically will be along the pipeline rights-of-way. The helicopter can also provide ambulatory service, if needed, as well as help with fire patrol and the delivery of equipment and crew to the field.

4.6 PLANNED TIMBER REMOVAL OPERATIONS

4.6.1 General Requirements

Before initiating timber removal activities, Atlantic and DTI will conduct environmental training for company and contractor personnel. The training program will focus on the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures), other Project-specific construction, restoration, and mitigation plans; and applicable permit conditions. In addition, the Project will provide large-group training sessions before each crew commences construction with periodic follow-up training for groups of newly assigned personnel.

A detailed civil survey will be conducted before timber removal activities begin to delineate and flag the limits of approved work areas (i.e., the construction rights-of-way, temporary and ATWS, aboveground facility sites and associated workspace, staging areas, and contractor yards). The locations of approved access roads will also be flagged and marked with signs.

Riparian and wetland areas will be clearly labeled in the field. Other areas/sensitive features will be flagged prior to clearing (e.g., existing snags or large diameter trees on the edge of the construction rights-of-way to be saved/protected as green recruitment or habitat/shade trees). Applicable erosion and sediment control measures will be installed in accordance with the Plan and Procedures to prevent unnecessary disturbance associated with initial clearing. Additionally, temporary bridges will be installed at waterbody crossings along the rights-of-way in accordance with the Plan and Procedures.

Timber will be felled from construction areas using the method best suited to terrain and topography. Merchantable timber will be skidded or carried to landings for loading onto trucks and hauling off site. Non-merchantable timber will be burned, chipped, stacked along the edge of the right-of-way, hauled off-site, or salvaged for use during restoration activities (e.g., habitat construction, off-highway vehicle [OHV] blocking). After it is cut, non-merchantable timber that will be salvaged for restoration will be flagged, quantified, labeled, and placed along the edge of the construction rights-of-way or at the nearest staging area.

Slash will not be windrowed or left in a manner that creates an obstruction. Slash may be chipped and blown off the right-of-way outside wetlands or stream channels. If approved by the AO, slash may be burned. Stumps will be cut as close to the ground as possible and left in place, except over the trench line, or where grading is necessary to create a safe and level work surface. The top of the stumps will be ground flush to grade within the majority of the rights-of-way. All stumps excavated from the trench line that cannot be ground to mulch onsite will be placed along the edge of the construction rights-of-way or in temporary extra workspaces. Stumps will be hauled from the extra workspaces to a

pulp mill, a permitted disposal facility, used on the rights-of-way for restoration purposes, burned, or disposed of according to land managing agency or landowner specifications.

During construction, the Project will monitor compliance with the environmental requirements and permit conditions for the Project. The EIs will be responsible for monitoring contractor compliance with this *Timber Removal Plan*.

4.6.2 Access Roads and Storage Areas

Approved access roads and storage areas for timer removal activities will be depicted on Project alignment sheets and flagged or otherwise marked in the field.

4.7 MITIGATION MEASURES

4.7.1 General Mitigation Measures

The Project will implement several additional measures to reduce or minimize impacts associated with timber removal activities, including the following:

- During timber removal, temporary erosion control devices will be installed, inspected, and maintained in accordance with the Plan and Procedures. Erosion control and all other timber removal activities taking place during the winter season will be conducted in accordance with the Winter Construction Plan.
- Any debris entering a waterbody as a result of felling and yarding of timber will be removed as soon as practical and will be placed outside the 100-year floodplain where feasible.
- Logs and slash will not be yarded across perennial streams unless fully suspended.
- During logging/clearing operations, the direction of log or slash movement will be conducted to minimize the potential for sediment reaching waterbodies.
- Logs firmly embedded in the bed or bank of waterbodies that are in place prior to felling and yarding of timber will not be disturbed unless they prevent trenching or fluming operations or operation of equipment.
- Any existing logs that are removed from waterbodies to construct the pipeline crossing will be returned to the waterbody after the pipeline has been installed, backfilling is complete, and while stream banks are being restored.
- Landings for clearing operations will not be located in wetlands or riparian areas, and, where feasible, logs yarded out of wetlands or riparian areas will be skidded with at least one end suspended from the ground to minimize soil disturbance.
- Any timber cleared from the pipeline rights-of-way or other work areas that will be used for in-stream or upland wildlife habitat diversity structures will be stored in approved temporary workspace areas for use during restoration.
- Prior to clearing operations, EIs will flag existing snags on the edges of the construction rights-of-way or ATWS, where feasible, to save from clearing. These snags will be

saved as mitigation to benefit primary and secondary cavity nesting birds, mammals, reptiles, and amphibians.

- Other large diameter trees on the edge of the construction rights-of-way and ATWS areas will be flagged by EIs to save/protect as green recruitment or habitat/shade trees, where feasible.

Where ground skidding is used, the following measures will be implemented to minimize soil disturbance:

- Low ground weight (pressure) vehicles will be used, where feasible.
- The removal of soil duff layers will be avoided to maintain a cushion between the soil, logs, and logging equipment.
- Designed skid trails will be used to restrict detrimental soil disturbance (e.g., compaction and displacement) to a smaller area of the rights-of-way over the pipeline trenching area.

4.7.2 Additional Mitigation Measures for Forest Service Lands

On NFS lands, additional measures will be implemented, in conformance with LRMP standards and guidelines. If a general mitigation measure is more stringent than its counterpart Forest mitigation measure below, the more stringent measure will be applied.

4.7.2.1 Monongahela National Forest

- Whole trees will not be yarded without approval from the AO (MNF LRMP TR05).
- Slash will be removed from permanent roads and recreation trails. Slash may be retained in wildlife openings in brush piles if approved by the AO (MNF LRMP TR08). Slash will not be windrowed or left in a manner that creates an obstruction. Slash may be chipped and blown off the right-of-way outside wetlands or stream channels.
- NFS roads will not be used for skidding (MNF LRMP TR09).
- NFS roads will not be used as log landings unless approved by the AO. Any wildlife openings used as log landings will be restored similarly to all pipeline construction work areas upon completion of construction (MNF LRMP TR10).
- Log landings and other concentrated timber removal activities will be located outside channel buffers (MNF LRMP TR11).
- Skid trails will be kept to the minimum necessary to yard the logs (MNF LRMP TR13).
- right-of-way edges will be “feathered” in irregular patterns to blend in with the landscape in the immediate foreground, foreground or midground of visually sensitive areas (MNF LRMP TR20).
- Access roads identified for pipeline access will be used for timber removal activities as well. To the extent possible, landings will be sited at locations where extra workspace for pipeline construction is needed, to avoid disturbing more area than is necessary.

4.7.2.2 George Washington National Forest

- Advanced harvesting methods (such as cable or helicopter) will be used on sustained slopes greater than 35 percent (GWNF LRMP FW-125).
- Log landings will be located outside of riparian corridors. (GWNF LRMP FW-139).
- All equipment used for harvesting and hauling operations will be serviced outside of riparian corridors (GWNF LRMP FW-140).
- Unless otherwise authorized by the Forest AO, log landings will be ripped to a depth of 6-8 inches to break up compaction, and to ensure soil productivity and the successful reestablishment of vegetation. (GWNF LRMP FW-141).
- Skid trails will cross riparian corridors only at Forest-designated crossings. If crossing a perennial or intermittent stream is unavoidable, temporary bridges will be used. All streams will be crossed as close to a right angle as possible. Stabilization of skid trails will occur as soon as possible after use, to minimize soil movement downslope. (GWNF LRMP FW-142).
- Skidding of trees will be directed in a manner that prevents creation of channels or gullies that concentrate water flow to adjacent streams. (GWNF LRMP FW-143).
- Temporary stream crossings associated with timber harvest operations will be removed and rehabilitated. (GWNF LRMP FW-144).
- Dips or waterbars or other dispersal methods will be constructed and maintained to direct stormwater off skid trails and reduce potential sediment flow to streams. (GWNF LRMP FW-145).
- Designated trails will not be used as skid trails. Crossing of designated trails will occur at right angles to the extent feasible. Designated trail treads and profiles will be restored upon completion of pipeline construction. (GWNF LRMP FW-146).
- Right-of-way edges will be shaped “feathered” in irregular patterns to blend in with the existing landscape in High and Moderate SIO areas. At the direction of the Forest AO, some edges may not need feathering to meet the Scenic Integrity Objectives. Geometric shapes will not be utilized. (GWNF LRMP FW-184).
- If visible within a 100-foot zone of Concern from Level 1 & 2 travelways and use areas, slash will be removed, burned, chipped or lopped. These treatments result in an average slash height of 2 feet of the ground. (GWNF LRMP FW-186). Slash will not be windrowed or left in a manner that creates an obstruction. Slash may be chipped and blown off the right-of-way outside wetlands or stream channels.
- To the extent practical, log landings, access roads and bladed skid trails will be located out of view to avoid bare mineral soil observation from Concern Level 1 travel routes and viewing platforms. (GWNF LRMP FW-190).

- Access roads identified for pipeline access will be used for timber removal activities as well. To the extent possible, landings will be sited at locations where extra workspace for pipeline construction is needed, to avoid disturbing more area than is necessary.

5.0 FIRE PREVENTION AND SUPPRESSION PLAN

5.1 PURPOSE

The purpose of this Fire Plan is to identify BMPs for preventing fires on NFS lands and responding to inadvertent fires that occur during construction of the ACP on or near NFS lands. It is based upon the Fire Plan prepared in connection with Atlantic's application to the FERC for the entire Project. This Fire Plan focuses on NFS lands. It incorporates elements that are applicable across the Project as well as elements specific to either or both National Forests crossed by the ACP (the MNF and the GWNF). It incorporates by reference both Forests' standards and guidelines pertaining to fire prevention and suppression (Attachment E).

The Fire Plan identifies responsibilities and procedures for suppressing fire ignitions, responding to and reporting fire emergencies, and working with emergency response agencies in the event of fire, regardless of cause. The Fire Plan is designed to be consistent with applicable Federal and State/Commonwealth laws, regulations, plans, and policies, including Chapter 14 of the 2003 International Fire Code (Combustible Dust-Producing Operations) and Section A104 of the International Wildland-Urban Interface Code (Ignition Source Control).

The Fire Plan provides an implementation strategy to ensure immediate and aggressive action to suppress inadvertent fires that occur during construction of the Project and establishes protocols and lines of communication for reporting fires that occur. Implementation of the Fire Plan will ensure that proper types and quantities of safety and fire extinguishing equipment are available in construction areas to suppress fires, and that construction workers are adequately trained for response to fires. The Plan will be used to familiarize ACP personnel with basic fire emergency planning, response, and evacuation procedures, and their individual roles in fire prevention and suppression. Planning and training will help ACP personnel respond effectively in the event of a fire, thereby avoiding or minimizing injuries and/or damage to property or the environment.

5.2 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Company and Contractor personnel. The training program will focus on the FERC Plan and Procedures, other construction, restoration, and mitigation plans, including this Fire Plan; and applicable permit conditions. In addition, Atlantic and DTI will provide large-group training sessions before each work crew begins construction with periodic follow-up training for groups of newly assigned personnel.

Training for fire suppression and response will include:

- the chain of command and fire reporting process;
- emergency contacts and numbers;
- basic fire prevention behavior controls;
- basic uses of hand tools, water backpacks, and other fire suppression equipment;
- fire suppression procedures and precautions; and
- emergency response and evacuation procedures.

5.3 RESPONSIBILITIES

Atlantic will be responsible for fire prevention during construction of the Project. Atlantic along with the appropriate emergency response or jurisdictional agencies, will be responsible for fire suppression and investigation. All ACP personnel, including contractors, will be responsible for

complying with applicable laws and regulations for fire prevention and suppression as well as the measures described in this Fire Plan.

5.3.1 Interagency Coordination

Interagency coordination of wildfire management in the southeastern United States is overseen by the Southern Area Multi-Agency Coordination Group (SAMACG), which includes representation from Federal land managing agencies and State/Commonwealth forestry agencies. The SAMACG and an adjunct organization, the Southern Area Coordination Center (SACC), encompass Virginia and North Carolina. Virginia and North Carolina also have their own centers for coordination of wildfire management.

Interagency coordination of wildfire management in the northeastern United States is overseen by the Eastern Area Coordination Group (EACG), which includes representation from Federal land managing agencies and State/Commonwealth forestry agencies. The EACG and an adjunct organization, the EACC, encompasses West Virginia.

Each of the States/Commonwealths crossed by the Project has fire prevention and suppression laws, regulations, and programs. Responsible agencies include the West Virginia Division of Forestry and the Virginia Department of Forestry (VDOF). Each of these agencies participates in the appropriate SAMACG and EACG for coordination of wildfire management.

When a fire is initially reported, local and partner firefighting agencies initially respond to the emergency. A local agency can ask for support from the appropriate State/Commonwealth or a regional coordination center if a fire could or does exceed the response capabilities of the local agency. The State/Commonwealth or regional coordination center may in turn request support from the National Interagency Coordination Center if a regional center exhausts its fire suppression resources.

During a fire emergency, coordination is implemented through the Incident Command System (ICS), which is part of the National Incident Management System (NIMS). ICS is a standard incident management system used by firefighters and emergency medical teams to establish an organizational structure for management. A chain of command initially is established by the local response agencies to direct the response. As an incident progresses, personnel with higher authority and training assume responsibility for directing the response. ICS and NIMS provide a framework that assists agencies, non-governmental organizations, and the private sector in preventing, responding to, and mitigating the effects of incidents and ensuring an appropriate response based on the capabilities of response agencies.

5.3.2 ACP Project Responsibilities

The construction contractors working on the Project will be required to implement the provisions of this Fire Plan. Additionally, each contractor will be required to prepare and implement an individual fire control plan, which will identify responsibilities and describe actions to be implemented by the contractor in the event of an inadvertent fire. Copies of each fire control plan will be appended to this Fire Plan.

The key persons responsible for fire prevention and suppression during construction of the Project are the Construction Site Supervisor, Spread Superintendents, Field Safety Officers (FSO), EIs, AOs, and Station Managers. Contact information for these persons will be appended to the "issued-for-construction" Fire Plan prior to the start of construction. At a minimum, each construction spread for the pipelines and each aboveground facility site will have one FSO trained in accordance with National Fire Protection Standards 1521, Chapter 4, Responsibilities for a Health and Safety Officer.

Chief Inspector

The Construction Site Supervisor will be responsible for oversight of all activities along the pipeline, including fire prevention and suppression.

Spread Superintendents

Spread Superintendents will be responsible for general construction operations associated with their individual spreads including compliance with this Fire Plan. Spread Superintendents will be in communication with Construction Site Supervisors, FSOs, EIs, AOs, and local emergency response, as necessary, to ensure that construction personnel are aware of fire hazards and prevention methods. Spread Superintendents will coordinate with Federal, State/Commonwealth, and local emergency responders during periods of high or severe fire conditions to ensure that appropriate preventive measures are in place during construction. Spread Superintendents also will be responsible for:

- monitoring construction areas to identify fire hazards and risks;
- developing and implementing fire protection strategies;
- ensuring adequate firefighting equipment is deployed to high risk areas and that equipment is visible and accessible; and
- ensuring that all firefighting equipment is inspected on a regular basis and maintained in good condition.

Field Safety Officers

The FSOs will be responsible for managing on-site fire suppression documentation, ensuring that fire suppression equipment is available and maintained, ensuring that construction personnel are trained to use equipment properly, and communicating fire hazards and threat levels to construction personnel. Additional responsibilities of the FSOs include:

- reporting all uncontrolled fires within or in the vicinity of the construction area, regardless of source, to the Spread Superintendent, emergency responders, and nearest fire dispatch;
- conducting weekly inspection of tools, equipment, personal protective equipment, and first aid kits;
- developing and maintaining a register of emergency equipment;
- conducting weekly inspections of flammable materials;
- posting “No Smoking” and “Designated Smoking Area” signs and fire rules at appropriate locations within the construction area;
- providing initial response support in the event of a fire and supervising fire suppression activities until relieved;

- providing and gaining approval of site-specific burn and smoke management plans for pre-planned controlled fires that will be implemented in accordance with Federal, State/Commonwealth, and Local requirements;
- providing written burning and blasting schedules, as required, to the appropriate Federal, State/Commonwealth, and Local fire control jurisdiction;
- monitoring construction areas where activities may present for safety issues, such as blasting;
- complying with regulatory requirements in the storage and handling of flammable substances and maintaining a registry of flammable substances;
- establishing facilities for on-site chemical management and maintaining Safety Data Sheets (formally known as Material Safety Data Sheets) for flammable materials;
- establishing controls that minimize exposure to flammable materials;
- ensuring that flammable substances are removed from the construction area when not in use or when the location is unattended;
- training and instructing workers in the use, handling, and storage of flammable materials;
- ensuring that construction personnel have been trained in the requirements of this Fire Plan; and
- monitoring compliance with applicable Federal, State/Commonwealth, and Local laws, ordinances, and regulations regarding fire prevention and suppression.

Station Managers

Station Managers at aboveground facility sites will have the same responsibilities as the Spread Superintendents as described above.

Environmental Inspectors

EIs provide environmental regulatory guidance and oversight. This oversight includes fire prevention and suppression within and in the vicinity of construction areas. EIs will be familiar with Federal, State/Commonwealth, and Local rules and regulations pertaining to fire prevention and response. In the event of a fire emergency, EIs will assist with fire suppression.

Authorized Officer (AO) – Note: Does USFS designate a Fire AO that is different from the overall AO?

The AO may include Interagency Dispatch Centers or staff from land managing agencies. AO will provide information on current fire danger ratings, the presence of other fires in the vicinity of construction areas, natural disaster warnings, and temporary restrictions on construction activities due to fire or other emergencies. If extreme fire danger is identified by a land managing agency, the AO may direct the Chief Inspector or Spread Superintendents to increase the level of fire monitoring, install additional fire prevention or suppression equipment, or stop work, if necessary.

The Chief Inspector, Spread Superintendents, FSOs, EIs, AOs, and local fire authorities have the authority to stop or reduce construction activities or operations that pose a fire hazard until appropriate measures are implemented to minimize risk. The FSOs will accompany Spread Superintendents, AOs, or third-party CMs on fire inspections and take corrective action when observing or having been notified that fire protection measures have not been properly installed or maintained.

5.4 EMERGENCY NOTIFICATION

In the event of a fire or other emergency, construction personnel on the scene will notify the appropriate Spread Superintendent and FSO immediately. The Spread Superintendent will be responsible for immediately notifying the appropriate fire dispatch center and AO or land managing agency, where appropriate. In the case of a serious injury, first aid treatment will be provided onsite. The FSO or another supervisor will coordinate with local emergency responders if additional support is required. In the event of a fire emergency, personnel will contact 911 or the nearest emergency response center. Contact information for emergency responders will be appended to the "issued-for-construction" version of this Fire Plan.

A fire emergency is defined as an incident requiring a coordinated response from one or more agencies. When a response is required, the Spread Superintendent or person in charge will communicate the location and extent of the fire and steps underway to control or suppress the fire.

5.5 FIRE DANGER RATINGS

Fire danger ratings based on standard vegetation fuel models will be used by the USFS to determine required fire prevention, control, and monitoring efforts. Based on the fire danger ratings, certain activities such as blasting, welding, or grinding may be restricted at the discretion of the USFS. Additionally, the land managing agency or local fire authority may modify or change requirements based on changes in fire restriction notices or localized hazards or risks.

On NFS Lands, fire danger ratings and associated precautions relevant to the Project include:

- No Fire Restrictions – normal fire precautions.
- Stage 1 Fire Restrictions – normal fire precautions, except that designated smoking areas and permits for burning are required.
- Stage 2 Red Flag Warning – special fire precautions including:
- Extra precautions such as designating a fire watch, using a spark shield, or wetting work areas down prior to active construction.
- Machine treatment of slash, skidding, yarding, blasting, welding, metal cutting, and offloading are subject to land managing agency requirements.
- No slash burning is allowed.
- Power saws must be shut down from 1:00 p.m. to 8:00 p.m. local time.
- Hauling trucking must stay on the right-of-way or surfaced roads after 6:00 p.m. local time.
- Additional personnel, equipment, and prevention measures are required.

- Stage 3 Fire Restrictions – special fire precautions including:
- All restrictions listed above.
- Shutdown of all construction activities except operations on soil or graded areas, watering, grading, trench excavation, padding, backfilling, and clean-up.
- Activities such as blasting and welding require an exemption from the AO unless these activities are completed on the graded portions of the right-of-way.

The FSOs will contact the USFS _____ to obtain information on fire danger ratings. Contacts will be daily when conditions are favorable for fires and weekly at other times. The FSOs will communicate the fire danger ratings to the Chief Inspector, Spread Superintendents, Station Managers, EIs, and construction crews.

5.6 FIRE PREVENTION

5.6.1 Blasting

Procedures for blasting are discussed in Atlantic's and DTI's *Blasting Plan*. Additional measures to be implemented in blasting areas are described below.

When fire danger is high, a two-person fire watch will patrol the blast area for a period of one hour after the completion of blasting.

If blasting occurs when the fire danger rating is Stage 1, an FSO will be on site during the operation and remain on site for one hour after the completion of blasting. At least one Size 0 or larger shovel and one water-filled backpack pump or fire extinguisher will be on site. In addition, a fire watch will be assigned to each crew utilizing blasting equipment.

When the fire danger rating is Stage 2 or 3, blasting will be prohibited unless an exemption is granted by the local fire authority. If an exemption is granted, additional fire prevention equipment and personnel will be on site prior to blasting. Equipment may include water trucks, fire tankers, shovels, backpack pumps, bulldozers, etc. A fire watch will remain on site for at least two hours after the completion of blasting activities.

5.6.2 Welding

During fire season, welding, cutting, or drilling of metal components of the ACP will require the approval of the Spread Superintendent and the Construction Site Supervisor. In areas where approval has been granted, vegetation will be cleared at a minimum diameter of 30 feet around the center of the work area unless the area has been watered to eliminate the fire danger. Each welding crew will be outfitted with at least one Size 0 or larger shovel, one water-filled backpack pump, and one five-pound dry powder ABC fire extinguisher.

When the fire danger rating is Stage 1, a fire watch will be assigned to each crew utilizing cutting and welding equipment. The fire watch will remain on site for one hour after the completion of welding activities.

When the fire danger rating is Stage 2, an exemption by the AO will be required prior to welding activities unless the activities are performed within the graded portions of the right-of-way or other work areas. If an exemption is granted, all Stage 1 measures will be implemented. In addition, a water tanker

and bulldozer will be required to be on site during welding operations, and a fire watch will remain on site for at least two hours after the completion of welding activities.

When the fire danger rating is Stage 3, welding activities will require approval from the AO. If an approval is granted, all Stage 1 and 2 measures will be implemented.

Fire restriction measures also apply to welding operations performed for equipment maintenance. All welding activities require a permit from the jurisdictional agency as per 29 CFR 1910 Subpart Q (welding) and 29 CFR 1910 Subpart I (personal protective equipment).

5.6.3 Equipment

The construction contractor will develop a list of equipment to be used during construction. Equipment used in the construction area may be inspected by the AO or other third-party compliance monitor prior to use on the Project. The equipment may be used only while in good operating order.

5.6.3.1 Fire Extinguishers

The FSAs will inspect fire extinguishers on a monthly basis to verify that:

- each extinguisher is in its designated place, clearly visible, and not blocked by equipment or other objects that could interfere with access to the fire extinguisher during an emergency;
- the nameplate with operating instructions is legible and facing outwards;
- the pressure gauge is showing that the extinguisher is fully charged;
- the pin and tamper seal are intact; and
- the extinguisher is in good condition, showing no signs of physical damage, corrosion or leakage.

The FSO performing the monthly inspection will initial and date each extinguisher inspection tag. Defective units will be taken out of service and replaced immediately.

Fire extinguishers will be used in accordance with 29 CFR 1910.157. Use of fire extinguishers by construction personnel to suppress fires will only be undertaken if:

- the fire is small and is not spreading to other areas;
- escaping the area is possible;
- the fire extinguisher is in working condition and the individual understands how to use it; and
- the fire extinguisher has been professionally inspected and tagged annually;

5.6.4 Spark Arrestors

Spark arresters used for portable equipment, such as chainsaws, will be in good working condition. Light trucks and cars with factory installed or equivalent mufflers, in good condition, may be used on roads where the roadway is cleared of vegetation.

Vehicles equipped with catalytic converters are potential fire hazards. These vehicles will be inspected and cleaned, as necessary, and parked on areas cleared of vegetation.

All vehicles operating in vegetation-covered areas will maintain clean and clear undercarriage and exhaust systems, with no chaff, grass, or brush lodged in the exhaust system and skid plates. Cross-country driving outside designated work areas will be prohibited.

5.6.5 Equipment Parking and Storage

Equipment parking areas and small stationary engine sites will be cleared of all extraneous flammable materials. Gas and oil storage areas will be cleared of extraneous flammable material and "No Smoking" signs will be posted within these areas.

All used and discarded oil, oil filters, oily rags, or other waste will be disposed of in approved and marked containers. Containers will be stored in approved locations and removed from the site by licensed contractors or approved personnel and disposed of or recycled at approved facilities. Glass containers will not be used to hold gasoline or other flammable materials.

5.6.6 Power Saws

All gasoline-powered saws will be provided with approved spark arresters/mufflers and maintained in good operating condition. Chainsaw operation will comply with the following:

- the arrester/muffler will contain a 0.023-inch mesh, stainless steel screen;
- a fire extinguisher or water backpack and shovel will be available during chainsaw operations;
- chainsaws will be moved at least 10 feet from the place of fueling before starting; and
- chainsaw fuel and oil will be carried in safety cans designed for that purpose.

5.6.7 Warning Devices

Highway flares or other devices with open flames will not be allowed in the construction area because of the danger for fire. Contractors will only use electric or battery-operated warning devices within the construction area.

5.6.8 Warming and Cooking Fires

Warming and cooking fires will be prohibited on the right-of-way.

5.6.9 Smoking

Smoking is allowed only in areas designated by the FSO. Smoking signs visible to all personnel will be posted at designated areas. The supervisory personnel will be responsible for enforcing smoking restrictions. "No Smoking" signs will be posted in all refueling areas and in areas where flammable materials are used, stored, or discarded.

5.6.10 Refueling

All fuel trucks will be equipped with a 35-pound minimum ABC fire extinguisher. If required, helicopter refueling trucks will be electrically grounded to the helicopter during refueling. Storage areas

will be cleared of all extraneous flammable materials. All discarded oil, oil filters, oily rags, or other potentially flammable wastes will be disposed of or as described in Section 5.6.5 above. Only approved and properly maintained containers will be used to store or transport flammable liquids.

5.7 BURNING

Burning of slash or non-merchantable wood is not currently anticipated. If burning is deemed necessary, it will be done only after Atlantic has acquired all applicable permits and approvals, including specific authorization from the AO. In addition, any such burning will be conducted in accordance with the *Fire Prevention and Suppression Plan* (Fire Plan). If the burn is approved, the appropriate burn center will be notified 24 hours prior to the scheduled burn.

5.8 FUEL LOADING

The USFS has identified fire-related concerns associated with potential increased fuel loadings on the proposed right-of-way if un-utilized woody material is left on the right-of-way. Atlantic will work with the MNF and GWNF to determine the proper balance between the increased fuel loading risks that this may represent and the beneficial uses of some of this material for wildlife habitat, OHV blocking, reduction of visual impacts, and erosion control/restoration purposes. Measures such as lopping and scattering tops and/or burning some of the material on site will be evaluated.

5.9 FIRE AND EMERGENY RESPONSE EQUIPMENT

5.9.1 Construction Vehicles

All foreman vehicles and crew buses assigned to the construction area will be equipped with one 10-pound ABC fire extinguisher, one shovel, and an operable backpack water pump of four-gallon capacity.

One water truck per construction spread during blasting “red flag warnings” and a fire danger rating of Stage 2 will be outfitted with a pressure pump, adjustable nozzle, threaded rubber-lined hose with a minimum of 300 feet of 1½-inch cotton jacket, and have a minimum water storage capacity of 1,500 gallons. Water trucks on the right-of-way will be able to help with wildfire fighting in the vicinity of the Project.

The construction companies use water trucks that typically have a 4,000-gallon capacity and 150 feet of 1½-inch water hose that would support fire suppression activities. Many of these vehicles have water cannons mounted on the roof. All vehicles and auxiliary equipment will be equipped with properly functioning and baffled exhaust systems.

5.9.2 Fire Fighting Tools

At least three 10-person tool caches will be maintained per spread. One cache will be placed in an EI’s vehicle. The second cache will be located with the Spread Superintendent, or Station Manager. The third cache will be assigned to the FSO. Tool boxes will be red in color, sealed with metal box-car-type seals, and labeled “For Fire Fighting Only.” The tool caches will contain the following:

- ten electric headlamps with batteries;
- one first aid kit, 10-person unit;
- two knapsacks;
- five pulaskis with sheaths;
- five long-handled, round-point, Size 0 shovels;

- five fire rakes; and
- ten one-gallon canteens, filled with water.

The Spread Superintendent will expedite delivery of the tool caches upon request of the FSO or AO or when alerted to an emergency requiring the tools.

In case a tool cache or first aid kit has been used, it will be immediately replenished. All replenished tool caches or first aid boxes will be inspected by the FSO. These will then be resealed before being returned to the construction site.

5.9.3 Field Safety Officer

The FSO vehicle will maintain the following required equipment at all times, although suitable substitutions may be made as necessary:

Item	Description	Quantity
1	Pickup Truck	1
2	Two-Way Mobile Radio Operating (Administrative Unit) Frequency	1
3	Fire-Fighting Tool Cache (see above)	1
4	Axe, Double Bit, Cruiser Type	1
5	Sheath for Axe	1
6	Round-Point Shovel Size 0	2
7	Hard Hat	2
8	Backpack Pump, Complete (filled with water)	2
9	Hoses: Cotton Jacket, 1-1/2 inches (NS Thread) Cotton Jacket, 1 inch (IP Thread) High Pressure, 1 inch (IP Thread) Suction, 1-1/2 inch	 200 feet 400 feet 250 feet 24 feet
10	Hose Fittings: R-F Forester Nozzles R-S Nozzle, Tips (a) Fog (b) Straight Stream Reducer, 1-1/2-inch NS to 1-inch IP Stainer, Suction, 1-1/2 inch Siamese, 1-1/2-inch NS Thread, both Male and Female	 2 6 6 4 1 1 1
11	Tools: Spanner-Wrench, Large, 1-1/2-inch Hose Spanner-Wrench, Small, 1-inch Hose Carpenter Hammer Pliers, Slip Joint	 1 1 1 1
12	Fire Extinguishers ABC, 35-pound minimum	 1

5.10 EVACUATION

During an emergency evacuation, the Project will depend upon response teams, consisting of trained personnel, to attend to injured and/or trapped victims. Construction workers providing medical attention will not help beyond their capability.

Atlantic will establish an emergency communications system utilizing cell phones, hand-held radios, and/or satellite phones to notify workers of emergencies and contact local law enforcement and fire departments. If an immediate evacuation of a construction work area is required, the Construction

Site Supervisor, Spread Supervisor, FSO, EI, or other supervisor will direct the evacuation via the nearest escape route to a "safe area." Otherwise, evacuations will be directed by local emergency responders. Designated evacuation wardens will be assigned to each spread or station to account for all personnel present before, during, and after the evacuation. Construction workers will not return to an evacuated work area until emergency responders have deemed it safe and the Construction Site Supervisor, Spread Supervisor, or Station Manager has given an "all-clear" signal.

5.11 PIPELINE OPERATIONS AND FIRES

Most prescribed fire and wildfire management activities undertaken on NFS lands will not be affected by operation of the proposed ACP. The principal concerns for these activities with respect to pipeline safety have to do with: 1) excavation or removal of cover on the right-of-way, and 2) excessive loadings over the pipeline. While the amount of cover over the pipeline would be sufficient to protect the line from fire, grading or excavation on the right-of-way that might be associated with fire management or firefighting activities would not be allowed, other than planned activities coordinated with and supervised by the pipeline operator. Such activities, for example, may require the addition of extra cover over the pipeline at selected crossing locations. Fire management activities not directly affecting the pipeline right-of-way would not be restricted, unless the activity may indirectly cause or contribute to undermining or erosion of the right-of-way.

Any issues associated with planned or unplanned fire management activities that may affect the pipeline right-of-way should be referred to **[Contact Number to be Inserted in Final Document]**

6.0 BLASTING PLAN

6.1 PURPOSE

Based on an analysis of the Natural Resource Conservation Service's Soil Survey Geographic (SSURGO) Database, approximately 5.0 miles of the proposed ACP pipeline route on the MNF and 12.8 miles on the GWNF will cross areas with bedrock at depths of less than 60 inches. Some of this bedrock is considered paralithic (soft) and may not require blasting during construction. About 3.6 miles on the MNF and 7.9 miles on the GWNF cross soils with a lithic contact (hard bedrock) within 60 inches of the surface that may require blasting or other special construction techniques during installation of the proposed pipelines.

This *Blasting Plan* is based on the blasting plan prepared in connection with Atlantic's application to the FERC for the entire ACP. The plan outlines the procedures and safety measures that Atlantic will adhere to while conducting blasting activities required for the construction of the ACP. Before blasting, a site-specific Blasting Specification Plan, which is consistent with the provisions in this *Blasting Plan*, will be submitted by the Contractor to Atlantic for approval. Approval of a site-specific Blasting Specification Plan does not relieve the Contractor from responsibility or liability.

6.2 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Company and Contractor personnel. The training program will focus on the FERC Plan and Procedures, other construction, restoration, and mitigation plans, including this *Blasting Plan*; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

6.3 GENERAL REQUIREMENTS

Blasting for grade or trench excavation will be used where deemed necessary by the Contractor, and approved by an Atlantic representative, after examination of the site. Blasting operations will be conducted by or under the direct and constant supervision of personnel legally licensed and certified to perform such activity in the jurisdiction where blasting occurs. Prior to any blasting activities, the Contractor will provide Atlantic with appropriate information documenting the experience, licenses, and permits associated with blasting personnel.

Blasting-related operations will comply with applicable Federal and/or State/Commonwealth, and local regulations, permit conditions, and the construction contract. These operations include:

- obtaining, transporting, storing, handling, loading, detonating, and disposing of blasting material;
- drilling; and
- ground-motion monitoring.

6.4 PRE-BLASTING REQUIREMENTS

Prior to the initiation of blasting operations, the Contractor will comply with the following:

- The Contractor will obtain all required Federal, State/Commonwealth, and local permits relating to the transportation, storage, handling, loading, and detonation of explosives.
- The Contractor will be responsible for the protection of existing underground facilities.
- Before performing any work on, or accessing the construction right-of-way within either Forest, the Contractor will verify with an Atlantic representative that the USFS, specifically the MNF and/or the GWNF have been notified of the upcoming construction activities. The Contractor will notify all such parties at least 48 hours prior to blasting.
- The Contractor will submit to Atlantic its site-specific Blasting Specification Plan for approval prior to the execution of blasting activity.

6.5 SITE-SPECIFIC BLASTING PLANS

For each area determined to require blasting, a site-specific Blasting Specification Plan will be prepared by the Contractor. This plan will include, at a minimum, the following information:

- blaster's name, company, copy of license, and statement of qualifications;
- seismograph company, names, equipment and sensor location;
- site location (milepost and stationing), applicable alignment sheet numbers, and associated rock type and geological structure (solid, layered, or fractured);
- copies of all required Federal, State/Commonwealth, and local permits;
- methods and materials, including explosive type, product name and size, weight per unit, and density; stemming material; tamping method; blasting sequence; use of non-electrical initiation systems for all blasting operations; and magazine type and locations for storage of explosives and detonating caps;
- site dimensions, including explosive depth, distribution, and maximum charge and weight per delay; and hole depth, diameter, pattern, and number of holes per delay;
- global positioning system (GPS) coordinates of blasting location(s), distance and orientation to nearest aboveground and underground structures, and dates and hours blasting will be conducted;
- blasting procedures for:
    - storing, handling, transporting, loading, and firing explosives;
    - prevention of misfires, fly-rock, fire prevention, noise, and stray current accidental-detonation;
    - signs, flagmen, and warning signals prior to each blast;

- locations where the pipeline route:
  - parallels or crosses an electrical transmission corridor, cable, or pipeline;
  - parallels or crosses a highway or road;
  - approaches within 500 feet of a water well or within 150 feet of an oil and gas well; or
  - approaches within 1,000 feet of any residence, building, or occupied structure;
- local notification;
- inspections after each blast; and
- disposal of waste blasting material.

6.6 MONITORING

During blasting operations, the Contractor will be required to monitor operations in the following manner:

- The Contractor will provide seismographic equipment to measure the peak particle velocity (PPV) of all blasts in the vertical, horizontal, and longitudinal directions.
- The Contractor will measure the PPV at any existing pipelines, domestic structures, water supply wells, oil and gas wells, electrical transmission tower footings, and other utilities within 150 feet of the blasting. If none of these structures/facilities are present, the Contractor will measure the PPV at the edge of the construction right-of-way.
- The Contractor will complete a Blasting Log Record immediately after each blast and submit a copy to an Atlantic representative upon completion of blasting activities at each blasting site.

6.7 SAFETY

6.7.1 Protection of Aboveground and Underground Structures

Where blasting is determined to be required, Atlantic will identify any municipal water mains proposed for crossing, and will consult the local water authority. Reports of identified crossings will include location by milepost, owner, and status and results of contacts with the water authority.

The Contractor will exercise control to prevent damage to aboveground and underground structures including pipelines, domestic structures, water supply wells, oil and gas wells, electrical transmission tower footings, and other utilities. The Contractor will implement the following procedures:

- If blasting occurs within 500 feet of an identified water well, water flow performance and water quality testing will be conducted before blasting. If the water well is damaged as a result of ACP blasting, and upon confirmation through a damage claim investigation, the well will be repaired or otherwise restored or the well owner will be compensated for

damages. Atlantic will provide an alternative potable water supply to the landowner pending the result of the damage claim investigation, and any resulting repairs.

- If blasting occurs within 150 feet of aboveground structures, the Contractor and an Atlantic representative will inspect and photograph the structures before blasting. In the event that blasting damage to the aboveground structure is confirmed, the owner will be compensated, pending the result of a damage claim investigation.
- Blasting will not be allowed within 15 feet of an existing pipeline, unless specifically authorized by an Atlantic representative.
- Holes that have contained explosive material will not be re-drilled. Holes will not be drilled where danger exists of intersecting another hole containing explosive material.
- Blasting mats or padding will be used on all shots where necessary to prevent scattering of loose rock onto adjacent property and to prevent damage to nearby structures and overhead utilities.
- Blasting will not begin until occupants of nearby buildings, stores, residences, places of business, places of public gathering, and farmers have been notified by the Contractor in advance to protect personnel, property, and livestock. The Contractor will notify all such parties at least 48 hours prior to blasting.
- Blasting in or near environmentally sensitive areas, such as streams and wildlife areas, may include additional restrictions.
- All blasting will be subject to the following limitations:
- Maximum PPV of 12.0 inches per second, or the maximum PPV in accordance with State/Commonwealth or local regulations, in any of three mutually perpendicular axes measured at the lesser distance of the nearest facility or the edge of the permanent easement.
- Maximum drill size will be 2.5 inches unless otherwise approved by an Atlantic representative.
- Maximum quantity of explosive per delay will be governed by the recorded measurements as influenced by the test blast program or a scaled distance formula.
- Explosive agents and ignition methods will be approved by an Atlantic representative. Ammonium nitrate/fuel oil and other free flowing explosives and blasting agents are not acceptable and will not be used.
- Drill holes will not be left loaded overnight.
- Approved stemming material will be used in all holes.
- The drilling pattern will be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications. The

Contractor will submit the proposed drilling pattern to an Atlantic representative for approval.

- Under pipeline crossings and all other areas where drilling and blasting is required within 15 feet of existing facilities:
- Drill holes will be reduced to a maximum of 2 inches or less in diameter.
- The number of holes shot at one time will be limited to three unless otherwise approved by an Atlantic representative.
- Appropriate delay between charges will be used to attain desired fragmentation.

6.7.2 Protection of Personnel

The Contractor will include in its procedures all Federal, State/Commonwealth, and local safety requirements for blasting. The Contractor's procedures will address, at a minimum, the following requirements:

- Blasting will be performed during daylight hours only.
- Only authorized, qualified, and experienced personnel will handle explosives.
- No explosive materials will be located where they may be exposed to flame, excessive heat, sparks, or impact. Smoking, firearms, matches, open flames, and heat- and spark-producing devices will be prohibited in or near explosive magazines or while explosives are being handled, transported, or used.
- A code of blasting signals will be established, posted in conspicuous places, and utilized during blasting operations. Employee training will be conducted on the use and implementation of the code.
- The Contractor will use every reasonable precaution including, but not limited to, visual and audible warning signals, warning signs, flag persons, and barricades to ensure personnel safety.
- Warning signs, with lettering a minimum of 4 inches in height on a contrasting background, will be erected and maintained at all approaches to the blast area.
- Flaggers will be stationed on all roadways passing within 1,000 feet of the blast area to stop all traffic during blasting operations.
- Both workers involved in the detonation and personnel not involved in the detonation will stand back at a distances determined by the person in charge from the time the blast signal is given until the "ALL CLEAR" is sounded.
- No loaded holes will be left unattended or unprotected. No explosives or blasting agent will be abandoned.
- In the case of a misfire, the blaster will provide proper safeguards for personnel until the misfire has been re-blasted or safely removed.

- The exposed areas of the blast will be matted wherever practicable. In cases where such a procedure is not deemed to be feasible, the Contractor will submit an alternative procedure for review by an Atlantic representative and the site in question will be visited and examined by the consultant before any approval is granted.

- Atlantic may employ two-way radios for communication between vehicles and office facilities. The Contractor will advise Atlantic and other Contractors of any need to cease use of such equipment during blasting activities.

- All loading and blasting activity will cease and personnel in and around the blast area will retreat to a position of safety during the approach and progress of an electrical storm irrespective of the type of explosives or initiation system used. This is a major safety precaution and will always be observed. All explosive materials, all electrical initiation systems, and all non-electric initiation systems are susceptible to premature initiation by lightning.

- Previous blast areas must be inspected to verify the absence of misfires. No drilling may commence until such inspection occurs. If a misfire occurs adjacent to a hole to be drilled, the misfire will be cleared by the blaster using reasonable techniques required for the situation prior to commencement of drilling. If a misfire occurs at some distance from the drilling area, drilling may be stopped while clearing preparations are underway. When the misfire is to be cleared by re-shooting, drilling will be shut down and personnel evacuated to a place of safety prior to detonation.

- All transportation of explosives will be in accordance with applicable Federal, State/Commonwealth, and local laws and regulations. Vehicles used to transport explosives will be in good working condition and equipped with tight wooden or non-sparking metal floor and sides. If explosives are carried in an open-bodied truck, they will be covered with a waterproof and flame-resistant tarp. Wiring will be fully insulated to prevent short-circuiting and at least two fire extinguishers will be carried. The vehicle will be plainly marked to identify its cargo so that the public may be adequately warned. Metal, flammable, or corrosive substances will not be transported in the same vehicle with explosives. There will be no smoking, and unauthorized or unnecessary personnel will not be allowed in the vehicle. Competent, qualified personnel will load and unload explosives into or from the vehicle.

- No sparking metal tools will be used to open kegs or wooden cases of explosives. Metallic slitters will be used to open fiberboard cases, provided the metallic slitter does not come in contact with the metallic fasteners of the case. There will be no smoking, no matches, no open lights, or other fire or flame nearby while handling or using explosives. Explosives will not be placed where they are subject to flame, excessive heat, sparks, or impact. Partial cases or packages of explosives will be re-closed after use. No explosives will be carried in the pockets or clothing of personnel. The wires of an electric blasting cap will not be tampered with in any way. Wires will not be uncoiled. The use of electric blasting caps will not be permitted during dust storms or near any other source of large charges of static electricity. Uncoiling of the wires or use of electric caps will not be permitted near radio-frequency transmitters. The firing circuit will be completely insulated from the ground or other conductors.

- No blast will be fired without a positive signal from the person in charge. This person will have made certain that all surplus explosives are in a safe place; all persons, vehicles,

and/or boats are at a safe distance; and adequate warning has been given. Adequate warning of a blast will consist of, but not be limited to, the following:

- notifying nearby homeowners and local agencies, if necessary;
- stopping vehicular and/or pedestrian traffic near the blast site; and
- signaling with an air horn, whistle, or similar device using standard warning signals.
- Only authorized and necessary personnel will be present where explosives are being handled or used.
- The condition of the hole will be checked with a wooden tamping pole prior to loading. Surplus explosives will not be stacked near working areas during loading. Detonating fans will be cut from spool before loading the balance of charge into the hole. No explosives will be forced into a bore hole past an obstruction. Loading will be done by a blaster holding a valid license or by personnel under his direct supervision.
- Fly-rock leaving the right-of-way will be collected immediately and disposed of at disposal sites approved by Atlantic. This work will not be left to the cleanup crew.

6.7.3 Lightning Hazard

A risk of accidental detonation caused by lightning strikes exists at any time the workplace is experiencing an electrical storm and there are loaded holes on site. If this hazard is judged to exist by an Atlantic representative, work will discontinue at all operations and workers will be moved to secure positions away from the loaded holes. Furthermore, workers will not return to the work site until the storm has passed and an Atlantic representative has indicated it is clear to return.

The Contractor will have on site an approved lightning instrument capable of measuring the degree of electrical activity as a storm approaches, and the distance to the storm front from the instrument on the right-of-way.

6.8 KARST

In accordance with Atlantic's *Karst Monitoring and Mitigation Plan* (Attachment H), and in addition to the measures described above, the following procedures will be implemented in areas of karst terrain:

- Blasting will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of known or presumed habitat for federally listed threatened and endangered species in the subterranean karst environment (e.g. Madison cave isopod).
- Excavations will be inspected for voids, openings or other tell-tale signs of solution (karst) activity.
- If rock removal intercepts an open void, channel, or cave, construction activities will cease in the vicinity of the void, channel, or cave until a remedial assessment is performed by a qualified geologist or engineer with experience in karst terrain.

- Use of explosives will be limited to low-force charges designed to transfer the explosive force only to the rock which is designated for removal (e.g., maximum charge of 2 inches per second ground acceleration).

- If the track drill used to prepare drill holes for explosive charges encounters a subsurface void larger than 6 inches within the first 10 feet of bedrock, or a group of voids totaling more than 6 inches within the first 10 feet of bedrock, then explosives will not be used until a subsurface exploration is conducted to determine if the voids have connectivity to a deeper karst structure. The subsurface exploration will be carried out with track drill probes, coring drill, electrical resistivity, or other techniques capable of resolving open voids in the underlying bedrock. If a track drill or coring rig is used, then all open holes will be grouted shut after the completion of the investigation.

6.9 STORAGE REQUIREMENTS

All explosives, blasting agents, and initiation devices will be stored in locked magazines that have been located, constructed, approved, and licensed in accordance with Federal, State/Commonwealth, and local regulations. Magazines will be dry, well ventilated, reasonably cool (painting of the exterior with a reflective color), bullet and fire resistant, and kept clean and in good condition.

Initiation devices will not be stored in the same box, container, or magazine with other explosives. Explosives, blasting agents, or initiation devices will not be stored in wet or damp areas; near oil, gasoline, or cleaning solvents; or near sources of heat radiators, steam pipes, stoves, etc. No metal or metal tools will be stored in the magazine. There will be no smoking, matches, open lights, or other fire or flame inside or within 50 feet of storage magazines or explosive materials.

Magazines will be constructed and located in accordance with Federal, State/Commonwealth, and local regulations. Magazines will be marked in minimum 3-inch-high letters with the words "DANGER – EXPLOSIVES" prominently displayed on all sides and roof, and be kept locked at all times unless explosives are being delivered or removed by authorized personnel. Admittance will be restricted to the magazine keeper, blasting supervisor, or licensed blaster.

Accurate and current records will be kept of the explosive material inventory to ensure that oldest stocks are utilized first, satisfy regulatory requirements, and for immediate notification of any loss or theft. Magazine records will reflect the quantity of explosions removed, the amount returned, and the net quantity used at the blasting site.

When explosive materials are taken from the storage magazine, they will be kept in the original containers until used. Small quantities of explosive materials may be placed in day boxes, powder chests, or detonator boxes. Any explosive material not used at the blast site will be returned to the storage magazine and replaced in the original container as soon as possible.

6.10 SPECIFIC USFS GUIDELINES

The GWNF's LRMP includes several standards regarding the use of explosives in the Forest. In addition to aforementioned blasting procedures citied in this document, Atlantic will also adhere to the following standards:

- Explosives shall not be used within 200 feet of hibernacula, maternity colonies, or bachelor colonies unless analysis can demonstrate that this activity will not have an adverse effect on bat populations or habitat. Explosives outside of this area shall not be

used when such use has potential to damage the cave or disturb the bat. (GWNF LRMP TE20).

- Explosives may be allowed within the primary range if it can be demonstrated that this activity will not have an adverse effect on bat populations or habitat. (GWNF LRMP TE39).

- Explosives shall not be used within 200 feet of hibernacula, within key areas, or within 2.5 miles of active maternity sites, unless analysis can demonstrate that this activity will not have an adverse effect on bat populations or habitat. Explosives outside of these areas shall not be used when such use has potential to damage the cave or disturb the bat. (GWNF LRMP TE50).

The MNF's LRMP does not offer specific standards, goals, or guidelines that addressed blasting or the use of explosives.

7.0 TRAFFIC AND TRANSPORTATION MANAGEMENT PLAN

7.1 PURPOSE

The purpose of the Transportation Plan is to identify BMPs that Atlantic will implement during construction of the Project to minimize impacts on roadways and traffic. This plan is based on the Transportation Plan prepared in connection with Atlantic's application to the FERC for the entire ACP. This Transportation Plan incorporates elements that are applicable to construction across roads and highways, commuting of the construction workforce, maintenance of traffic, movement of construction vehicles and delivery of equipment and materials within both National Forests crossed by the ACP).

Operation and maintenance of the proposed facilities will not affect traffic flow on roads and highways on USFS lands. Periodic maintenance and inspection procedures along the pipeline will involve a low frequency of light vehicle movement on and off roadways. Therefore, no impacts on roads or traffic are expected during operation of the Project.

7.2 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Atlantic and Contractor personnel. The training program will focus on the FERC Plan and Procedures , other construction, restoration, and mitigation plans, including this *Traffic and Transportation Management Plan*; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

7.3 GENERAL REQUIREMENTS

Prior to construction, Atlantic will obtain applicable Federal, State/Commonwealth, and local road use and crossing permits, as required. ACP personnel will comply with all permit requirements and conditions to provide for public safety and minimize impacts on public roads. West Virginia or Virginia guidelines will be utilized on USFS properties where there are no specific federal guidelines regarding maintenance of traffic, flagging protocol and signage. Copies of this *Traffic and Transportation Management Plan* as well as applicable state/commonwealth guideline documents will be provided to the appropriate personnel and maintained at each Contractor's field office.

Atlantic will consult with the MNF and GWNF, the West Virginia Department of Transportation (WVDOT) and the Virginia Department of Transportation (VDOT) regarding detour routes, speed/load limits, and other use limitations, conditions, or restrictions on the roads that will be utilized during construction. Before the start of construction, Atlantic will refer to the WVDOT's Manual on Temporary Traffic Control for Streets and Highways, the Virginia Work Area Protection Manual, the MNF and GWNF LRMPs and the United States Department of Agriculture (USDA) Guidelines for Road Maintenance Levels to develop maintenance of traffic plans that are acceptable to the USFS.

As discussed further in the following sections, Atlantic will place and maintain traffic control measures, such as flag persons, warning signs, lights, and/or barriers, as appropriate, to safeguard construction workers and the public and to minimize traffic congestion. The aforementioned measures will be in accordance with the WVDOT's Manual on Temporary Traffic Control for Streets and Highways, the Virginia Work Area Protection Manual, and specific temporary traffic control measures adopted by the MNF or the GWNF.

Atlantic and will maintain traffic flow and emergency vehicle access on roadways and will work with local law enforcement, fire departments, and emergency medical services to coordinate access for effective emergency response during construction.

The USDA Guidelines for Road Maintenance Levels, prepared for the USFS, provides guidelines for road types, and maintenance within USFS property. ACP will provide protective measures to avoid damage to Forest Service road surfaces crossed by construction equipment. The ACP will comply with weight limitations for and restrictions pursuant to prescription guidelines on designated NFS roads.

Tires, equipment mats, or plywood sheets will be used to minimize the potential for damage from tracked equipment crossing paved roads. If excess soil or mud is tracked onto paved roadways, it will be removed as soon as practicable and placed back into the construction work area. Sediment barriers will be installed at the base of slopes adjacent to roads to prevent sediment from the construction right-of-way from being washed onto roads during rain events.

7.4 ACCESS TO THE RIGHT-OF-WAY

Atlantic has endeavored to utilize existing roads to the extent practicable to provide access to the construction right-of-way on NFS lands. Construction traffic will be limited to access roads approved by the FERC and the USFS. Prior to and throughout construction, signs will be posted to identify approved access roads for construction traffic. If additional roads are identified as necessary for construction, they will not be used without authorization of both the FERC and the USFS. A table listing the access roads planned on NFS lands is included in Section 1, Table 1 of this COM Plan.

Some of the existing NFS roads identified for access to the pipeline right-of-way may require improvement (such as grading, widening, the addition of gravel, or removal of obstructions) to provide for proper drainage or to safely accommodate construction equipment and vehicles. Roads requiring improvements are identified in Table 1, Section 1, of this COM Plan. Such improvements will be consistent with the USDA Guidelines for Road Maintenance Levels as well as the LRMPs for both National Forests.

The erosion control and restoration measures approved by the USFS, the West Virginia Division of Environmental Protection and the Virginia Department of Environmental Quality (DEQ), will be utilized for improving, using, and restoring access roads or when constructing new access roads. If culverts are required to improve an access road at stream crossings, the culverts will be adequately sized to accommodate stormwater runoff as required by Federal, State, or local permits, and will be of sufficient strength to support construction and maintenance equipment.

Atlantic will perform maintenance activities during construction, including blading or filling activities, to ensure the safety and proper functioning of all access roads. Dust emissions along unpaved access roads will be controlled by applying water, as needed, and by restricting vehicle speeds. If excessive rutting takes place on access roads, Atlantic will perform maintenance activities on the road prior to continued use. Road maintenance will conform to the USDA Guidelines of Road Maintenance Levels, as well as any standard contained in the LRMPs of the MNF or the GWNF.

Atlantic's construction contractors will be responsible for removing obstructions affecting access roads, if present, within the boundaries of the roadway (up to a width of approximately 30 feet centered on the road centerline). Such obstructions will be cleared using the following methods, as appropriate.

- The removal of trees, limbs, brush, and other obstructions will be limited to those obstructing the driver's sight distance or within 15 feet of vertical clearance above the roadway.

- Limbing will be accomplished by the use of pruning saws, power saws, nippers, bow saws, or crosscuts. Limbs will be pruned flush with the trunk of the tree, except for portions of overhanging limbs. Use of axes for limbing will be prohibited.

- Material removed will be disposed of in approved areas or at the direction of the landowner or land managing agency.

During winter, snow will be removed, as necessary, from approved access roads to allow safe access to the construction rights-of-way. Plowing of access roads will continue as necessary through the end of active construction. See Atlantic's *Winter Construction Plan* (Attachment D) for additional information regarding plowing.

If existing Forest Service roads are damaged during construction, Atlantic will restore the roads to their maintence prescription guidline as described in the USDA Guidelines for Road Maintenance Levels. All construction access roads will also be used for pipeline operation and maintenance purposes. Further information regarding planned improvements to access roads are included in Attachment F.

7.5 ROAD CROSSINGS

Construction across state maintained roads will be conducted in accordance with permits received from the WVDOT and the VDOT. Temporary traffic measures flagging and maintenance of traffic will be conducted in a manner consistent with the WVDOT Manual on Temporary Traffic Control for Streets and Highways and the Virginia Work Area Protection Manual. Construction planned across federally maintained roads on USFS lands will adhere to applicable federal standards. If there are not applicable federal standards for signage, flagging or maintenance of traffic, Atlantic will utilize WVDOT or VDOT standards and guidelines. Table 7.5-1 lists the roads crossed by the ACP on USFS lands.

As shown in Table 7.5-1, U.S. Forest Service roads will be crossed by open cut and restored to preconstruction condition. This method will require temporary closure of the road to traffic and establishment of detours. Most open-cut road crossings will be completed and the road restored in a few days using the same type of sub-bed and surface material as the original construction, or flowable fill material. Atlantic will follow the appropriate signage protocol and maintenance of traffic planning pursuant to the posting signs at open-cut road crossings for safety and to minimize traffic disruptions. If the USFS does not have specific protocols for one-lane operation, Atlantic will utilize the applicable state DOT standards.

If road closures are necessary, a road closure schedule will be arranged with the USFS prior to the closure. Landowners, land managing agencies, and local businesses that could be affected by the closure, as well as law enforcement agencies, will be notified in advance of the closure.

TABLE 7.5-1

U.S. Forest Service Roads Crossed by the Atlantic Coast Pipeline Project

U.S. Forest Road No.	Approximate Milepost	Road Crossing Method
MNF Road 1014 (Shock Run)	83.2	Open Cut
MNF Road 1017 (Upper Shock Run)	83.3	Open Cut
MNF Road 55 (Allegheny Road)	83.7	Open Cut
MNF Road 55 (Allegheny Road)	83.8	Open Cut
MNF Road 55 (Allegheny Road)	83.8	Open Cut
GWNF Road 281C	96.3	Open Cut
GWNF Road 281	96.3	Open Cut
GWNF Road 1748	97.1	Open Cut
GWNF Road 1748	97.2	Open Cut
GWNF Road 348.1	116.5	Open Cut
GWNF Road 449	117.0	Open Cut
GWNF Road 449	117.1	Open Cut
GWNF Road 449A	118.7	Open Cut
GWNF Road 449A	118.8	Open Cut
GWNF Road 449B	119.1	Open Cut
GWNF Road 466A	120.2	Open Cut
GWNF Road 466	120.4	Open cut
GWNF Road 1755	121.2	Open cut
GWNF Road 1755	121.5	Open cut
GWNF Road 1755	121.7	Open cut

Where construction crosses roads necessary for access to private residences or businesses and no alternative entrance exists, Atlantic will implement measures (e.g., plating over the open portion of the trench or a temporary bridge) to maintain passage for landowners and emergency vehicles. Atlantic will place and maintain traffic control measures during construction, and use flaggers, warning signs, lights, and barriers, as appropriate, for safety and to minimize traffic congestion.

Within NFS lands, Atlantic will adhere to applicable federal traffic control standards, however, in the absence of specific federal standards, Atlantic will defer to the applicable sections of the WVDOT's Manual on Temporary Traffic Control for Streets and Highways or the Virginia Work Area Protection Manual for flagging, signage, road closures, and maintenance of traffic.

Once construction is complete, Atlantic will repair road damage that occurs as a result of construction, and roadways will be restored to their preconstruction condition.

7.6 MOVEMENT OF PERSONNEL, EQUIPMENT, AND MATERIALS

The movement of construction equipment, materials, and personnel will cause a temporary increase in traffic volumes along USFS maintained roadways. Impacts are expected to be minor and short term because construction spreads and personnel will be geographically dispersed and personnel will commute to and from work areas in early morning and late evening during non-peak traffic hours.

Contractor yards will be used to stage construction, store materials, and park equipment when not on-site. Construction equipment will be moved from the contractor yard and delivered to the construction right-of-way. Once on the right-of-way, construction equipment will move in a linear manner along the right-of-way as work progresses, minimizing traffic on local roads. The amount of equipment moved by hauling from site to site will be reduced due to the accessibility created by the construction right-of-way. Traffic control measures consistent with the WVDOT/VDOT and the USFS will be implemented to

further minimize impacts to traffic on roadways and park service roads, to assist with transportation of construction equipment and materials, and to provide for public safety. The construction contractors will post caution signs on roads, where appropriate, to alert motorists of pipeline construction and warn them of slow traffic caused by construction across roadways. Flaggers, signs, barricades, guardrails, safety fence, and/or signals will be placed and maintained at road crossings as required by Federal, State, or local permits. Flaggers will be equipped with high visibility green/yellow safety vests and stop/slow signs pursuant to WVDOT or VDOT standards will be used on each side of the road when equipment is working on or crossing over the road. Posted speed limits will be observed on all roads or as specified by the USFS.

7.7 SPECIFIC FEDERAL GUIDLEINES

7.7.1 U.S. Forest Service

The ACP will cross roads and utilize access roads on NFS lands in the MNF in West Virginia and the GWNF in Virginia. Traffic and transportation management and maintenance activities on these lands will conform to the standards and guidelines contained within the USDA Guidelines for Road Maintenance Levels and the LRMPs of the MNF and GWNF for road use, maintenance, and construction as well as WVDOT and VDOT standards where applicable. Potentially applicable federal standards and guidelines are listed below.

7.7.1.1 Monongahela National Forest Land and Resource Management Plan

- Roads shall be constructed to the standard appropriate to their intended use, considering safety and other resource concerns. (MNF LRMP RF04).

- Cooperators or permittees may be allowed to locate, design, and build special purpose roads on USFS lands. The USFS shall review all such locations and designs, and approve them where appropriate. Location and standards shall be coordinated with the needs for management and for protection of other resources. (MNF LRMP RF05).

- New road construction shall avoid wetlands where feasible. If a wetland cannot be avoided, road construction may be allowed as long as the subsurface drainage patterns can be preserved and maintained. Any road that would cross a wetland shall cross in a way that minimizes disturbance to the wetland. (MNF LRMP RF06).

- Where new roads cross streams or high-risk areas, disturbed soils shall be stabilized and designed drainage structures shall be installed as soon as practical. High-risk areas include landslide prone areas, steep slopes, and highly erosive. soils (MNF LRMP RF07).

- The process to determine road maintenance levels should evaluate the purpose of the road, the type of vehicles expected, the duration and frequency of use, and necessary environmental protection measures. (MNF LRMP RF11)

- Temporary roads may be constructed and used to provide for short-term management access needs. (MNF LRMP RF14)

- Temporary roads shall be rehabilitated and returned to productivity following their use. (MNF LRMP RF15).

- Vehicle use on closed roads by permittees, contractors, or other cooperators may be authorized to conduct official business or to perform resource management activities. (MNF LRMP RF20)

7.7.1.2 George Washington National Forest

- Roads shall be designed and constructed to the standard necessary to provide access and manage resources according to management prescription desired conditions and public safety. (GWNF LRMP FW-230).

- All new and reconstructed roads will blend into the landscape to the extent practical. (GWNF LRMP FW-232).

- Apply the level of maintenance needed to protect the investment, facilitate resource management, and provide for user safety. (GWNF LRMP FW-234).

- Closed system roads are planted with native or desirable non-native wildflowers, forbs, shrubs, and/or grasses. (GWNF LRMP FW-235).

- Specify management requirements for permittee access roads in the designated use permit, where roads are included in the authorization. (GWNF LRMP FW-248).

7.7.2 United States Department of Agriculture Guidelines for Road Maintenance Levels

- Maintenance prescription guidelines for roads level 1 through level 5

- Road Management Strategies

8.0 UPLAND EROSION CONTROL PLANS

8.1 PURPOSE

This Erosion and Sedimentation Control Plan (ESCP) has been prepared for use by Atlantic and its contractors as a guidance manual for minimizing erosion of disturbed soils and transportation of sediments off the construction ROW and into sensitive resource and residential areas during natural gas pipeline construction. The procedures developed in this plan, which represent Atlantic's BMPs, are designed to accommodate varying field conditions while achieving compliance with regulatory requirements and protecting environmentally sensitive areas.

This ESCP is designed to provide guidelines, BMPs, and typical techniques for the installation and implementation of soil erosion and sediment control measures while permitting adequate flexibility to use the most appropriate BMP measures based on site-specific conditions. The intent of the ESCP is to provide general information on the pipeline construction process and sequence, and to describe specific measures that will be employed during and following construction to minimize impacts to the environment.

The goal of the ESCP is to preserve the integrity of the construction area and environmentally sensitive areas and to maintain existing water quality by:

- Minimizing the extent and duration of disturbance;
- Diverting runoff to stabilized areas;
- Installing temporary and permanent erosion control measures; and
- Establishing an effective inspection and maintenance program.

All land-disturbing activities will conform, at a minimum, to the FERC Plan and Procedures. Atlantic will also prepare and comply with Stormwater Pollution Prevention Plans (SWPPP) that meet each state's requirements. The SWPPPs are currently being prepared. Atlantic will also prepare Construction Alignment Sheets depicting the locations of erosion and sediment controls in construction work areas, consistent with the FERC Plan and Procedures, as well as the West Virginia Department of Environmental Protection, Division of Water and Waste Management, *Erosion and Sediment Control Best Management Practice Manual*[7] (2006), the Virginia Department of Environmental Quality's *Virginia Erosion and Sediment Control Handbook* (VESCH) [8] (1992), Virginia's *Forestry Best Management Practices for Water Quality Technical Manual,* DTI's 2016 *Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management for Construction and Maintenance of Linear Gas Transmission Pipeline* (Standards and Specifications), and Dominion's Slip Avoidance, Identification, Prevention, and Remediation (SAIPR) Policy and Procedure Handbook (Attachment C).

In addition, the MNF and GWNF are managed under LRMPs issued in 2011 and 2014, respectively. The LRMPs are comprehensive planning documents designed to guide land management decisions within the National Forest boundaries. The LRMPs describe desired conditions and outline Management Prescriptions to be pursued to achieve those conditions.

The VDOF, *Virginia's Forestry Best Management Practices for Water Quality, Technical Manual,* 2011 was also consulted during selection of erosion and sediment control measures.

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[7] An online copy is available on the West Virginia Department of Environmental Protection website at https://apps.dep.wv.gov/dwwm/stormwater/BMP/index.html

[8] Hardcopy 1992 editions identify this as a Virginia Department of Conservation and Recreation document; the online version identifies this as a Virginia Department of Environmental Quality document.

Atlantic selected the more stringent or protective of the erosion and sediment control requirements set forth by FERC, West Virginia, Virginia, and the USFS to include in this ESCP. Consultation with USFS staff regarding specific control and restoration measures to be used in the MNF and GWNF is ongoing.

8.2 SOILS

An Order 1 Soil Survey (Survey) was performed between May 9 and June 22, 2016 along the available sections of the approximately 21.4-mile portion the route between MP 47 and MP 115. The Survey included approximately 5.2 miles of the route within the Marlinton Ranger District in the MNF, and 15 miles in the Warm Springs and North River Districts in the GWNF. Due to access restrictions associated with cultural resource clearance, a full Survey was not completed in an approximately 1.2 mile section of the route located near MP 155 and MP 156 in the GWNF Pedlar Ranger District.

The Survey activities were conducted in a manner compliant with the requirements outlined in special use permit #GBR205003for surveys in the MNF, and special use permit #GWP433201T for surveys in the GWNF.

8.2.1 Soil Survey

The Survey was conducted in four phases: (1) Desktop Study, (2) Preliminary Field Reconnaissance, (3) Team Training, and (4) Field Investigation. Background information was obtained during the desktop study to help identify the prevalent soil-landscape relationships across the proposed pipeline route within the Project area. The background information was also used by the soil scientist team to identify preliminary test pit locations and develop strategies for conducting the Survey. Preliminary GIS-generated maps were prepared for planning and field use. This section outlines the objectives and accomplishments of each phase. The Survey Report and results are found in Attachment G.

8.3 CONSTRUCTION WORK AREAS

Construction work areas include the construction right-of way (ROW), additional temporary work space, access roads, temporary pipe storage and contractor yards, and aboveground facilities.

8.3.1 Pipeline Right-of Way

For the AP-1 mainline, the construction corridor in non-agricultural uplands will measure 125 feet in width, with a 40-foot-wide spoil side and an 85-foot-wide working side. In areas where full width topsoil segregation is required (e.g., agricultural areas), an additional 25 feet of temporary construction workspace will be needed on the working side of the corridor to provide sufficient space to store topsoil. In wetlands, the width of the construction ROW will be reduced to 75 feet, with 25 feet on the spoil side and 50 feet on the working side. Over short distances and where topography allows, it may be possible to reduce the width of the corridor to a minimum of 75 feet in ecologically sensitive areas to minimize impacts. Atlantic will work with the USFS to determine where the width of the construction ROW can be reduced, and where the additional corresponding ATWS on each side of the narrowed section will be located. Following construction, a 53.5 foot-wide permanent easement will be maintained for operation of the pipeline.

During construction of the pipeline, the top width of the excavated pipe trench in most areas will typically range from 10 to 15 feet. This assumes that construction personnel will not be required to work in the trench, which is typical for most installations. In areas with steep terrain, construction personnel will be required to work in the trench to weld the pipeline. In these areas, the top of the trench will

typically be 30 feet wide to provide sufficient space for construction personnel to work in the trench safely. The additional spoil from excavation of a wider trench will be stockpiled in the temporary construction ROW and ATWS.

Refer to Attachment A for typical construction ROW diagrams showing general land-disturbing boundaries and construction techniques.

8.3.2 Additional Temporary Workspace

In addition to the construction ROW, ATWS will be required to stage construction activities and store equipment, materials, and spoil at wetland, waterbody, and road crossings. ATWS will also be required in areas with steep side slopes or where special construction techniques are implemented as well as at tie-ins with existing pipeline facilities, utility crossings, truck turnaround areas, and spread mobilization/de-mobilization areas.

ATWS measuring 50 by 150 feet will typically be required on both sides of the corridor and both sides of the crossing at wetlands, waterbodies measuring greater than 10 feet in width, two lane roads, and railroads. ATWS measuring 25 by 100 feet will typically be required on both sides of the corridor and both sides of the crossing at waterbodies measuring less than 10 feet in width and single lane roads. Consistent with the LRMPs, ATWS will be set back 100 feet from in-stream waterbody crossings on NFS lands.

8.3.3 Access Roads

Atlantic has identified roads to be used to provide access to the ROW during construction and operation of the Project. Atlantic will mostly utilize existing roads, but three new roads are proposed to be constructed on NFS lands (see Section 2.1.1.4). Some existing roads will require improvement (such as grading, gravelling, replacing or installing culverts, minor widening, and/or clearing of overhead vegetation) to safely accommodate construction equipment and vehicles.

8.4 CRITICAL AREAS

Atlantic developed and implemented the Slip Avoidance, Identification, Prevention, and Remediation - Policy and Procedure (SAIPR) in August of 2015 to avoid, minimize, and mitigate potential landslide issues in slip prone areas prior to, during, and after construction. The SAIPR (Attachment C) includes considerations for slips associated with pipeline construction during routing, engineering design, preconstruction planning, construction, and post construction.

8.4.1 Steep Terrain

Atlantic recognizes the increased risk in slips associated with pipeline construction particularly while traversing steep slopes. Special construction procedures and erosion and sediment control measures will be used in steep terrain areas, as described in Section 8.7.2. Additionally, Atlantic has developed and implemented a BIC Program to proactively manage construction and operation in steep slope areas, as described in Section 8.7.2.

Atlantic will:

- ensure that the erosion and sediment control measures in West Virginia are in compliance with an approved SWPPP or the *West Virginia Erosion and Sediment Control Best Management Practice Manual*;

- conduct monthly inspections to assess potential concerns and document and remediate identified slope failures;
- complete a geotechnical analysis to evaluate the causes of past slope failures along its pipeline rights-of-way;
- identify procedures and measures to identify, prevent, contain, and remediate slope failures; and
- develop and implement policy and procedures to address slip prone areas.

8.4.2 Karst Geological Formations

A Karst Terrain Assessment, Construction, Monitoring and Mitigation plan was developed for the proposed Project and is located in Attachment H.

8.4.3 Waterbodies and Wetlands

A Stream and Wetland Crossing Procedure Plan was developed for the proposed Project and is located in Section 9 of this COM Plan.

8.5 EROSION AND SEDIMENT CONTROL MEASURES

Cross-country pipeline construction typically proceeds in assembly line fashion, with multiple stages of construction occurring simultaneously at different locations to minimize the time needed to complete the Project. The stages of construction include survey and flagging, clearing and mowing, grubbing and grading, trenching, pipe assembly (including stringing, bending, welding, testing, coating, and lowering-in), backfilling, hydrostatic testing, final grading, and restoration. The locations of the erosion and sediment control measures to be installed for each of these stages are described below. Detailed typical drawings of general erosion and sediment control measures are provided in Attachment I, and are also shown on the Construction Alignment Sheets in Attachment A.

8.5.1 Site Preparation

- Survey and flag the construction ROW and mark environmentally sensitive areas;
- Install rock access pads during grading;
- Conduct initial clearing, limited to that necessary to install temporary sediment barriers;
- Install all perimeter BMPs immediately after any bulk earth-moving activity;
- Conduct progressive clearing with installation of temporary sediment barriers and temporary equipment bridges keeping pace with clearing;
- Modify access roads by grading and installing stone where needed;
- Grade the ROW, and segregate topsoil where necessary; and
- Install temporary slope breakers, also referred to as interceptor dikes, also called temporary ROW diversions or water bars, as needed to reduce runoff velocity and divert water off the construction ROW.

8.5.2 Pipe Installation

- Excavate new trench to accommodate new/replacement pipeline segment;
- String pipe, bend the pipe joints;
- Weld the pipe, inspect welds;
- Lower the pipe into the trench;
- Install permanent trench plugs;
- Backfill the trench;
- Install hydrostatic test dewatering structures;
- Hydrostatically test the pipe and dewater;
- Bring the pipeline to gas service;
- Final grade ROW and temporary workspaces to original contours to the extent practicable;
- Install permanent interceptor dikes; and
- Replace segregated topsoil.

8.5.3 Restoration

- Conduct ROW restoration and cleanup. As soon as slopes, channels, ditches, and other disturbed areas reach final grade, they must be stabilized;
- Apply soil amendments, permanent seed, mulch and/or erosion control fabric;
- Restore temporary access roads or any paved surfaces to original condition; and
- Remove temporary sediment barriers from an area when replaced by permanent erosion control measures or when the area has been successfully restored to uniform 70% perennial vegetation. Temporary erosion control BMPs will not be removed until inspection by the EI to confirm site stabilization.

8.5.4 Survey and Flagging

- The limits of the approved work areas, boundaries of environmentally sensitive areas, and the location of the facilities must be marked in the field prior to the start of mechanized activities. Environmentally sensitive areas are those that are more susceptible to serious erosion problems and thus may require enhanced erosion and sediment control measures. Examples of such areas may include steep slopes and sinkholes down-gradient of Project activities. Examples of specialized controls that may be used in these areas include specialized pipeline construction methods that combine several construction stages, thereby reducing earth disturbance.

- The limits of approved work areas (i.e. the construction ROW, temporary and ATWS, and staging areas) will be established and visibly marked before clearing. The locations of approved access roads will be flagged and marked with signs.

- Signs and highly visible flagging will also be used to mark the boundaries of sensitive resource areas, including waterbodies and wetlands, and/or areas with special requirements along the construction work area, in accordance with the Construction Alignment Sheets. Orange plastic fencing may be more useful than flagging to assure that equipment operators stay out of critical areas. Only unavoidable work should take place within critical areas and their buffers.

- Safety fencing will be installed as needed during grading at public access points or around open unattended excavations to warn pedestrians of possible hazards. In addition, lights, signs and other warnings are required at road entrances and road crossings (see West Virginia or VDOT permits and regulations).

- Safety fencing may also be used to identify sensitive areas to be protected during construction or to highlight hazards along the ROW (e.g., a single-strand electric fence). Safety fencing may not be substituted for wire fencing in active pastures.

- Flagging or marking shall be maintained throughout construction.

- Other large diameter trees on the edge of the construction rights-of-way and ATWS areas will be flagged by EIs to save/protect as green recruitment or habitat/shade trees, where feasible.

Virginia Requirements

Refer to Virginia E&S Handbook for further details on the following requirement:

- Per Virginia Standard & Spec 3.38 (Tree Preservation and Protection), at a minimum the limits of clearing shall be located outside the drip line of any tree to be retained. In addition, heavy equipment, vehicular traffic, or stockpiles shall not be permitted within the drip line of any tree to be retained.

8.5.5 Construction Entrance

A construction entrance will be constructed at any point where construction equipment leaves the ROW and enters a paved public road or other paved surface. Typically, a construction entrance is comprised of filter fabric overlain by 6 inches of coarse aggregate extending a minimum of 70 feet from the edge of the pavement. It must extend the full width of the vehicular ingress and egress area and have a minimum 12-foot width. Conveyance of surface water through culverts under the entrance shall be provided, as necessary.

The construction entrance must function to remove mud from vehicles and equipment leaving the ROW. As mud accumulates on the entrance, clean stone must be added or the tire mats lifted and shaken to remove mud. Any mud that is carried onto the pavement must be thoroughly removed by the end of the day by shoveling or sweeping. The mud will be returned to the ROW. The use of water to remove sediment tracked onto roadways is not permitted.

If the majority of the mud is not removed by the vehicles traveling over the stone, then tires of the vehicles must be washed before entering the public road.

Maintenance of the construction entrance may require periodic top dressing with additional stone and cleanout of any structures used to trap sediment. If any inadvertently sediment tracking occurs on the public roadway, the road shall be cleaned thoroughly by the end of each day.

8.5.6 Clearing and Mowing

Clearing operations include the removal of vegetation within the construction ROW. Various clearing methods are employed depending on tree size, contour of the land, and the ability of the ground to support clearing equipment. Vegetative clearing can be accomplished either by hand or by cutting equipment. The Timber Removal Plan(Section 4) provides additional information regarding timber removal.

- All construction activities and ground disturbance will be confined to within the construction ROW shown on the Construction Alignment Sheets;
- All brush and trees will be felled into the construction ROW to minimize damage to trees and structures adjacent to the ROW. Trees that inadvertently fall beyond the edge of the ROW will be immediately moved onto the ROW and disturbed areas will be immediately stabilized, per landowner approval;
- Slash will be ground up and used as mulch, hauled to an approved disposal site, or burned.
- All stumps excavated from the trench line that cannot be ground to mulch onsite will be placed along the edge of the construction rights-of-way or in temporary extra workspaces. Stumps will be hauled from the extra workspaces to an approved disposal site, used on the ROW for restoration purposes, burned, or disposed of according to land managing agency or landowner specifications.
- Existing surface drainage patterns shall not be altered by the placement of timber or brush piles at the edge of the construction ROW.
- Where ground skidding is used, the following measures will be implemented to minimize soil disturbance:
    - Low ground weight (pressure) vehicles will be used, where feasible.
    - The removal of soil duff layers will be avoided to maintain a cushion between the soil, logs, and logging equipment.
    - Designed skid trails will be used to restrict detrimental soil disturbance (e.g., compaction and displacement) to a smaller area of the rights-of-way over the pipeline trenching area.
- Erosion and sediment control measures shall be installed immediately following mechanized clearing of trees, brush and vegetation.

8.5.7 Install Temporary Sediment Barriers and Diversions

Sediment barriers, which are temporary sediment controls intended to minimize the flow and deposition of sediment beyond approved workspaces or into sensitive resource areas, shall be installed following vegetative clearing operations. The primary sediment barrier methods to be used on the ACP Project will include silt fencing, temporary diversion dikes, and sediment traps. Sediment traps, perimeter dikes, sediment barriers and other measures intended to trap sediment shall be constructed as a first step in any land-disturbing activity and shall be made functional before upslope land disturbance takes place. General requirements are as follows:

- Install temporary sediment barriers at the base of slopes greater than 5% where the base of the slope is less than 50 feet from a road crossing, waterbody and/or wetland until revegetation is complete. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition. For silt fencing, an effort should be made to locate the fencing at least 5 feet to 10 feet beyond the toe of the slope.

- Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as shown on the construction alignment sheets.

- Inspect temporary sediment barriers daily in areas of active construction to ensure proper functioning and maintenance. In other areas with no construction or equipment operation, sediment barriers will be inspected and maintained on a weekly basis throughout construction.

- Sediment removed from erosion controls will be disposed by adding to existing onsite soil stockpiles and stabilizing, or will be reused onsite within the construction ROW and outside of any wetlands, streams or riparian areas.

- Maintain all temporary sediment barriers in place until permanent revegetation measures are successful or the upland areas adjacent to wetlands, waterbodies, or roads are stabilized.

8.5.7.1 West Virginia Requirement

Refer to West Virginia BMP Manual for further details for the following requirement:

- Remove temporary sediment barriers from an area when replaced by permanent erosion or sediment control measures or when the area has been successfully restored to uniform 70% perennial vegetation.

8.5.7.2 Virginia Requirement

Refer to Virginia E&S Handbook for further details for the following requirement:

- Remove temporary sediment barriers from an area when replaced by permanent erosion or sediment control measures or when the area has been successfully restored to perennial vegetation. Permanent vegetation shall not be considered established until a ground cover is achieved that is uniform, mature enough to survive and will inhibit erosion.

8.5.8 Silt Fencing

The following specifications can be found in the DEQ Virginia Erosion & Sediment Control Field Manual and are consistent with the FERC Plan and Procedures.

- Silt Fencing constructed of synthetic filter fabric stretched across and attached to supporting posts, and in some cases a wire support fence, will be placed across or at the toe of a slope or in a minor drainage way to intercept and detain sediment and decrease flow velocities from drainage areas of limited size. Silt fencing is applicable where sheet and rill erosion or small concentrated flows may be a problem.

- Silt fencing will be used where the size of the drainage area is not more than one quarter acre per 100 feet of silt fence length; the maximum slope length behind the barrier is 100 feet; and the maximum gradient behind the barrier is 50% (2:1).

- Silt fencing can be used in minor swales or ditches where the maximum contributing drainage area is no greater than 1 acre and flow is no greater than 1 cubic feet per second. In ditches or swales where higher velocity flow is expected, rock check dams should be used in place of silt fence.

- Silt fencing will not be used in areas where rock or some other hard surface prevents the full and uniform depth anchoring of the barrier.

- Wooden stakes must have a minimum length of 5 feet. Fabric shall not be stapled to existing trees.

- Steel posts shall be placed a maximum of 6 feet apart.

- The height of the fence shall be a minimum of 16 inches above grade and shall not exceed 34 inches above ground elevation.

- Filter cloth shall be spliced together only at support posts with a minimum 6-inch overlap.

- A trench shall be excavated approximately 4-inches wide and 4-inches deep on the upslope side of the proposed location of the measure.

- When wire support is not used, extra-strength filter fabric shall be fastened to the upslope side of the posts using one inch long (minimum) heavy-duty wire staples or tie wires and the fabric shall be extended into the trench. The posts shall be placed a maximum of 6 feet apart.

- When wire support is used, the wire mesh fence must be fastened securely to the upslope side of the posts using heavy duty wire staples at least one inch long, tire wires or hog rings. The wire shall extend into the trench. The posts shall be placed a maximum of 10 feet apart.

- If silt fence is to be constructed across a ditch line or swale, the measure must be of sufficient length to eliminate end flow and the configuration shall resemble an arc with the ends oriented upslope.

- The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric.

- Remove accumulated sediments when sediment reaches ½ the above-ground height of the fence.

8.5.9 Temporary Diversion Dike

A temporary ridge of compacted soil constructed at the top of a sloping disturbed area will be used to divert stormwater runoff from upslope drainage areas away from the unprotected slope. Temporary diversion dikes can also be constructed at the base of a slope to protect adjacent and downstream areas by diverting sediment-laden runoff from a disturbed area to a sediment-trapping control measure. A temporary diversion dike is a good choice when the control limits of a silt fence are exceeded. The temporary diversion dike must be installed as a first step in the land-disturbing activity at locations shown on the Construction Alignment Sheets and must be functional prior to upslope land disturbance.

- The maximum allowable drainage area is 5 acres.

- The channel behind the dike shall have a parabolic or trapezoidal cross-section shape to avoid high velocity flow which could arise in a v-shaped ditch. The channel will have a positive grade to a stabilized outlet.

- The diversion dike and channel will be stabilized immediately following installation with temporary or permanent vegetation. Where channel slope is greater than 2%, Rolled Erosion Control Product (RECP) will be used to stabilize soil until vegetation is established.

- The temporary diversion dike will be inspected and repairs made to the dike, flow channel, outlet or sediment trapping area, as necessary. Once every day in active construction areas, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed. Damages caused by construction traffic or other activity must be repaired before the end of each working day.

8.5.9.1 West Virginia Requirements

Refer to West Virginia BMP Manual for detailed specifics on the following requirements.

- Temporary (less than 6 months) diversions must be designed to handle peak discharge from a 2-year/24-hour storm.

- The side slopes shall be no steeper than 2:1

- The design shall include a 10% settlement factor.

8.5.9.2 Virginia Requirements

Refer to Virginia E&S Handbook for detailed specifics on the following requirements.

- The minimum height measured on the upslope side of the dike is 18 inches.

- The dike should be compacted to prevent failure and have side slopes 1.5:1 or flatter with a minimum base width of 4.5 feet.

8.5.10 Temporary Sediment Trap

A temporary ponding area formed by constructing an earthen embankment with a stone outlet may be used to detain sediment-laden runoff from small disturbed areas (where total drainage area is less than three acres) to allow sediment to settle out prior to discharge. The sediment trap may be constructed either independently or in conjunction with a temporary diversion dike as a suitable option for outlet control. The temporary sediment trap must be installed as a first step in the land-disturbing activity at locations shown on the Construction Alignment Sheets and must be functional prior to upslope land disturbance.

- The maximum useful life of a temporary sediment trap is 18 months. Traps will be replaced should the construction period exceed 18-months.
- The total contributing drainage area to a sediment trap is less than 3 acres
- The sediment trap must be designed to have an initial storage volume of 134 cubic yards per acre of drainage area with a minimum 2:1 length to width ratio, if possible.
- Side slopes of the excavated area should be no steeper than 1:1 and the maximum depth of excavation within the wet storage area should be 4 feet.
- Outlet requirements include a combined coarse aggregate/riprap stone section of the embankment. Filter cloth shall be placed at the stone-soil interface. The length of the stone outlet will be detailed on the Construction Alignment Sheets (Attachment A) and will be designed at 6 feet times the total drainage area in acres. The crest of the stone outlet must be at least 1.0 foot below the top of the embankment.
- The maximum height of the embankment shall be 5 feet measured to the base of the stone outlet. Side slopes of the embankment shall be 2:1 or flatter.
- Fill material shall be free of roots or other woody vegetation, large stones, or organic matter and compacted in 6-inch lifts.
- The temporary sediment trap will be stabilized immediately following installation with temporary or permanent vegetation.
- Remove accumulated sediments when sediment reaches ½ the design storage volume. Sediment removed will be deposited in a disturbed area in a manner that it will not erode and cause sedimentation problems.
- Stone will be replaced if it becomes choked with sediment.

8.5.10.1 West Virginia Requirements

Refer to West Virginia BMP Manual for further details for the following requirement:

- The sediment trap should have a storage volume of 3600 cubic feet per acre of drainage area. (WV BMP 3.29).

8.5.10.2 Virginia Requirements

Refer to Virginia E&S Handbook for further details for the following requirement:

- Outlet requirements include a combined coarse aggregate/riprap stone section of the embankment (VDOT #3, #357 or #5 Coarse Aggregate and Class I riprap). The length of the stone outlet will be detailed on the Construction Alignment Sheets (Attachment A).

8.5.11 Grubbing and Grading

The construction ROW will be graded as needed to provide a level workspace for safe operation of heavy equipment used in pipeline construction. The following procedures will be standard practice during grading.

8.5.12 Topsoil Segregation

During construction, topsoil and subsoil will be disturbed by grading of the ROW, trench excavation, and by heavy equipment moving along the ROW. Atlantic will conduct topsoil segregation in accordance with the FERC Upland Erosion Control, Revegetation and Maintenance Plan.

Topsoil segregation methods will be used in all residential areas (except where the topsoil is being replaced), wetlands (except areas where standing water is present or soils are saturated), cultivated or rotated croplands, managed pastures, hayfields, and other areas at the landowner's or land managing agency's request. In areas where full width topsoil segregation is required, an additional 25 feet of temporary construction workspace would be needed on the working side of the corridor to provide sufficient space to store topsoil. Because of the increased need for additional ROW width and loss of additional forestland, and need to remove stumps, which would increase topsoil mixing with subsoil and the increase the potential for erosion, topsoil segregation is generally not conducted in forested areas.

Either the "ditch plus spoil side" or the "full ROW" segregation method would be used where topsoil segregation is necessary.

In areas where topsoil segregation is performed on the MNF and GWNF, the O and A horizons will be segregated from the transition soil horizons AB/ BA. O horizon soils are defined as a soil layer containing a high percentage of organic matter. A horizon soils are defined as the dark subsoil below the O horizon. AB/BA horizon soils are defined as light colored subsoils located below the O and A horizons.

- 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).
- Segregate at least 12 inches of topsoil in deep soils with more than 12 inches of topsoil. In soils with less than 12 inches of topsoil, make every effort to segregate the entire topsoil layer.
- Within wetlands, segregate the top 12 inches of topsoil within the trenchline, except in areas where standing water is present or soils are saturated.
- Maintain separation of salvaged topsoil and subsoil throughout all construction activities.
- Leave gaps in the topsoil piles and spoil piles for the installation of temporary slope breakers to allow water to be diverted off the construction ROW.

- Never use topsoil for padding the pipe, constructing temporary slope breakers, trench breakers or trench plugs, improving or maintaining roads, or as a fill material.
- Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, or functional equivalents.
- Topsoil operations (stripping and replacement) should not be performed when the soil is excessively wet or frozen.
- All perimeter dikes, berms, sediment basins, and other sediment controls shall be in place prior to stripping. These practices must be maintained during topsoiling.
- Side slopes of the stockpile shall not exceed 2:1.
- Perimeter controls must be placed around the stockpile immediately.
- Prior to dumping and spreading topsoil, the subgrade shall be loosened by discing or scarifying to a depth of at least 4 inches to ensure bonding of the topsoil and subsoil.
- Topsoil shall be uniformly distributed to a minimum compacted depth of 2 inches on 3:1 slopes or steeper slopes and 4 inches on flatter slopes.

8.5.12.1 West Virginia Requirements

Refer to West Virginia BMP's Handbook for detailed information for the following requirements:

- Seeding of stockpile shall be completed within 7 days of the formation of the stockpile if it is to remain dormant for longer than 21 days in accordance with West Virginia Std & spec 3.10 (Temporary Seeding). Stabilization of stockpiles with a temporary cover (i.e. mulch) in accordance with West Virginia Std & spec 3.12 (Mulching) is also acceptable.
- In areas which are not going to be mowed, the surface should be left rough by not fine grading in accordance with West Virginia Std &Spec 3.08 (Surface Roughening).

8.5.12.2 Virginia Requirements

Refer to Virginia E&S Handbook for detailed information for the following requirements:

- Seeding of stockpile shall be completed within 7 days of the formation of the stockpile if it is to remain dormant for longer than 14 days in accordance with Virginia Std & Spec 3.31 (Temporary Seeding) and Minimum Standard #1 and #2. Stabilization of stockpiles with a temporary cover (i.e. mulch) in accordance with Virginia Std & Spec 3.35 (Mulching) is also acceptable.
- In areas which are not going to be mowed, the surface should be left rough by not fine grading in accordance with Virginia Std &Spec 3.29 (Surface Roughening).

8.5.13 Rock Management

Rock, including blast rock, will be used, removed or disposed of in one of the following ways:

- 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 material or waste, unless approved for use as mulch or for some other use on the construction work areas by the land owner or land managing agency);
- Windrowed on the edge of the ROW per AO approval;
- Used to create wildlife habitat as directed by the AO;
- Burying of large rock within the construction ROW;
- Removed and disposed of at an authorized disposal site;
- Used as riprap for streambank stabilization as allowed by applicable regulatory agency(ies) and provided the rock is uncontaminated and free of soil and other debris.

8.5.14 Temporary Slope Breakers

Temporary slope breakers, also called temporary ROW diversions and water bars, are temporary erosion control measures intended to reduce runoff velocity and divert water off the construction ROW. Temporary slope breakers may be constructed of materials such as compacted soil, silt fence, or sand bags. Segregated topsoil may not be used for constructing temporary slope breakers.

- Install temporary slope breakers on all disturbed areas as necessary following topsoil removal and grading operations to avoid excessive erosion. Unless otherwise specified by permit conditions, temporary slope breakers must be installed on slopes at the recommended spacing interval indicated below.
- The temporary diversion should be constructed across the disturbed portion of the ROW;
- Positive grade with less than 2% slope should be provided to a stabilized outlet; steeper grading may be utilized as necessary to promote positive drainage.
- Direct the outfall of each slope breaker to a stable, well vegetated area or construct an energy-dissipating device (silt fence, staked straw bales, erosion control fabric) at the end of the slope breaker.
- Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive resource areas.
- Each diversion should exit onto stabilized ground. It should never exit onto the ROW where it can run down to the next diversion.
- Install temporary slope breakers on slopes greater than 5% where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings.
- Side slopes should be 2:1 or flatter to allow the passage of construction traffic, along with a minimum base width of 6 feet.

- Inspect temporary slope breakers daily in areas of active construction to insure proper functioning and maintenance. In other areas, the slope breakers will be inspected and maintained on a weekly basis throughout construction, and following every rainfall.

- Slope breakers which will not be subject to construction traffic should be stabilized with temporary seeding.

8.5.14.1 West Virginia Requirements

Refer to West Virginia BMP Manual for detailed specifics on the following requirements.

- Closer spacing may be used if determined necessary by the EI. The WV BMP Manual spacing requirements are recommended since they are more stringent than FERC Plan requirements (see Table 8.5.5-1):

TABLE 8.5.5-1

Recommended Spacing and Materials for Permanent Slope Breakers [a]
(WV BMP Manual Std & spec 3.18)

Trench Slope	Distance (feet)
Less than 5%	300
10%	175
15%	125
20%	100
Greater than 25%	75

[a] Slope breaker spacing in areas of steep terrain may be decreased as a result of the steep slopes BIC Program described in Section 2.1.9.5. Accordingly, this table may be revised to reflect more stringent spacing requirements.

8.5.14.2 Virginia Requirements

Refer to Virginia E&S Handbook for detailed information for the following requirements:

- Closer spacing may be used if determined necessary by the EI. The VESCH spacing requirements are recommended since they are more stringent than FERC Plan requirements (see Table 8.5.5-2):

TABLE 8.5.5-2

Recommended Spacing and Materials for Permanent Slope Breakers [a]
(VESCH Std & Spec 3.11)

Trench Slope	Distance (feet)
Less than 7%	100
7–25%	75
25–40%	50
Over 40%	25

[a] Slope breaker spacing in areas of steep terrain may be decreased as a result of the steep slopes BIC Program described in Section 2.5.6. Accordingly, this table may be revised to reflect more stringent spacing requirements.

8.5.15 Timber Mat Stabilization

Atlantic utilizes construction timber mats to provide access through areas such as wetlands and waterbodies, some agricultural fields, and other areas as determined by the Construction Supervisor. This practice reduces soil compaction and provides a stable travel lane for contractors along the Project ROW, thus minimizing land disturbance. This practice may be incorporated in addition to the WV BMP and VESCH practices and requirements.

The use of construction timber mats generally does not constitute soil disturbance or a change in hydrology. Therefore, the installation of timber mat access roads and work pads is not considered a regulated land-disturbing activity and these areas are generally not included in land disturbance area calculations.

8.5.16 Temporary Stabilization

West Virginia Requirements

When acceptable final grade cannot be achieved (e.g. during winter or early spring construction), when permanent seeding cannot be applied due to adverse soil and weather conditions, or any time an area will remain idle for more than 21 days, temporary stabilization (temporary seed, mulch, additional sediment barriers as directed by the EI) must be applied within seven (7) days to that area. Erosion and sediment control measures will be monitored and maintained until conditions improve and final restoration can be completed.

Virginia Requirements

When acceptable final grade cannot be achieved (e.g. during winter or early spring construction), when permanent seeding cannot be applied due to adverse soil and weather conditions, or any time an area will remain idle for more than 14 days, temporary stabilization (temporary seed, mulch, additional sediment barriers as directed by the EI) must be applied within seven (7) days to that area. Erosion and sediment control measures will be monitored and maintained until conditions improve and final restoration can be completed.

The seed mixtures and application rates, seeding dates, soil amendment recommendations, and planting recommendations are currently pending additional consultation with the USFS staff.

8.5.17 Trenching

The trench centerline will be staked after the construction ROW has been prepared. In general, a trench will be excavated to a depth that will permit burial of the pipe with a minimum of 3 feet of cover.

The following procedures will be standard practice during ditching:

- Flag drainage tiles damaged during ditching activities for repair;
- Place spoil in additional extra work areas or at least 10 feet away from the waterbody's edge in the construction ROW. Spoil will be contained with erosion and sediment control devices to prevent spoil materials or sediment-laden water from transferring into waterbodies and wetlands or off of the ROW;

- If temporary erosion or sediment controls are damaged or removed during trenching, they shall be repaired and/or replaced before the end of the work day;

- Excavated material shall be placed on the uphill side of trenches.

8.5.18 Trench Breakers

Permanent sacks of sand, polyurethane foam, bentonite clay, or possibly cement (in areas of steep terrain) bags installed around the pipe will remain in the trench to prevent subsurface channeling of water along the trench. Topsoil will not be used in trench breakers. Trench breakers are not employed in trenchless pipeline construction such as HDD or for non-linear facilities (e.g. compressor stations, M&R stations).

The need for and spacing of trench breakers will be indicated on the Construction Alignment Sheets (Attachment A). Trench breakers will be installed at the same spacing as and upslope of permanent slope breakers.

Permanent trench breakers will be installed 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.

Trench breakers must be installed at wetland boundaries or the trench bottom must be sealed, as specified in the Procedures. Trench breakers will not be installed within a wetland.

8.5.19 Trench & Site Dewatering

Dewatering may be periodically conducted to remove accumulated groundwater or precipitation from the construction ROW, including from within the trenchline. The need for erosion controls as well as the type of control used will vary depending on the type and amount of sediment within the water, and volume and rate of discharge.

8.5.20 Dewatering Filter Bag

No discharge of hydrostatic test water is planned on NFS lands. However, trench dewatering on NFS lands may be necessary at locations along the pipeline, for example, if a high water table is encountered. Atlantic utilizes filter bags for dewatering and velocity reduction on a majority of pipeline construction Project in accordance with the dewatering practices illustrated in the WV BMP Manual (Std. & Spec. 3.22 Dewatering) and VESCH (Std. & Spec. 3.26 Dewatering Structure). Design criteria and specifications vary by dewatering bag manufacturer. A variety of filtering dewatering bag products are available on the market. All manufacturers' guidance on the use, design, sizing, maintenance and application of the geotextile dewatering bag shall be followed.

- Conduct dewatering (on or off the construction ROW) in such a manner that does not cause erosion and does not result in heavily silt-laden water flowing into any waterbody, wetland, or off-site property.

- Elevate and screen the intake of each hose used to withdraw the water from the trench to minimize pumping of deposited sediments.

- Remove dewatering structures as soon as practicable after the completion of dewatering activities.

8.5.15.1 Virginia Requirements

Refer to Virginia E&S Handbook for detailed information for the following requirements:

- If discharging to a well-vegetated area, per VESCH Std. & Spec 3.26, a minimum filtering lengths will be available in order for such a method to be feasible.

8.5.21 Pipe Installation

During all phases of the pipe installation process, ensure that all roadway crossings and access points are safe and accessible conditions. Repair damaged temporary erosion controls by the end of the work day. If portions of slope breakers are removed from the travel lane to facilitate safe work conditions, they shall be restored prior to the end of the work day. Pipe installation will commence according to Atlantic construction and implementation plans and generally consists of stages such as stringing and bending, welding, and lowering-in and tie-ins.

8.5.22 Backfilling

Backfilling consists of covering the pipe with the earth removed from the trench or with other fill material hauled to the site when the existing trench spoil is not adequate for backfill. Backfilling will follow lowering-in of the pipeline as close as is practical.

In areas where the trench bottom is irregularly shaped due to consolidated rock or where the excavated spoil materials are unacceptable for backfilling around the pipe, padding material may be required to prevent damage to the pipe. This padding material will generally consist of sand, crushed limestone, or screened spoil materials from trench excavation. Material used for backfilling trenches shall be properly compacted in order to minimize erosion and promote stabilization.

8.5.23 Hydrostatic Testing

While hydrostatic testing will occur on all pipeline sections of the Project, including those of NFS lands, there will be no hydrostatic test water appropriations or test water discharges on NFS lands.

8.5.24 Restoration and Final Cleanup

Restoration of the ROW will begin after pipeline construction activities have been completed. Restoration measures include the re-establishment of final grades and drainage patterns as well as the installation of permanent erosion and sediment control devices to minimize post-construction erosion. Property shall be restored as close to its preconstruction condition as practical unless otherwise specified by the landowner. All temporary ESC measures shall be removed within 30 days after final site stabilization or after the temporary measures are no longer needed.

- The Contractor shall make every reasonable effort to complete final cleanup of an area (including final grading, topsoil replacement and installation of permanent erosion control structures) within 20 days after backfilling the trench in that area (within 10 days in residential areas). If seasonal or other weather conditions prevent compliance with these timeframes, continue to inspect and maintain temporary erosion and sediment controls (i.e. temporary slope breakers, sediment barriers, and mulch) until conditions allow completion of cleanup.

- As soon as slopes, channels, ditches, and other disturbed areas reach final grade, they must be stabilized. The disturbed ROW will be seeded as soon as possible and within no more than 7 days of final grading, weather and soil conditions permitting.

- Grade the ROW to pre-construction contours, with the exception of the installation of any permanent measures required herein.

- Grading practices such as stair-stepping or grooving slopes or leaving slopes in a roughened condition by not fine-grading will be used on all slopes steeper than 3:1 in accordance with West Virginia Standard & Specification 3.08 (Surface roughening) and Virginia Standard and Specification 3.29 (Surface roughening) on all slopes steeper than 3:1 or that have received final grading but will not be stabilized immediately.

- Spread segregated topsoil back across the graded ROW to its original profile.

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

- A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion and sediment control structures are installed, regularly inspected and maintained. When access is no longer required, the travel lane must be removed and the ROW restored.

- Remove all construction debris (used filter bags, skids, trash, etc.) from all construction work areas unless the landowner or land managing agency approves leaving material onsite for beneficial reuse, stabilization, or habitat restoration. Grade or till the ROW to leave the soil in the proper condition for planting.

- For construction activities occurring in winter, conditions such as frozen soils or snow cover could delay successful soil compaction mitigation or seeding activities. In these conditions, Atlantic will follow its *Winter Construction Plan* (Attachment D) and resume clean-up and restoration efforts the following spring. Atlantic will monitor and maintain temporary erosion controls (e.g., temporary slope breakers, sediment barriers, or mulch) until conditions allow for completion of cleanup and installation of permanent erosion control structures.

8.5.15.2 West Virginia Requirements

Refer to West Virginia BMP Manual for detailed information for the following requirements:

Final site stabilization means that all soil-disturbing activities are completed, and that either a permanent vegetative cover with a density of 70% or greater has been established or that the surface has been stabilized by hard cover such as pavement or buildings. It should be noted that the 70% requirement refers to the total area vegetated and not just a percent of the site.

8.5.15.3 Virginia Requirements

Refer to Virginia E&S Handbook for detailed information for the following requirement.

Permanent vegetation shall not be considered established until a ground cover is achieved that is uniform, mature enough to survive and will inhibit erosion.

8.5.25 Permanent Slope Breakers

Permanent slope breakers will be installed during final grading, where required, to slow runoff velocity and direct water off the ROW and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, stone, or some functional equivalent.

- Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, unless requested by the landowner, using spacing shown on the Construction Alignment Sheets.
- Spacing for permanent slope breakers will be the same as temporary slope breakers described in Section 9.1.5.3
- Construct permanent slope breakers with a minimum of a 2 to 8 percent outslope to divert surface flow to a stable vegetative area without causing water to pool or erode behind the slope breaker; steeper grading may be utilized as necessary to promote positive drainage. In the absence of a stable vegetative area, install an energy-dissipating device at the end of the breaker.
- Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction ROW to effectively drain water off the disturbed area. Where permanent breakers extend beyond the edge of the construction ROW, they are subject to compliance with all applicable survey and permit requirements.
- Where drainage is insufficient in upland areas, install a rock-lined drainage swale as approved by the EI. The drainage swale is generally 8 feet wide and a maximum of 18-24 inches deep.

8.5.26 Soil Stabilization Blankets and Matting

Erosion control fabric or blankets are used during restoration, including as mulch, to slow down stormwater and stabilize soil until vegetation becomes established. Care will be taken to avoid areas of steep slopes as much as practical; however, areas which could not be avoided will be addressed with slope breakers and RECP. RECPs must be consistent with WV BMP Manual Standard and Specification 3.13 for RECPs and VESCH Standard and Specification 3.36 for Soil Stabilization Blankets and Matting. RECPs are also suitable as an effective vegetation stabilization technique on waterbody banks, vegetated channels, and the swale side of permanent slope breakers where moving water is likely to wash out new plantings.

- As shown on the detail drawings, soil stabilization blankets must be installed vertically downslope on steep slopes and on shallow slopes the mats can be installed across the slope.
- Slope surface must be smooth with minimum rocks, lumps, grass and sticks such that the blanket can be placed flat on the surface for uniform soil contact.

- Seed is applied to the graded slope prior to installation of the blanket. Seed should be lightly raked into the soil;
- The blanket will be rolled from the top of the slope or top of the channel downgradient toward the toe of the slope or channel outlet and keyed into a minimum 6 inch deep trench at the top of the slope.
- Upslope ends will be buried in an anchor slot not less than 6-inches deep and tamped to firmly embed the material.
- The blankets will be anchored with staples or other appropriate devices in accordance with the manufacturers' recommendations.
- On highly erodible soils and on slopes steeper than 4:1, erosion check slots may be made by inserting a fold of a separate piece of material into a 6-inch trench and tamping firmly. Staple the fold to the main blanket at minimum 12-inch intervals across the up-gradient and down-gradient portion of the blanket. The need for and spacing of check slots will based on manufacturers' recommendations.
- The terminal end of the material is folded with 4 inches of material underneath and stapled every 12 inches at minimum.

8.5.15.4 West Virginia Requirements

Refer to West Virginia BMP Manual for detailed information on the following requirements:

- Adjacent blankets will be overlapped, or by abutting product as defined by the manufacturer, and stapled together.
- Join a new roll of material by creating an anchor slot as with the upslope ends and overlapping the end of the up-gradient roll and stapling across the end of the previous roll just below the anchor slot.

8.5.15.5 Virginia Requirements

Refer to Virginia E&S Handbook for detailed information on the following requirements:

- Soil stabilization blankets will be mechanically fastened and used on slopes of 3:1 or greater and in stormwater conveyance channels.
- Adjacent blankets will be overlapped and stapled together.
- Join a new roll of material by creating an anchor slot as with the upslope ends and overlapping the end of the upgradient roll and stapling across the end of the previous roll just below the anchor slot.

8.5.27 Soil Compaction

A Restoration and Rehabilitation Plan has been prepared for the ACP to address post-construction restoration rehabilitation activities on NFS lands. Soil Compaction is addressed in Section 10.3.1.3 of the COM Plan.

8.5.28 Revegetation

A Restoration and Rehabilitation Plan has been prepared for the ACP to address post-construction restoration and rehabilitation activities on NFS lands. Revegetation is addressed in Section 10.3.1.2 of the COM Plan.

8.5.29 Mulching

A Restoration and Rehabilitation Plan has been prepared for the ACP to address post-construction restoration and rehabilitation activities on NFS lands. Mulching is addressed in Section 10.3.1.9 of the COM Plan.

8.6 ACCESS ROAD CONSTRUCTION

Atlantic has identified roads which will be used to provide access to the proposed ACP pipeline ROW and other facilities during construction and operation of the Project. Atlantic will primarily utilize existing roads. Section 2.1.1.4 provides information regarding new access roads proposed to be constructed on NFS lands.

The following conditions apply to the use of all access roads:

- During construction and restoration activities, access to the ROW is limited to the use of new or existing access roads identified on the construction drawings.
- The only access roads that can be used in wetlands, other than the construction ROW, are those existing roads requiring no modification or improvements, other than routine repair, and posing no impact on the wetland.
- The construction ROW may be used for access across wetlands when the wetland soil is firm enough to avoid rutting or the construction ROW has been appropriately stabilized to avoid rutting (e.g., timber matting). However, access is not allowed through wetlands that would not otherwise be impacted by the Project.
- 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 ROW.
- Maintain safe and accessible conditions at all road crossings and access points during construction and restoration. Access road maintenance through the construction sequence may include grading and the addition of gravel or stone when necessary.
- Maintain access roads in a stable manner to prevent off-ROW impacts, including impacts to adjacent and/or nearby sensitive resource areas, and implement all appropriate erosion and sediment control measures for construction/improvement of access roads.
- 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.
- All access roads across a waterbody must use an equipment bridge.
- For access through environmentally sensitive areas such as saturated wetland or waterbodies, use timber mats or an equivalent, unless otherwise authorized by agency permits.
- Limit construction equipment operating in wetland areas to that needed to clear the ROW, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction ROW. All other construction equipment shall use access roads located in upland areas to the maximum extent practical.
- In some cases, existing roads will require improvement (such as grading, gravelling, replacing or installing culverts, minor widening, and/or clearing of overhead vegetation) to safely accommodate construction equipment and vehicles.
- Boundary line restrictions or other physical features, such as rock outcroppings, will have additional measures taken to prevent erosion and/or water quality degradation:
    - Will locate roads as far as practical from the stream channel and maintain an unbroken organic litter layer on the forest floor.
    - Roads will be surfaced with gravel, mulch or other suitable material to provide a non-erodible running surface.
    - Cut-banks and fill-slopes will be stabilized as soon as feasible to a non-erodible condition using vegetation, rock, geotextile material or other suitable material.
    - Will install a properly constructed silt fence or rip rap outlet protection at outlets of drainage structures.
- Traffic will be restricted on access roads during unfavorable conditions, such as saturated soil. Gravel, wooden mats or a combination of geotextile and gravel may be used to help facilitate operations during wet periods.
- Skimming or removal of saturated soils from access roads will be avoided.
- Do not side-cast fill material if there is a chance that it will enter a stream, or if side slope exceeds 60 percent. Full bench construction with end hauling material to a suitable location is recommended when side slopes exceed 60 percent.
- When access roads intersect public highways, the contractor will use a combination of geotextile and gravel (temporary stone construction entrance) to help keep mud off highway entrances.
- Will maintain road so that water can flow freely from the road surface.

8.7 SPECIAL CONSTRUCTION PROCEDURES

Sensitive areas (e.g. wetland/water body crossings or residential developments) or areas requiring specialized construction measures (e.g. boring or directional drilling) will be treated as separate construction entities. Sensitive areas require additional erosion and sediment control procedures. Specialized construction often combines several construction stages into one and reduces earth disturbance, reducing the amount of erosion and sediment control measures.

8.7.1 Winter Construction

Atlantic has developed and filed a Project-specific winter construction plan with the FERC application; it is included as Attachment D.

The plan addresses:

- Winter construction procedures (e.g., snow handling and removal, access road construction and maintenance, soil handling under saturated or frozen conditions, topsoil stripping);
- 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
- Final restoration procedures (e.g., subsidence and compaction repair, topsoil replacement, seeding).

8.7.2 Steep Terrain and Best in Class (BIC) Program

8.7.2.1 Steep Terrain

Atlantic recognizes the increased risk in slips associated with pipeline construction particularly while traversing steep slopes.

When routing the ACP, the goal has been to do so perpendicularly to topographic contours and to minimize routing on slip prone steep slopes to the extent practicable, in accordance with Atlantic's SAIPR (Attachment C). In addition, Atlantic is implementing a comprehensive Geohazards Analysis Program to assess potential geohazards, including slope failures, along the proposed pipeline routes and at aboveground facility sites. The study for slope failures will include:

- a desktop analysis to prepare an inventory of and categorize potential slope hazards along the proposed routes;
- a field program to verify the locations and limits of slope hazards along the routes;
- a risk analysis of slope hazards along the routes; and
- recommendations for landslide and landslip mitigation, if and where warranted.

Atlantic has completed the desktop portion of the Geohazards Analysis Program and is currently working on the field reconnaissance portion and anticipates filing a report on the results of the Program to

FERC in the third quarter of 2016. The final report will provide recommendations on geological hazards and potential risks to be mitigated during construction and operation of the proposed ACP facilities.

As specified in the SAIPR, Atlantic has developed the following engineering design methods which will apply to slip prevention and correction during construction:

- drainage improvement that may include providing subsurface drainage at seep locations through granular fill and outlet pipes, incorporating drainage into trench breakers using granular fill, and/or intercepting groundwater seeps and diverting them from the ROW;
- buttressing slopes with Sakrete trench breakers;
- changing slope geometry by making the slope more shallow;
- benching and re-grading with controlled backfill;
- using alternative backfill;
- chemical stabilization of backfill;
- Geogrid reinforced slope that consists of benching existing slope, installing subsurface drains, and incorporating Geogrid reinforcement into compacted backfill; and/or
- retaining structures.

Selection of the most appropriate engineered prevention measure or combination will be dependent on the individual site conditions and constraints.

8.7.3 Best in Class Program for Slopes Greater than 30 Percent

Atlantic has implemented a BIC Program to proactively address steep slopes (defined as slopes greater than 30 percent) and landslide hazards related to pipeline construction. The BIC program is intended to incorporate the permit requirements from West Virginia, Virginia, and North Carolina, and then go above and beyond all these regulatory standards, in order to mitigate for potential erosion and sediment discharges related to steep slope and landslide hazards. The ultimate goal of the BIC Program is to develop Project-specific engineering mitigation recommendations targeting un-authorized discharges to water bodies resulting from steep slope, landslide and erosion hazards.

The conceptual work-flow process of the BIC Program (see FiguresA-1/2 through A-4) is organized around four general steps, briefly described as follows:

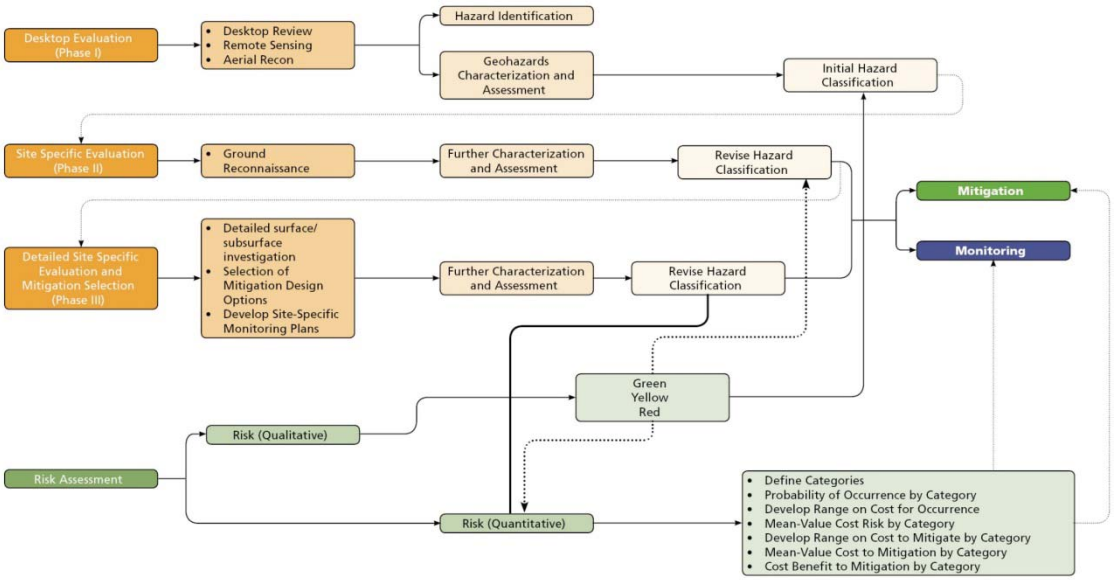
- Hazard Identification - Geologic hazards are systematically identified during the Geohazards Analysis Program through desktop analysis and field reconnaissance as well as by supporting evaluations (e.g. karst studies and soil surveys).
- Hazard Characterization, Assessment, and Threat Classification - As part of the Geohazards Analysis Program, the nature of the geohazards and their potential impacts on the pipeline and environmental resources are assessed. A semi-quantitative ranking of hazard threat level to the proposed pipeline from various geohazards is used to identify areas for further investigation to determine where appropriate mitigation and monitoring measures may need to be designed and implemented during construction.

- Hazard Mitigation - Areas for mitigation are selected based upon potential risk to the pipeline, environment, and operation and maintenance. Overall hazard reduction techniques may include BIC construction practices and/or best management practices.

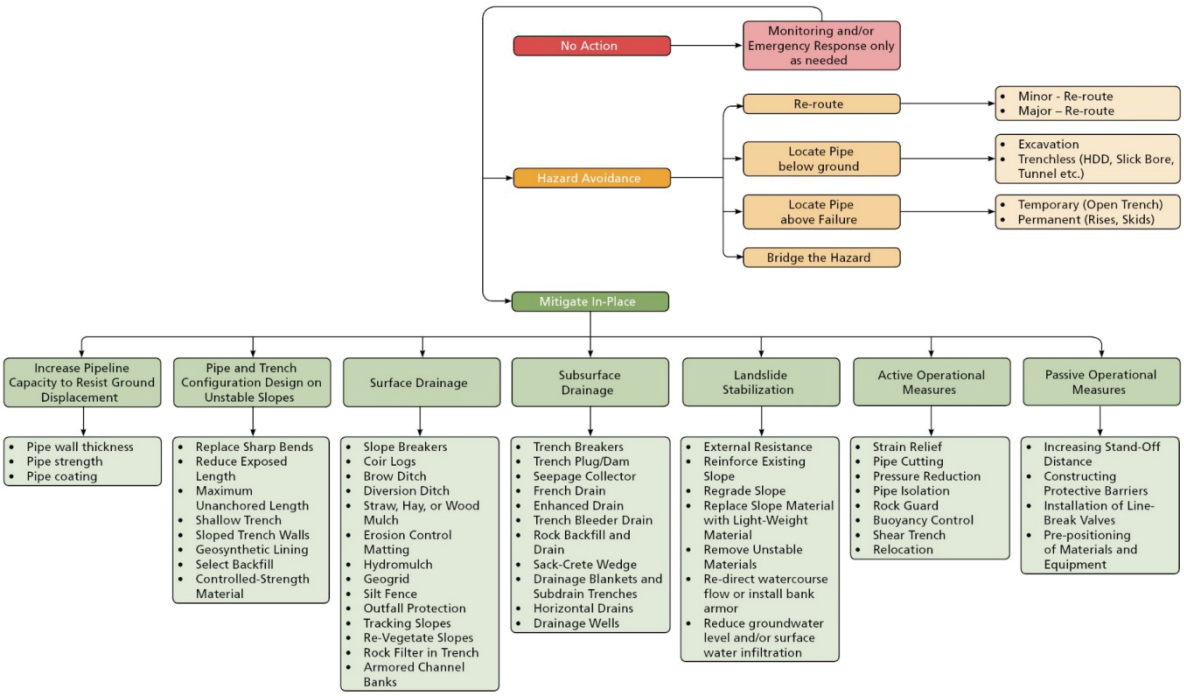
- Site and hazard specific plans will be developed based on the recommendations of the Geohazards Analysis Program and mitigation techniques selected by a BIC team of experts. The site and hazard specific plans will address the specific geologic hazard (e.g., slip, stream scour, ground displacement) with detailed mitigation measures, as applicable, for construction and/or operation of the Project. Atlantic will incorporate these measures into E&SC Plans and corresponding SWPPPs.

- Hazard Monitoring - Atlantic will monitor mitigation techniques to assess their effectiveness and the need for further mitigation, if appropriate.

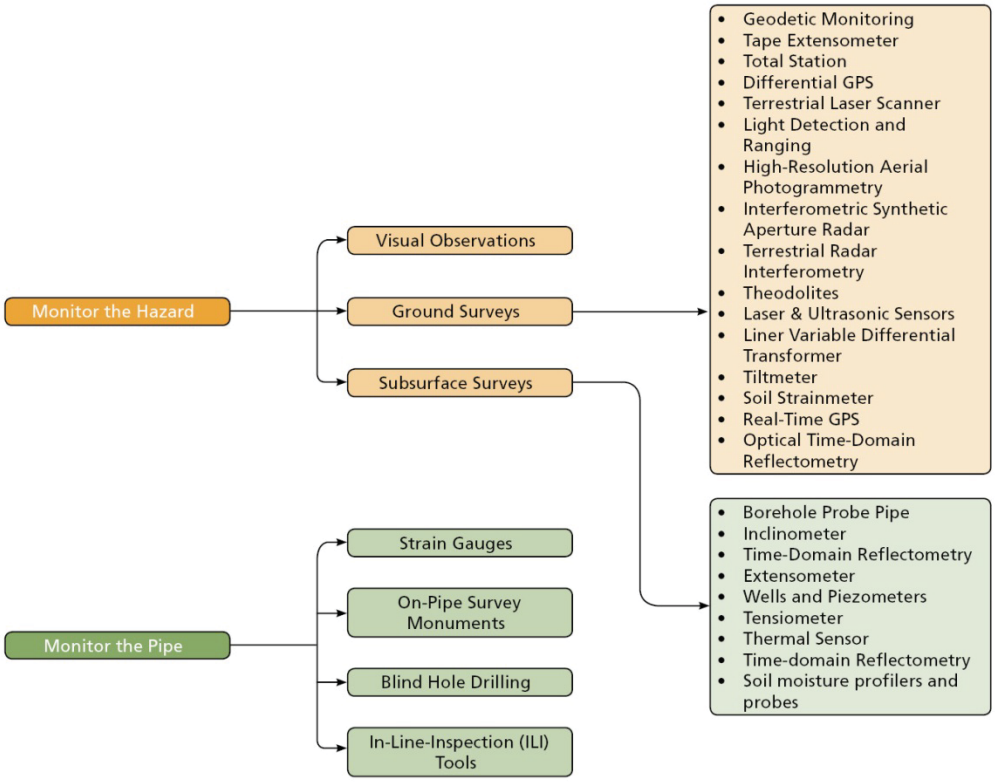
A-1/2: Hazard Identification and Assessment



A-3: Hazard Mitigation



A-4: Hazard Monitoring



8.7.4 Seeps

In the event that subsurface flow is encountered, an Under Drain will be utilized, as necessary, to divert water outside of the LOD. If encountered, seeps can be mitigated by using seep collectors placed down-slope of areas showing seepage. Armored fill placed at the toe of the slope may be used in areas of steep slopes in addition to a perforated drain pipe to divert subsurface water away from the cut slope.

8.7.5 Karst Geological Formations

A Karst Terrain Assessment, Construction, Monitoring and Mitigation plan was developed for the proposed Project and is located in Attachment H.

8.7.6 Horizontal Direction Drilling

Horizontal Direction Drilling is addressed in Section 9.0 of the COM Plan.

8.7.7 Agricultural Areas

Agricultural areas are addressed in Section 10.0 of the COM Plan.

8.7.8 Road Crossings

Road Crossings are addressed in Section 7.0 of the COM Plan.

8.7.9 Residential Areas

Residential Areas are addressed in Section 2.0 of the COM Plan.

8.7.10 Waterbody Crossings

Waterbody Crossing are addressed in Section 9.0 of the COM Plan.

8.7.11 Wetlands Crossings

Wetland Crossings are addressed in Section 9.0 of the COM Plan.

8.8 CONSTRUCTION INSPECTION AND MAINTENANCE

Construction Inspection and Maintenance is addressed in Section 3.0 of the COM Plan.

8.9 INSPECTION FREQUENCY

Inspection of temporary erosion and sediment control measures with occur at least:

- On a daily basis in areas of active construction or equipment operation;
- On a bi-weekly basis in areas with no construction or equipment operation; and
- Within 24 hours of each stormwater event (runoff from precipitation, snowmelt, surface runoff and drainage, including rainfall events resulting in 0.5 inches or more).

8.10 CORRECTIVE ACTION

DIT and/or their contractors will take corrective action to any of the inspected areas that have reported deficiencies to the control measures in place. Repairs will be made within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts.

8.11 REPORTING

Section 3.8 of the COM Plan discusses general inspection reporting requirements. Additional reporting requirements specific to the ESCP are as follows:

- Atlantic shall maintain records that identify by milepost:
  - method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;
  - acreage treated;
  - dates of backfilling and seeding;
  - names of landowners requesting special seeding treatment and a description of the follow-up actions;

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

- any problem areas and how they were addressed.

- Atlantic shall file with the FERC quarterly activity reports documenting the results of follow-up inspections; any problem areas, including those identified by the landowner; and corrective actions taken for at least 2 years following construction.

8.12 POST-CONSTRUCTION ACTIVITIES AND MAINTANANCE

8.12.1 Monitoring Program

Atlantic and/or their contractors will follow the following post-construction monitoring and maintenance guidelines.

- Restoration will be considered successful if the ROW surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless otherwise approved by the landowner or land managing agency), revegetation is successful, and proper drainage has been restored.

- Once final stabilization is conducted, Atlantic and/or their contractors will 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.

- 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.

- Revegetation efforts will continue until revegetation is successful.

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

- Slopes that are found to be eroding excessively within one year of permanent stabilization shall be provided with additional slope stabilizing measures until the problem is corrected.

- Monitor and record the success of wetland revegetation annually until wetland revegetation is successful. Wetland revegetation shall be considered successful if all the following criteria are satisfied:

  a. The affected wetland satisfies the current federal definition for a wetland;

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

8.12.2 Maintenance

- Conduct routine vegetation mowing or clearing over the full width of the permanent ROW 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 FWS.

- Do not conduct routine vegetation mowing or clearing over the full width of the permanent ROW 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 ROW. Do not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.

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

- Will conduct routine vegetation mowing or clearing over the full width of the permanent ROW 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 USFWS.

- Within 3 years after construction, Atlantic will file a report with the FERC identifying the status of the wetland revegetation efforts and documenting success. For any wetland where revegetation is not successful at the end of 3 years after construction, develop and implement a remedial revegetation plan in consultation with a professional wetland ecologist. Continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

- Will make 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.

8.13 STORMWATER MANAGEMENT

Where pre-development land cover conditions are changed significantly triggering requirements for post-construction stormwater quality and quantity requirements, post-construction BMPs may be required to comply with water quality and water quantity criteria and MS-19 of the Erosion and Sediment Control Regulations.

8.13.1 West Virginia Requirements

The WVDEP recognizes that construction of aboveground and underground linear utilities may not result in changes to the post-development runoff characteristics of the land surface after the completion of the construction and final stabilization. The installation of the ACP pipeline is an example of such a Project where the areas disturbed will be returned to their pre-development condition. Therefore, the preparation and implementation of post-construction stormwater management measures for the pipeline portion of the Project is not warranted.

Within the MNF, forest/open space or managed turf will be returned to a vegetative state and characteristics of stormwater runoff should remain unchanged. Therefore, post-construction stormwater management will not be required for the portion of the Project within the MNF.

8.13.2 Virginia Requirements

The DEQ recognizes that construction of aboveground and underground linear utilities may not result in changes to the post-development runoff characteristics of the land surface after the completion of the construction and final stabilization. The installation of the ACP pipeline is an example of such a Project where the areas disturbed will be returned to their pre-development condition. Therefore, the preparation and implementation of post-construction stormwater management measures for the pipeline portion of the Project is not warranted.

Within the GWNF, forest/open space or managed turf will be returned to a vegetative state and characteristics of stormwater runoff should remain unchanged. Therefore, post-construction stormwater management will not be required for the portion of the Project within the GWNF.

8.14 VARIANCE TO OPEN TRENCH LENGTH

The Virginia Erosion and Sediment Control Law Minimum Standard 16a requires that no more than 500 feet of trench remain open at one time. However, this requirement would significantly slow construction and increase the amount of time the work area remains disturbed. In accordance with 9 VAC 25-870-50, Atlantic will request to that DEQ waive Minimum Standard 16a.

Any other variances to this plan or the State Minimum Standards must be approved prior to implementation. The EI will monitor any variance-related activities.

8.15 ADDITIONAL MITIGATION MEASURES FOR U.S. FOREST SERVICE LANDS

On NFS lands, additional measures will be implemented in conformance with the applicable standards and guidelines identified in the MNF LRMP. If a general mitigation measure as described above is more stringent than an applicable standard or guideline, the more stringent measure will be applied.

8.15.1 Monongahela National Forest

- Maintain, restore, or improve soil quality, productivity, and function. Manage soil disturbances from management activities such that they do not result in long-term loss of inherent soil quality and function. (**MNF LRMP SW01**).

- Disturbed soils dedicated to growing vegetation shall be rehabilitated by fertilizing, liming, seeding, mulching, or constructing structural measures as soon as possible, but generally within 2 weeks after Project completion, or prior to periods of inactivity, or as specified in contracts. Rip compacted sites when needed for vegetative re-establishment and recovery of soil productivity and hydrologic function. The intent is to minimize the time that soil is exposed on disturbed sites or retained in an impaired condition. (**MNF LRMP SW03**).

- Erosion prevention and control measures shall be used in program and Project plans for activities that may reduce soil productivity or cause erosion. (**MNF LRMP SW04**).

- Severe rutting resulting from management activities shall be confined to less than 5 percent of an activity area. (**MNF LRMP SW06**).

- Use of wheeled and/or tracked motorized equipment may be limited on soil types that include the following soil/site area conditions:

    - Steep Slopes (40 to 50 percent) – Operation on these slopes shall be analyzed on a case-by- case basis to determine the best method of operation while maintaining soil stability and productivity.

    - Very Steep Slopes (more than 50 percent) – Use is prohibited without recommendations from interdisciplinary team review and line officer approval.

    - Susceptible to Landslides – Use on slopes greater than 15 percent with soils susceptible to downslope movement when loaded, excavated, or wet is allowed only with mitigation measures during periods of freeze-thaw and for one to multiple days following significant rainfall events. If the risk of landslides during these periods cannot be mitigated, then use is prohibited.

    - Soils Commonly Wet At Or Near The Surface During A Considerable Part Of The Year, Or Soils Highly Susceptible To Compaction. Equipment use shall normally be prohibited or mitigated when soils are saturated or when freeze-thaw cycles occur. (**MNF LRMP SW07**).

    - Management actions that have the potential to contribute to soil nutrient depletion shall be evaluated for the potential effects of depletion in relation to on-site acid deposition conditions. (**MNF LRMP SW08**).

- Inventory the soil resource to the appropriate intensity level as needed for Project planning and/or design considerations. (**MNF LRMP SW10**).

- Soil stabilization procedures should take place as soon as practical after earth-disturbing activities are completed or prior to extended periods of inactivity. Special revegetation measures may be required. (**MNF LRMP SW11**).

- Use Forest-wide soils map(s) and county soil survey report interpretations to help determine soil characteristics and protection needs. (**MNF LRMP SW12**).

- Topsoil should be retained to improve the soil medium for plant growth on areas to be disturbed by construction. Topsoil should be salvaged from an area during construction and stockpiled for use during subsequent reclamation, or obtained from an alternate site. On some areas, soil material may have to be added to obtain vigorous plant growth. Soil to be used for this purpose should have chemical tests made to determine its desirability for use. (**SW15**).

- Where the removal of vegetative material, topsoil, or other materials may result in erosion, the size of the area may be limited from which these materials are removed at any one time. (**MNF LRMP SW16**).

- Management activities that may result in accelerated erosion and loss of organic matter should have one or more of the following practices applied to mitigate potential effects:

  - Limiting mineral soil exposure,

  - Appropriately dispersing excess water,

  - Ensuring sufficient effective groundcover,

  - Stabilizing disturbed soils through revegetation, mulching, or other appropriate means,

  - Preventing or minimizing excessive compaction, displacement, puddling, erosion, or burning of soils, and

  - Preventing or minimizing the initiation or acceleration of mass soil movement (e.g., slumps, debris flows, or landslides). (**MNF LRMP SW19**)

- Where new roads and skid roads cross stream channels, channel and bank stability shall be maintained. (**MNF LRMP SW35**).

- When stream crossing structures are removed, stream channels shall be restored to their near natural morphology (width, depth, and gradient associations for streambeds, streambanks, floodplains, and terraces). Disturbed soil shall be stabilized. (**MNF LRMP SW36**).

- New structures (culverts, bridges, etc.) shall be designed to accommodate storm flows expected to occur while the structures are in place. Use scientifically accepted methods for calculating expected storm flows. (**MNF LRMP SW46**).

- Ground disturbance should be avoided within seeps, vernal pools, bogs, fens, and other wetlands during Project implementation. These areas should be managed to protect wet soils and rare plants and provide wildlife watering sources using the following protection:

  - No new system roads or skid roads should be located within these areas except at essential crossings. Such crossings should be designed to minimize disturbance to the extent practical.

- Logs should not be skidded through these areas. Keep slash and logs out of them.

- For protection of cold water fisheries, apply the following to the channel buffers of perennial trout streams (stocked and native) during the period of October 1 to June 1:

  - Potential sediment-producing ground disturbance exceeding two consecutive days shall only be initiated after consultation with a Forest fisheries biologist.

  - Sediment-producing ground disturbance during this period shall use additional erosion control measures and seeding or mulching, applied concurrently with the activity. (**MNF LRMP WF14**).

- Work with USDA State and Private forestry and county extension agents to identify or develop sources for noxious weed free hay, straw, and mulch. (**MNF LRMP VE20**).

8.15.2 George Washington National Forest

- On all soils dedicated to growing vegetation, the organic layers, topsoil and root mat will be left in place over at least 85% of the activity area and revegetation is accomplished within 5 years. (The activity area is the area of potential soil disturbance expected to produce vegetation in the future, for example: timber harvest units, prescribed burn area, grazing allotment, etc.). **(GWNF LRMP FW-5)**

- Locate and design management activities to avoid, minimize, or mitigate potential erosion. **(GWNF LRMP FW-6)**

- Use ditchlines and culverts when new permanent road construction grades are more than 6% and the road will be managed as open for public use. **(GWNF LRMP FW-7)**

- Where soils are disturbed by management activities, appropriate revegetation measures should be implemented. When outside the normal seeding seasons, initial treatments may be of a temporary nature, until permanent seeding can be applied. Revegetation should be accomplished within 5 years. For erosion control, annual plants should make up >50% of seed mix when seeding outside the normal seeding season and the area should be reseeded with perennials within 1½ years. **(GWNF LRMP FW-9)**

- Clearcutting is not allowed where high risk soils (as described in Chapter 3-Management Approach for Soils and in the Glossary) are identified. **(GWNF LRMP FW-12)**

- Management activities expose no more than 10% mineral soil in the channeled ephemeral zone. **(GWNF LRMP FW-16)**

- Favor use of native grasses and wildflowers beneficial as wildlife foods when seeding temporary roads, skid roads, log landings and other temporary openings when slopes are less than 5%. On slopes greater than 5%, favor use of vegetation that best controls erosion. **(GWNF LRMP FW-93)**

- A contractor's sources of fill, soil, shale, and related materials will be pre-approved. Contractors will submit a description of the source. The Project inspector or a qualified designee will inspect the supply source. Use of the source will be prohibited if contaminated by transferable agents of invasive species. **(GWNF LRMP FW-95)**

- The soils of riparian corridors have an organic layer (including litter, duff, and/or humus) of sufficient depth and composition to maintain the natural infiltration capacity, moisture regime, and productivity of the soil (recognizing that floods may periodically sweep some areas within the floodplain of soil and vegetation). **(GWNF LRMP DC 11-03)**

- Exposed mineral soil and soil compaction from human activity may be present but are dispersed and do not impair the productivity and fertility of the soil. Any human-caused disturbances or modifications that cause environmental degradation through concentrated runoff, soil erosion, or sediment transport to the channel or waterbody are promptly rehabilitated or mitigated to reduce or eliminate impacts. **(GWNF LRMP DC 11-04)**

- Management activities expose no more than 10 percent mineral soil within the Project area riparian corridor. **(GWNF LRMP DC 11-003)**

- To minimize the length of streamside disturbance, ensure that approach sections are aligned with the stream channel at as near a right angle as possible. Locate riparian corridor crossings to minimize the amount of fill material needed and minimize channel impacts. Generally, permanent structures or temporary bridges on permanent abutments are provided when developing new crossings on perennial streams. Permanent structures, temporary bridges or hardened fords are used when crossing intermittent streams. **(GWNF LRMP DC 11-050)**

- If culverts are removed, stream banks and channels must be restored to a natural size and shape. All disturbed soil must be stabilized. **(GWNF LRMP DC 11-054)**

- For activities not already covered in the above standards, ground disturbing activities are allowed within the corridor if the activity will cause more resource damage if it were located outside the corridor, on a case-by-case basis following site-specific analysis. Any activity allowed under these conditions is minimized and effective sediment trapping structures such as silt fences, brush barriers, straw bale barriers, gravelling, etc., are required. Sediment control, prior to, or simultaneous with, the ground disturbing activities, is provided. **(GWNF LRMP DC 11-058)**

9.0 STREAM AND WETLAND CROSSING PROCEDURES

9.1.1 PURPOSE

The intent of these Procedures is to identify mitigation measures for minimizing the extent and duration of Project-related disturbance on wetlands and waterbodies in the MNF and GWNF The Procedures are based on Project-wide wetland and waterbody measures developed by the FERC, modified to take into account standards and guidelines from both Forests' LRMPs. Tables 4 and 5 show waterbodies crossed on MNF and GWNF lands, respectively. Only two wetlands are crossed; both on the GWNF. Wetlands are discussed in Section 9.5.If, prior to Project construction, Atlantic identifies individual measures in the FERC's standard wetland and waterbody procedures considered unnecessary, technically infeasible, or unsuitable due to local conditions, it may request variations to the FERC procedures (and to this COM Plan). Any such request will fully describe alternative measures, and explain how those alternative measures would achieve a comparable level of mitigation.

9.1.2 DEFINITIONS

- "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:
  - "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;
  - "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
  - "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.
- "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.

9.2 PRECONSTRUCTION FILING

For any wetlands and waterbodies on NFS lands, the following information will be submitted to the AO prior to the beginning of construction, for the review and written approval by the AO. Such information must also be approved in writing by the FERC:

- site-specific justifications for extra work areas that would be closer than 50 feet from a waterbody or wetland; and
- site-specific justifications for the use of a construction right-of-way greater than 75-feet-wide in wetlands.

9.3 ENVIRONMENTAL INSPECTORS

At least one EI having knowledge of the wetland and waterbody conditions in the Project area is required for each construction spread. The number and experience of EIs assigned to each construction spread will be appropriate for the length of the construction spread and the number/significance of resources affected. EI's responsibilities are outlined in the Plan.

9.4 WATERBODY CROSSINGS

9.4.1 NOTIFICATION PROCEDURES AND PERMITS

Atlantic will do the following:

- Apply to the COE, or its delegated agency, for the appropriate jurisdictional wetland and waterbody crossing permits.
- 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.
- Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.
- Notify appropriate federal and state authorities, including the USFS, at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in applicable permits.

9.4.2 INSTALLATION

9.4.2.1 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, will occur during the following time windows:

Monongahela National Forest

- coldwater fisheries - June 1 through September 15; and
- warmwater fisheries - July 1 through March 31.

George Washington National Forest

- Virginia Brook Trout fisheries – April 1 – September 30

The MNF specifies that stream crossing construction on temporary and permanent roads should be completed as soon as practical, with mitigation as needed to minimize the potential for sedimentation (SW62). The GWNF specifies that construction of crossings is completed on all channeled ephemerals as soon as possible after work has started on the crossing. Permanent and temporary roads on either side of crossings within the channeled ephemeral zone are to be graveled (SW-24).

9.4.2.2 Extra Work Areas

Atlantic will do the following:

- Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 100 feet away from water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

- Submit for review and written approval by the AO, site-specific justification for each extra work area with a less than 100-foot setback from the water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification will specify the conditions that will not permit a 50-foot setback and measures to ensure the waterbody is adequately protected. Such information must also be approved in writing by the FERC.

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

9.4.2.3 General Crossing Procedures

Atlantic will do the following:

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

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

- 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.

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

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

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

- 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 EI verifies that water is unlikely to flow between initial disturbance and final stabilization of the feature. In the event of perceptible flow, Atlantic will comply with all applicable Procedure requirements for "waterbodies".

- Design crossings so stream flow does not pond above the structure during normal flows to reduce sediment deposition and safely pass high flows (MNF SW60).

- Provide passage for fish and other aquatic organisms at all new or reconstructed stream crossings of existing or potential fish-bearing streams. Exceptions may be allowed to prevent the upstream migration of undesired species (MNF WF21).

- Improve connectivity of stream systems through replacement of standard culverts with crossing structures that allow for full passage of all aquatic organisms (GWNF Strategy).

- Allow pipelines within channel buffers but limit them to essential crossings (MNF MG41).

- Avoid construction of pipelines running parallel to streams (MNF MG40).

- Use culverts, temporary bridges, hardened fords, or corduroy where needed to protect channel or bank stability when crossing channeled ephemeral streams (GWNF FW-23).

- Restore steam channels when stream crossing structures are removed to their near-natural morphology (width, depth, and gradient associations for streambeds, streambanks, floodplains, and terraces). Stabilize disturbed soil (MNF SW36).

9.4.2.4 Spoil Pile Placement and Control

All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings will 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 8.2.2. Atlantic will use sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody.

9.4.2.5 Equipment Bridges

Only clearing equipment and equipment necessary for installation of equipment bridges will cross waterbodies prior to bridge installation. Atlantic will limit the number of such crossings of each waterbody to one per piece of clearing equipment. Atlantic will construct and maintain equipment bridges to allow unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:

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

Additional options for equipment bridges may be utilized by Atlantic that achieves the performance objectives noted above. Atlantic will not use soil to construct or stabilize equipment bridges.

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

Atlantic will design and maintain equipment bridges to prevent soil from entering the waterbody and remove temporary equipment bridges as soon as practicable after permanent seeding. 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, Atlantic will remove temporary equipment bridges as soon as practicable after final cleanup.

Culverts and bridges will be designed to accommodate storm flows expected to occur while the structures are in place and use scientifically accepted methods for calculating expected storm flows (MNF SW46). Atlantic will construct stream crossings and bridges to withstand major storm and runoff events (GWNF Climate Change Strategy).

9.4.2.6 Roads and Skid Trails

During watershed or Project-level analysis, Atlantic will assess existing or proposed road stream crossings for effects to stream channel form and function, including channel stability, passage of storm

flows and associated debris, and passage of aquatic organisms. It will prioritize crossings to address or correct identified concerns (GWNF SW32)

Where new roads cross stream channels, channel and bank stability shall be maintained (MNF SW35). Where new roads cross streams or high-risk areas, disturbed soils will be stabilized and designed drainage structures will be installed as soon as practical. High-risk areas include landslide prone areas, steep slopes, and highly erosive soils (MNF RF07).

Skid trails used for logging may cross riparian corridors at designated crossings. If crossing a perennial or intermittent stream is unavoidable, Atlantic will use a temporary bridge or other approved method within the State BMP. Stabilization of skid trails will occur as soon as possible to minimize soil movement downslope (GWNF FW-142). Skidding of trees should be directed in a manner that prevents creation of channels or gullies that concentrate water flow to adjacent streams (GWNF FW143).

9.4.2.7 Dry-Ditch Crossing Methods

Unless approved otherwise by the appropriate federal or state agency, Atlantic will 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.

Dam and Pump

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. Implementation of the dam-and-pump crossing method will meet the following performance criteria:

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

Flume Crossing

The flume crossing method requires implementation of the following steps:

- install flume pipe after blasting (if necessary), but before any trenching;
- 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);
- properly align flume pipe(s) to prevent bank erosion and streambed scour;

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

- 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.

9.4.2.8 Temporary Erosion and Sediment Control

Atlantic will 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 will 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 will be implemented at stream crossings:

- 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;

- 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

- 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.

9.4.2.9 Trench Dewatering

Atlantic will 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.

9.4.3 RESTORATION

Atlantic will do the following:

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, it will 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 EI

4. Install erosion control fabric or a functional equivalent on waterbody banks at the time of final bank recontouring. Atlantic will 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. Comply with the COE or its delegated agency, permit terms and conditions in the application of riprap for bank stabilization.

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 EI, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

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

Atlantic will maintain, enhance, or restore vegetation conditions that provide (MNF SW31):

- Ecological functions of riparian, wetland, and aquatic ecosystems.
- Canopy conditions that regulate riparian and stream temperature regimes for native and desired non-native fauna and flora.
- Natural recruitment potential for large woody debris and other sources of nutrient inputs to aquatic ecosystems.
- Bank and channel stability and structural integrity.
- Habitat and habitat connectivity for aquatic and riparian-dependent species and upland species that use riparian corridors.
- Buffers to filter sediment.

If culverts are removed, banks and channel will be restored to a natural size and shape. All disturbed soil will be stabilized (GWNF FW-25). Temporary stream crossings will be removed and rehabilitated (GWNF FW-144).

9.4.4 POST-CONSTRUCTION MAINTENANCE

Atlantic will 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. Atlantic will not conduct any routine vegetation mowing or clearing in riparian areas that are between HDD entry and exit points. Atlantic will not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

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.

9.5 WETLAND CROSSINGS

Wetland crossings shall minimize disturbance to the wetland (MNF MG33).

New road construction will avoid wetlands where feasible. If a wetland cannot be avoided, road construction may be allowed as long as the subsurface drainage patterns can be preserved and maintained. Any road that would cross a wetland will cross in a way that minimizes disturbance to the wetland (MNF RF06).

Atlantic will 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, Atlantic will route the new pipeline in a manner that minimizes disturbance to wetlands.

Atlantic will limit the width of the construction right-of-way to 75 feet or less. Prior written approval of the AO will be sought 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. Such requests must also be approved in writing by the FERC.

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

Ground disturbance to the extent practicable will be avoided within seeps, vernal pools, bogs, fens, and other wetlands during Project implementation. These areas will be managed to protect wet soils and rare plants and provide wildlife watering sources using the following protection (MNF SW51):

- No new road will be located within these areas except at essential crossings. Such crossings should be designed to minimize disturbance to the extent practical.
- Logs will not be skidded through these areas and slash and logs will be kept out of them.
- Where available, a canopy of 60-100 percent crown closure will be maintained within and adjacent to these areas, unless a more open canopy is needed for Threatened, Endangered, and Protected species or Regional Forest Sensitive Species management.
- Mast trees or shrubs may be planted in seeps if mast plants are currently lacking.

9.5.1 INSTALLATION

9.5.1.1 Extra Work Areas and Access Roads

Atlantic will 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.

Atlantic will submit to the AO for review and written approval, 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 will specify the site-specific conditions that will not permit a 50 foot setback and measures to ensure the wetland is adequately protected. Such requests must also be approved in writing by the FERC.

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). Severe rutting resulting from management activities shall be confined to less than 5 percent of an activity area (MNF SW06).

In wetlands that cannot be appropriately stabilized, all construction equipment other than that needed to install the wetland crossing will use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, Atlantic will limit all other construction equipment to one pass through the wetland using the construction right-of-way.

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.

9.5.1.2 Crossing Procedures

Atlantic will comply with COE permit terms and conditions. It will assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe. Atlantic will use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow. Atlantic will 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.

Atlantic will 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.

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

Atlantic may 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.

Atlantic will limit pulling of tree stumps and grading activities to directly over the trenchline. It will not grade or remove stumps or root systems from the rest of the construction right-of-way in wetlands unless the Construction Site Supervisor and EI 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.

Atlantic will segregate the top 1 foot of topsoil from over the trenchline within wetland areas, except in areas where standing water is present or soils are saturated. Immediately after backfilling is complete, Atlantic will restore the segregated topsoil to its original location.

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

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

Atlantic will remove all Project-related material used to support equipment on the construction right-of-way upon completion of construction.

9.5.1.3 Temporary Sediment Control

Atlantic will 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 this Section, Atlantic will 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.

Atlantic will 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.

Where wetlands are adjacent to the construction right-of-way and the right-of-way slopes toward the wetland, Atlantic will 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.

Atlantic will 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.

If soils are commonly wet at or near the surface during a considerable part of the year, or if soils are highly susceptible to compaction, equipment use will normally be avoided or mitigated by Atlantic when soils are saturated or when freeze-thaw cycles occur (MNF SW07d).

9.5.1.4 Trench Dewatering

Atlantic will 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. Atlantic will remove the dewatering structures as soon as practicable after the completion of dewatering activities.

9.5.2 RESTORATION

Where the pipeline trench may drain a wetland, Atlantic will construct trench breakers at the wetland boundaries and/or seal the trench bottom as necessary to maintain the original wetland hydrology. Atlantic will restore pre-construction wetland contours to maintain the original wetland hydrology.

For each wetland crossed, Atlantic will install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. It will 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, Atlantic will install sediment barriers as outlined in the Plan. In some areas, with the approval of the EI, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

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

Atlantic will 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 non-native invasive species and noxious weeds (e.g., purple loosestrife), and monitoring the success of the revegetation and weed control efforts. Atlantic will provide this plan to the FERC staff upon request.

Atlantic will ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.

Atlantic will 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.

9.5.3 POST-CONSTRUCTION MAINTENANCE AND REPORTING

Atlantic will 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. Atlantic will not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.

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

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.

Atlantic will monitor and record the success of wetland revegetation annually until wetland revegetation is successful.

Wetland revegetation will be considered successful if all of the following criteria are satisfied:

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

- 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

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

For any wetland where revegetation is not successful at the end of 3 years after construction, Atlantic will develop and implement (in consultation with a professional wetland ecologist) a remedial revegetation plan to actively revegetate wetlands. Atlantic will continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

9.6 HYDROSTATIC TESTING

9.6.1 NOTIFICATION PROCEDURES AND PERMITS

No hydrotest water withdrawals or discharges are planned on NFS lands.

10.0 RESTORATION AND REHABILITATION PLAN

10.1 PURPOSE

This Restoration and Rehabilitation Plan was prepared for the ACP to address post-construction restoration and rehabilitation activities on NFS lands. NFS lands are managed in accordance with various management directives, including standards and guidelines for restoration and revegetation activities. This Restoration and Rehabilitation Plan has been written to conform to FERC requirements and procedures and industry-accepted practices and standards, and guidelines contained within the MNF and GWNF LRMPs and site-specific requirements and recommendations for restoration developed in consultation with USFS staff. Furthermore, the Restoration and Rehabilitation Plan will be implemented in conjunction with the 2013 versions of the FERC Plan and Procedures as well as Atlantic's other construction, restoration, and mitigation plans developed for National Forest lands (e.g., *Timber Removal Plan, Upland Erosion Control Plan, Stream and Wetland Crossing Plan, SPCC Plan*, *Non-Native Invasive Species Management Plan, and Appalachian Trial Crossing Plan*).

Atlantic has consulted with the USDA's Natural Resources Conservation Service (NRCS) and is still in the process of consulting with the USFS and State/Commonwealth land managing agencies, to identify appropriate seed mixes, soil amendments, and cultural for use during restoration. Based on discussions to date with the local NRCS offices, seed mixes and soil amendments have been developed and added to this Restoration and Rehabilitation Plan for Pocahontas and Augusta, Bath, and Highland Counties.

10.2 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Company and Contractor personnel. The training program will focus on the FERC's Plan and Procedures; other construction, restoration, and mitigation plans, including this *Restoration and Rehabilitation Plan*; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

10.3 RESTORATION AND REHABILITATION MEASURES AND BEST MANAGEMENT PRACTICES

This section provides a description of restoration and rehabilitation measures and BMPs that would be used to restore the pipeline rights-of way on NFS lands. These measures and BMPs are based on FERC requirements and industry-accepted practices (Section 10.3.1). In addition to site-specific requirements and recommendations for restoration developed in conjunction with USFS staff (Section 10.3.2).

10.3.1 Restoration and Rehabilitation Measures and Best Management Practices

Based on FERC requirements identified in the Plan and Procedures and industry-accepted practices, Atlantic has identified and developed restoration and rehabilitation measures and BMPs for restoration and rehabilitation of areas disturbed by construction activities. These restoration and rehabilitation measures and BMPs have been used to establish Atlantic's standards for restoration and revegetation as described below.

10.3.1.1 Erosion Control

Construction of the pipelines will be followed by restoration of the rights-of-way, stabilization of the soil, and seeding (where needed). Atlantic will complete final grading and installation of permanent erosion control structures (e.g., trench breakers or permanent slope breakers) generally within 20 days after backfilling the trench (10 days in residential areas), seasonal or other weather conditions permitting. For construction activities occurring in Winter, conditions such as frozen soils or snow cover could delay successful soil compaction mitigation or seeding activities. In these conditions, Atlantic will resume clean-up and restoration efforts the following Spring. Atlantic will monitor and maintain temporary erosion controls (e.g., temporary slope breakers, sediment barriers, or mulch) until conditions allow for completion of cleanup and installation of permanent erosion control structures.

Temporary erosion control measures and permanent erosion control devices to be employed during and after construction are described in *Section 8 – Upland Erosion Control Plan*. Atlantic will continue to consult with the USFS to identify other site-specific measures which may be required.

During construction, the effectiveness of temporary erosion control devices will be monitored by Atlantic's EI. Where appropriate for local resource priorities, the role of the EI may be filled by agricultural or horticultural monitors. The effectiveness of revegetation and permanent erosion control devices will be monitored for the life of the Project by Atlantic operating personnel during the long-term operation and maintenance of the pipeline systems.

10.3.1.2 Soil Restoration

Successful revegetation is dependent on appropriate soil conditions and can be influenced by several factors, including soil texture, drainage class, salinity, and acidity. Unless otherwise approved by the USFS, soil restoration will include:

- removal of excavated rock as described in Section 2.1.6
- distribution of rock on the work area as described in Section 2.1.6;
- grading of the rights-of-way to restore preconstruction contours to the extent practicable; and
- preparation of the soil for revegetation.

10.3.1.3 Soil Compaction

Soil compaction resulting from construction activities may reduce the potential for successful revegetation. Fine-textured soils with poor internal drainage that are moist or saturated during construction are the most susceptible to compaction and rutting. Atlantic will minimize impacts by implementing the mitigation measures for compaction and rutting as described in the Atlantic's Soil Erosion Control Plan. Atlantic will test for soil compaction:

- in areas requested by the USFS;
- in undisturbed areas adjacent to the construction workspace with the same soil type under similar moisture conditions to approximate preconstruction conditions; and

- in areas identified by the EIs, who will be responsible for conducting subsoil and topsoil compaction testing and determining the need for corrective measures.

Compaction impacts will be mitigated through the use of tillage equipment during restoration activities such as a paraplow or similar implement. In areas where topsoil segregation occurs, plowing with a paraplow or other deep tillage implement to alleviate subsoil compaction will be conducted before replacement of the topsoil. In rocky or heavily rooted soils, compaction may be impossible to measure and rectify without additional damage. If compaction testing is impeded by rock or roots, Atlantic may conclude that there is a suitable amount of large material in the soil to rectify potential compaction. Soil compaction will be remediated prior to re-spreading of salvaged topsoil.

10.3.1.4 Topsoil Segregation, Replacement, and Soil Conditioning

The potential mixing of topsoil or surface soil with the subsoil from construction activities could result in a loss of soil fertility. To prevent mixing of the soil horizons or incorporation of additional rock into the topsoil, topsoil segregation will be:

- performed in the trenchline within non-saturated wetlands and in other areas requested by the USFS;
- conducted as described in the Plan and Procedures;
- stockpiled on the rights-of-way; and
- excluded from materials used for padding the pipe.

Topsoil will be layered above subsoil where seeds stored in the soil will be encouraged to grow.

10.3.1.5 Re-Contouring

Grading will be conducted prior to construction where necessary to provide a reasonably level work surface. Upon completion of construction, Atlantic will:

- restore the ground surface as closely as practicable to original contours to restore natural overland water flow patterns, aquifer recharge, and drainage patterns;
- re-contour disturbed areas in a fashion designed to stabilize slopes, remove ruts and scars, and support successful revegetation; and
- restore, to original or better condition, drainage ditches and culverts that are diverted or damaged during construction.

10.3.1.6 Steep Slope Areas

Areas with steep slopes along the pipeline route may make the establishment of vegetation more difficult due to the increased potential for erosion by water. Slopes greater than 35 percent will be restored to natural contours to the extent practicable, or in accordance with specific requests from the USFS. Restoration of steep terrain may include:

- grading to the natural conditions;

- installation of permanent erosion control devices (i.e., slope breakers) designed to reduce runoff velocity, divert water from the surface of the rights-of-way, and encourage retention of soils; and

- the use of additional structural materials (e.g., rock or woody debris) to provide an anchor for revegetation and deposition of soil.

In addition to these general measures, Atlantic will develop and implement other additional site-specific measures, where warranted, to address land movement, surface erosion, backfill erosion, general soil stability when backfilling the trench, and restoring of the rights-of-way in steep slope areas. Atlantic is committed to employing BIC measures to protect the environment in steep slope areas. Best in Class is defined as the most efficient and/or protective design or configuration with the least environmental impact providing reliable construction and operations.

Atlantic will implement the Slip Avoidance, Identification, Prevention, and Remediation – Policy and Procedure, and are conducting geotechnical studies along the proposed pipeline routes in West Virginia, and western Virginia in steep terrain areas to assess the potential for landslides and landslips to occur during construction and operation of the Project.

The following lists some of the special design and construction mitigation measures that will be implemented during construction in steep slope areas:

- targeted management and diversion of surface water around landslide sites, including the use of ditches, berms, slope breakers, and/or grading;

- mitigation of surface erosion by armoring or otherwise stabilizing surface soils using riprap, coir cloth, hydroseeding, mulching, and/or tracking

- targeted management of water sources along the trench, including the use of trench breakers and/or added drainage piping in the trench;

- targeted mitigation of seeps, springs, or other subsurface water encountered along the rights-of-way using subsurface drains or other special drainage measures;

- engineering of the backfill around or within steep slope areas to dry the backfill, add compaction, improve backfill soil strength, and reduce saturation;

- installation of targeted structures to stabilize backfill using engineered fill, retaining walls, sack-crete placements, key trenches, and/or shear trenches; and

- reduction in surcharge on steep slope areas by reducing excess or saturated backfill.

10.3.1.7 Site Preparation and Seeding

Atlantic will complete final grading and permanent erosion control measures within 20 days after backfilling of the trench, seasonal or other weather conditions permitting. In the event that these timeframes cannot be met or construction or restoration activities are interrupted for an extended period, mulch will be spread prior to seeding. In these cases, all slopes within 100 feet of wetlands or waterbodies will be mulched at a rate of 3 tons per acre.

10.3.1.8 Seedbed Preparation

Proper preparation of the soil surface and seedbed is essential for rapid and healthy revegetation (Virginia DEQ, 1992). Successful germination of seed is enhanced by a well-prepared seedbed, the suitability of which decreases rapidly after rainfall.

Seedbed preparation starts immediately after soil has been replaced on the rights-of-way and final grading, contouring, and de-compaction activities are complete. Seedbed preparation will be conducted immediately prior to seeding to prepare a firm seedbed conducive to proper seed placement. Seedbed preparation will also be performed to break up surface crusts and to reduce weeds that develop between the initial ground clearing and final seeding.

Unless otherwise specified by the USFS, the seedbed will be prepared in disturbed areas to a depth of 3 to 4 inches using appropriate equipment (e.g., cultipacker roller) to provide a seedbed that is firm, yet rough. Atlantic will imprint exposed soils with a sheepsfoot, landfill compactor, tractor with studded tires, or land imprinter equipment. Soil imprinting, or tracking, leaves divots on the ground surface that trap moisture and seeds, creating catchments for native plant material to be spread across the seeded area (West Virginia Department of Environmental Protection, 2012). In addition, a seedbed with a rough surface is conducive to the capturing or lodging of seed when broadcasted or hydroseeded, and can reduce runoff and erosion potential. The rough seedbed surface will also retain soil moisture for seedling germination and promote faster establishment of vegetation.

In compacted areas, additional measures such as chisel plowing or disking may be necessary to improve water infiltration and soil aeration necessary to prepare an adequate seedbed. When hydroseeding, Atlantic will scarify the soil surface prior to seeding to anchor the seed to the soil surface and encourage germination.

10.3.1.9 Seedbed Augmentation

Lime and Fertilizer Application

In general, and in accordance with the Plan and Procedures, upland areas will have a fertilizer and pH supplement (i.e., lime) mixed in to the upper two inches of topsoil. No lime or fertilizer will be used within 100 feet of wetlands or waterbodies or within 300 feet of karst features. In upland areas without specific fertilization requirements, Atlantic will:

- apply 150 pounds per acre of 10-20-20 (or similar) fertilizer;
- apply phosphorus or potassium during the same installation, if required;
- avoid fertilizer drift through restricted application times that exclude periods of high winds or heavy rains; and
- store and mix all fertilizers in upland areas and away from karst features, where contamination of wetlands, waterbodies, or karst features will be avoided.

Mulching

In general, and in accordance with the Plan, Atlantic will apply mulch to slopes immediately after seeding to prevent erosion or as specified by the USFS. Mulch materials will be anchored to the soil with

stakes or liquid mulch tackifiers. No tackifiers will be used within 100 feet of wetlands and waterbodies or within 300 feet of karst features.

Possible mulch materials and application techniques are described below.

- Salvaged wood materials, including slash and non-merchantable timber, will be retained in forested areas and placed on the rights-of-way after final grading, re-contouring, and seeding is complete. Woody debris is expected to support revegetation while preventing erosion and providing micro-habitat for various species.

- Native wood chip materials will be used in forested systems and will be generated from cleared materials that are chipped and stockpiled on the edge of the rights-of-way. Native wood chips are expected to aid in the successful revegetation of disturbed areas.

- Wood fiber hydromulch may be used in shrubby areas to augment biomass salvaged during clearing. Hydromulch is evenly distributed and absorbs water quickly, which enhances seed survival rates and discourages erosion during regeneration of shrubby species.

- Bonded fiber matrix (BFM), a type of hydromulch designed to control erosion on steep slopes, may also be used where appropriate. BFM slurry contains thermally processed wood fibers (approximately 80 percent), water (approximately 10 percent), and tackifiers and polymer-based binding agents that are quick to dry upon application. BFM is hydraulically applied, which allows for controlled application on steep slopes where access may be difficult. BFM will only be applied to stable slopes where final grading has been completed and water runoff has been diverted from the slope face. Once BFM has had 24 to 48 hours to cure, an erosion-resistant blanket is formed that is flexible, absorbent, and biodegradable, and that will accelerate plant growth. BFM may be used in conjunction with slope breakers and other erosion control devices on slopes longer than 70 feet. BFM application rates will depend on manufacturers specifications, based upon the slope of the disturbed areas.

- Straw or hay that has been certified as weed-free will be used to preserve the soil base in areas where native salvaged material is not available. In areas that are seeded by drill, Atlantic will apply one bale of clean straw or hay per 1,000 square feet. Where broadcast seeding is used, Atlantic will apply two bales of clean straw or hay per 1,000 square feet, or in accordance with requirements specified by the USFS.

Seeding

Atlantic will perform seeding of permanent vegetation during the Fall of the year construction is completed, within the recommended seeding dates, and within six working days of final grading, weather and soil conditions permitting. Atlantic will prioritize seeding and other restoration work in high-elevation areas, in an attempt to avoid restoration delays due to Winter-related weather and field conditions. If seeding cannot be done within recommended Fall timeframes, appropriate temporary erosion control measures will be installed and temporary grass cover will be seeded. If temporary grass cover is used, seeding of permanent vegetation will occur at the beginning of the next recommended seeding season.

Atlantic has consulted with the NRCS and is still in the process of consulting with the USFS and State/Commonwealth land managing agencies, to identify appropriate seed mixes and other cultural

practices for use during restoration. Based on discussions to date with the local NRCS offices, seed mixes and soil amendments have been developed and added to this *Restoration and Rehabilitation Plan* for Pocahontas and Augusta, Bath, and Highland Counties.

All seed will be certified weed free. The EIs will review all seed tags prior to use to ensure that the seed is properly certified.

Summary of State and Federal Agencies Consulted

Table 10.3.1-1 provides a list of the Federal and State/Commonwealth agencies, and subject matter experts consulted to determine the appropriate seed mix prescriptions and BMPs to revegetate areas disturbed by the construction of the ACP facilities.

TABLE 10.3.1-1

Summary of Federal and State/Commonwealth Agencies and Subject Matter Expert Consultations

Contact Name	Agency/ Organization	County	Title/Role	Phone	Email
WEST VIRGINIA					
Greg Stone	NRCS - State Office	All Counties	Acting State Resource Conservationist	304-284-7579	greg.stone@wv.usda.gov
Jeff Griffith	USDA NRCS	Harrison; Lewis; Doddridge	District Conservationist	304-624-9232 x 110	jeff.griffith@wv.usda.gov
Jack O'Connell	USDA NRCS	Pocahontas	District Conservationist	304-799-4317	jack.oconnell@wv.usda.gov
Barbara Sargent	West Virginia Department of Natural Resources	Wetzel	Wildlife Biologist	304-637-0245	barbara.d.sargent@wv.gov
Cliff Brown	West Virginia Department of Natural Resources	Wetzel	Wildlife Biologist	304-637-0245	clifford.l.brown@wv.gov
Idun Guenther	NRCS	Pocahontas	District Conservationist	304-255-9225	idun.guenther@wv.usda.gov
Susan Davis	NRCS	Pocahontas	Soil Conservationist	304-799-4317	susan.davis@wv.usda.gov
Rob Silvester	West Virginia Department of Natural Resources	Randolph	District Wildlife Biologist	304-924-6211	rob.a.silvester@wv.gov
Steve Rauch	West Virginia Department of Natural Resources	Randolph; Wetzel	District Wildlife Biologist	304-825-6787	steven.e.rauch@wv.gov
Ben Collier	NRCS	Randolph; Upshur	District Conservationist	304-636-6703 x 305	ben.collier@wv.usda.gov
Jeremy Bennett	NRCS	Randolph; Upshur	District Conservationist	304-457-4516	jeremy.bennett@wv.nrcs.gov
Dustin Adkins	NRCS	Tyler; Wetzel	District Conservationist	304-758-2173 x 1	dustin.adkins@wv.usda.gov
Katie Fitzsimmons	NRCS	Marshall	District Conservationist	304-242-0576 x 108	katie.fitzsimmons@wv.usda.gov
VIRGINIA					
Amy Ewing	Virginia Department of Game and Inland Fisheries	Wetzel	Environmental Services Biologist/Fish & Wildlife Information Manager	804-367-2211	Amy.Ewing@dgif.virginia.gov

TABLE 10.3.1-1

Summary of Federal and State/Commonwealth Agencies and Subject Matter Expert Consultations (cont'd)

Contact Name	Agency/ Organization	County	Title/Role	Phone	Email
VIRGINIA					
Charles Ivins	NRCS	Augusta; Highland	District Conservationist	540-248-6218 x 122	charles.ivins@va.usda.gov
Charles Simmons	NRCS	Bath	District Conservationist	540-463-7124 x111	charles.simmons@va.usda.gov
Justin Folk	NRCS/Virginia Department of Game and Inland Fisheries	Bath	Private Lands Wildlife Biologist	540-248-6218 x 108	justin.folks@va.usda.gov
Davie Wade Harris	NRCS	Brunswick	District Conservationist	434-848-2145 x 102	davie.harris@va.usda.gov
David Harris	NRCS	Buckingham; Cumberland	District Conservationist	434-983-4757 x 101	david.harris@va.usda.gov
Bryan Poovey	FWS	Chesapeake; Suffolk (City); (Great Dismal Swamp National Wildlife Refuge)	Forestry Scientist	757-986-3705	bryan_poovey@fws.gov
David Bryd	FWS	Great Dismal Swamp NWR	Forestry Scientist	804-824-2412	david_byrd@fws.gov
Robert E. Williams	NRCS	Chesapeake	District Conservationist	757-547-7172 x 102	robert.williams@va.usda.gov
Bob Glennon	NRCS	Eastern Virginia Counties	Private Lands Biologist	757-357-7004 x 126	robert.glennon@va.usda.gov
Anthony Howell	NRCS	Dinwiddie	District Conservationist	804-469-7297 x 106	anthony.howell@va.usda.gov
Harvey Baker	NRCS	Greensville	District Conservationist	434-634-2115 x 109	harvey.baker@va.usda.gov
Jay Jeffreys	Virginia Department of Game and Inland Fisheries	Highland; Nelson	Biologist	540-248-9360	jay.jeffreys@dgif.virginia.gov
Kory Kirkland	NRCS	Nelson	District Conservationist	540-967-0233 x 111	kory.kirkland@va.usda.gov
Jeffray Jones	NRCS	All Counties	State Biologist	804-287-1691	jeffray.jones@va.usda.gov
J.B. Daniel	NRCS	Prince Edward	Agronomist Director	434-392-4171	j.b.daniel@va.usda.gov
Derek Hancock	NRCS	Nottoway; Prince Edward	District Conservationist	434-392-4127 x 101	derek.hancock@va.usda.gov
Yamika Bennett	NRCS	Southampton	District Conservationist	757-653-2532 x 122	yamika.bennett@va.usda.gov
Michael A. Faulk	NRCS	Suffolk (City)	District Conservationist	757-357-7004 x 114	mike.faulk@va.usda.gov
Ryan McCormick	National Park Service		Specialist Coordinator	828-348-3441	
NORTH CAROLINA					
Renessa Hardy-Brown	NRCS	Cumberland	District Conservationist	910-484-8479	renessa.brown@nc.usda.gov
Terry Best	NRCS	Halifax	District Conservationist	252-583-3481	terry.best@nc.usda.gov
Brian Loadholt	NRCS	Johnston	District Conservationist	919-934-7156	brian.loadholt@nc.usda.gov
Patrick Evens	NRCS	Nash	District Conservationist	252-459-4116 x 124	patrick.evans@nc.usda.gov
Paul Boone	NRCS	Northampton	District Conservationist	252-534-2591	paul.boone@nc.usda.gov

TABLE 10.3.1-1

Summary of Federal and State/Commonwealth Agencies and Subject Matter Expert Consultations (cont'd)

Contact Name	Agency/ Organization	County	Title/Role	Phone	Email
NORTH CAROLINA					
Jeremy Ruston	NRCS	Robeson	District Conservationist	910-739-5478	jeremy.roston@usda.gov
Gavin Thompson	NRCS	Sampson	District Conservationist	910-592-7963	gavin.thompson@nc.usda.gov
David Little	NRCS	Wilson	District Conservationist	252-237-2711	david.little@nc.usda.gov
SUBJECT MATTER EXPERTS					
Mark Fiely	Ernst Seeds	All Counties	Horticulturist	800-873-3321	hortpath@ernstseed.com
Jeremy Hamlington	Roundstone Native Seed	All Counties	Horticulturist	270-531-3034	jeremy@roundstoneseed.com
Bob Glennon	NRCS / The Xerces Society	All Counties	Private Lands Biologist	757-357-7004 x 126	robert.glennon@va.usda.gov
Nancy Lee Adamson	The Xerces Society for Invertebrate Conservation & NRCS East National Technology Support Center	All Counties	Pollinator Conservation Specialist	336-370-3443	nancy@xerces.org

Seed Mix Recommendations

Atlantic is working with Federal and State/Commonwealth land managing agencies to determine appropriate seed mixes and methods for revegetation and restoration of Federal and State/Commonwealth lands crossed by the pipeline. As part of these discussions, Atlantic will work with the USFS to identify ways in which pollinator-friendly species might be introduced into the seed mixes, consistent with other restoration objectives. These discussions are also expected to address the appropriate seed sources for the restoration effort.

The recommended seed mix prescriptions and amendment recommendations identified for Pocahontas County, West Virginia and Augusta, Bath, and Highland counties, Virginia are provided in below.

Monongahela National Forest—Pocahontas County, West Virginia

The following seed mixtures, application rates, and soil amendment recommendations are for Pocahontas County, West Virginia (Tables 10.3.1-2 and 10.3.1-3). The recommendations are based on correspondence and discussions with Iden Gunther (NRCS Conservationist) and Susan Davis (West Virginia Department of Natural Resources). Seed Mix WVPO01 provides seeding recommendations for disturbed areas from the NRCS Critical Area Planting Standard that is commonly used with a high success rate in the County.

Recommended Seed Mixes and Application Rates

TABLE 10.3.1-2

Seed Mix WVPO01: Recommended Seed Mixes for Pocahontas County, West Virginia

Seed Mixture	Species / Mixture [a]	Seeding Application Rate (lbs/acre/PLS) [b]	Soil Drainage Preference	pH Range
1	Crownvetch	10 – 15	Well – Moderately Well	5.0 – 7.5
	Perennial Ryegrass	20		
2	**KY Bluegrass**	20	Well – Moderately Well	5.5 – 7.5
	Redtop	3		
	Ladino Clover or	2		
	Birdsfoot Trefoil	10		
3	**Timothy**	8	Well - Poorly	5.5 – 7.5
	Birdsfoot Trefoil	8		
4	***Orchardgrass***	10	Well – Moderately Well	5.5 – 7.5
	Ladino Clover	2		
	Redtop	3		
5	***Orchardgrass***	10	Well – Moderately Well	5.5 – 7.5
	Ladino Clover	2		
5	**Birdsfoot Trefoil**	10	Well – Moderately Well	5.5 – 7.5
	Redtop	5		
	Orchardgrass	20		

Source: WVDEP, 2012

[a] Species in bold are more wildlife-friendly; species in italics are suitable for use in filter strips.

[b] lbs/acre/PLS = pounds per acre of pure live seed

Recommended Soil Amendments and Application Rates

TABLE 10.3.1-3

Recommended Lime and Fertilizer Application

pH of Soil [a]	Lime Application Rate (tons/acre) [b]	Fertilizer Application Rate (10-20-20 or equivalent) (lbs/acre)
> 6.0	2	500
5.0 to 6.0	3	
< 5.0	4	

Source: WVDEP, 2012

[a] The pH can be determined with a portable pH testing kit or by sending the soil samples to a soil testing laboratory. When four tons of lime per acre is applied it must be incorporated into the soil by disking, backblading, or tracking up and down the slope.

[b] lbs/acre/PLS = pounds per acre of pure live seed

Chemical Mulches, Soil Binders, and Tackifiers Recommendations

- Determine mulch-type and its appropriate application rate;
- A wide range of synthetic tackifiers (e.g., spray-on materials) are marketed to stabilize and protect the seeds and soil surfaces. These tackifiers are mixed with water and seed mixtures, and sprayed over the mulch and soils. They may be used alone in some cases as temporary stabilizers, or in conjunction with fiber mulch, straw or hay; and

- Chemical tackifiers, when used alone, do not have the capability to insulate the soil or retain soil moisture as effectively as organic mulches such wood fiber, straw, or hay.

Mulch Anchoring

- Depending on field conditions, mulch anchoring (e.g., mechanical methods or netting) may become necessary due to environmental conditions, including heavy winds or rapid water runoff (e.g., rain or snowmelt).

- Mechanical Anchoring

- Apply mulch and pull a mulch anchoring tool over the mulch. When a disk is used, set the disk straight and pull across the slope. Mulch material should be tucked into the soil about three inches.

- Mulch Netting

- Follow manufacturer's recommendations when positioning and stapling mulch netting into the soil.

George Washington National Forest - Augusta, Bath, and Highland Counties, Virginia

The following erosion control prevention, forage species seed mixtures, and recommended soil amendments are for Augusta, Bath, and Highland Counties, Virginia. These recommendations are based on the U.S. Department of Agriculture-NRCS Virginia Plant Establishment Guide (Jones, et. al., 2014), which was recommended by Federal and Commonwealth agency contacts, including Charles Ivins (NRCS Conservationist), Charles Simmons (NRCS Conservationist), Jeffray Jones (State Biologist), and Justin Folk (Wildlife Biologist).

Recommended Grass Seed Mixtures, Species, Application Rates, and Planting Dates

Seed Mix VABCHNP01 (Table 10.3.1-4) provides a list of species/mixes for erosion prevention, while Seed Mix VABCHNP02 (Table 10.3.1-5) provides a list of species/mixes for forage.

TABLE 10.3.1-4

Seed Mix VABCHNP01: Recommended Species/Mixes for Erosion Prevention

Seeding Mix	Common Species Name	Virginia Native	Seeding Rate (lbs/acre/PLS)[a] B:broadcast; D:drill (4-9" row)	Plant Depth (inches)	Mountain/Valley/Northern Piedmont Best Dates	Mountain/Valley/Northern Piedmont Possible Dates
Average Last Frost					May 1	
PERENNIAL GRASS						
1	Tall Fescue (use in high velocity and highly erosive situations		B: 60	¼-½	Aug 15-Sep 10; Mar 15-Apr 10	Aug 1-Sep 30; Mar 1-Apr 30
2	Switchgrass	√	D:10; B:15	¼	Mar 15-Jun 30	
MIXTURES						
3	Tall Fescue + Ladino Clover		B:40+3	¼	Aug 15-Sep 10; Mar 15-Apr 10	Aug 1-Sep 30; Mar 1-Apr 30
4	Tall Fescue + Red Clover		B:40+6	¼	Aug 15-Sep 10; Mar 15-Apr 10	Aug 1-Sep 30; Mar 1-Apr 30
5	Tall Fescue + Annual Lespedeza		B:40+10; D:30+8	¼	Mar 1-Apr 15	Mar 1-Apr 15
6	Tall Fescue + Redtop		D/B: 40+10	¼-½	Jul 25-Sep 1; Mar 20-Apr 20	Jul 15-Sep 15; Mar 1-May 15
7	Switchgrass + Red Fescue + Partridge Pea		D/B: 10+15+4	¼	Mar 15-April 30	Mar 15-Jun 30
8	Switchgrass + Indiangrass + Big Bluestem		D/B: 5 each	¼	Mar 15-Jun 30	Mar 15-Jun 30
9	Tall Fescue + Redtop + Birdsfoot Trefoil		D/B: 60+6+10	¼-½	Jul 25-Sep 1; Mar 20-Apr 20	Jul 15-Sep 15; Mar 1-May 15
10	Switchgrass + Deer tongue + Partridge Pea	√	D/B: 8+8+4	¼	Mar 15-April 30	Mar 15-Jun 30
11	Perennial Ryegrass + Redtop		D:5+2; B:7+3	½-¾	Mar 1-Apr 15	Aug 1-Sep 15

Source: Jones, et. al., 2014

Note: The Virginia Plant Establishment Guide (Jones, et. al., 2014) provides acceptable seed mixtures and/or plant species rates, seeding dates, and other information that may be needed in the planning of practices and development of specifications for individual sites.

[a] lbs/acre/PLS = pounds per acre of pure live seed

TABLE 10.3.1-5

Seed Mix VABCHNP02: Recommended Forage Species/Mixes

Seeding Mix	Common Species Name	Virginia Native	Seeding Rate (lbs/acre/PLS) B:broadcast; D:drill (4-9" row)	Plant Depth (inches)	Mountain/Valley/Northern Piedmont [a] Best Dates	Possible Dates
Average Last Frost					May 1	
PERENNIAL GRASSES						
101	Bermudagrass (Hybrid) [b] Sprigs – 1 bushel = 1.25 ft^3		B:30-40 bushels D:15-20 bushels	2"-4"	Not well adapted	May 1-Jun 15
102	Bermudagrass [b], Coated Seeds (Common & Cultivars)		B:10-12; D:8-10	¼	Not well adapted	May 1-Jun 15
103	Big Bluestem [c]	√	B:10-12; D:8-10	¼	Mar 15-Jun 30	Mar 15-Jun 30
104	Bluegrass		B:10-15; D:8-12 4-5 in mixtures	¼	Aug 15-Sep 1; Mar 15-Apr 1	Aug 1-Sep 15; Mar 1-Apr 15
105	Eastern Gamagrass [d] (use non-stratified seed for winter planting and stratified seed for spring plantings)	√	R:8-10	1- 1.5	Nov 15-Feb 15; May 1-May30	Nov 15- Feb 15: May 1-Jun 30
106	Indiangrass [c]	√	B:10-12; D:8-10	¼	Mar 15-Jun 30	Mar 15-Jun 30
107	Orchardgrass [e]		B:12-15; D:8-12	¼-½	Aug 20-Sep 10; Mar 15-Apr 1	Aug 15-Oct 1; Mar 1-Apr 15
109	Perennial Ryegrass [e]		D: 12-15 B:20-25; 6-10 in mixtures	¼-½	Aug 20-Sep 10; Mar 15-Apr 1	Aug 15-Sep 25; Mar 1-Apr 15
110	Prairiegrass		D:20-25; B:30-35 10-15 in mixtures	¼-½	Aug 15 - Sep 15; Mar 15-Apr 15	Aug 15-Oct 15; Mar 1-Apr 30
111	Switchgrass [c]	√	B:8-10; D:6-8	¼	Mar 15-Jun 30	Mar 15-Jun 30
112	Tall Fescue		B:20-25; D:15-20	¼-½	Aug 15-Sep 10; Mar 15-Apr 15	Aug 1-Sep 30; Mar 1-Apr 30
113	Timothy		B:10-12; D: 8-10	¼-½	Aug 15-Sep 10; Mar 15-Apr 1	Aug 15-Oct 1; Mar 1-Apr 15
MIXTURES						
114	Orchardgrass + Alfalfa [f]		B:5+20; D:3+15	¼-½	Aug 15-Sep 1; Mar 15-Apr 1	Aug 1-Sep 15; Mar 1-Apr15
115	Orchardgrass with 1 or more of the following: Ladino Clover Red Clover Annual Lespedeza		B: 10-12; D:8-10 1-2 4-6 10-12	¼-½	Aug 20-Sep 10; Mar 15-Apr 1	Aug 15-Oct 1; Mar 1-Apr 15
116	Orchardgrass and Timothy with 1 or more of the following: Ladino Clover Red Clover Annual Lespedeza		B: 10-12; D:8-10 B: 4; D:2 1-2 4-6 10-12	¼-½	Aug 20-Sep 10; Mar 15-Apr 1	Aug 15-Oct 1; Mar 1-Apr 15

TABLE 10.3.1-5

Seed Mix VABCHNP02: Recommended Forage Species/Mixes (cont'd)

Seeding Mix	Common Species Name	Virginia Native	Seeding Rate (lbs/acre/PLS) B:broadcast; D:drill (4-9" row)	Plant Depth (inches)	Mountain/Valley/Northern Piedmont [a] Best Dates	Mountain/Valley/Northern Piedmont [a] Possible Dates
Average Last Frost					May 1	
MIXTURES						
117	Tall Fescue with 1 or more of the following: Ladino Clover Red Clover Annual Lespedeza		B:20-25; D:15-20 1-2 4-6 10-12	¼-½	Aug 15- Oct 1; Mar 1-Apr 15	Aug 15- Oct 1; Mar 1-Apr 15
118	Prairiegrass with 1 or more of the following: Red Clover Alfalfa [f]		B:20-25; D:15-20; 4-6 15	¼-½	Aug 15 - Sep 15; Mar 10-Apr 10	Aug 1-Sep 20; Mar 1-Apr 15
ANNUAL GRASSES						
119	Crabgrass [g]		B:6-8; D:4-6	¼	May 15-May 31	May 1-Jun 30
120	Barley		B:140; D:120	1 – 1.5	Aug 15-Sep 15	Aug 10-Sep 30
121	Millet, Pearl		B:30-40; D:15-20	½ - 1	May 15-May 31	May 1-Jun 30
122	Millet, German Foxtail, Japanese		B:20-30;D:15-20	¼	May 15-May 31	May 1-Jun 30
123	Oats, Winter [h]		B:80-96; D:65-80	1 – 1.5	Aug 15-Sep 10	Aug 10-Sep 15; Feb 1-Mar 1
124	Oats, Spring		B:80-96; D:65-80	1 – 1.5	Mar 15-Apr 1	Mar 15-Apr 10
125	Rye		B:120-150; D:90-110	1 – 1.5	Aug 15-Aug 31	Aug 15-Oct 25
126	Ryegrass		B:30-40; D:20-30	¼-½	Aug 15-Sep 10	Aug 10-Sep 30
127	Teff [g, i]		B: 6-8; D 5-6	1/8	Jun 1-Jun 15	May 15 - Jul 1
128	Wheat		B:150; D: 120	1 – 1.5	Aug 15-Aug 31	Aug 15-Oct 25
129	Small grain Mix (2 Grains)		Reduce each selection by 50%	1 – 1.5	See dates for small grains.	See dates for small grains.
130	Small grain mixed with annual ryegrass		Reduce Small grain 25% & ryegrass 50%	½ - 1	See dates for grains and ryegrass.	
131	Sorghum-Sudangrass		B:30-40; D:20-30	½ - 1	May 15-May 31	May 1-Jun 30
132	Sorghum, Forage		B: 15-20; R:5-10	1 – 1 ½	May 15-May 31	May 1 – Jun 30
133	Sudangrass		B:30-35; D:15-20	½ - 1	May 15 -May 31	May 1 – Jun 30
134	Triticale		B:140-180; D: 120-140	1 – 1.5	Aug 15-Aug 31	Aug 15-Oct 25
PERENNIAL LEGUMES						
135	Alfalfa [f]		B:20-25; D:15-20	¼	Aug 25-Sep 15; Mar 20–Apr 7	Aug 15-Sep 25; Mar 15-Apr 15
136	Alfalfa (no-till seeding into grass)		D:10-12	¼ - ½	Mar 20–Apr 7	Mar 15-Apr 15

TABLE 10.3.1-5

Seed Mix VABCHNP02: Recommended Forage Species/Mixes (cont'd)

Seeding Mix	Common Species Name	Virginia Native	Seeding Rate (lbs/acre/PLS) B:broadcast; D:drill (4-9" row)	Plant Depth (inches)	Mountain/Valley/Northern Piedmont [a] Best Dates	Mountain/Valley/Northern Piedmont [a] Possible Dates
Average Last Frost					May 1	
PERENNIAL LEGUMES						
137	Birdsfoot Trefoil (no-till into suppressed grass sod)		D:6-8	¼	Aug 15-Sep 1	Aug1-Sep 15
138	Birdsfoot Trefoil (frost seed onto pasture)		B: 8-10	0	Feb 1-Mar 1	Jan 25-Mar 10
139	Ladino or White Clover (no-till into suppressed grass sod)		D:1-2	¼	Aug 20-Sep 10; Mar 15-Apr 1	Aug 15-Sep 25; Mar 1-Apr 15
140	Ladino or White clover (frost seed onto pasture)		B:1-2	0	Feb 1-Mar 1	Jan 25-Mar 10
141	Red Clover (no-till into suppressed grass sod)		D:4-6	¼ - ½	Aug 20-Sep 10; Mar 15-Apr 1	Aug 15-Sep 25; Mar 1-Apr 15
142	Red Clover (frost seed onto pasture)		B:4-6	0	Feb 1-Mar 1	Jan 25-Mar 10
ANNUAL LEGUMES						
143	Crimson Clover w/Ryegrass or small grain		B:20; D:15 & reduce small grain by 1/3	¼ - ½	Aug 15-Sep 10	Aug 10-Sep 30
144	Lespedeza, Kobe (Southeast VA) (frost seeded onto pastures)		B:10-15	0	Not adapted	Not adapted
145	Lespedeza, Korean (frost seeded onto pastures)		B:10-15	0	Feb 1-Mar 1	Feb 1-Mar 15
146	Hairy Vetch w/ small grain		B: 15; D 10 & reduce small grain by 50%	½ - 1 ½	Aug 15-Aug 31	Aug 15-Sep 15
OTHER SPECIES						
147	Chicory (in mixture w/grass & legume)		B: 3-4 D: 1-2	¼ - ½	Apr 15-May5	Apr 1-May 15

TABLE 10.3.1-5

Seed Mix VABCHNP02: Recommended Forage Species/Mixes (cont'd)

Seeding Mix	Common Species Name	Virginia Native	Seeding Rate (lbs/acre/PLS) B:broadcast; D:drill (4-9" row)	Plant Depth (inches)	Mountain/Valley/Northern Piedmont [a] Best Dates	Mountain/Valley/Northern Piedmont [a] Possible Dates
Average Last Frost					May 1	
OTHER SPECIES						
148	Brassicas [j] (sow 1-2 of the following in a 50% rate mix of summer or winter annual grasses in late spring or late summer respectively) Rape Kale Turnip Turnip X Rape Radish		B: 2-3 D: 1-2	¼ - ½	May 1 - Jun 30 Aug 1 - Sep 1	May 1 - Jun 30 Aug 1 - Sep 1

Source: Jones, et. al., 2014

[a] The northern piedmont planting dates may be on the opposite end of the planting range compared to the mountains and valley in Southwest VA.

[b] Sprigged and seeded Bermudagrass have been established in the mountain and valley region of the state but are not well adapted and have a higher chance of winter kill.

[c] Native warm season grass planting date will vary within the planting window depending on dormancy of seed and expected annual grass/weed competition in the field.

[d] Eastern Gama grass can be planted with a corn planter (30" row) or with a drill on approximately 15" row centers (by blocking every other seed tube).

[e] This species tends to be a short lived perennial when planted and managed in monocultures in the piedmont and eastern regions of VA; it seems does better in the mountain and valley regions of the state especially when managed with rotational stocking in a mixed stand with other grasses and legumes.

[f] Fall planted alfalfa should not be no-tilled; alfalfa should be planted in spring 30 days prior to last killing frost and in fall 30-60 days before first killing fros.t

[g] Planting too deep is a common cause of stand failure.

[h] It is generally not recommended to plant oats in the fall west of the Blue Ridge because they will winter kill, however they are sometimes planted late summer and grazed in the fall and early winter.

[i] Not recommended for no-till planting, needs a clean firm seedbed to ensure establishment.

[j] Brassicas are not recommended in a monoculture, they are low in fiber and have highly digestible protein and can cause problems with rumen function; they should be planted mixed with summer or winter annuals to avoid problems (50 percent seeding rate of brassicas and 50 percent annuals).

Recommended Soil Amendments and Application Rates

Table 10.3.1-6 provides a summary of the soil amendments and application rates recommended.

TABLE 10.3.1-6

Recommended Soil Amendments

Type	Application Rate
Lime	2 tons/acre
Fertilizer 10-10-10	1,000 lbs/acre

Mulching

The NRCS Conservation Practice Standard - Mulching (Code 484) (NRCS, 2014) provides a general recommendation for mulching in Virginia. Mulching materials should consist of natural/artificial materials that can provide a certain depth/thickness and durability to achieve adequate cover. Mulch should be applied evenly and, if necessary, anchored into the soil. As a minimum, apply manufactured mulches in accordance with the manufacturer's specifications. The Mulch Specifications table provides some general guidelines when using certain mulches (see Table 10.3.1-7).

Mulch should be applied to provide adequate protection from erosion, yet allow light and moisture to penetrate into the seedbed. Typical mulching provides 70 percent cover (approximately 2,000 pounds of straw per acre) with the appropriate erosion control measure to hold the seed and straw in place during establishment, depending on slope (NRCS Code 342) (NRCS, 2011). There are several types of mulches that can be used to conserve soil moisture, promote plant growth, and reduce erosion; however, there are also mulches that can have the reverse affect (see Mulch Considerations table; see Table 10.3.1-8). Consider potential benefit or detrimental effects of mulching to the impacted and surrounding areas.

TABLE 10.3.1-7

Mulch Specifications

Mulch Type	Suggested Cover
Cereal Grain/Grass Hay	70% Ground Cover
Wood Products (Wood Chips, Bark)	≤ 2-inch thickness
Gravel / Other Inorganic Materials	0.75 to 2-inch diameter / 2-inch thickness

TABLE 10.3.1-8

Mulch Considerations

Type	Warning	Recommendation
Rice Hulls (finely textured)	Limited oxygen penetration	<2 inches thick
Thick/Tightly Packed Materials	Soggy, anaerobic conditions during wet weather	Avoid excessively thick/tightly packed mulches
	Interference with insect movements, increase of rate of crop pests/diseases	
	Provides nesting habitat for ground-burrowing rodents that can chew extensively on tree trunks/roots	
Sawdust (finely-divided plant residues)	Similar Carbon/Nitrogen ratio ties up soil nitrogen and necessitate supplemental nitrogen applications on crops	Use coarser materials, such as grain straw/chipped brush
Plastic (Low permeability)	Increase concentrated flow and erosion on nearby sites	Refrain from using low permeability mulches
Black Mulch	Warm the soil by conduction	Good for weed control

Source: NRCS, 2014

Seeding Methods

Seeding may be conducted with the use of a seed drill, a mechanical broadcast seeder, or by hydroseeding. In the absence of requirements to the contrary, the standard application method will be seeding with a seed drill equipped with a cultipacker. 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 an EI. Broadcast or hydroseeding at double the recommended seeding rates may be used in lieu of drilling.

Broadcast seeding will be used for areas with minimal to moderate slopes and will be performed by dry dispersal or wet broadcast seeding. Wet broadcast seeding is an effective treatment for temporary erosion control and may be used when hydroseeding late in the season or on certain site conditions where hydroseeding is not practical. To support successful seed germination, seed will be broadcast once soil compaction has been rectified and soil composition includes proper aeration and water percolation to support plant development. Where seed is broadcast, the seedbed will be restructured with a cultipacker or imprinter after seeding. Once seed is broadcast, Atlantic will rake the area lightly to encourage plant establishment and minimize the seed that migrates from the site.

Hydroseeding involves the mixing of slurry (i.e., seed, water, fertilizer, tackifier, or mulch) in a truck-mounted mixing tank and ground application via a pressurized pump. Hydroseeding is the preferred method of seed dispersal on steep slopes greater than 60 percent, where site conditions require seed adherence to the disturbed soil. Prior to hydroseeding, Atlantic will scarify the seedbed to facilitate lodging and germination of seed. Tackifiers will be applied where necessary so that seed adheres to soil. Polymer binders, if selected, will be used in accordance with manufacturer's specifications to ensure proper compatibility with fertilizers and to avoid foaming that might otherwise result from excessive agitation. All chemical components will be mixed and administered in accordance with manufacturer guidelines. In addition, hydroseeding near wetlands or waterbodies will only be conducted in accordance with the FERC Plan and Procedures and other applicable USFS regulations.

Supplemental Plantings

Pending discussions with MNF and GWNF staff, Atlantic will address the supplementation of seeding with the planting of tree seedlings or small shrubs. While no additional supplemental plantings are anticipated or proposed for the permanent or temporary right-of-way, supplemental plantings may be required based on consultation with USFS.

10.3.2 Additional Restoration Mitigation Measures for National Forest Service Lands

On NFS lands, additional measures will be implemented, in conformance with LRMP standards and guidelines, and recommendations from USFS staff. If a mitigation measure or BMP is more stringent than its counterpart NFS mitigation measure below, the more stringent measure will be applied.

10.3.2.1 Monongahela National Forest

- Use of wheeled and/or tracked motorized equipment may be limited on soil types that include the following soil/site area conditions: d) soils commonly wet at or near the surface during a considerable part of the year, or soils highly susceptible to compaction. Equipment use shall normally be prohibited or mitigated when soils are saturated or when freeze-thaw cycles occur (MNF LRMP SW07). Assessment of the type of soils is

pending completion of the order1 soil survey and input and recommendations from the USFS.

- Management actions that have the potential to contribute to soil nutrient depletion shall be evaluated for the potential effects of depletion in relation to on-site acid deposition conditions (MNF LRMP SW08). Assessment of the area soil chemistry is pending completion of the order1 soil survey and input and recommendations from the USFS.

- Inventory the soil resource to the appropriate intensity level as needed for Project planning and/or design considerations (MNF LRMP SW10). The inventory of the soil types is the area is pending completion of the order1soil survey and input and recommendations from the USFS.

- Consider liming soils with a surface pH of less than 5.5 on seeding Project, except where there is an objective to maintain acidic ecosystems (MNF LRMP SW13). Pending completion of the order1soil survey and input and recommendations from the USFS.

- Topsoil should be salvaged from an area during construction and stockpiled for use during subsequent reclamation, or obtained from an alternate site. On some areas, soil material may have to be added to obtain vigorous plant growth. Soil to be used for this purpose should have chemical tests made to determine its desirability for use (MNF LRMP SW15).

- Mulch must be applied to all disturbed soils in the MNF.

- On NFS lands, O and A horizons and transition soil horizons AB and BA, must be segregated. Pending completion of the order1soil survey and input and recommendations from the USFS.

- Post-construction and post-disturbance monitoring for revegetation should be conducted in perpetuity, for the life of the Project on NFS lands.

- This section is pending additional input and recommendations from the USFS regarding seed mixes, soil amendments, and cultural practices.

10.3.2.2 George Washington National Forest

- Where soils are disturbed by management activities, appropriate revegetation measures should be implemented. When outside the normal seeding seasons, initial treatments may be of a temporary nature, until permanent seeding can be applied. Revegetation should be accomplished within 5 years. For erosion control, annual plants should make up >50 percent of seed mix when seeding outside the normal seeding season and the area should be reseeded with perennials within 1½ years (GWNF LRMP FW-9).

- Clearcutting is not allowed where high risk soils (soils very susceptible to nutrient depletion and acidification) are identified (GWNF LRMP FW-12). Pending completion of the order1soil survey and input and recommendations from the USFS.

- On NFS lands, O and A horizons and transition soil horizons AB and BA, must be segregated. Topsoil on the GWNF will be defined as the O and the A, and AB or BA

horizons determined on site. Pending completion of the order1soil survey and input and recommendations from the USFS.

- Post-construction and post-disturbance monitoring for revegetation should be conducted in perpetuity, for the life of the Project on NFS lands.

- This section is pending additional input and recommendations from the USFS regarding seed mixes, soil amendments, and cultural practices.

10.3.3 Riparian Restoration

Following initial stream bank stabilization, Atlantic will restore the banks of waterbodies to preconstruction contours to the extent practicable. In steep-slope areas, re-grading may be required to reestablish stable contours capable of supporting preconstruction drainage patterns. Riparian areas will be revegetated with native species across the entire width of the construction corridor. Restoration of riparian areas will be designed to:

- restore stream bank integrity, including both shore crossings up to the ordinary high water mark;

- withstand periods of high flow without increasing erosion and downstream sedimentation; and

- include temporary erosion control fencing, which will remain in place until stream bank and riparian restoration is complete.

Permanent bank stabilization and erosion control devices (e.g., natural structures, rock riprap, and/or large woody debris) will be installed as necessary on steep banks in accordance with permit requirements to permanently stabilize the banks and minimize sediment deposition into waterbodies.

This section is pending additional input and recommendations from the USFS regarding seed mixes, soil amendments, and cultural practices.

10.3.3.1 Forested Riparian Areas

Restoration of forested riparian areas will include seeding as discussed above, and may include supplemental plantings of tree seedlings and shrubs. Clearing of riparian trees in forested areas will reduce shade near streams, and may allow for an increase in local water temperature. Large woody debris, where available and appropriate habitat conditions exist, will be placed adjacent to waterbody crossings to add shade and fish habitat. Forested riparian areas will be restored and enhanced using plantings of native shrubs and trees, excluding the permanent easement, which will be retained in an herbaceous state. On a site-specific basis and in consultation with the USFS, Atlantic will design riparian revegetation with the use of fast growing native trees and shrubs placed closest to the bank top to provide canopy recovery as quickly as possible to shade and overhang the waterbodies.

10.3.4 Wetland Restoration

Atlantic will employ clearing and construction techniques designed to support regeneration of existing wetland vegetation, including the following:

- clearing vegetation at ground level in all non-forested wetland areas outside of the trench line to leave existing root systems intact to help stabilize soils, preserve existing ground elevations, and promote revegetation through sprouting and from existing seed stocks;
- using equipment mats to prevent soil compaction and allow intact root systems to regrow;
- replacing the topsoil segregated from the trenchline in unsaturated wetlands to promote reestablishment of existing wetland species and preserving the vegetative propagules (i.e., seeds, tubers, rhizomes, and bulbs) within the soil, which will have the potential to germinate or sprout when the topsoil is replaced; and
- limiting the removal of stumps to the trench area in forested wetlands, except where safety considerations necessitate additional stump removal, as retained stumps will facilitate reestablishment of woody species by enabling re-sprouting from existing root structures.

In accordance with the Procedures, sediment barriers will be installed immediately following clearing activities occurring within wetlands or adjacent upland areas along the pipeline rights-of-way. Where necessary, sediment barriers will be installed across the construction rights-of-way immediately upslope of the wetland boundary to prevent sediment flow into wetlands. Sediment barriers will be properly maintained throughout construction, reinstalled as necessary, and removed after restoration is complete and revegetation has stabilized the disturbed areas.

Seeding of wetlands is not anticipated as wetlands are expected to naturally revegetate. Unless specified by the USFS, revegetation will be monitored annually until wetland revegetation is successful in accordance with the Procedures. Wetland revegetation will be considered successful when vegetation community characteristics are similar to the vegetation in adjacent wetland areas that were not disturbed by construction. As described in the Procedures, restored wetland vegetation will include at least 80 percent of the species targeted for restoration, and the density (i.e., percent cover) and distribution (e.g., microsites and patches) of individual plants will be similar to areas not disturbed by construction.

After revegetation, Atlantic anticipates no permanent impact on emergent wetland vegetation within the rights-of-way. Scrub-shrub and forested wetlands will not be allowed to fully reestablish within portions of the permanent rights-of-way centered over the pipeline trench lines. Atlantic will periodically remove woody species from wetlands to facilitate post-construction inspections of the permanently maintained rights-of-way. Where the pipelines cross wetlands, Atlantic will maintain a 10-foot-wide corridor centered over the pipelines in an herbaceous condition, and remove deep rooted trees within a 30-foot-wide corridor centered over the pipelines.

This section is pending additional input and recommendations from the USFS regarding seed mixes, soil amendments, and cultural practices.

10.3.5 Exposed Bedrock

In areas with exposed bedrock or bedrock, Atlantic will restore the area using crushed rock rather than attempting to revegetate the area.

10.4 RESTORATION MONITORING AND MAINTENANCE

10.4.1 Monitoring

The general objectives of the monitoring program will be to determine the status and effectiveness of restoration efforts and to determine locations where additional maintenance may be required. Atlantic will inspect disturbed areas after the first and second growing seasons to determine the success of revegetation. In NFS lands, monitoring activities will be performed until reforestation is determined successful based on pre-defined success criteria, as determined through consultations USFS.

Atlantic will continue revegetation efforts until they are successful. Restoration will be considered successful when construction debris is removed, similar vegetative cover or bedrock has been restored, the original surface elevations are restored as closely as practicable to preconstruction contours, the surface condition is similar to adjacent non-disturbed areas, and proper drainage is restored.

10.4.2 Permanent Right-of-Way Maintenance

In order to maintain accessibility of the rights-of-way and to accommodate pipeline integrity surveys, vegetation within the permanent easements will be periodically cleared over the pipelines. In accordance with the Plan, a 10-foot-wide herbaceous corridor may be maintained annually, as needed. In addition, trees and brush will be cleared over the entire width of the permanent rights-of-way on an as-needed basis not to exceed once every 3 years. In wetlands and riparian areas, the Procedures allow a 10-foot-wide corridor centered over pipelines to be permanently maintained in an herbaceous state. The Procedures also allow for cutting and removing deep rooted trees greater within 15 feet of pipelines in wetlands.

Atlantic will use mechanical mowing or cutting along their rights-of-way for normal vegetative maintenance. Atlantic will monitor the rights-of-way for infestations of non-native invasive species that may have been created or exacerbated by construction, restoration, or maintenance activities, and will treat such infestations in consultation with applicable agencies in accordance with its *Non-Native Invasive Species Management Plan*.

11.0 NON-NATIVE INVASIVE PLANT SPECIES MANAGEMENT PLAN

11.1 PURPOSE

The areas crossed by the ACP (Project) contain widespread populations of many noxious weeds and other non-native invasive plant species. The purpose of this *Non-Native Invasive Plant Species Management Plan* is to describe methods to prevent and control the introduction or spread of non-native invasive plant species during and following construction of the Project on NFS lands. Atlantic and its Contractors[9] will be responsible for implementing the procedures described in this plan.

11.1.1 Training

Prior to the start of construction, Atlantic will conduct environmental training for Company and Contractor personnel. The training program will focus on the FERC's Plan and Procedures; other construction, restoration, and mitigation plans, including this *Non-Native Invasive Species Management Plan*; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

11.2 JURISDICTION

Noxious weeds are plant species designated by Federal, State/Commonwealth, or County/City governments as injurious to public health, agriculture, recreation, wildlife, or property (Sheley et al., 1999). The more general term "non-native invasive species" is used for species that are non-native to an ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Non-native invasive plants include not only noxious weeds, but other plants that are not native to an area. Both noxious weeds and non-native invasive plants are considered opportunistic species that flourish in disturbed areas and prevent native plants from establishing successive communities.

Under Executive Order 13112, a Federal agency shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of non-native invasive species in the United States or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by non-native invasive species, and that all feasible and prudent measures to minimize the risk of harm will be implemented.

The non-native invasive species found on the MNF and GWNF are monitored by the USFS as outlined in the respective Forests' LRMPs. . The results of the non-native invasive species surveys along the currently proposed route on NFS lands have been included as appendices to this report. .

11.3 NON-NATIVE INVASIVE PLANT SPECIES SURVEYS

Atlantic conducted field surveys for USFS-listed non-native non-native invasive plant species within a 300-foot-wide corridor along the proposed ACP pipeline route. A list of the non-native invasive plant species identified through July 2016 in the ACP survey corridors is provided in Table 11.3-1. The milepost locations of non-native invasive plant species identified through July 2016 are provided in Appendices A and B.

[9] Contractor refers to the company or companies retained by Atlantic or another contractor to construct the proposed facilities.

TABLE 11.3-1

Non-Native Invasive Plant Species Identified Within the Monongahela and George Washington National Forests

Latin Name	Common Name	Atlantic Coast Pipeline
Acer platanoides	Norway maple	
Ailanthus altissima	Tree of heaven	
Alliaria petiolata	Garlic mustard	X
Amaranthus hybridus	Common pigweed or green amaranth	
Ampelopsis brevipendunculata	Porcelain berry	
Anthoxanthum odoratum	Sweet vernal grass	
Arctium minus	Lesser burrdock	
Arthraxon hispidus	Jointed grass or small carpetgrass	
Barbarea vulgaris	Winter cress or yellow rocket	
Berberis thunbergii	Japanese barberry	X
Bidens aristosa	Ozark tickseed sunflower	
Bromus commutatus	Hairy chess or meadow brome	
Bromus inermis var. inermis	Smooth brome	
Bromus sterilis	Barren bromegrass or poverty brome	
Bromus tectorum var. tectorum	Downy chess or cheatgrass	
Butomus umbellatus	Flowering rush	
Carduus crispus	Curled thistle	
Carduus nutans	Musk Thistle	
Celastrus orbiculata	Oriental bittersweet	
Centaurea biebersteinii (C. maculosa)	Spotted knapweed	
Chrysanthemum leucanthemum	Ox-eye daisy	
Cichorium intybus	Chicory	
Cirsium arvese	Canada thistle	
Cirsium vulgare	Bull thistle	
Clerodendrum trichotomum	Harlequin glorybower	
Coronilla varia	Crown vetch	
Daucus carota	Queen Anne’s lace	
Dioscorea oppositifolia	Chinese yam	
Dipsacus laciniatus	Cut-leaved teasel	
Echium vulgare	Viper’s bugloss	
Elaeagnus angustifolia	Russian olive	
Elaeagnus umbellata	Autumn olive	X
Elytrigia repens	Quackgrass	
Epipactis helleborine	Broadleaf hellborine	
Festuca aruninacea	Kentucky 31 fescue	
Festuca elatior	Tall fescue	
Festuca pratensis	Meadow fescue	
Glechoma hederacea	Ground ivy or gill-over-the-ground	
Heracleum mantegazzianum	Giant hogweed	
Heracleum mantegazzianum	Giant hogweed	
Hesperis matronalis	Dame’s rocket	
Hieracium pretense	King devil or field hawkweed	
Holcus lanatus	Velvet grass	
Hydrilla verticillata	Hydrilla	
Hydrilla verticillata	Hydrilla	
Hypericum perforatum	Common St. John’s wort	
Iris pseudacorus	Yellow iris or yellow flag	
Lespedeza bicolor	Japanese bushclover	

TABLE 11.3-1

Non-Native Invasive Plant Species Identified Within the Monongahela and George Washington National Forests (cont'd)

Latin Name	Common Name	Atlantic Coast Pipeline
Lespedeza cuneata	Sericea lespedeza	
Ligustrum obtusifolium	Regal privet or border privet	
Ligustrum vulgare	European privet or common privet	
Lonicera spp.	Japanese amur, Morrow's, Tartarian, or Bell's honeysuckle	
Lysimachia nummularia	Moneywort or creeping jenny	
Lythrum salicaria	Purple loosestrife	
Melilotus alba	White sweet clover	
Melilotus officinalis	Yellow sweet clover	
Microstegium vimineum	Japanese stiltgrass	X
Muscari botryoides	Grape hyacinth	
Myriophyllum spicatum	Eurasian water-milfoil	
Orinthogalum umbellatum	Star of Bethlehem	
Orithogalum nutans	Drooping star of Bethlehem	
Paulownia tomentosa	Princess-tree	
Perilla frutescens	beefstakeplant	
Phleum pretense	Timothy	
Phragmites australis	Common reed	
Plantago major	Great plantain	
Poa compressa	Canada bluegrass	
Poa pratensis	Kentucky bluegrass	
Poa trivialis	Rough bluegrass	
Polygonum aviculare	Knotweed	
Polygonum cespitosum var. longisetum	Asiatic water pepper	
Polygonum cuspidatum	Japanese knotweed	
Polygonum sachalinense	Sachaline or giant knotweed	
Poncirus trifoliate	Hardy orange	
Potamogeton crispus	Curly pondweed	
Pueraria lobate	Kudzu	
Ranunculus ficaria	Lesser celandine or fig buttercup	
Rhamnus cathartica	Common buckthorn	
Rhodotypos scandens	Jetbead	
Rorippa sylvestris	Creeping yellow cress	
Rosa multiflora	Multiflora rose	X
Rubus phoenicolasius	Wineberry	
Rumex acetosella	Sheep sorrel	
Rumex crispus	Yellow dock or curly dock	
Sorghum halepense	Johnsongrass	
Spiraea japonica	Japanese spiraea	
Stellaria media	Common chickweed	
Tussilago farfara	Colt's-foot	X
Verbascum Thapsus	Great mullein	
Vinca minor	Periwinkle	

11.4 NON-NATIVE INVASIVE PLANT SPECIES MANAGEMENT

The non-native invasive plant species management program for the ACP is designed to:

- identify areas supporting non-native invasive plants prior to construction;
- prevent the introduction and spread of non-native invasive plants from construction equipment moving along the right-of-way;
- contain non-native invasive plant propagules by preventing segregated topsoil from being spread to adjacent areas along the construction right-of-way; and
- address non-native invasive plant infestations that develop during restoration and operation of the Project.

Attachment J identifies the primary and alternative treatment methods for non-native invasive species identified during survey in the ACP Project area. The primary and/or alternative treatment method will be used based on the growing stage and prevalence of the non-native invasive species. Methods may vary based on proximity to environmental features (e.g., wetlands, open water, sensitive species locations, and agricultural fields), in accordance with USFS regulations, and MNF & GWNF LRMPs. Atlantic is currently conducting further consultation with the USFS, West Virginia and Virginia Natural Heritage Programs on sensitive species adjacent to non-native invasive species, and the recommendations will be provided in Fall 2016. Instances of Regional Forester's Sensitive Species and Occurrence Analysis Results species that have been found adjacent to non-native invasive plant species have been reported in Appendices A and B.

11.4.1 Identification of Problem Areas

As noted above, Atlantic conducted surveys for non-native invasive plant species within the ACP Project area. Additional areas supporting non-native invasive plant species may be identified during preconstruction inspections by Atlantic's EI[10]. Prior to construction, the EIs will mark areas of non-native invasive plant infestations by using color-coded flagging, staking, and/or signs on the construction rights-of-way. Identification of existing non-native invasive plant locations will alert EIs and construction personnel to implement control measures during construction.

11.4.2 Treatment Measures

11.4.2.1 Pre-Treatment

Prior to clearing and grading operations, pre-treatment of non-native invasive plant infestations may be conducted if it will aid in controlling the spread of non-native invasive plant species during construction. The control measures to be implemented may include the application of herbicide or mechanical measures such as mowing. The control measure chosen will be the best method available for the time, place, and species, as determined through consultation with the USFS.

Herbicide application is an effective means of reducing the size of non-native invasive plant species populations. Herbicide treatment methods will be based on species-specific and area-specific conditions (e.g., annual vs. perennial species; proximity to wetlands, open water, riparian areas, or agricultural areas; and time of year), and will be coordinated, as necessary, with the USFS. Hand

[10] The role and responsibilities of an EI are defined in the FERC's Plan.

application methods (e.g., backpack spraying) will be used to treat occurrences of non-native invasive species within the right-of-way and in other work areas. Preconstruction treatment of infestation areas will be controlled, as described in Section 7.0, to minimize impacts on surrounding vegetation.

Application of herbicides will be completed in accordance with applicable chemical contact times (as specified by the manufacturer) in advance of clearing and grading within the construction right-of-way. Treatment may be restricted in areas that are not readily accessible (e.g., difficult topography, saturated/inundated soils) or where there are documented occurrences of protected species that could be adversely impacted by herbicide applications. Atlantic will continue to work with the USFS to address non-native invasive plant species control options where protected species and their habitats occur along the ACP.

In accordance with 18 CFR 380.15(f)(3), herbicides will not be used as a treatment unless authorized by the landowner or land managing agency. Atlantic will obtain permission from the USFS prior to applications of herbicides within the right-of-way or other work areas. Additionally, Atlantic will use products which are approved by the U.S. Environmental Protection Agency (EPA) for use as herbicides, and applications of these products will be in accordance with applicable regulations.

In addition to complying with 18 CFR 380.15(f)(3), Atlantic will: 1) use herbicides which are registered with the EPA; 2) apply herbicides according to specifications of the *Federal Insecticide, Fungicide, and Rodenticide Act*; and 3) use only certified applicators to apply herbicides.

Mechanical control (e.g., mowing or disking) can also be an effective control measure for annual species. The efficacy of mechanical control measures are dependent upon proper timing to cut the vegetation prior to the maturation of seed and may require multiple treatments during the growing season.

11.4.2.2 Preventive Measures during Construction

The following measures will be implemented to prevent the spread of non-native invasive plant species during construction activities.

- Atlantic will direct its Contractors to clean equipment and vehicles prior to initial arrival at contractor yards and staging areas.

- All equipment (including timber mats) will be cleaned prior to arriving on the construction site. The equipment will be inspected by the Contractor and EI to verify that it is clean of soil and debris, which are capable of transporting non-native invasive plant propagules, prior to working on the Project. Atlantic will install intermediate cleaning stations at additional locations based on non-native invasive plant species survey results and other mitigating factors (such as accessibility). In selecting locations for cleaning stations, Atlantic will consider prevalence of non-native invasive plants, the locations of sensitive resources (e.g., wetlands), and/or recommendations from the USFS. Atlantic will provide the locations of cleaning stations as they are identified in supplemental filings. A final list of intermediate cleaning stations will be provided prior to construction.

- Cleaning will be conducted using high pressure washing equipment, compressed air, and/or manually to remove excess soil and debris from the tracks, tires, and blades of equipment.

- Wash water will be managed on site at the wash station. The water will be allowed to infiltrate into upland soils within the work area. Debris which collects around the work area will be collected and disposed of at an approved facility.

- The Contractor and EI will maintain logs documenting the cleaning history of each piece of equipment. The EI will use stickers or other visual marking to identify that equipment has been cleaned and an inspection has been completed.

- Topsoil will be segregated and buried in all infested areas, including the spoil-side and working-side portions of the construction right-of-way as a method to prevent equipment and workers from transporting and spreading non-native invasive species.

- Cleared vegetation and segregated topsoil from areas of non-native invasive plant infestations will be maintained adjacent to the areas from which they were removed to eliminate the transport of soil-borne propagules to other areas along the right-of-way. The stockpiles will be identified as non-native invasive plant species stockpiles with signs. The Contractor will install sediment barriers (e.g., silt fence) around the stockpiles to ensure the material is not transported to adjacent areas. During reclamation, the materials will be returned to the areas from which they were obtained.

- Equipment required for initial vegetation clearing and/or topsoil segregation in areas of non-native invasive plant infestation will be cleaned prior to leaving the area. Once the topsoil has been segregated, subsequent equipment will not require cleaning as it will not come into contact with non-native invasive plant species or topsoil potentially containing propagules. Equipment required for topsoil replacement during restoration activities will also be cleaned prior to moving out of an area of infestation.

- All equipment which comes in contact with soils potentially contaminated with non-native invasive species will be cleaned prior to being transported from ACP work sites to other job sites.

- Materials used for erosion control (e.g., hay bales or straw mulch) will be certified as weed free.

11.4.2.3 Post-Construction Treatment Methods

Atlantic's objective is to comply with regulatory and Project-specific requirements to prevent the spread of non-native invasive plant species and treat areas of the rights-of-way where non-native invasive plant species form a significant portion of the vegetation community in comparison to adjacent areas. Atlantic will utilize established restoration procedures to prevent the establishment of non-native invasive plant species in areas disturbed by construction.

In non-frozen soil conditions, the construction Contractor will implement restoration procedures on disturbed lands immediately following construction. In frozen soil conditions, restoration activities will be delayed until the Spring or Summer following construction. In either case, ongoing revegetation and monitoring efforts will ensure adequate vegetative cover to discourage the establishment of non-native invasive plant species.

Following construction, the ACP Project area will be monitored in accordance with the Plan and Procedures. In the event that non-native invasive plant species become established in the right-of-way, Atlantic will implement measures (e.g., mowing or treatment with herbicides) to control non-native

invasive plants within the right-of-way and prevent the spread of non-native invasive plants to adjacent lands which do not contain non-native invasive species. In addition, Atlantic will implement control measures at the aboveground facility sites to prevent the spread of non-native invasive plant species onto adjacent properties. Weed infestations that develop during operations as a result of construction will be treated using approved herbicides or mechanical methods (e.g., mowing) as appropriate for the species and in accordance with applicable laws and regulations. The method selected will be the best available for the time, place, and species as determined through consultation with the USFS.

Post-construction herbicide applications will be conducted prior to seed maturation where possible and where necessary. Applications will be controlled, as described in Section 7.0, to minimize impacts on surrounding vegetation. Herbicide treatment methods will be based on species-specific and area-specific conditions as described above and will be coordinated with the USFS as applicable. Hand application methods (e.g., backpack spraying) will be used to treat occurrences of non-native invasive species within the right-of-way and in other work areas. Following the treatment, a seeding program will be implemented in accordance with the *Restoration and Rehabilitation Plan*. The timing of subsequent revegetation efforts will be based on the persistence of the herbicide.

Mechanical methods entail the use of equipment to mow or disk non-native invasive plant species populations. Mechanical treatments will be conducted prior to seed maturation where required. If such a method is used, subsequent seeding will be conducted, if necessary, to re-establish a desirable vegetative cover that will stabilize the soils and slow the potential reoccurrence of non-native invasive plant species.

Where warranted, Atlantic will consult with the USFS regarding the use of biological and alternative non-native invasive plant control methods. The implementation of these measures will require approval from the USFS.

Increased accessibility of lands along the proposed pipeline rights-of-way, particularly during operations, could lead to OHV use into previously restricted or inaccessible areas. Atlantic has prepared an OHV Bocking Plan as part of this COM Plan to discourage use of the pipeline right-of-way by OHV users.

11.4.2.4 Monitoring

Following construction, non-native invasive plant infestations will be monitored as part of Atlantic's restoration monitoring activities as described in the *Restoration and Rehabilitation Plan*. Atlantic will inspect disturbed areas after the first and second growing seasons, at a minimum, to determine the success of revegetation. Revegetation shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar to adjacent undisturbed lands. Atlantic will continue revegetation efforts and monitoring until successful revegetation is achieved. Following successful revegetation, Atlantic's operations staff will monitor and treat non-native invasive plant species as part of its normal operations and maintenance activities in accordance with applicable USFS regulations.

11.5 HERBICIDES

11.5.1 Herbicide Application and Handling

To comply with the MNF and GWNF LRMPs, a selective herbicide application method will be utilized. Herbicide application will be based on information gathered from field surveys and consultations with the USFS. Before application, Atlantic or its Contractors will obtain required USFS permits and approval. Herbicide application will be conducted in accordance with applicable laws and

regulations by a licensed contractor. Hand application methods (e.g., backpack spraying) will be used to treat occurrences of non-native invasive species within the right-of-way and in other work areas. Calibration checks of equipment will be conducted at the beginning of spraying and periodically to ensure proper application rates.

Herbicides will be transported to the site with the following provisions:

- on-site herbicide quantities will be limited where practical;
- concentrate will be transported in approved containers only, in a manner that will prevent tipping or spilling, and in a compartment that is isolated from food, clothing, and safety equipment;
- mixing will be conducted in an upland area and at a distance greater than 100 feet from waterbodies or wetlands; greater than 200 feet from private wells, private land, riparian corridors, open water, or other sensitive areas;
- herbicides will not be ground applied within 60 feet of any known threatened, endangered, proposed, or sensitive plant, buffers will be clearly marked, and physical barriers must be sufficient to protect the non-target vegetation from herbicide drift and flow;
- storage and handling of all herbicides and equipment will be in accordance with all applicable regulations; and
- all herbicide equipment and containers will be maintained as needed and inspected for leaks on a daily basis.

11.5.2 Herbicide Spills

Atlantic has prepared and will implement a SPCC Plan to avoid or minimize the potential impact of hazardous material spills during construction and operation of the Project. In accordance with this plan, herbicide contractors will be responsible for keeping spill kits in their vehicles and in herbicide storage areas to allow for quick and effective response to spills. Response to an herbicide spill will vary depending on the material spilled, and the size and location of the spill. The order of priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and conduct cleanup and remediation activities.

All herbicide contractors will obtain and have readily available copies of the appropriate Safety Data Sheets (formally known as Material Safety Data Sheets) and labels for the herbicides used. All herbicide spills will be reported in accordance with applicable laws and requirements. Further information regarding spill response and reporting is provided in the SPCC Plan.

11.6 OTHER CONTROL MEASURES

As outlined in the MNF and GWNF LRMPs, Atlantic will use a secondary treatment method in the event the temperature requirements have been exceeded and/or the wind speed has been exceeded on the day of application. Other control measures like hand pulling, and/or basal spot treatment may be utilized. Treatment methods would be species specific or based on proximity to sensitive features. Stem-specific treatments should be used on rock outcrops or sinkholes. Atlantic will ensure soil-active herbicides will not be used on slopes over 45 percent or on aquifer recharge zones. These areas will be

marked by buffers. Atlantic will continue to coordinate with the USFS during construction to ensure these treatment measures are implemented as an alternative to the primary method of herbicide application.

11.7 TREATMENT SCHEDULE

Atlantic will provide the USFS with a treatment schedule once the Project nears the construction timeframes.

12.0 SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN

12.1 PURPOSE

The purpose of this SPCC Plan is to identify preventive measures, such as training, equipment inspection, and refueling procedures, to reduce the likelihood of spills; and mitigation measures, such as containment and cleanup, to minimize potential impacts should a spill occur. Atlantic's construction Contractors, [11] whose activities could result in a spill of fuel or other hazardous materials, will be required to adopt the following protocols for spill prevention, cleanup, and reporting during construction of the ACP.

Transportation and temporary storage of hazardous materials, including fuels, oils, hydraulic fluid, and blasting materials, could be required on USFS lands. The locations of temporary storage areas for these materials on USFS lands will be determined in consultation with USFS staff and discussions with the construction contractor.

12.2 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Company and Contractor personnel. The training program will focus on the FERC Plan and Procedures; other construction, restoration, and mitigation plans, including this SPCC Plan; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

Experienced, well-trained personnel are essential for the successful implementation of the SPCC Plan. Contractors will provide spill prevention and response training to their work crews. The training program will be designed to improve awareness of safety requirements, pollution control laws, and proper operation and maintenance of equipment. Contractors will train all employees who handle fuels and other regulated substances to prevent spills and to quickly and effectively contain and cleanup spills that may occur in accordance with applicable regulations and the provisions of this plan.

12.3 ROLES AND RESPONSIBILITIES

A. **Spill Coordinator –** Each Contractor will appoint a Spill Coordinator who will be responsible for coordinating Contractor Work Crews for spill cleanup, conducting site investigations, and completing spill reports. The Spill Coordinator will report spills to an EI, who will initiate the spill reporting process (see Section 12.6). The Spill Coordinator will be responsible for completing a Spill Report Form (Attachment K) within 24 hours of the occurrence of a spill, regardless of the size of the spill.

B. **Contractor Work Crews –** Contractor Work Crews will comply with this SPCC Plan and will notify the crew foreman or Spill Coordinator immediately of a spill of fuel or other hazardous material, regardless of the volume of the spill.

C. **Environmental Inspectors –** The EIs will monitor the Contractors' compliance with the provisions of the SPCC Plan to ensure that spill resources are allocated and cleanup is accomplished in accordance with this plan and applicable regulatory requirements. The EIs will work in conjunction with Atlantic's environmental team to promptly report spills to appropriate

[11] Contractor or Contractors refer to the company or companies retained by Atlantic or another contractor to construct the proposed facilities.

Federal, State/Commonwealth, and local agencies, as required, and to coordinate with these agencies regarding contacting additional parties or agencies as may be required.

12.4 PREVENTIVE MEASURES

Contractors will minimize the potential for a spill during construction activities by implementing appropriate measures to prevent and contain spills. Equipment and materials will be located onsite to meet the provisions of this plan. The Contractors will comply with applicable environmental and safety laws and regulations, and the standards within the MNF and GWNF LRMPs. Contractors will ensure that a copy of this plan is available onsite to all Construction Work Crew members and Forest Service Fire Management personnel (GWNF FW-149; MNF FM01). All cleanup and other construction-related spill activities will be completed by the appropriate Contractors.

Spill prevention measures are described below.

12.4.1 Staging Areas and Facility Sites:

A. Prior to construction, the Contractors will provide site-specific descriptions and maps depicting locations of fixed and mobile hazardous material containers and the types of materials located within containers. The site-specific descriptions and maps will identify the direction, rate of flow, and total quantity of petroleum or hazardous liquid which could be discharged from containers or from major equipment failures.

B. Contractors will visually inspect aboveground storage containers for leaks and spills on a regular basis and whenever containers are refilled. Contractors will maintain inspection records for every container.

C. Contractors will construct secondary containment structures (e.g., temporary liners and seamless impermeable berms) around aboveground, single wall, storage containers so that liquids will be contained and collected in specified areas isolated from waterbodies in the event of a leak or spill. Double wall containers will not require secondary containment. Storage containers will not be placed in areas subject to periodic flooding and washout.

D. Secondary containment structures must provide a containment volume equal to a minimum of 110 percent of the maximum storage volume of the storage container for single wall containers.

E. Secondary containment structures must be constructed so that no outlet is provided and a spill will be contained within the containment structure. Accumulated rainwater may be removed if authorized by the EI. Accumulated water with a visible sheen will be collected for proper storage, transport, and disposal.

F. Contractors will remove all secondary containment structures at the conclusion of the Project. Contractors also will be responsible for returning the storage impoundment area to its original contours and appearance upon completion of the Project.

G. Hazardous materials, including chemicals, fuels, and lubricating oils, will be stored only at designated staging areas and in appropriate service vehicles. Containers will be located in a manner that minimizes the possibility of contamination to water resources, including drinking water, groundwater dependent ecosystems, karst areas, and cave soils

and their natural hydrology. The storage areas will be located at least 100 feet away from wetlands, waterbodies, and springs; at least 200 feet away from private water supply wells; at least 300 feet away from karst features; and at least 400 feet away from municipal water supply wells unless a larger buffer is required by regulatory agencies. Containers will not be located within 500 feet of a developed recreation area or Scenic Area.

H. Storage containers will display labels that identify the contents of the container and whether the contents are hazardous. Contractors will maintain and provide to Atlantic, when requested, copies of all Safety Data Sheets (formally known as Material Safety Data Sheets). All containers used for the storage of hazardous materials, including chemicals, fuels, and lubricating oils, will be of material and construction compatible with the material stored and the conditions of storage such as pressure and temperature. All containers will be in good condition.

I. Contractors will conduct routine equipment maintenance, such as oil changes, in staging areas and will dispose of waste oil in an appropriate manner (e.g., the Contractors will collect the waste oil in labeled, sealed containers and transport the waste oil to a recycling facility).

J. Contractors will correct visible leaks in storage containers as soon as possible. Leaks outside of secondary containment, regardless of volume, will be reported to the Spill Coordinator and an EI.

K. Drain valves on temporary storage containers will be locked to prevent accidental or unauthorized discharges from the containers.

L. All fuel nozzles will be equipped with functional automatic shut-off valves.

M. The drivers of tank trucks will be responsible for spill prevention and the provision of secondary containment during tank truck unloading. Procedures for loading and unloading tank trucks will meet the minimum requirements established by applicable law and associated regulations. Drivers will observe and control the fueling operations at all times to prevent overfilling. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

N. Prior to departure of a tank truck, all outlets of the vehicle will be closely examined by the driver for leakage and tightened, adjusted, or replaced, as necessary, to prevent liquid leakage while in transit. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

O. Pumps operating within 100 feet of a waterbody or wetland boundary will utilize appropriate secondary containment systems to prevent spills

P. All machinery will arrive on the right-of-way in a clean, washed condition, maintained free of fluid leaks. All equipment will be in good working order and inspected on a regular basis.

Q. Overnight parking of equipment, as well as refueling and servicing of construction equipment, will be restricted to upland areas at least 100 feet away from waterbodies, wetlands, and springs; at least 200 feet from private water-supply wells; at least 300 feet

from karst features; and at least 400 feet from municipal water-supply wells. Where this is not practicable, and where the EI finds in advance no reasonable alternative, the equipment will be fueled by designated personnel with specific training in refueling, spill containment, and cleanup, under the supervision of an EI. Prior to refueling, appropriate steps will be taken (including deployment of secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill.

R. Fuel trucks transporting fuels to construction areas will only travel on approved access roads.

S. Contractors will keep a spill kit onsite and on all equipment in case of machinery leaks or spills. If a spill kit is used, it will be replaced within 24 hours.

1. Restricted Refueling Areas will be identified in the field with flagging or signs. A site-specific plan and written approval from an EI will be required to refuel in restricted areas.

2. Approval must be received from an Atlantic representative and, where necessary, appropriate regulatory permits must be obtained, prior to refueling in Restricted Refueling Areas.

3. In large wetlands where no upland site is available for refueling, auxiliary fuel tanks may be mounted to equipment to minimize the need for refueling.

4. Trained Contractor personnel must be available for refueling, and an EI or another trained Atlantic representative must be present.

5. Equipment such as large, stationary pumps will be fitted with auxiliary tanks as appropriate. The auxiliary tanks will be placed within secondary containment which provides for a containment volume equal to a minimum of 110 percent of the volume of the auxiliary tanks.

6. Refueling within Restricted Refueling Areas will take place in areas designated by an EI. Fuel trucks with a capacity in excess of 300 gallons will not be allowed within a Restricted Refueling Area unless adequate secondary containment is provided.

7. Refueling of dewatering pumps, generators, and other small, portable equipment will be performed using approved containers with a maximum volume of 5 gallons.

12.4.2 Staging Areas and Facility Sites:

A. Contractors will stock a sufficient supply of sorbent and barrier materials at construction staging areas to allow the rapid containment and recovery of a spill. Sorbent and barrier materials will also be used to contain runoff from spill areas.

B. Shovels and 55 gallon drums will be kept at each individual staging area. If small quantities of soil become contaminated within the staging area, they will be collected and placed in the drums. The drums will be labelled to indicate the contents of the drum, including the spilled/recovered material.

C. Large quantities of contaminated soil will be collected using heavy equipment and will be stored in drums or other suitable containers prior to disposal. The drums will be labelled to indicate the contents of the drum, including the spilled/recovered material.

D. The Contractors will dispose of all contaminated soil in accordance with applicable State/Commonwealth and Federal regulations.

E. Right-of-way

1. Each construction crew will have adequate absorbent materials and containment booms on hand to enable the rapid and complete cleanup of spills, as well as sufficient tools and materials to stop leaks.

2. Contractors must maintain spill kits containing a sufficient quantity of absorbent and barrier materials to adequately contain and recover foreseeable spills. These kits may include, but are not limited to: absorbent pads, straw bales, absorbent clay, sawdust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, and 55 gallon drums. The equipment will be located near fuel storage areas and other locations, as necessary, to be readily available in the event of a spill.

3. All fuel equipment, and where practicable, service trucks, will carry adequate spill response materials. Spill response materials present on trucks will consist of absorbent pads, absorbent material, plastic bags, and a shovel.

4. The Spill Coordinator will inform the EIs and all Contractor personnel of the location of spill control equipment and materials, and have them readily accessible while construction activities are occurring.

5. If a spill kit is used, it will be replaced within 24 hours.

F. Concrete Coating

G. Concrete coating activities and washout activities will not be performed within 100 feet of wetlands, waterbodies, or springs, or with 300 feet of karst features unless the location is an existing industrial site designated for such use.

H. Hydrostatic Testing

If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, secondary containment and refueling of these pumps will be addressed in site-specific procedures will be developed to prevent, contain and clean potential spills.

12.5 SPILL RESPONSE

A. The first priorities after discovering a spill are to protect the safety of personnel and the public and to minimize damage to the environment. Actions to be taken immediately following a spill will include the following:

1. The safety of the situation (including the surrounding public) will be assessed.

2. Sources of ignition will be removed from the area by trained personnel if safe to do so.

3. The source of the spill will be shut off by trained personnel if safe to do so.

4. Efforts to contain the spill immediately will be initiated by trained personnel if safe to do so.

5. Cleanup activities will be initiated as soon as possible after the spill is contained using properly trained and protected personnel with adequate spill cleanup materials and equipment (see Section 12.7).

6. If necessary, an Emergency Response Contractor will be secured for large spills to further contain and clean up the spill.

12.6 SPILL REPORTING

A. All spills will be reported immediately to Atlantic. Reports will include the following information (found on the Spill Report Form):

1. Date, time, and location of the spill.

2. Type of material spilled.

3. Amount of material spilled.

4. Extent of spill area.

5. Whether the material has reached or has the potential to reach a wetland, waterbody, or karst feature.

6. Status of spill containment and cleanup.

7. Circumstances leading up to the spill.

B. Atlantic's environmental team will report the spill to the MNF or GWNF, as apprpriate, as well as the applicable state regulatory agencies if the spill meets or exceeds a reportable threshold. Table 12.6-1 lists the Federal and State/Commonwealth agencies that would be contacted if a spill meets or exceeds a reportable threshold.

C. Federal standards for reportable quantities (RQs) of hazardous materials are listed at 40 CFR 302.4, which is incorporated into this SPCC Plan by reference. Additional requirements by State/Commonwealth are as follows:

1. West Virginia:

a. Hazardous waste spills must be reported when equal to or exceeding the Federal RQs at 40 CFR 302.4 (see e.g., W. Va. CSR § 60-3-5).

b. Oil spills must be reported when "causing a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or

upon adjoining shorelines" (see CWA 111; 40 CFR 110.3(b); and, by analogy, W. Va. Legislative Rules § 31-1).

c. Toxic air pollutant spills must be reported when exceeding (i) 1 pound for ethylene oxide and vinyl chloride, (ii) 10 pounds for acrylonitrile and butadiene, or (iii) 50 pounds for all others (W. Va. CSR § 45-27-10.4).

TABLE 12.6-1

Agency Notification List

Agency	Program	Contact Information	Hours of Operation	Applicable Areas Served
Federal				
Environmental Protection Agency	National Response Center	800-424-8802	24-hour hotline	All Areas
West Virginia				
Department of Environmental Protection (WVDEP)	Emergency 24-hour Hotline for Hazardous Waste Release	800-642-3074	24-hour hotline	Entire State
WVDEP	Elkview Emergency Response Unit	304-558-5938	Monday – Friday 8:00 am – 4:00 pm	Entire State
Virginia				
DEQ	Pollution Response Program- Valley Regional Office	540-574-7800	Monday – Friday 8:30 am – 4:30 pm	Augusta, Highland, and Nelson Counties
DEQ	Pollution Response Program- Blue Ridge Regional Office	540-562-6700	Monday – Friday 8:30 am – 4:30 pm	Buckingham, Cumberland, Prince Edward, and Nottoway Counties
DEQ	Pollution Response Program- Piedmont Regional Office	804-527-5020	Monday – Friday 8:30 am – 4:30 pm	Dinwiddie, Brunswick, and Greensville Counties
DEQ	Pollution Response Program- Tidewater Regional Office	757-518-2000	Monday – Friday 8:30 am – 4:30 pm	Southampton County and Cities of Suffolk and Chesapeake
DEQ	Pollution Response Program – Online Reporting System	Online form at: http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/PollutionReportingForm.aspx	24-hour online reporting option	Entire Commonwealth
Department of Emergency Management	Virginia Emergency Response Team	800-468-8892 or 804-674-2400	24-hour hotline	Entire Commonwealth

2. Virginia:

a. Oil discharges to land must be reported in amounts equal to or greater than 25 gallons (or less if certain recordkeeping and clean-up requirements are not met) (Va. Code § 62.1-44.34:19).

b. An oil spill that discharges or may reasonably be expected to discharge into Commonwealth waters must be reported, regardless of amount (Va. Code § 62.1-44.34:19).

c. Hazardous waste spills must be reported when equal to or exceeding Federal RQs at 40 CFR 302.4 (see 9 Virginia Code 25-880-70, generally describing applicable reporting quantities).

D. Contractors are responsible for assisting Atlantic and DTI with preparing follow-up written incident reports to regulatory agencies upon request.

12.7 SPILL CONTAINMENT AND CLEANUP

A. Land Spill

1. Berms will be constructed with available equipment to physically contain the spill and sorbent materials will be applied to the spill area. Traffic on contaminated soils will be prevented to the extent practicable. Some traffic on contaminated soils may be necessary to avoid impacts on adjacent or sensitive resources (e.g., wetlands).

2. Contaminated soils and vegetation will be removed and disposed of at a properly licensed waste disposal facility.

3. Waste materials from the spill will be disposed of according to applicable regulatory requirements.

4. The following information will be provided to an EI and Atlantic and DTI as available following containment and cleanup (but no later than 24 hours after transport and disposal of the contaminated waste material):

   a. The amount of the spilled material that was recovered during cleanup.

   b. Proposed reclamation of remaining contaminated areas.

   c. Storage method for the contaminated waste material before transport and disposal.

   d. Transport and disposal documentation for the contaminated waste material.

5. If necessary, an Emergency Response Contractor will be secured for large spills to further contain and clean up the spill.

B. **Wetland or Waterbody Spill**: The following measures will be implemented immediately to control a spill into a wetland or waterbody:

1. For spills in standing water, floating booms, skimmer pumps, and holding tanks will be readily available and used, as appropriate, by the Contractors to recover and contain released materials on the surface of the water.

2. Berms and/or trenches will be constructed in upland areas to contain a spill before it enters a wetland or waterbody. Deployment of booms, skimmers, and sorbent materials will be utilized if the spill reaches a waterbody. The spilled product will be retrieved and the contaminated area cleaned-up in accordance

with recommendations from the Spill Coordinator and applicable regulations and guidelines.

3. If necessary, an Emergency Response Contractor will be secured for large spills in wetlands or waterbodies to further contain and clean up the spill.

4. Approvals or permits from regulatory agencies may be required to place equipment into a wetland or waterbody. Therefore, Contractors must receive written permission from Atlantic or DTI before placing equipment into a wetland or waterbody for the purpose of spill cleanup.

C. Karst: In addition to the measures described above, the following procedures will be implemented in areas of karst terrain:

1. Buffers of 300 feet around karst features (e.g., sinkholes, caves, sinking or losing streams, ponors, pinnacled bedrock, and large springs) within or adjacent to the construction right-of-way will be marked with signs and/or highly visible flagging until construction related ground disturbing activities are completed.

2. Equipment refueling will not be permitted within flagged or marked buffer areas for karst features or areas draining into karst features, except by hand-carried cans (5 gallon maximum capacity), when necessary.

3. Equipment servicing and maintenance areas will be sited outside of flagged or marked buffer areas for karst features or areas draining into karst features.

4. Erosion and sediment controls will be implemented, as appropriate, to prevent runoff resulting from construction equipment washing operations (if applicable) to directly enter a karst feature by locating these operations outside of karst buffer areas.

5. Construction equipment, vehicles, materials, hazardous materials, chemicals, fuels, lubricating oils, and petroleum products will not be parked, stored, or serviced within 300 feet of a karst feature.

6. Equipment will be checked for leaks daily by the Contractors prior to beginning work in karst areas; and damaged or defective equipment will be removed or repaired prior to use in karst areas.

7. Atlantic or DTI will notify the National Response Center and either the West Virginia Department of Environmental Protection or Virginia DEQ if a reportable spill impacts a karst feature (see Table 1).

12.8 CERTIFICATION BY A PROFESSIONAL ENGINEER

This SPCC Plan has been certified by a professional engineer in accordance with 40 CFR 112.7 – *General Requirements for Spill Prevention, Control, and Countermeasure Plans*.

_____ _____

Professional Engineer Date

12.9 CERTIFICATION BY THE CONTRACTOR

The Contractor listed below agrees to follow the requirements of Atlantic's *Spill Prevention, Control, and Countermeasure Plan* during all work activities conducted for Atlantic.

_____ _____

Contractor Date

_____ _____

Responsible Official (Print Name) Title

_____

Responsible Official (Signature)

13.0 CONTAMINATED MEDIA PLAN

13.1 BACKGROUND

Atlantic searched Federal and State/Commonwealth databases to identify contaminated sites in the vicinity of the proposed ACP facilities. The EPA's Facility Registry System map service was used to locate sites within 1 mile of the proposed facilities that are listed on the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and the Assessment, Cleanup and Redevelopment Exchange System (ACRES) (EPA, 2014).[12] In addition, various map services and databases for known contaminated sites were reviewed for each State/Commonwealth (see Resource Report 2).

As shown in Table 2-1, review of EPA records identified no Federal Brownfield site and three Federal Superfund sites within one mile of the proposed ACP facilities none of which are in the MNF or GWNF. Based on the geospatial point data available on the EPA's Facility Registry System map service and Envirofacts online database, none of the Federal Brownfield or Superfund sites appear to be crossed by the proposed facilities. Sites identified in the State/Commonwealth databases consist of landfills, solid waste sites, and Leaking Underground Storage Tanks (LUST). None of the landfills or solid waste sites appears to be crossed by the Project. One LUST may be crossed, while others are in close proximity to the Project. No LUST site were identified in the MNF or GWNF.

The locations of the contaminated sites listed in Table 13.1-1 are based on publicly available geospatial point data. Point data alone are insufficient for identifying the boundaries and extent of contamination at each site. Atlantic has submitted information requests to the EPA and State/Commonwealth agencies for additional information regarding the location and extent of contamination at the sites. If contaminated sites are found to be crossed or impacted by the proposed routes, Atlantic will investigate options for avoiding these sites, including route variations. This *Contaminated Media Plan* will be updated, as appropriate, based on the results of the information requests.

[12] CERCLIS and ACRES sites are commonly known as Federal Superfund and Brownfield sites, respectively.

TABLE 13.1-1

Contaminated Sites, Landfills, and Leaking Underground Storage Tanks Near the Atlantic Coast Pipeline Project [a]

County/ City and State/ Commonwealth	Pipeline Segment	Nearest Milepost	Site Name	Distance and Direction from Centerline (ft)	Facility Type	Surface Drainage Direction from Project [c]	Open or Closed Status [d]
ATLANTIC COAST PIPELINE							
CERCLIS and ACRES Sites Identified within 1 mile of the Centerline and Aboveground Facilities							
Chesapeake, VA	AP-3	81.9	Money Point Creosote Site	4,109 N	Superfund Site	Down Gradient	Active
Chesapeake, VA	AP-3	81.9	Eppinger & Russel Co Inc.	4,472 N	Superfund Site	Down Gradient	Active
Chesapeake, VA	AP-3	82.4	Borden Smith Douglass	54 S	Superfund Site	Side Gradient	Active
Landfill and Solid Waste Sites Identified within 0.5 mile of the Centerline and Aboveground Facilities							
Augusta, VA	AP-1	141.5	Jolivue Landfill/Augusta Regional Landfill	915 NE	Closed MSW Landfill and Active MSW Landfill Complex	Up Gradient	Closed
Chesapeake, VA	AP-3	81.0	Dominion Chesapeake Energy Center	317 E	Closed Industrial Landfill and Active Industrial Landfill	Side Gradient	Closed
Chesapeake, VA	AP-3	82.5	Atlantic Aggregate Recyclers	884 NE	Inert Landfill	Up Gradient	Closed
Southampton, VA	AP-3	34.5	SPSA-Boykins Transfer Station	131 SW [b]	Active Waste Transfer Station	Down Gradient	Open
Southampton, VA	AP-3	34.5	SPSA-Franklin Transfer Station	137 SW [b]	Closed Waste Transfer Station	Up Gradient	Closed
Leaking Underground Petroleum Storage Tank (LUST) Sites within 1000 feet of the Centerline and Aboveground Facilities							
Highland, VA	AP-1	87.6	Bussard Residence	207 N [b]	LUST	Up Gradient	Closed
Highland, VA	AP-1	109	VDOT McDowell Area Headquarters	52 E [b]	LUST	Up Gradient	Closed
Highland, VA	AP-1	109	VDOT McDowell	173 N [b]	LUST	Up Gradient	Closed
Augusta, VA	AP-1	134.0	Deerfield Grocery	833 S	LUST	Down Gradient	Closed
Augusta, VA	AP-1	143.9	Starkey Residence	148 SW	LUST	Side Gradient	Closed
Nelson, VA	AP-1	194.5	Ridge Crest Baptist Church	980 SW	LUST	Up Gradient	Closed
Buckingham, VA	AP-1	235.2	Betty Brown Property	646 E	LUST	Up Gradient	Closed
Brunswick, VA	AP-1	301.4	Russel Residence	992 E	LUST	Side Gradient	Closed
Southampton, VA	AP-3	23.6	Cooke Residence	889 NW	LUST	Up Gradient	Closed
Suffolk, VA	AP-3	62.0	City of Suffolk Pump Station 11	244 NW	LUST	Side Gradient	Closed
Chesapeake, VA	AP-3	78.6	Deep Creek Pharmacy	160 S	LUST	Down Gradient	Closed
Chesapeake, VA	AP-3	78.8	Mid Atlantic Repair, Inc.	535 S	LUST	Down Gradient	Closed
Chesapeake, VA	AP-3	78.8	Watkins Motor Lines, Inc.	363 S	LUST	Down Gradient	Closed
Chesapeake, VA	AP-3	80.1	Deep Creek Pumping Station	725 N	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	81.1	Chesapeake Energy Center	923 E	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	81.2	IMTT-Chesapeake Terminal	626 NW	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	81.5	Chesapeake Energy Center	698 S	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	81.6	Chesapeake Energy Center	748 S	LUST	Up or Side Gradient	Open

TABLE 13.1-1

Contaminated Sites, Landfills, and Leaking Underground Storage Tanks Near the Atlantic Coast Pipeline Project [a] (cont'd)

County/ City and State/ Commonwealth	Pipeline Segment	Nearest Milepost	Site Name	Distance and Direction from Centerline (ft)	Facility Type	Surface Drainage Direction from Project [c]	Open or Closed Status [d]
Leaking Underground Petroleum Storage Tank (LUST) Sites within 1000 feet of the Centerline and Aboveground Facilities							
Chesapeake, VA	AP-3	81.6	Chesapeake Energy Center	730 S	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	81.6	Chesapeake Energy Center	720 S	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	81.7	Chesapeake Energy Center	850 S	LUST	Up or Side Gradient	Closed
Chesapeake, VA	AP-3	82.0	One Steel Recycling	899 N	LUST	Down Gradient	Closed
Chesapeake, VA	AP-3	82.4	Quest Transport LLC	305	LUST	Side Gradient	Closed
Chesapeake, VA	AP-3	82.4	Former Smith Douglass Plant	431 S	LUST	Side Gradient	Closed

[b] Sites are nearest to aboveground facilities not the centerline. Mileposts for these sites are identified for the nearest milepost in a direct line to the centerline.

[c] USGS topographic maps were reviewed to evaluate the topographic disposition of each site in relation to the Project.

[d] Active = Superfund sites are reported as active in EPA files; however, an active status does not necessarily mean that any ongoing investigations or cleanups are taking place or are planned to take place at the site.

Closed = specific requirements for site closure varies between States/Commonwealths, but generally speaking, this means that the tank has been removed, the site has been remediated, and any remaining contaminant concentrations do not pose an unacceptable risk to human health or the environment.

13.2 PURPOSE

Atlantic recognizes the potential for encountering unknown contaminated soil or groundwater during construction. This *Contaminated Media Plan* describes the steps that Atlantic and its Contractors [13] will implement in the event that suspected contaminated soil or groundwater is encountered during construction.

13.3 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Atlantic and Contractor personnel. The training program will focus on the FERC Plan and Procedures; other construction, restoration, and mitigation plans, including this *Contaminated Media Plan*; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

13.4 IDENTIFICATION OF CONTAMINATED MEDIA AND INITIAL RESPONSE

Contractor personnel and Atlantic's EIs will observe work areas during construction for signs of potential contamination, including:

- discoloration of soil;
- chemical-like odors from soil or water;
- oily sheens or puddles on soil;
- oily sheens on water;
- buried drums or other waste containers;
- buried waste (e.g., garbage, debris, ash, medical waste, or clinical containers);
- discolored surface water;
- differences in vegetation growth (phytotoxicity); and/or
- evidence of waste treatment practices.

If signs of contamination are encountered, the Contractor will stop work in the vicinity of the suspected contamination; restrict access to the suspected contamination site; and notify the crew foreman, an EI, the Spill Coordinator (identified in the SPCC Plan, Atlantic and the site's landowner.

13.5 CONTAINMENT AND CHARACTERIZATION

The Contractor will initiate measures to avoid the spread of contaminants until the type of contaminant, its concentration, potential exposure routes, and management options are evaluated. If signs of potential contamination are observed during construction, the following response actions will be implemented.

A. If potentially contaminated soil or groundwater is exposed during excavation activities, excavation will stop in the area of potential contamination and an EI and Atlantic representative will be contacted immediately.

[13] Contractor refers to the company or companies retained by Atlantic or another contractor to construct the proposed facilities.

B. If potentially contaminated soil will not be backfilled, the soil will be placed on an impervious surface or 10-mil polyethylene and covered with 10-mil polyethylene to prevent rainfall run-on and run-off. The potentially contaminated soil will not be moved from the site by the Contractor unless approved to do so by the EI and/or Atlantic representative.

C. If potentially contaminated groundwater is draining from the sides of the excavation and standing in the trench, temporary trench plugs will be installed to avoid the migration of the potentially contaminated groundwater to uncontaminated areas within the trench. Potentially contaminated groundwater will not be pumped from the trench.

D. If a trench or excavation will be left open and precipitation may occur, measures will be implemented to prevent precipitation run-off from entering the trench (e.g., by installing waterbars to divert runoff from the trench and trench plugs to prevent the flow of contaminated water in the trench).

Concurrent with the management of the contaminated media, representative soil and groundwater samples, as applicable, will be collected for chemical analysis. Appropriate tests or analyses will be conducted by a qualified laboratory. Initial testing will be based on field observations and the suspected nature of the contamination. Laboratory analyses could include: total petroleum hydrocarbons, oil and grease, pH, volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, and/or metals.

Depending on the nature and extent of the contamination, Atlantic will notify the MNF or GWNF, as appropriate, and the appropriate Federal, State/Commonwealth, and local regulatory agencies. Appropriate agencies include, but are not be limited to, the following:

A. West Virginia Department of Environmental Protection at 1-800-642-3074 (24-hours).

B. Virginia Department of Emergency Management at 1-800-468-8892 (24-hours, in-state calls only) or at 1-804-674-2400 (24-hours, out-of-state calls). Online spill reporting for non-emergency releases can be completed at http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/PollutionReportingForm.aspx.

C. National Response Center (Washington, D.C.) at 1-800-424-8802 (24 hours).

13.6 AVOIDANCE OR RESPONSE PLANS

If the contaminant identified is found to be a health or safety hazard or harmful to the pipeline or operation of its CP system, a route variation may be considered to avoid the area of contamination. Applicable permits and regulatory approvals will be obtained prior to proceeding with a route variation.

If the contaminant does not pose a health or safety concern and will not otherwise interfere with the pipeline, a written plan for completing construction within the contaminated area will be prepared. Test pits or borings may be excavated within the right-of-way to assess the extent of the contamination. Depending on the nature and extent of contaminated media, site-specific measures will be identified to complete construction across the contaminated area. These measures may include:

- storing excavated soil on an impervious surface or a sheet of 10-mil polyethylene;
- avoiding water withdrawals from the trench;

- removing and disposing of contaminated media at an approved disposal facility;
- replacing contaminated soil with clean backfill; and/or
- implementing staged withdrawal and disposal of standing trench water during backfilling to avoid overflow and runoff.

Contaminated soil will not be placed back in the trench unless approved by the appropriate regulatory agency and by Atlantic in writing. Site-specific construction plans for areas of contamination will be developed in accordance with environmental regulations, and approval of the plans by appropriate regulatory agencies will be obtained prior to implementation of the plans.

14.0 CULTURAL RESOURCES

14.1 PURPOSE

The purpose of this section is to summarize the cultural resources studies conducted to date, remaining studies which are yet to be completed, and procedures that should be followed if an unanticipated discovery occurs.

14.2 SUMMARY OF CULTURAL RESOURCES INVESTIGATIONS ON NFS LANDS

In order to minimize the potential during construction for accidental discovery of cultural resources, Atlantic Coast Pipeline, LLC (Atlantic) contracted GAI Consultants, Inc. (GAI) to conduct Phase I archaeological survey and historic architectural reconnaissance of the Project's defined Area of Potential Effect (APE) in the GWNF and the MNF. The studies encompass locations associated with the proposed undertaking where there will be alteration and disturbance of surface and subsurface soils that contain or have potential to contain archaeological sites, including proposed construction areas, access roads, staging areas, etc. The APE along the pipeline consists of a 91.4-meter) [300-foot] corridor centered on the proposed pipeline. The APE for access roads consists of a 15.2 meter (50-foot) corridor centered on the proposed/existing roadways. An APE wider than the proposed limit of disturbance was studied for both the pipeline and access roads to allow flexibility in final design.

In the MNF, cultural resources field studies have been completed for the proposed Project and a combined technical report is in review by MNF personnel. No architectural resources were identified and five pre-contact-period isolated archaeological finds were recorded, all of which are recommended as not eligible for listing in the National Register of Historic Places (NRHP).

In the GWNF, field studies have not yet been completed in the area of Ft. Lewis. However, cultural resources field studies have been completed for the remainder of the proposed Project and a combined technical report is in review by GWNF personnel. To date, GAI recorded four new pre-contact-period archaeological sites, two new historic-era archaeological sites, and six pre-contact-period isolated finds. GAI also re identified two previously recorded pre-contact-period archaeological sites, but was unable to re-identify two other previously recorded archaeological sites. GAI concluded that two newly-identified sites and one previously recorded site are Potentially Eligible for listing in the NRHP under Criterion D. All three of these sites are pre-contact period lithic scatters with relatively high artifact densities and formally prepared tools. Based on the results of Phase I investigations, site avoidance or additional archaeological investigations (Phase II) are recommended for these three site areas. No architectural resources have been identified.

A separate detailed Unanticipated Discoveries Plan (UDP) has been prepared for each the GWNF (Attachment K) and the MNF (Attachment L) in order for Atlantic to comply with the relevant state and federal regulations concerning the protection of cultural resources. Procedures outlined in the UDPs must be followed during construction. As per the UDP, EIs and possibly Archaeological Monitors will have the responsibility to monitor altered and disturbed areas for potential archaeological remains throughout construction. The EI and the Archaeological Monitor will be responsible for advising the construction contractor's personnel on the procedures to follow in the event that an unanticipated discovery is made. A copy of each UDP will be maintained by the EI, the Archaeological Monitor, and at the construction field office. Training will occur as part of the pre-construction on-site training program for foremen, company inspectors, and construction supervisors. The EI will advise all operators of equipment involved in grading, stripping, or trenching activities to:

- Stop work immediately if they observe any indications of the presence of cultural materials, animal bone, or possibly human bone.

- Immediately contact the EI (if not available contact the Construction Site Supervisor).
- Treat human remains with dignity and respect.

15.0 THREATENED AND ENDANGERED PLANTS AND ANIMALS

Information on threatened and endangered plants and animals as well as USFS species of concern is contained within the Biological Evaluation submitted to the USFS on August 15, 2016, and filed with the FERC under Accession Number 20160816-5051. The Biological Evaluation is incorporated by reference into this COM Plan.

16.0 FUGITIVE DUST CONTROL AND MITIGATION PLAN

16.1 PURPOSE

The purpose of this *Dust Control Plan* is to identify potential sources of fugitive dust emissions arising from construction activities and to provide direction to Contractors [14] on measures for avoiding, minimizing, and controlling fugitive dust. This plan is based on the *Fugitive Dust Control & Mitigation Plan* prepared in connection with Atlantic's application to the FERC for the entire ACP. Fugitive dust includes total suspended particulates, particulate matter with an aerodynamic diameter less than 10 micrometers, and particulate matter with an aerodynamic diameter less than 2.5 micrometers (collectively, "fugitive dust").

Fugitive dust will result from land clearing, grading, excavation, concrete work, and vehicle traffic on paved and unpaved roads. The amount of fugitive dust generated at any given time will be a function of construction activity, soil type, soil moisture content, wind speed, precipitation, vehicle traffic, vehicle types, and roadway characteristics. Fugitive dust emissions will be greater during dry periods and in areas of fine-textured soils subject to surface activity. The ACP will employ proven BMPs to control and limit releases of fugitive dust, such as the application of water to disturbed surfaces or roads.

16.2 TRAINING

Prior to the start of construction, Atlantic will conduct environmental and safety training for Company and Contractor personnel. The training program will focus on the FERC Plan and Procedures; other construction, restoration, and mitigation plans, including this *Dust Control Plan*; and applicable permit conditions. In addition, Atlantic will provide large-group training sessions before each work crew begins construction with periodic follow-up training for groups of newly assigned personnel.

EIs and/or construction supervisors will be responsible to ensure that contractor personnel are complying with all dust control measures and have authority to enforce and require compliance with this plan.

16.3 FUGITIVE DUST SOURCES

Fugitive dust is generated by the mechanical disturbance of granular material exposed to air. Dust from open sources is termed "fugitive" because it is not discharged to the atmosphere in a confined flow stream.

The following construction activities have the potential to generate fugitive dust:

- vehicle and equipment movement on paved and unpaved surfaces;
- vegetation removal;
- clearing, grading, and excavation;
- soil stabilization; and
- bulk/pile material loading, unloading, and hauling.

[14] Contractor refers to the company or companies retained by Atlantic or another contractor to construct the proposed facilities

16.4 DUST CONTROL MEASURES

16.4.1 Application of Water or Other Dust Suppressant

Atlantic will make all practicable efforts to minimize fugitive dust emissions from construction activities. Atlantic will have one or more water trucks available per spread that will load water from approved permitted sources to spray areas for dust control. Disturbed and trafficable areas will be kept sufficiently damp during working hours in dry conditions to minimize wind-blown or traffic-generated dust emissions.

Areas to be watered include, but are not limited to, the following:

- the construction corridor for each pipeline, including ATWS;
- contractor yards and staging areas;
- access roads;
- aboveground facility sites;
- active grading areas;
- un-stabilized areas;
- soil stockpiles; and
- parking areas.

The frequency at which water trucks will spray construction areas will vary based on weather and site conditions. More frequent applications will be required in dry conditions and where dust generation is likely.

Other, locally-approved, dust suppression agents (e.g., wetting with calcium chloride) may be used in addition or in lieu of water.

16.4.2 Use of Approved Access Roads

Atlantic will install signs to direct traffic to designated access roads for construction of the ACP. Any traffic that deviates from designated access roads will be redirected to designated access roads and reported to the appropriate supervisor and an EI for corrective action. [15] All vehicles and equipment leaving a work site will implement BMPs to prevent dirt or mud from being transferred or tracked to public roads. For example, track-out onto paved public roads will be cleaned up as needed and in a timely manner using street sweeping or an equivalent method.

16.4.3 Enforcing Speed Limits

All vehicle and equipment traffic will be limited to a speed limit of 15 miles per hour on or in designated access roads, the construction right-of-way, contractor yards, and other work areas. Atlantic will post speed limit signs on designated access roads to ensure that all equipment/vehicle operators are aware of the speed limit on the road that is being travelled. Any observations of excessive speeds will be reported to the appropriate supervisor and an EI for corrective action. EIs will have the authority to adjust speed limits for individual operations based on site-specific conditions to minimize fugitive dust.

[15] The role and responsibilities of an EI are defined in the Federal Energy Regulatory Commission's *Plan.*

16.4.4 Best Management Practices for Open-body Haul Trucks

If excessive dust is generated from open-body haul trucks, corrective measures will be implemented to mitigate the generation of dust. Corrective measures may include: adjusting speed limits along designated haul roads during periods where conditions contribute to excessive dust; misting/wetting soils or other materials prior to loading into haul trucks; or covering open-body haul trucks to prevent fugitive dust emissions.

16.4.5 Restoration of Disturbed Areas

All disturbed areas will be stabilized and restored as soon as practicable, which will minimize conditions favorable to dust generation (see the Plan, Procedures, *Winter Construction Plan*, and *Restoration and Rehabilitation Plan*).

16.4.6 Maintenance of Spoil Stockpiles

If construction is inactive for more than 7 days, the Contractor will cover or stabilize spoil piles with a soil binder, tackifier, mulch, vegetation, or equivalent method in accordance with applicable permit requirements and regulations. If sustained winds are likely in areas susceptible to dust, temporary fencing may be installed to reduce wind speeds around spoil piles and minimize dust.

17.0 PUBLIC ACCESS PLAN

17.1 PURPOSE

The purposes of this *Public Access Plan* are to:

- Identify measures for informing casual users of the MNF and GWNF about construction of the ACP.
- Identify measures to inform specific user groups whose activities may intersect ACP construction about any closures, detours, restrictions, alternative access routes, etc. associated with ACP construction.
- Ensure the safety of recreational users of MNF and GWNF lands, while at the same time minimizing impacts to recreational use, during the period of pipeline construction.

17.2 RESPONSIBILITIES

The following individuals are responsible for developing and coordinating ACP Project information to be used to inform the public about Project construction on the National Forests.

ACP Public Affairs:
Name: _____
Phone: _____
E-mail: _____

Monongahela National Forest Public Affairs:
Name: _____
Phone: _____
E-mail: _____

George Washington National Forest Public Affairs:
Name: _____
Phone: _____
E-mail: _____

17.3 PROJECT WIDE MEASURES

The ACP Project website, found at https://www.dom.com/corporate/what-we-do/atlantic-coast-pipeline, provides general information about the Project. The website also provides a telephone hotline, allowing members of the public to speak to a Project representative. Prior to the start of construction, ACP will add contact information for FERC and USFS representatives to its website as well.

17.4 NATIONAL FOREST-SPECIFIC MEASURES

- Prior to and during construction, ACP public affairs representatives will work with public affairs specialists from both the MNF and GWNF as necessary to provide updated Project information for communication to Forest users.

- ACP public affairs representatives will work with public affairs specialists from the MNF and GWNF to plan and implement any targeted outreach to particular groups of Forest users, e.g. hiking, hunting or fishing organizations, etc.

- Prior to ACP construction activity in any particular part of either Forest, ACP will post temporary signs on Forest roads used as construction access roads alerting road users to the presence of logging and construction vehicles on the roads.

- Prior to construction, ACP will work with both Forests to identify any specific road or trail closures or detours necessary to facilitate pipeline construction and ensure safety of the public.

- On roads that cross the pipeline right-of-way, ACP will post temporary signs informing road users of any closures, detours, or other restrictions associated with crossing the construction zone. All signage will be developed in consultation with the Forest public affairs specialists.

- On Forest Service roads remaining open during construction, ACP will employ flagmen during periods of active construction at road/pipeline right-of-way intersections, when construction equipment or vehicles may be crossing the road.

- On Forest trails that cross the pipeline right-of-way, ACP will post temporary signs at trailheads informing trail users of any closures, detours, or other restrictions associated with crossing the construction zone. All signage will be developed in consultation with the Forest public affairs specialists.

- On Forest trails that cross the pipeline right-of-way remaining open during construction, ACP will erect exclusion fencing on either side of the trail where it crosses the construction zone, with appropriate signage warning hikers to stay on the trail. During periods of active construction when vehicles and equipment may be crossing over the trail, ACP will employ flagmen/spotters to escort hikers safely across the construction zone. If temporary trail detours are employed, detour routes will be developed in consultation with Forest recreational specialists, and the routes will be prominently demarcated.

18.0 OFF HIGHWAY VEHICLE BLOCKING PLAN

18.1 PURPOSE

The purpose of this *OHV Blocking Plan* (Blocking Plan) is to prevent OHV travel along the proposed pipeline, on NFS lands. OHV travel along the proposed pipeline could lead to entrance into restricted areas, damage sensitive biological and cultural resources, create or exacerbate erosion, impede right-of-way restoration, and compromise the integrity of the right-of-way. Consequently, both the Forests and the pipeline operator have an interest in preventing unauthorized OHV use along the proposed pipeline.

The Blocking Plan identifies a process for determining where OHV blocking measures are necessary, for identifying approaches appropriate at specific locations, and for follow-up monitoring to assess the effectiveness of the measures, and adjust accordingly. Examples of methods that may be used include boulders, stumps, berms, gates, visual marking, downed woody debris, visual screening, and rough road access.

18.2 OHV USE ON NFS LANDS

The ACP Project crosses through no areas of either the MNF or the GWNF where OHV use is authorized. The pipeline right-of-way will be maintained in an herbaceous state for pipeline surveillance and maintenance purposes. In predominantly forested areas where the right-of-way crosses Forest roads, the right-of-way can present a tempting linear path for some OHV users, despite Forest rules prohibiting such use. While such unauthorized use is difficult to stop entirely, measures to discourage OHV use of the right-of-way are appropriate.

The blocking measures must take into consideration that access to every point along the pipeline by maintenance and repair crews is necessary. Blocking measures must be designed to avoid creating unreasonable impediments to pipeline maintenance vehicles or larger equipment that must access the right-of-way in emergency events or major maintenance work.

18.3 LOCATIONS REQUIRING BLOCKING MEASURES

Blocking measures will be considered at all Forest Service roads crossed by the ACP, and other locations determined by the AO to be likely access points for OHVs to travel along the pipeline. These locations are provided in Table 18.3-1.

TABLE 18.3-1

Potential OHV Blocking Locations

Forest Road No.	Approximate Milepost	Access Road No.	Road Crossing Method
Un-numbered road connecting with MNF Road 212	81.8	05-001-E064.AR1	N/A
MNF Road 1014 (Shock Run)	83.2	N/A	Open cut
MNF Road 1017 (Upper Shock Run)	83.3	05-001E064.AR3	Open cut
MNF Road 55 (Allegheny Road)	83.7	N/A	Open cut
MNF Road 55 (Allegheny Road)	83.8	N/A	Open cut
MNF Road 55 (Allegheny Road)	83.8	N/A	Open cut
Un-numbered road connecting with Highway 84	85.0	06-001-B001.AR3	N/A
Un-numbered road connecting with Highway 84	85.4	06-001-B001.AR4	N/A
GWNF Road 124	93.6	36-014-AR2	N/A
Un-numbered Road connecting with GWNF Road 614	94.1	36-014.AR3	N/A
GWNF Road 281C	96.3	N/A	Open Cut

TABLE 18.3-1

Potential OHV Blocking Locations (cont'd)

Forest Road No.	Approximate Milepost	Access Road No.	Road Crossing Method
GWNF Road 281	96.3	36-026.AR1	Open cut
GWNF Road 1748	97.1	N/A	Open Cut
GWNF Road 1748	97.2	N/A	Open Cut
GWNF Road 309	99.6	36-016.AR2	N/A
GWNF Road 348.1	116.5		Open cut
GWNF Road 449	117.0	N/A	Open cut
GWNF Road 449	117.1	N/A	Open cut
New road connecting to GWNF Road 449	117.2	07.001-AR1-AR4	N/A
Un-numbered road connecting to GWNF Road 449A	118.0	07-001.AR1-AR 6	Open Cut
GWNF Road 449A	118.7	07-001-AR3	Open cut
GWNF Road 449A	118.8	N/A	Open cut
GWNF Road 449B	119.1	N/A	Open cut
GWNF Road 466A	120.2	07-001.AR1-AR8	Open cut
GWNF Road 466	120.4	07-001.AR1-AR9	Open cut
GWNF Road 1755	121.2	07-001-AR1-AR7	Open cut
GWNF Road 1755	121.4	N/A	Open cut
GWNF Road 1755	121.8	N/A	Open cut

18.4 BLOCKING MEASURES

The following blocking measures will be considered for installation at each of the locations listed in Table 18.3-1. The site-specific measures, and placement of any physical barriers, will be determined by the AO and the Project EI.

- Berms. Berms will be placed across the right-of-way where it intersects an existing road. Berm slopes shall not exceed 30 per cent. Berms will be placed across the right-of-way as part of erosion control, strategically placed to reduce visibility and mimic local topography.

- Rock and woody material distribution. Large rocks, stumps, limbs, and related material removed and stockpiled during construction will be strategically placed, without making it appear as a challenging obstacle course. The placement will be done in a manner to present a physical barrier as well as to erase visual cues signaling the presence of the right-of-way from the access point.

- Utilize existing vegetation. At locations where the pipeline has been bored beneath paved roads, vegetation between the bore pits and the road way will be left in place, except for sufficient clearing to allow access by construction vehicles and equipment.

- Surface preparation. At locations where the pipeline has open cut across the access point (as opposed to where the pipeline has been bored beneath paved roads), the right-of-way will be back-bladed or raked by bulldozer or by hand, to erase the traces of the intersection of the pipeline right-of-way with the access point.

- Gates. Where deemed appropriate by the AO, locking gates may be installed according to USFS specifications. Gate openings will be a minimum of 16 feet wide to accommodate pipeline maintenance vehicles and equipment.

- Signs. Signs warning the public that OHV use is prohibited along the pipeline right-of-way will be installed if requested by the USFS. Signs may dissuade some OHV users, but they may also call attention to the right-of-way, so their effectiveness is best judged by USFS recreation staff.

18.5 POST-CONSTRUCTION MONITORING

The Project EI will document the establishment of OHV blocking measures at each crossing location upon completion. The documentation will identify what measures were installed, date of completion, and will include photographs of the sites. In conjunction with its post-construction restoration monitoring, Atlantic will monitor each site for two full seasons following installation of the blocking measures, and will annually prepare a report documenting their effectiveness. Each OHV blocking location will be visited to photograph the site, assess whether OHV use appears to be occurring and what, if any corrective measures are recommended. Any necessary corrective measures will be determined in consultation with USFS staff.

After two years, the locations will be monitored periodically by USFS and pipeline operations staff to determine whether further corrective action is warranted. Regular aerial patrols will also note changed conditions on the right-of-way, such as the appearance of vehicle tracks, that may provide evidence of unauthorized OHV use along the pipeline.

19.0 WATER QUALITY MONITORING PLAN

The purpose of this plan is to describe how water quality monitoring activities will be conducted on NFS lands where stream crossings are planned. Stream crossing methods are designed to minimize stream bank and bed erosion thus preventing the release of sediment into streams, and are short-term in duration. Streams less than 10-feet-wide will be crossed within 24 hours and streams 10-feet-wide to 100-feet-wide will be crossed in 48 hours, unless rock is encountered and requires blasting or other rock removal methods. Atlantic will install the pipeline using dry-ditch methods for crossings of waterbodies on the MNF and GWNF (dam and pump or flume crossing methods), which further limits sediment release and elevated turbidity downstream of crossing areas.

This plan augments the other construction, restoration, and mitigation plans prepared for the Project. Atlantic will install stream crossings in accordance with the FERC Procedures, which stipulate how crossings are planned, constructed, restored and monitored.

19.1 JURISDICTIONS

Of the two National Forests crossed by the ACP, the MNF in West Virginia and GWNF in Virginia, only the state of West Virginia has numeric standards applicable to turbidity. This Water Quality Monitoring Plan has been written to conform to the West Virginia numeric standards and will be applicable to both National Forests. The Commonwealth of Virginia provides narrative guidance with respect to erosion and sediment control[16], and these guidelines have also been incorporated in the procedures described in this plan.

19.2 BACKGROUND AND PURPOSE

Excess turbidity in aquatic systems can adversely affect aquatic life or other beneficial use of a waterbody. The biological effects of excess turbidity are exerted primarily as a result of reduced light

[16] http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx

penetration or as a smothering effect associated with reduced dissolved oxygen. Turbidity is a measure of the 'cloudiness' of water, which is analytically measured as the degree to which light is scattered and absorbed by suspended sediment. Turbidity is most commonly measured using a nephelometric instrument called a turbidimeter and expressed in terms of Nephelometric Turbidity Units (NTUs) (Oregon DEQ, 2010). Most published criteria for turbidity in the United States and Canada is in the form of a limited increase above background.

The purpose of this Water Quality Monitoring Plan is to monitor and address chronic impacts to water quality. Corrective actions utilizing BMPs will be implemented when necessary to address sources of chronic turbidity.

19.3 NUMERIC STANDARD

As articulated in West Virginia guidance, chronic turbidity should not exceed 10 NTUs over background turbidity when the background is 50 NTU or less, or have more than a 10% increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTUs averaged over any four-day period. The turbidity standard does not contain an acute criterion for cold or warm waters designations. This standard will apply to all stream crossings as measured 50 feet above (background) and 50 feet below the crossing area for streams $\leq$ 30 feet in width.

Construction related to stream crossings will adhere to timing restrictions related aquatic life according to agency guidelines or specifications contained in state water quality permits. Timing restrictions are based on readily available data from agency consultation letters or online data. Additional consultations with state and federal agencies, as well as field survey data for protected species will occur to further refine timing restrictions.

19.4 INSPECTION AND MONITORING

As articulated in the *Stream and Wetland Crossing Procedures*, one or more EIs having knowledge of the wetland and stream conditions in the project area is required for each construction spread. The EIs will be responsible for the inspection of all in-stream activities (e.g. setting of flumes or dam and pump operations, and their removal) and to take all required water quality measurements.

Measurements of turbidity will occur at all stream crossings that are state-designated as either coldwater or significant coolwater or warmwater fisheries. Monitoring will be accomplished through the use of a hand held turbidity meter (e.g., YSI 6600 V2-2 data sonde, or similar), for short term continuous monitoring and grab samples. The turbidity meter will be calibrated prior to the commencement of construction and as required throughout the duration of the monitoring activities.

Monitoring will occur at a minimum rate of 4 times per day during the period when active construction is occurring, in both the background location (50 feet above activity) and downstream location (50 feet below activity). The first monitoring event will occur approximately 30 minutes prior to the commencement of construction, and the second will occur a minimum 2-4 hours after start of instream construction. Measurements of turbidity grab samples will continue during instream pipeline installation activities. Once the crossing is complete and restoration occurs, monitoring will be conducted for four days at a minimum rate of 1 time per day. Should the chronic turbidity reading (4-day average) exceed standards, remediation of the source will occur and monitoring will continue once per day until the source is addressed and readings are within water quality standards.

Attached is an example of a daily Turbidity Monitoring Data Sheet. All incidents of exceeding the numeric limits identified in Section 6.0 shall result in the prompt implementation of mitigation measures (described below).

19.5 CONSERVATION MEASURES

Atlantic will implement the following BMPs for all stream crossings to reduce impacts:

- develop and implement a state-approved ESCP;
- installing sediment barriers;
- appropriately site sediment filtering devices associated with trench dewatering activities;
- reducing the volume of large equipment operating in or near the waterbody; and/or
- halting work, if necessary to address issue or implement corrective actions.

In addition, Atlantic will develop site-specific BMPs to address steep slopes and unique crossing conditions.

19.6 REPORTING

The EI will complete a Turbidity Monitoring Data Sheet daily, and is responsible for identifying, documenting, and overseeing corrective actions, as necessary. Daily Turbidity Monitoring Data Sheets will be submitted to the ECC to be included with a final construction report and will be made available to the NFS within two weeks of the crossing.

Turbidity Monitoring Data Sheet

Project Name & Permit Number: ____________________

Site Address (Location): ____________________

Monitor Name: ____________________

Company: ____________________

Phone Number: ____________________

Date & Time of Sample: ____________________

Weather Conditions: ____________________

Upstream Location* / Reading (NTU)	Downstream Location* / Reading (NTU)	Turbidity Increase (Downstream - Upstream) (NTU)	Allowable Turbidity Increase (NTU)	Turbidity Increase Above Standard? (Y/N)	Contractor Notified of results? (Y/N)

Upstream Location* / Reading (NTU)	Downstream Location* / Reading (NTU)	Turbidity Increase (Downstream - Upstream) (NTU)	Allowable Turbidity Increase (NTU)	Turbidity Increase Above Standard? (Y/N)	Contractor Notified of results? (Y/N)

Upstream Location* / Reading (NTU)	Downstream Location* / Reading (NTU)	Turbidity Increase (Downstream - Upstream) (NTU)	Allowable Turbidity Increase (NTU)	Turbidity Increase Above Standard? (Y/N)	Contractor Notified of results? (Y/N)

Mitigation Measures Taken By Contractor (if turbidity increase is above standard): [continue on back]

____

____

____

* Number of feet from activity; **Source**: City of Bellevue, Department of Planning & Community Development, P.O. Box 90012 □ Bellevue, Washington □ 98009

20.0 REFERENCES

Dominion Transmission, Inc., 2016 Annual Standards and Specification, Erosion and Sediment Control and Stormwater Management for Construction and Maintenance of Pipeline Project in Virginia. February 2016.

Federal Energy Regulatory Commission. 2013a. Upland Erosion Control, Revegetation, and Maintenance Plan. Available online at: http://www.ferc.gov/industries/gas/enviro/plan.pdf.

Federal Energy Regulatory Commission. 2013b. Wetland and Waterbody Construction and Mitigation Procedures. Available online at: http://www.ferc.gov/industries/gas/enviro/procedures.pdf

Jones, J., Daniel, J.B., Glennon, B., Lawrence, C., Faulkner, D., Gordon, S., and C. Wentz. 2014. USDA-NRCS Virginia Plant Establishment Guide. Revised 2014.

Natural Resource Conservation Service. 2011. National Conservation Practice Standard - Critical Area Planting, Code 342.

Natural Resource Conservation Service. 2014. Conservation Practice Standard - Mulching, Code 484. Technical Guide Section IV: 484-VA-1.

Oregon Department of Environmental Quality. 2010. Turbidity Technical Review Summary of Sources, Effects, and Issues Related to Revising the Statewide Water Quality Standard for Turbidity. Last Updated: 09/7/10. By: Aron Borok. 10-WQ-022.

Sheley, R., J. Petroff, M. Borman. 1999. *Introduction to Biology and Management of Noxious Rangeland Weeds*, Corvallis, OR.

Soil Survey Staff. 2015a. Web Soil Survey. Natural Resources Conservation Service, U.S. Department of Agriculture. Available online at: http://websoilsurvey.nrcs.usda.gov/. Accessed June 2015.

Soil Survey Staff. 2015b. Official Soil Series Descriptions. Natural Resources Conservation Service, U.S. Department of Agriculture. USFS, Region 8, Revised land and Resource Management Plan: George Washington National Forest, R8-MB 143A, November 2014.

U.S. Department of Agriculture. 2014. *Introduced, Invasive, and Noxious Plants*. Available online at: http://plants.usda.gov/java/noxiousDriver. Accessed December 2014.

U.S. Forest Service. 2016. *Non-native invasive species.* Available online at: http://www.fs. usda. gov/Internet/FSE_DOCUMENTS/stelprdb5090755.pdf. Accessed June 2016.

U.S. Forest Service. George Washington National Forest. 2014. *Revised Land and Resource Management Plan.* Available online at: http://www.fs.fed.us/gwjeff/core/2014-GWNF-Revised-Forest-Plan-full-document.pdf. Accessed November 2015.

U.S. Forest Service. Monongahela National Forest. 2011. *Land and Resource Management Plan*. Available online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5330420.pdf. Accessed November 2015.

U.S. Forest Service, *Land and Resource Management Plan: Monongahela national Forest*, September 2006, Updated 2011.

U.S. Forest Service, Region 8, *Revised Land and Resource Management Plan: George Washington National Forest*, R8-MB 143A, November 2014

Virginia Department of Environmental Quality. 1992. Virginia Erosion and Sediment Control Handbook. Available online at: http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx. Accessed June 2015.

Virginia Department of Environmental Quality. 1992. Virginia Erosion and Sediment Control Handbook. Available online at: http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx. Accessed June 2015.

Virginia Department of Forestry. *Virginia's Forestry Best Management Practices for Water Quality*. Technical Manual, Fifth Edition. March 2011.

West Virginia Department of Environmental Protection, 2012. West Virginia Erosion and Sediment Control Field Manual. Office of Oil and Gas. Available online at: http://www.dep.wv.gov/oil-and-gas/Documents/Erosion%20Manual%2004.pdf. Accessed June 2015.

West Virginia Department of Environmental Protection, Division of Water and Waste Management, *Erosion and Sediment Control Best Management Practice Manual*, 2006.

APPENDIX H

HORIZONTAL DIRECTIONAL DRILL PLANS

H1 HORIZONTAL DIRECTION DRILL FLUID MONITORING, OPERATIONS, AND CONTINGENCY PLAN

H2 CONTINGENCY PLAN FOR THE PROPOSED CROSSING OF THE APPALACHIAN NATIONAL SCENIC TRAIL AND BLUE RIDGE PARKWAY

H3 SITE-SPECIFIC HORIZONTAL DIRECTIONAL DRILL PLANS

H1 HORIZONTAL DIRECTION DRILL FLUID MONITORING, OPERATIONS, AND CONTINGENCY PLAN

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket Nos. CP15-554-000
CP15-554-001

and

DOMINION TRANSMISSION, INC.
SUPPLY HEADER PROJECT
Docket No. CP15-555-000

Horizontal Directional Drill Drilling Fluid Monitoring, Operations, and Contingency Plan

Updated, Rev. 1

Prepared by

ERM

July 18, 2016

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LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Atlantic	Atlantic Coast Pipeline, LLC
DTI	Dominion Transmission, Inc.
DES	Dominion Environmental Services
EI	Environmental Inspector
HDD	horizontal directional drill
HDD Plan	*Horizontal Directional Drill Drilling Fluid Monitoring, Operations, and Contingency Plan*
MSDS	Material Safety Data Sheet
SDS	Safety Data Sheet
SHP	Supply Header Project

1.0 INTRODUCTION

Atlantic Coast Pipeline, LLC (Atlantic) – a company formed by four major energy companies – Dominion Resources, Inc.; Duke Energy Corporation; Piedmont Natural Gas Co., Inc.; and AGL Resources, Inc. – proposes to construct and operate approximately 600 miles of natural gas transmission pipelines and associated aboveground facilities in West Virginia, Virginia, and North Carolina. This Project, referred to as the Atlantic Coast Pipeline (ACP), will deliver up to 1.5 million dekatherms per day of natural gas from supply areas in the Appalachian region to demand areas in Virginia and North Carolina. Atlantic has contracted with Dominion Transmission, Inc. (DTI), a subsidiary of Dominion Resources, Inc., to construct and operate the ACP on behalf of Atlantic.

In conjunction with the ACP, DTI proposes to construct and operate approximately 37.5 miles of pipeline loop and modify existing compression facilities in Pennsylvania and West Virginia. This Project, referred to as the Supply Header Project (SHP), will enable DTI to provide firm transportation service to various customers, including Atlantic.

2.0 PURPOSE

For the ACP, the horizontal directional drill (HDD) construction method is proposed for 15 waterbody crossings, two highway crossings, and the Appalachian National Scenic Trail/Blue Ridge Parkway. Other HDD crossings for the ACP could be evaluated as a result of ongoing engineering design or consultation with permitting agencies. For the SHP, the HDD method is not currently anticipated for river crossings.

This *Horizontal Directional Drill Drilling Fluid Monitoring, Operations, and Contingency Plan* (HDD Plan) describes the procedures to be implemented by Atlantic/DTI and their Contractors [1] for monitoring drilling operations and responding to inadvertent returns of drilling fluid to the surface. It also provides contingency plans in the event that an HDD cannot be completed during construction (e.g., due to repeated collapse of the drill hole).

Each HDD will have a customized plan that will be prepared and in place prior to commencement of HDD operations. [2] This HDD Plan serves as a template for the individual plans. Each individual plan will identify the appropriate agency contacts and reporting timelines in the event of an inadvertent return of drilling fluid to the surface and provide a list of the information which needs to be reported to the agency.

3.0 TRAINING

Prior to the start of construction, Atlantic and DTI will conduct environmental and safety training for Company and Contractor personnel. The training program will focus on the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedures*; other construction,

[1] Contractor refers to the company or companies retained by Atlantic/DTI or another contractor to complete the HDD installations.

[2] A draft contingency plan for the crossing of the Appalachian National Scenic Trail/Blue Ridge Parkway was filed on May 13, 2016 (FERC Accession Number 20160513-5223).

restoration, and mitigation plans, including this HDD Plan; and applicable permit conditions. In addition, Atlantic and DTI will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

4.0 OVERVIEW OF PLAN ELEMENTS

The elements of the HDD Plan consist of three operational conditions as follows:

- Condition 1 – Normal Drilling Conditions;
- Condition 2 – Loss of Circulation; and
- Condition 3 – Drilling Fluid Return and Remediation

An overview of the corresponding monitoring and operational actions for each condition is provided in Table 4-1. Subsequent sections of this plan provide additional detail regarding each of the three conditions described in the table.

TABLE 4-1

Overview of Plan Elements

Condition	Status	Actions
Condition 1- Normal Drilling Conditions	Normal drilling fluid circulation is maintained	• Perform routine collection of drilling fluid at drill entry and exit points • Perform routine drilling data collection • Conduct routine visual monitoring
Condition 2- Loss of Circulation	Loss or significant reduction of fluid circulation	• Discontinue drilling; continue pumping and rotating and slowly swab the drill string, if appropriate • Immediately notify an Environmental Inspector, Atlantic/DTI representative, and Dominion Environmental Services • Adjust drilling fluid and parameters in an effort to regain circulation • Perform focused visual monitoring • Continue drilling if no return to the surface is detected
Condition 3- Drilling Fluid Return and Remediation	Drilling fluid return to the surface is confirmed	• Notify regulatory agencies and authorities having jurisdiction • Discontinue pumping; continue rotating and slowly swab the drill string, if appropriate • Monitor and document the return area • Contain and collect the return, if practical • If the return is contained and collected, resume pumping and drilling • If containment and collection is not practical, suspend HDD operations • Atlantic or DTI, in consultation with the appropriate regulatory agencies, will issue a notice to proceed, notice to relocate, or notice to shut down

5.0 MATERIALS AND EQUIPMENT

Equipment and materials required to contain inadvertent returns of drilling fluid will be available at the drilling sites. Each individual involved in drilling operations will be familiar with the locations of containment equipment and the specific procedures for handling inadvertent returns of drilling fluid. The following materials and equipment will be on site in ample supply depending on the extent of sensitive resources at each crossing:

- spill sorbent pads and booms;
- straw bales (certified weed-free);

- wood stakes;
- sandbags;
- silt fence;
- plastic sheeting;
- corrugated plastic pipe;
- shovels;
- push brooms;
- centrifugal, trash, and sump pumps;
- vacuum truck;
- rubber-tired or wide-track backhoe;
- bobcat (if needed);
- storage tanks (if needed); and
- floating turbidity curtain (may be considered for use on large streams).

6.0 CONDITION 1: NORMAL DRILLING CONDITIONS

6.1 Drilling

Documentation of the composition and properties of drilling fluids will be maintained at the jobsite and will be available for review by Atlantic/DTI and its designated representatives. Documentation will include manufacturer's literature and Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets (or MSDSs) for additives, such as thickening agents, if used (Atlantic's/DTI's standard practice is to not utilize additives). Prior to the use of additives, Atlantic and DTI will consult with and obtain permission from the appropriate State/Commonwealth regulatory agencies regarding the use of additives, and confirm that the additives will not violate water quality standards if inadvertently released into the water. Additives that do not comply with permit requirements and environmental regulations will not be used during drilling.

The HDD Contractor will maximize the reuse of drilling fluid surface returns by providing solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.

The Contractor at all times will provide and maintain instrumentation that will:

- locate the pilot hole;
- measure drill string axial and torsional loads;
- measure annulus pressures; and
- measure drilling fluid discharge rate and pressure.

Atlantic/DTI and its designated representatives will have access to these instruments and readings at all times. If requested, Atlantic/DTI will provide this information to agencies with regulatory jurisdiction over the crossing. A log of all recorded readings will be maintained at the jobsite and become a part of the "As-Built" information to be supplied by the Contractor to Atlantic/DTI.

6.2 Monitoring

Routine monitoring under Condition 1 will consist of visual inspection by the Contractor and/or an Environmental Inspector (EI) [3] along the drilled alignment on land and on the waterbody bed where visible from land or by boat. These examinations will be made periodically on a time interval no less than every four hours, except during hours of darkness. Additionally, Atlantic and DTI will monitor source waters, such as seeps and springs, along or near the drill path for possible inadvertent returns on a time interval no less than every four hours, except during hours of darkness. The name of the inspector, time of the examination, and observations of the inspector will be kept in a separate log at the jobsite and be available for inspection by Atlantic/DTI and its designated representatives. Upon request, Atlantic/DTI will make the logs available to agencies with regulatory jurisdiction over the crossing. If loss of circulation and a possible return of drilling fluid to the surface are detected, Condition 2 will be implemented.

7.0 CONDITION 2: LOSS OF CIRCULATION

7.1 Drilling

The following procedures will be implemented if a loss or significant reduction of drilling fluid circulation occurs.

- The Contractor will discontinue drilling or reaming activities as soon as possible. The contractor will continue pumping and rotating and slowly swab the drill string, if appropriate. Swabbing involves withdrawing the drill string to mechanically clean the drilled hole, which reduces the chances of the drill string getting stuck in the hole.

- The Contractor will immediately notify an EI (the lead EI, if possible), an Atlantic/DTI representative, and Dominion Environmental Services (DES) that operations are continuing under Condition 2.

- The Contractor will immediately take steps to restore circulation. These steps will include, but not be limited, to the following.

    - Adjusting drilling fluid properties and parameters to encourage annular flow by weighting up or down, increasing viscosity, or adding lost circulation material to plug the seam where fluid is being lost. Flow will be maintained such that annular velocities promote returns to the drilling rig tanks.

    - Employing lost circulation materials provided such materials are approved by Atlantic or DTI and comply with permit requirements and environmental regulations.

[3] The role and responsibilities of an EI are defined in the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan*.

- Focused monitoring will be performed along the drill path for a drilling fluid return to the surface.

- If circulation is restored or drilling fluid is not observed on the surface, drilling will continue under Condition 2 for a period of no less than eight drilling hours. If a return is not identified and either loss or significant reduction of drilling fluid circulation does not occur during this eight-hour period, the Contractor will notify Atlantic/DTI that drilling under Condition 1 has resumed.

- If a drilling fluid return is identified through focused monitoring during the eight-hour period or after, Condition 3 will be implemented

7.2 Focused Monitoring

Focused monitoring under Condition 2 will consist of visual observation along the drilled alignment and at source waters such as seeps and springs along and near the drill path by the Contractor and/or an EI with no other jobsite responsibilities. The EI will ensure that a sufficient number of individuals are assigned to monitoring given the size of the HDD and the number of seeps or springs along or near the drill path. Focused monitoring will occur over the minimum eight-hour Condition 2 drilling timeline, as indicated above. The time and results of drilled alignment observations will be kept in a log at the jobsite and be available for inspection by Atlantic/DTI and its designated representatives. Upon request, Atlantic/DTI will make the logs available to agencies with regulatory jurisdiction over the crossing. If a drilling fluid return to the surface is confirmed, Condition 3 will be implemented.

8.0 CONDITION 3: DRILLING FLUID RETURN AND REMEDIATION

8.1 Drilling Operations

The following procedures will be implemented if an inadvertent return of drilling fluid to the surface is confirmed.

- The Contractor will cease drilling and immediately notify an EI (lead, EI if possible), an Atlantic/DTI representative, and DES.
- In the event of an inadvertent return within a waterbody or wetland, or an upland return that results in drilling fluid entering a waterbody or wetland, the Atlantic/DTI representative will immediately notify the agencies with regulatory jurisdiction over the crossing.
- The Contractor will discontinue pumping and will rotate and slowly swab the drill string, if appropriate. Swabbing involves withdrawing the drill string to mechanically clean the drilled hole, which reduces the chances of the drill string getting stuck in the hole.
- If public health, safety, and/or the environment are threatened by an inadvertent return, drilling operations will be shut down and the drill string removed from the hole until the threat is eliminated.

- If the return occurs on land or within a wetland, it will be contained with hand placed barriers (e.g., hay bales, sand bags, silt fences, etc.) and collected for disposal or reuse. If the amount of the return exceeds that which can be contained with hand placed barriers, a small pit will be excavated at the return site to contain the spread of the fluid, and a pump will be used to transfer the fluid from the pit into a containment vessel. Drilling may resume under Condition 2 as long as the return is being contained and collected.
- If the amount of return occurring on land or within a wetland exceeds that which can be contained and collected using small sumps, drilling operations will be suspended until return volumes can be brought under control.
- If an inadvertent return occurs in a waterbody it will be more difficult to contain because the fluid will be dispersed into the water and carried downstream. In those areas that can be contained (e.g., in shallow, standing or slow moving water), the underwater return will be collected using pumps. Drilling may resume under Condition 2 as long as the return is being contained and collected.
- If the return cannot be contained using the methods described above, an attempt may be made to plug the flow path by adding thickening agents to the drilling fluid, such as additional bentonite, cottonseed hulls, or other non-hazardous materials. As noted above, Atlantic/DTI will consult with and obtain permission from the appropriate State/Commonwealth regulatory agencies regarding the use of additives and confirm that the additives will not violate water quality standards if inadvertently released into the water.
- If the amount of a drilling fluid return, either on land or within a waterbody or wetland, exceeds that which can be practically contained and collected, drilling operations will be suspended, and the Contractor will notify Atlantic/DTI that drilling cannot continue without a continuous return of drilling fluid. Atlantic/DTI, in consultation with the appropriate regulatory agencies, will issue a notice to proceed, notice to relocate, or notice to shut down until further notice.
- If impacts to fish or wildlife are observed due to exposure to drilling fluids, drilling operations will be suspended and the Contractor will notify Atlantic/DTI immediately. Atlantic/DTI, in consultation with the appropriate regulatory agencies, will issue a notice to proceed, notice to relocate, or notice to shut down until further notice.
- If an inadvertent return occurs within a source water, such as a seep or spring, Atlantic/DTI will test the water for water quality and provide an alternate supply of water to affected landowners until the inadvertent return is remediated.
- If necessary, an Emergency Response Contractor will be deployed for assistance containing and remediating large returns. Emergency Response Contractors will be identified in the individual plans prepared for each crossing.

8.2 Focused Monitoring

Focused monitoring under Condition 3 will consist of visual observation along the drilled alignment, at source waters such as seeps and springs along and near the drill path, and at the location of the inadvertent return. Focused monitoring will be conducted by the Contractor and/or an EI with no other jobsite responsibilities. The EI will ensure that a sufficient number of individuals are assigned to monitoring given the size of the HDD, the number of seeps or springs along or near the drill path, and the location of the inadvertent return. The time and results of focused monitoring observations will be kept in a written log at the jobsite. The log will be available for inspection by Atlantic/DTI and its designated representatives. Upon request, Atlantic/DTI will make the logs available to agencies with regulatory jurisdiction over the crossing.

9.0 RESTORATION

All areas affected by inadvertent returns will be restored to pre-existing condition and contours to the extent practicable. Upland areas will be restored through typical right-of-way restoration procedures, such as grading, seeding, and temporary and permanent stabilization. Restoration of wetlands and waterbodies will vary depending on the extent of disturbance during the initial response to the inadvertent return. Recommendations from the appropriate regulatory agencies (e.g., the U.S. Army Corps of Engineers) will be solicited and followed for restoration activities in regulated wetlands and waterbodies.

10.0 GENERAL CONTINGENCY PLANS

If the actions described above do not address the problem with the HDD, Atlantic/DTI may opt to select a new drill path, abandon the drill hole, or consider alternate crossing measures. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting and regulatory agencies, and required approvals will be obtained prior to implementing alternative crossing measures.

10.1 New Drill Path

Depending on the nature of the problem, Atlantic/DTI may identify a new drill path that mitigates the cause of the problem. This could result in an altered path, deeper path, or shallower path, and may retain sections of the original drilled path that are not at risk to the problem. For sections of abandoned hole, the abandonment procedures identified below will apply to the abandoned section of the hole.

10.2 Abandonment

In the event a drill hole is abandoned, the following procedures will be implemented:

- Heavy drilling fluid or a cement mixture will be pumped into the hole as the drill assembly is extracted to seal the abandoned drill hole.
- The drill end points within approximately 5 feet of the surface will be filled with soil and the location will be graded to the original contour.

10.3 Alternative Crossings

Before implementing alternative crossing measures, an attempt will be made to identify and assess the reason for the drill failure as this may be critical for selection of an appropriate alternate crossing. Potential alternative measures could include:

- changing the drill entry and exit points;
- changing of the profile (depth) of the drill;
- changing drill procedures (e.g., fluid viscosity/pressure/flow velocity, bit rotation/velocity, etc.);
- conducting an open cut from the banks with the pipe pulled across the trench;
- conducting an open cut from the banks and a barge with the pipe laid from the barge; or
- implementing a dry crossing method (e.g., conducting a partial stream diversion using a cofferdam).

In developing an appropriate alternate measure, consideration will be given to:

- stream bank type, flow, width, depth, velocity, and volume;
- surrounding topography;
- condition of riparian areas;
- condition and extent of wetlands, if present, on each side of the crossing; and
- aquatic biota present.

These and other factors will be considered and discussed with the appropriate regulatory agencies to minimize environmental impact and secure appropriate approvals. No in-stream work will occur until approval from the appropriate regulatory agencies is obtained. Final selection of an alternative crossing measure will be submitted to the Federal Energy Regulatory Commission with supporting data.

11.0 SITE-SPECIFIC CONTINGENCY PLAN

A site-specific contingency plan for the Appalachian National Scenic Trail and Blue Ridge Parkway is currently being developed. This plan will be provided to FERC upon completion and subsequent consultation with applicable agencies, such as the U.S. Forest Service and National Park Service. Atlantic and DTI anticipate filing a copy of this plan in December 2016. The site-specific contingency plan will be appended to the "issued-for-construction" version of this HDD Plan.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

and

DOMINION TRANSMISSION, INC.
SUPPLY HEADER PROJECT

Horizontal Directional Drill Drilling, Operations, and Contingency Plan

ATTACHMENT A
Site-Specific Contingency Plan
(to be provided in the "issued-for-construction" version of this plan)

H2 CONTINGENCY PLAN FOR THE PROPOSED CROSSING OF THE APPALACHIAN NATIONAL SCENIC TRAIL AND BLUE RIDGE PARKWAY

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket Nos. CP15-554-000 &
CP15-554-001

Contingency Plan for the Proposed Crossing of the Appalachian National Scenic Trail and Blue Ridge Parkway

August 4, 2016

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
AT	Appalachian National Scenic Trail
Atlantic	Atlantic Coast Pipeline, LLC
BRP	Blue Ridge Parkway
HDD	horizontal directional drill
NPS	National Park Service
USFS	U.S. Forest Service

1.0 INTRODUCTION

Atlantic Coast Pipeline, LLC (Atlantic) – a company formed by four major energy companies - Dominion Resources, Inc.; Duke Energy Corporation; Piedmont Natural Gas Co., Inc.; and AGL Resources, Inc. – proposes to construct and operate approximately 603.8 miles of natural gas transmission pipelines and associated aboveground facilities in West Virginia, Virginia, and North Carolina. This Project, referred to as the Atlantic Coast Pipeline (ACP), will deliver up to 1.5 billion cubic feet per day of natural gas from supply areas in the Appalachian region to demand areas in Virginia and North Carolina. Atlantic has contracted with Dominion Transmission, Inc., a subsidiary of Dominion Resources, Inc., to construct and operate the ACP on behalf of Atlantic.

2.0 PURPOSE

Atlantic has proposed to cross underneath the Blue Ridge Parkway (BRP), located on National Park Service (NPS) lands, and the Appalachian National Scenic Trail (AT), located on U.S. Forest Service (USFS) lands, using horizontal directional drilling (HDD) and installation technology. Atlantic has completed geotechnical subsurface borings at the HDD crossing location and has confirmed its expectations that the drill path would be primarily through solid rock approximately 800 feet below the BRP and the AT. Drilling through solid rock, while a time consuming process, significantly helps to ensure the success of the drill operation due to the avoidance of rock fragments and cobbles that can disrupt or block the drill pathway. As such, and in consultation with its drilling consultant, J. D. Hair & Associates, Atlantic is very confident in a successful HDD and pipeline installation at this location. In the unlikely event that the HDD procedure fails, however, Atlantic has identified the following steps to be implemented as part of a prudent contingency planning process. Selection of the correct contingency action would depend on the specific circumstances of the HDD failure and the stage of HDD operation when failure occurred and action halted.

3.0 CONDITIONS FOR CONTINGENCY

If insurmountable problems are encountered during the HDD process, Atlantic may decide to select a new drill path, abandon the drill hole, or consider alternate crossing methods. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting, regulatory, and land managing agencies, and required approvals will be obtained prior to implementing alternative crossing measures.

Adverse conditions most commonly encountered during the HDD process are associated with the loss of structural integrity of the drill path. This loss of integrity is generally the result of debris collapsing into the drill path opening. While this can generally occur at any point during an HDD drilling process (i.e., pilot hole, reaming, or pipe pull-back), because this drill will be primarily through solid rock, the likelihood of losing the structural integrity of the drill path is significantly lowered and localized to the drill path through the overburden near the entrance and exit points.

Regardless of when the adverse conditions are encountered, efforts will be made to retrieve the drilling tools from the hole and free the drill path of obstructions. If this cannot be

accomplished, a new drill path will be established within the existing and approved HDD workspace. Development of a new drill path will be the default initial drill contingency plan.

4.0 INITIAL CONTINGENCY PLAN – NEW HDD PATHS

Efforts will be made to identify and assess the reason for the drill failure as this will be critical for selection of an appropriate alternate HDD pathway. In developing an appropriate alternate measure, consideration will be given to site conditions, such as surrounding topography. The proposed workspace and right-of-way planned for the HDD is adequately sized to allow for multiple attempts of a new drill path. That is, the entry/exit points can be relocated several times within the currently proposed limits of disturbance for the HDD.

Either a modified drill path or an all new drill path would be identified that mitigates or avoids the cause of the problem for the HDD failure. This could result in altering the existing path to utilize a deeper or more shallow vertical path, or a laterally expanded path, while retaining sections of the original drilled path that are not at risk to the problem. Alternatively, depending on the type of obstruction, the drill rig may need to be moved or slightly re-aligned to drill a completely new hole.

5.0 DRILL PATH ABANDONMENT

For any section of abandoned hole, the abandonment procedures identified below will apply to the abandoned section of the hole:

- Heavy drilling fluid or a cement mixture will be pumped into the hole as the drill assembly is extracted to seal the abandoned drill hole.

- The drill end points within approximately 5 feet of the surface will be filled with soil and the location will be graded to the original contour.

6.0 ALTERNATE CROSSING METHOD

In the event that all options outlined in the initial contingency plan results in failure, either by way of execution failure or it is determined that the schedule does not permit continued HDD efforts, alternative crossing methods will be initiated.

The alternative crossing would use both traditional open-trench construction as well as a 1,400-foot-long trenchless crossing installed using Direct Pipeline technology. The traditional open-trench section would lead up to the entry and exit locations of the Direct Pipeline trenchless crossing. At these points, surface disturbance would cease and the trenchless crossing would be used to cross beneath USFS and NPS land, the AT, and the BRP simultaneously. The entry and exit points for the trenchless crossing would be on private land, approximately 600 feet south of the BRP and 400 feet north of the AT, respectively. An approximately 200 X 200 foot temporary work space would be located at the entry point and used for drill operations and pipe fabrication (see attached figure).

No ground disturbance or tree clearing would be required on NPS lands or within approximately 600 feet of the BRP. Similarly, no ground disturbance or tree clearing would be

required within approximately 350 feet of the AT. The approximate limits of disturbance are identified in Figure 1 below.

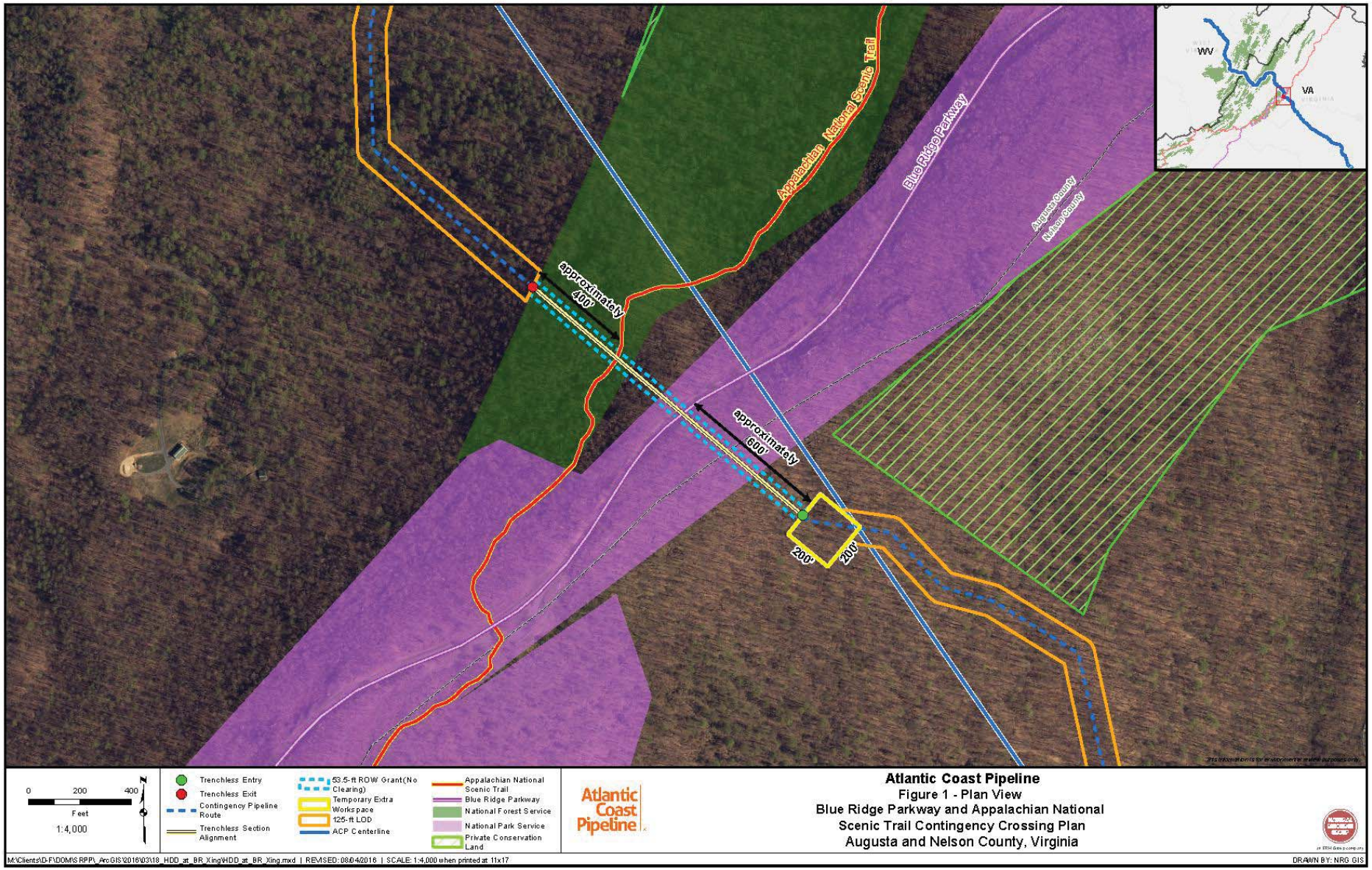
The Direct Pipe installation will require approximately 150,000 gallons of water for the mixing and use of bentonite drilling mud, which will be disposed of at an approved landfill following completion of the Direct Pipe installation. Additionally, the drilling activities will produce approximately 26,000 cubic feet of spoil which will be removed from the drilled path; this spoil will also be disposed of at an approved landfill.

Temporary access to the entry/rig side (south side) of the Direct Pipe installation would be accomplished through the improvement and use of an existing logging/access road off Beech Grove Road. Access to the exit side of the Direct Pipe installation (north side) would be accomplished using the cleared pipeline right-of-way.

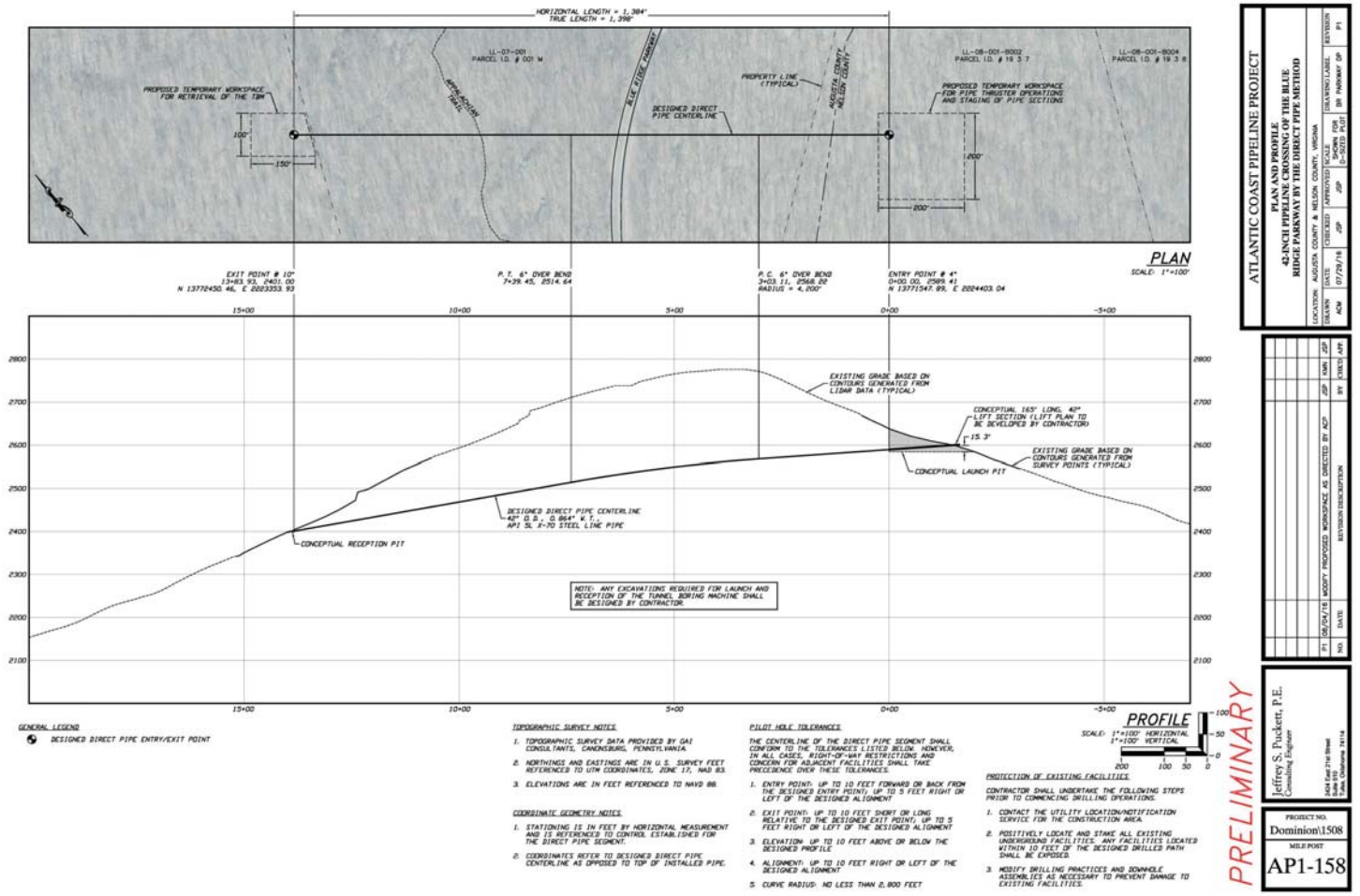
The Direct Pipe installation and the traditional open-trench construction associated with the Alternate Crossing Method will occur simultaneously and together will take approximately 16 weeks to complete. Drilling operations associated with the Direct Pipe installation will take approximately 12 weeks to complete, assuming a 24-hour per day, 7-day per week schedule.

Restoration of access roads, workspace, and temporary construction easements would be restored to as near pre-existing conditions as practical.

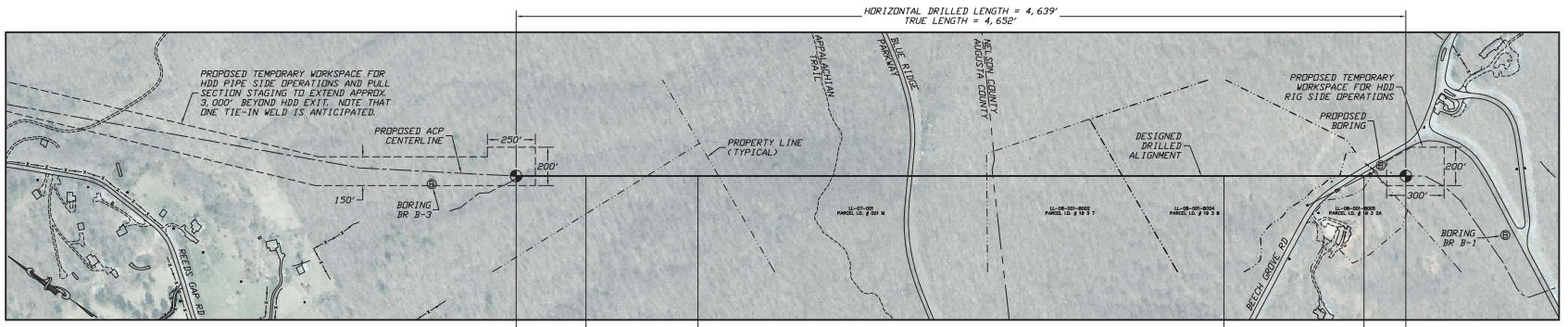
H2-6


Appalachian National Scenic Trail
Blue Ridge Parkway
Augusta County
Nelson County
WV
VA
approximately 400'
approximately 600'
200'
200'
0 200 400
Feet
1:4,000
Trenchless Entry
Trenchless Exit
Contingency Pipeline Route
Trenchless Section Alignment
53.5-ft ROW Grant(No Clearing)
Temporary Extra Workspace
125-ft LOD
ACP Centerline
Appalachian National Scenic Trail
Blue Ridge Parkway
National Forest Service
National Park Service
Private Conservation Land
Atlantic Coast Pipeline
Atlantic Coast Pipeline
Figure 1 - Plan View
Blue Ridge Parkway and Appalachian National Scenic Trail Contingency Crossing Plan
Augusta and Nelson County, Virginia
M:\Clients\D-F\DOM\S RPP_ArcGIS\2016\03\18_HDD_at_BR_Xing\HDD_at_BR_Xing.mxd | REVISED: 08/04/2016 | SCALE: 1:4,000 when printed at 11x17
DRAWN BY: NRG GIS

H2-7

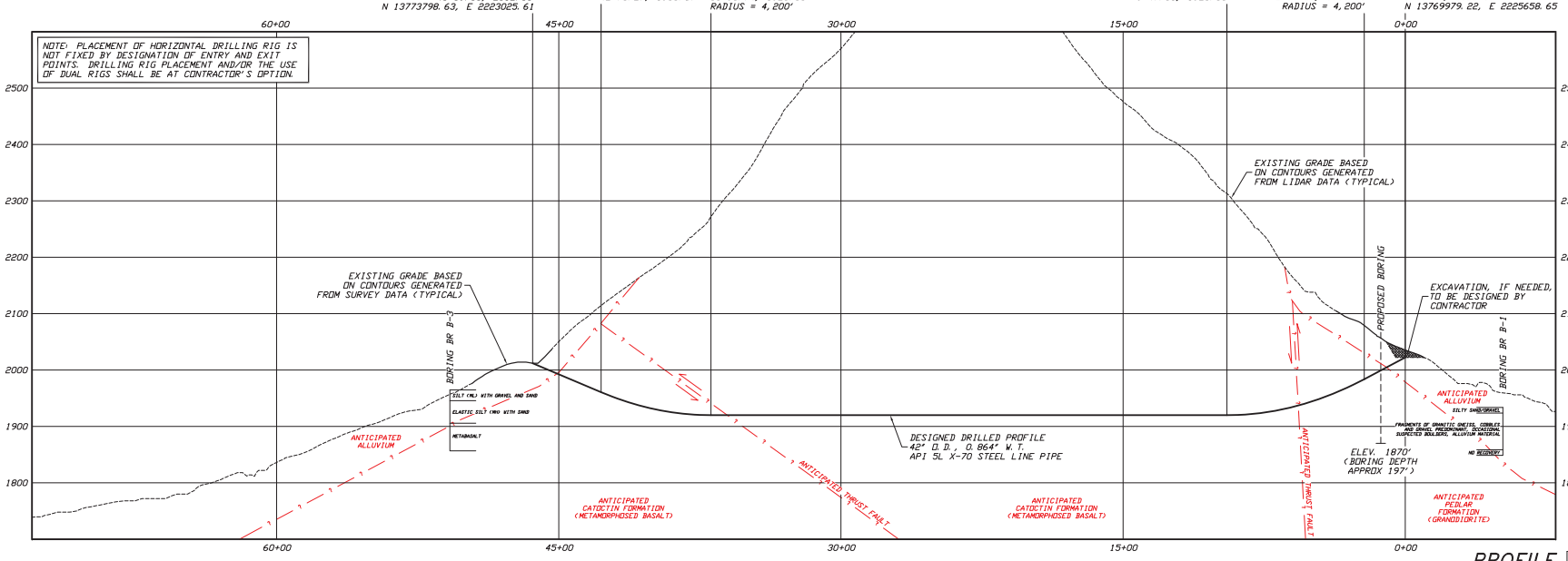

HORIZONTAL LENGTH = 1,384'
TRUE LENGTH = 1,398'
LL-07-001
PARCEL I.D. # 001 M
LL-08-001-B002
PARCEL I.D. # 19 3 7
LL-08-001-B004
PARCEL I.D. # 19 3 8
PROPOSED TEMPORARY WORKSPACE FOR RETRIEVAL OF THE TBM
APPALACHIAN TRAIL
BLUE RIDGE PARKWAY
DESIGNED DIRECT PIPE CENTERLINE
PROPERTY LINE (TYPICAL)
AUGUSTA COUNTY - NELSON COUNTY
PROPOSED TEMPORARY WORKSPACE FOR PIPE THRUSTER OPERATIONS AND STAGING OF PIPE SECTIONS
100'
150'
200'
200'
PLAN
SCALE: 1"=100'
EXIT POINT @ 10°
13+83.93, 0401.00
N 13772450.46, E 2023353.93
P.T. 6° OVER BEND
7+39.45, 2514.64
P.C. 6° OVER BEND
3+03.11, 2568.82
RADIUS = 4,000'
ENTRY POINT @ 4°
0+00.00, 2589.41
N 13771547.89, E 2024403.04
15+00
10+00
5+00
0+00
-5+00
2800
2700
2600
2500
2400
2300
2200
2100
EXISTING GRADE BASED ON CONTOURS GENERATED FROM LIDAR DATA (TYPICAL)
CONCEPTUAL 165° LONG, 42" LIFT SECTION (LIFT PLAN TO BE DEVELOPED BY CONTRACTOR)
15.3°
EXISTING GRADE BASED ON CONTOURS GENERATED FROM SURVEY POINTS (TYPICAL)
CONCEPTUAL LAUNCH PIT
DESIGNED DIRECT PIPE CENTERLINE
42" O.D., 0.864" W.T.,
API 5L X-70 STEEL LINE PIPE
CONCEPTUAL RECEPTION PIT
NOTE: ANY EXCAVATIONS REQUIRED FOR LAUNCH AND RECEPTION OF THE TUNNEL BORING MACHINE SHALL BE DESIGNED BY CONTRACTOR.
PROFILE
SCALE: 1"=100' HORIZONTAL
1"=100' VERTICAL
100
50
0
200
100
50
0
GENERAL LEGEND
DESIGNED DIRECT PIPE ENTRY/EXIT POINT
TOPOGRAPHIC SURVEY NOTES:
1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.
COORDINATE GEOMETRY NOTES:
1. STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DIRECT PIPE SEGMENT.
2. COORDINATES REFER TO DESIGNED DIRECT PIPE CENTERLINE AS OPPOSED TO TOP OF INSTALLED PIPE.
PILOT HOLE TOLERANCES
THE CENTERLINE OF THE DIRECT PIPE SEGMENT SHALL CONFORM TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.
1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 10 FEET ABOVE OR BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,800 FEET
PROTECTION OF EXISTING FACILITIES
CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:
1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.
ATLANTIC COAST PIPELINE PROJECT
PLAN AND PROFILE
42-INCH PIPELINE CROSSING OF THE BLUE RIDGE PARKWAY BY THE DIRECT PIPE METHOD
LOCATION: AUGUSTA COUNTY & NELSON COUNTY, VIRGINIA
DRAWN: ACM
DATE: 07/29/16
CHECKED: JSP
APPROVED: JSP
SCALE: SHOWN FOR 11x17 PLOT
DRAWING LABEL: BR PARKWAY DP
REVISION: P1
NO. DATE REVISION DESCRIPTION BY CHECK APP
P1 08/04/16 MODIFY PROPOSED WORKSPACE AS DIRECTED BY ACP JSP KMN JSP
PRELIMINARY
Jeffrey S. Puckett, P.E.
Consulting Engineer
2454 East 21st Street
Suite 310
Tulsa, Oklahoma 74114
PROJECT NO.
Dominion\1508
MILE POST
AP1-158

H3 SITE-SPECIFIC HORIZONTAL DIRECTIONAL DRILL PLANS



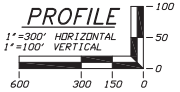
PLAN

SCALE: 1"=300'



PROFILE

SCALE: 1"=300' HORIZONTAL
1"=100' VERTICAL



GENERAL LEGEND

- DRILLED PATH ENTRY/EXIT POINT
- Ⓑ BORING LOCATION

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.
2. STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES.
3. THE ANTICIPATED SUBSURFACE CONDITIONS SHOWN IN RED ARE BASED ON A GENERAL GEOLOGIC PROFILE INCLUDED IN THE GEOTECHNICAL SITE INVESTIGATION REPORT AS FIGURE 4.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 30 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 15 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,800 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

H3-1

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
42-INCH PIPELINE CROSSING OF THE BLUE RIDGE PARKWAY BY HORIZONTAL DIRECTIONAL DRILLING

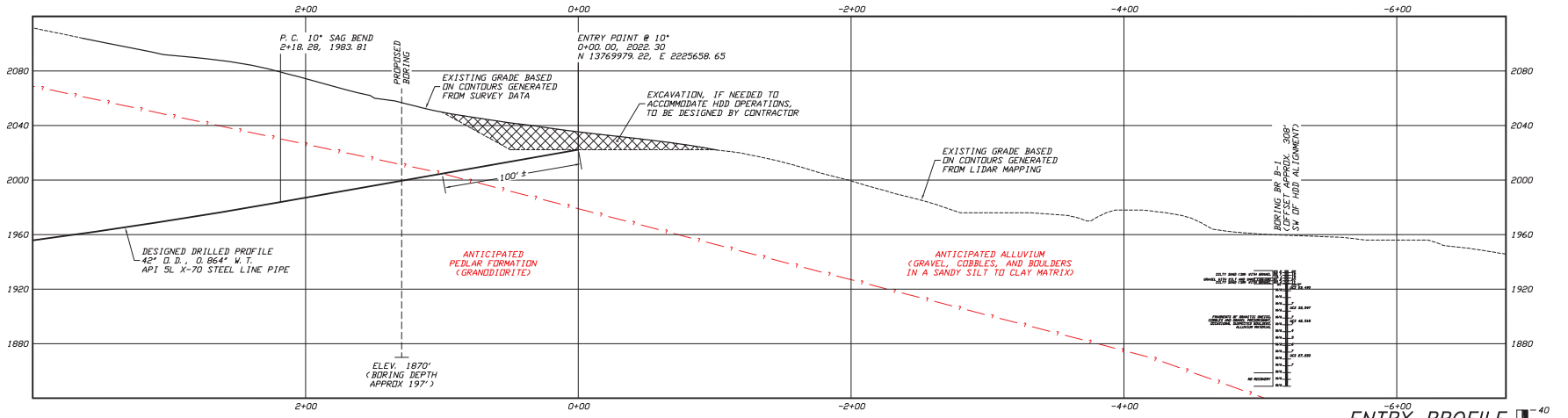
LOCATION	DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
AUGUSTA COUNTY & NELSON COUNTY, VIRGINIA	KMN	05/19/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	BR PARKWAY 1	0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 560
Tulsa, Oklahoma 74114

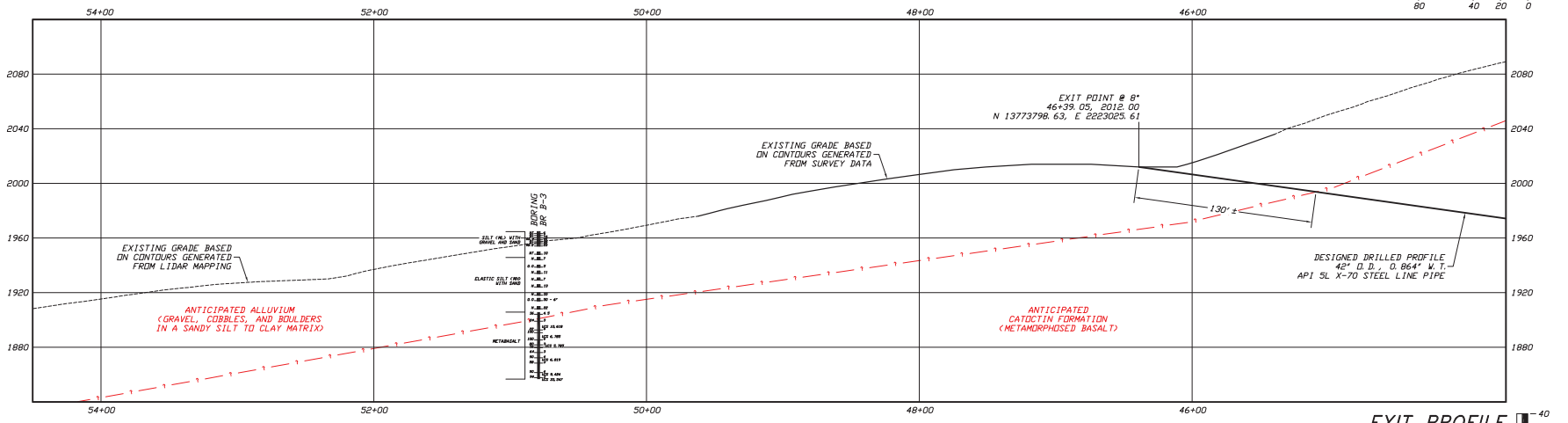
PROJECT NO.
Dominion\1508

MILE POST
AP1-158



ENTRY PROFILE

SCALE: 1"=40' HORIZONTAL
1"=40' VERTICAL



EXIT PROFILE

SCALE: 1"=40' HORIZONTAL
1"=40' VERTICAL

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

SPLIT SPOON SAMPLE

53 / 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6, 250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 / 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

GEOTECHNICAL NOTES (CONTINUED)

4. STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES.
5. THE ANTICIPATED SUBSURFACE CONDITIONS SHOWN IN RED ARE BASED ON A GENERAL GEOLOGIC PROFILE INCLUDED IN THE GEOTECHNICAL SITE INVESTIGATION REPORT AS FIGURE 4.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

ENTRY/EXIT PROFILES - NATURAL SCALE
42-INCH PIPELINE CROSSING OF THE BLUE RIDGE PARKWAY
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION	DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
AUGUSTA COUNTY & NELSON COUNTY, VIRGINIA	KMN	05/19/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	BR PARKWAY 2	0

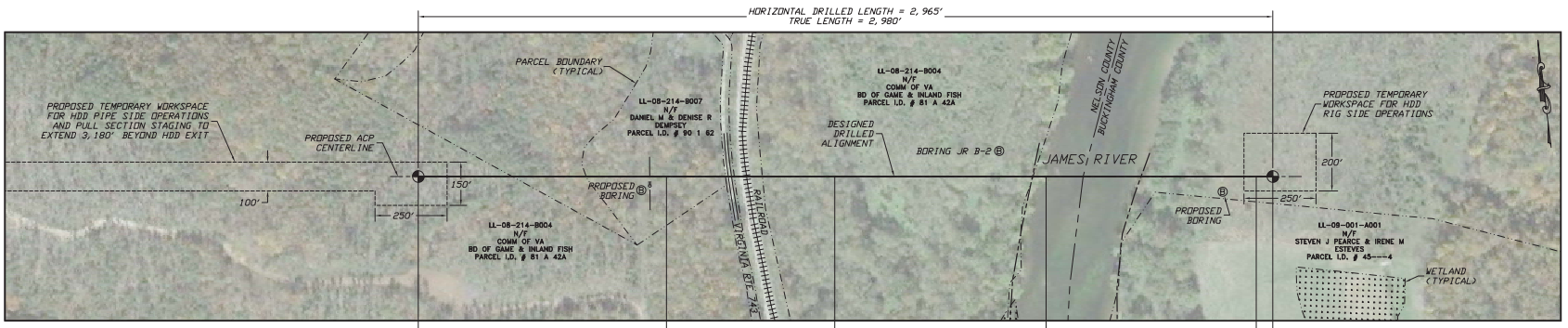
NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

MILE POST
AP1-158

H3-2



PLAN

SCALE: 1"=200'

EXIT POINT @ 8°
29+65.04, 426.87
N 13684214.51, E 2298350.29

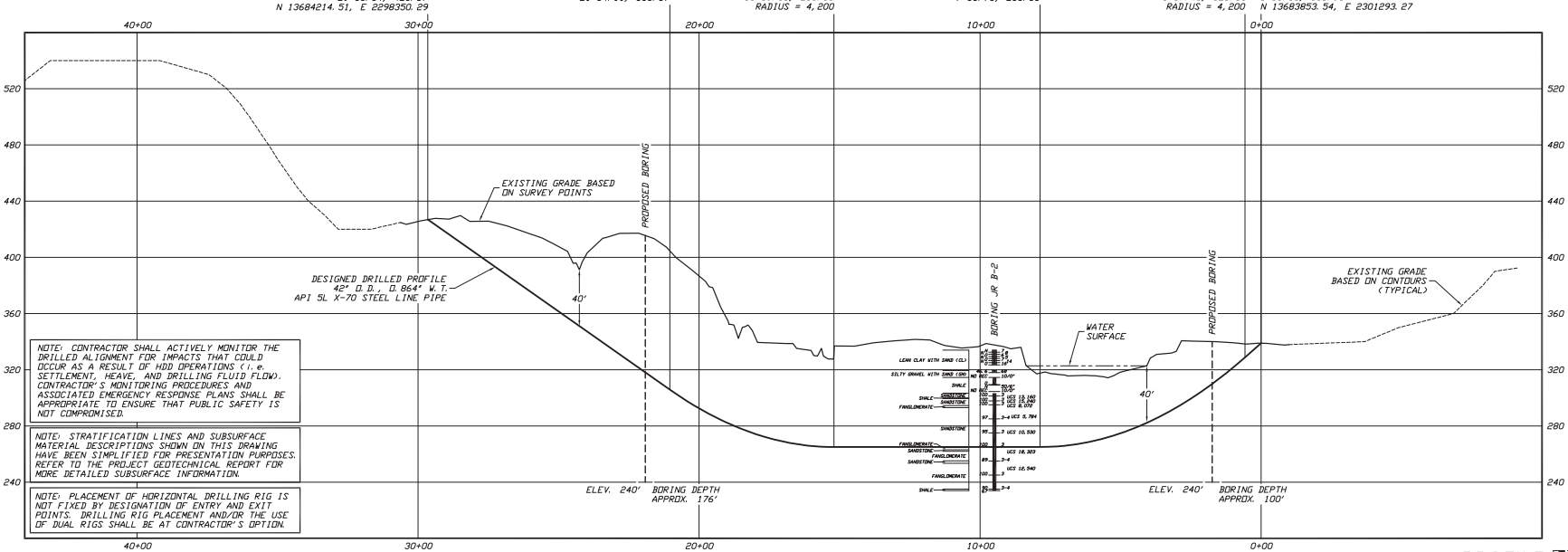
P.T. 8° SAG BEND
21+04.11, 305.87

P.C. 8° SAG BEND
15+19.59, 265.00
RADIUS = 4,200

P.T. 10° SAG BEND
7+86.75, 265.00

P.C. 10° SAG BEND
0+57.43, 328.81
RADIUS = 4,200

ENTRY POINT @ 10°
0+00.00, 338.99
N 13683853.54, E 2301293.27



NOTE: CONTRACTOR SHALL ACTIVELY MONITOR THE DRILLED ALIGNMENT FOR IMPACTS THAT COULD OCCUR AS A RESULT OF HDD OPERATIONS (i.e. SETTLEMENT, HEAVE, AND DRILLING FLUID FLOW). CONTRACTOR'S MONITORING PROCEDURES AND ASSOCIATED EMERGENCY RESPONSE PLANS SHALL BE APPROPRIATE TO ENSURE THAT PUBLIC SAFETY IS NOT COMPROMISED.

NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 40' VERTICAL

400 200 100 0
40 20 0

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 R 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT DATED JUNE 2016 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
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TOPOGRAPHIC SURVEY NOTES

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2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT, UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT, UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 30 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,800 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
42-INCH PIPELINE CROSSING OF THE JAMES RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION:	BUCKINGHAM & NELSON COUNTIES, VIRGINIA				
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
ACM	07/27/16	DLB	JSP	SHOWN FOR D-SIZED PLOT	JAMES RIVER	0

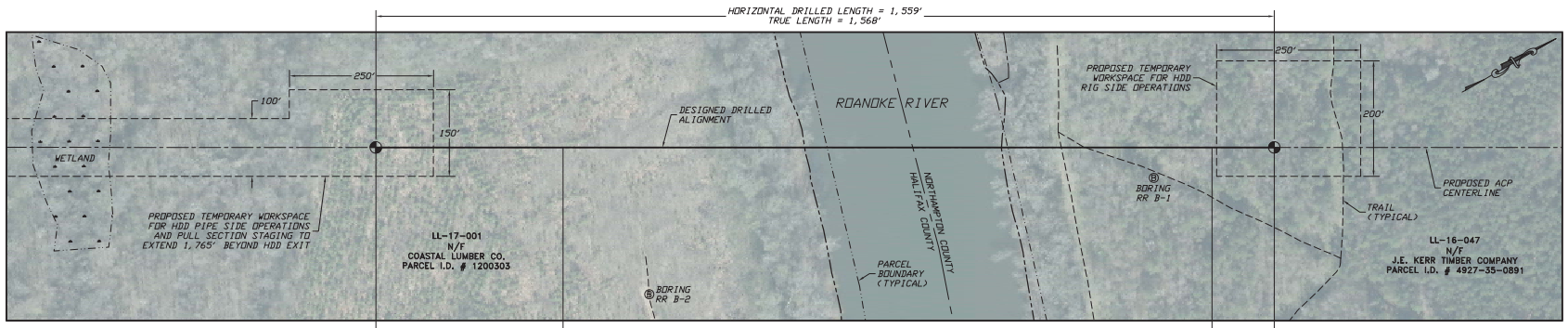
NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

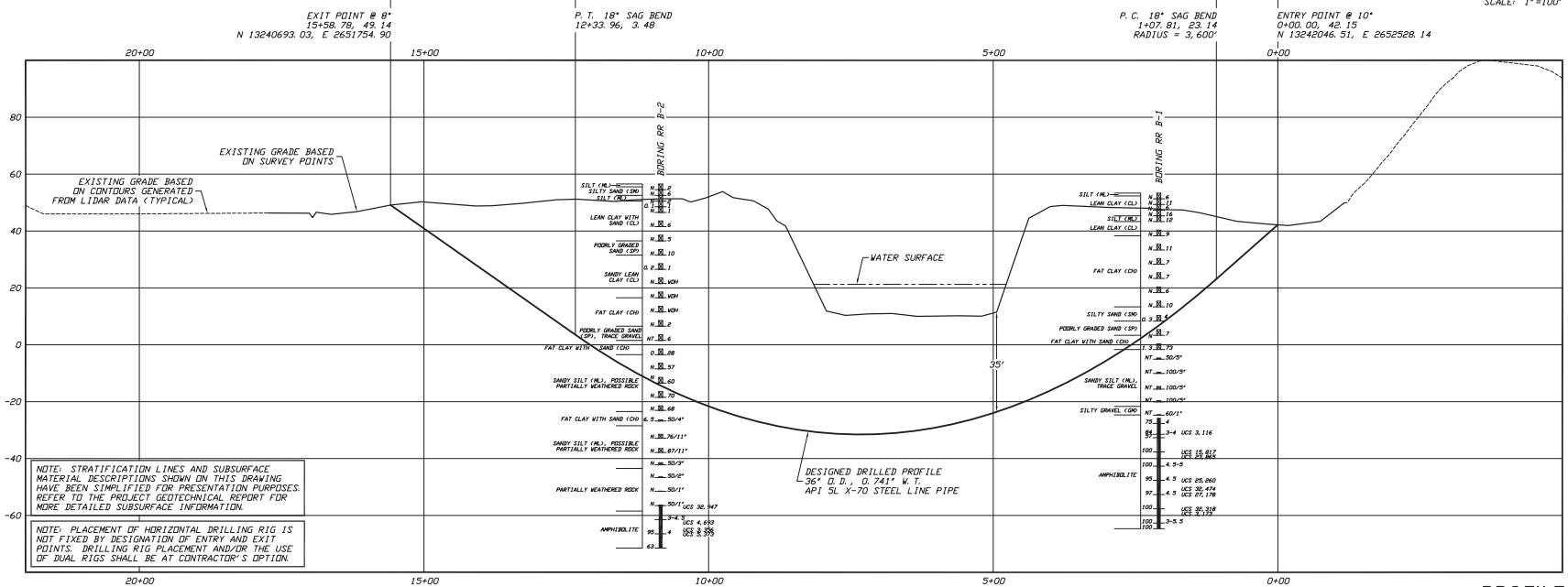
MILE POST
AP1-184

H3-3



PLAN

SCALE: 1"=100'



NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

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PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

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PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

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2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 20 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

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3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF THE ROANOKE RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION:	HALIFAX & NORTHAMPTON COUNTIES, NORTH CAROLINA			DRAWING LABEL:	REVISION
DRAWN: KWN	DATE: 06/17/16	CHECKED: DMP	APPROVED: JSP	SCALE: SHOWN FOR D-SIZED PLOT	ROANOKE	0

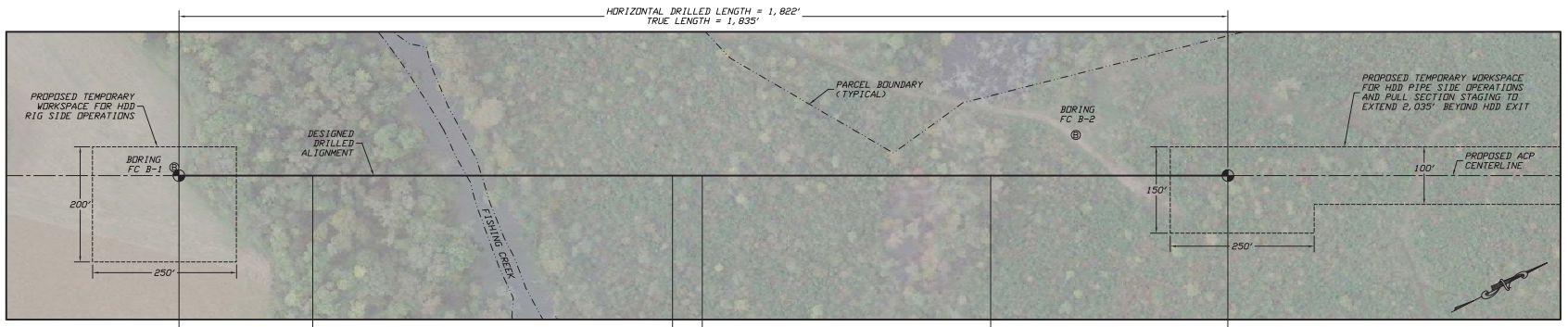
NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

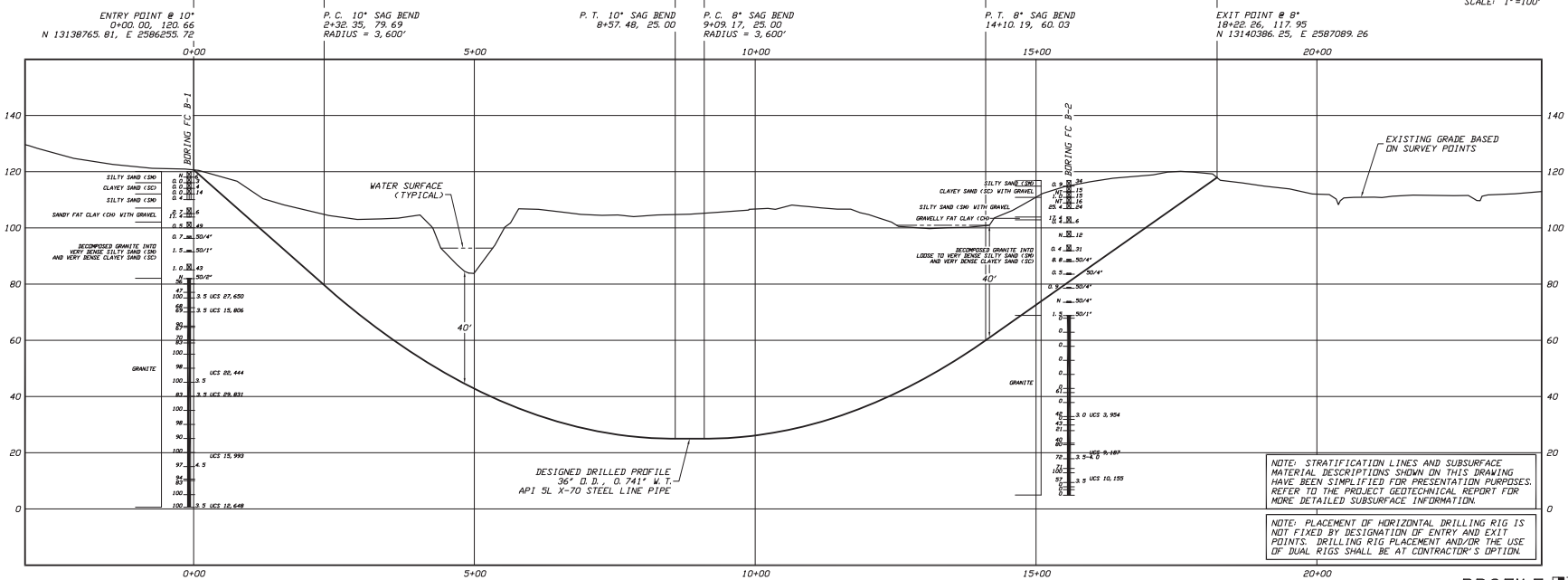
SHEET NO.
AP2-10

H3-4



PLAN

SCALE: 1"=100'



PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL

H3-5

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)

53 6 — MOHS HARDNESS

ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RALEIGH, NORTH CAROLINA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT DATED SEPTEMBER 2016 FOR MORE DETAILED SUBSURFACE INFORMATION.
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TOPOGRAPHIC SURVEY NOTES

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3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT, UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT, UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 20 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

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2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF FISHING CREEK
BY HORIZONTAL DIRECTIONAL DRILLING

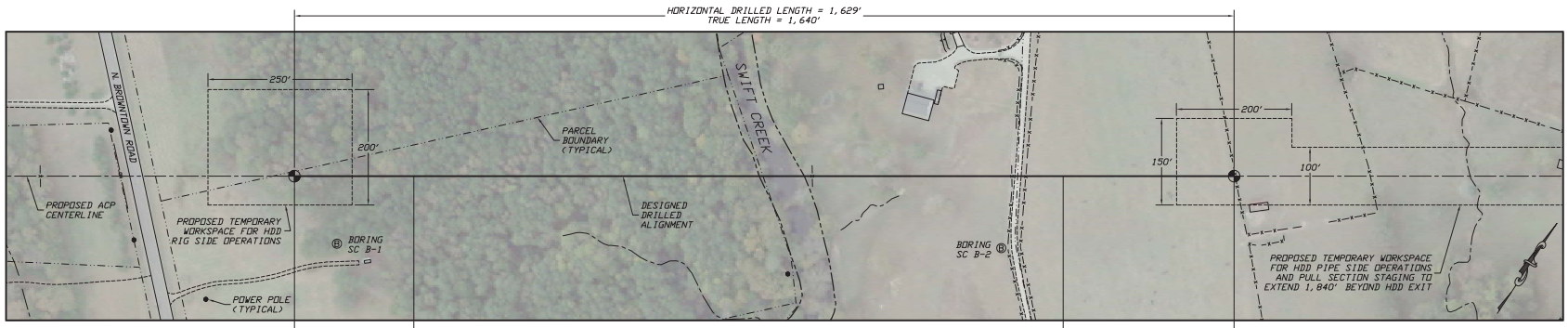
LOCATION: HALIFAX & NASH COUNTIES, NORTH CAROLINA					
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
KMN/LKB	10/07/16	DMP/ACM	JSP	SHOWN FOR D-SIZED PLOT	FISHING CREEK	0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

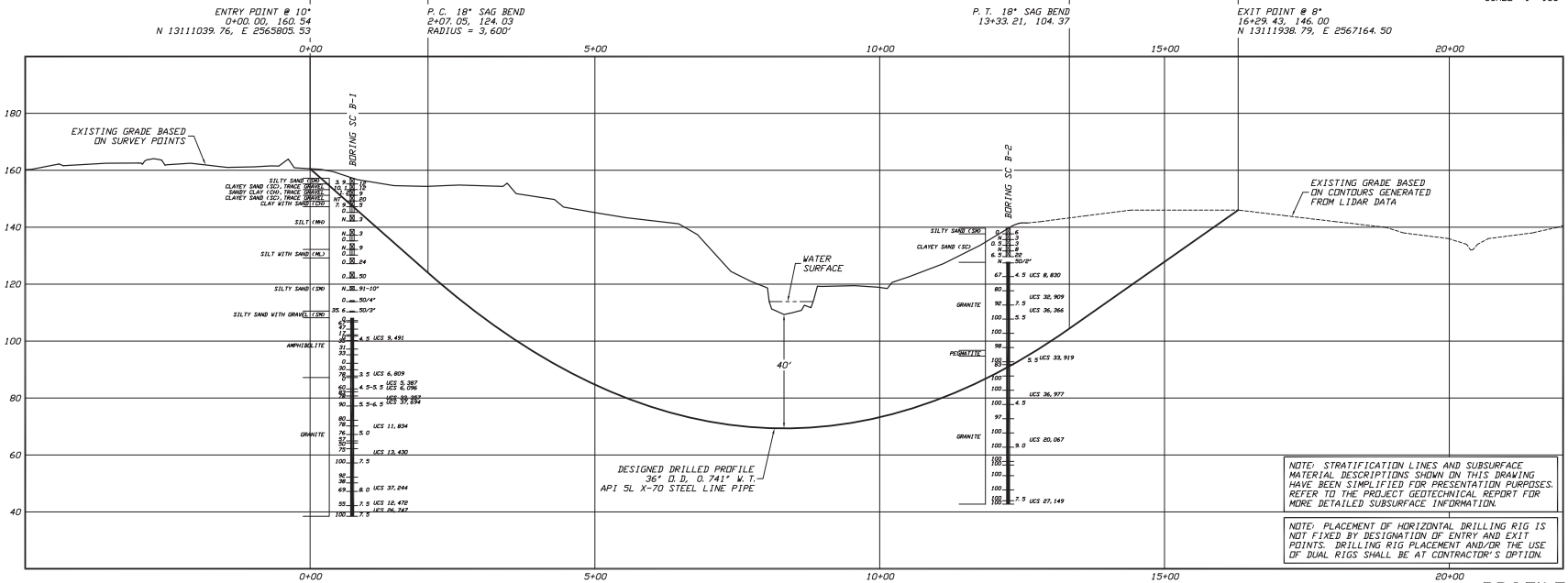
PROJECT NO.
Dominion\1508

AP2-034



PLAN

SCALE: 1"=100'



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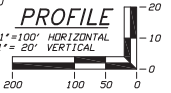
PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 50 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)

53 6 — MOHS HARDNESS

ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

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PILOT HOLE TOLERANCES

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2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 15 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

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H3-6

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF SWIFT CREEK
BY HORIZONTAL DIRECTIONAL DRILLING

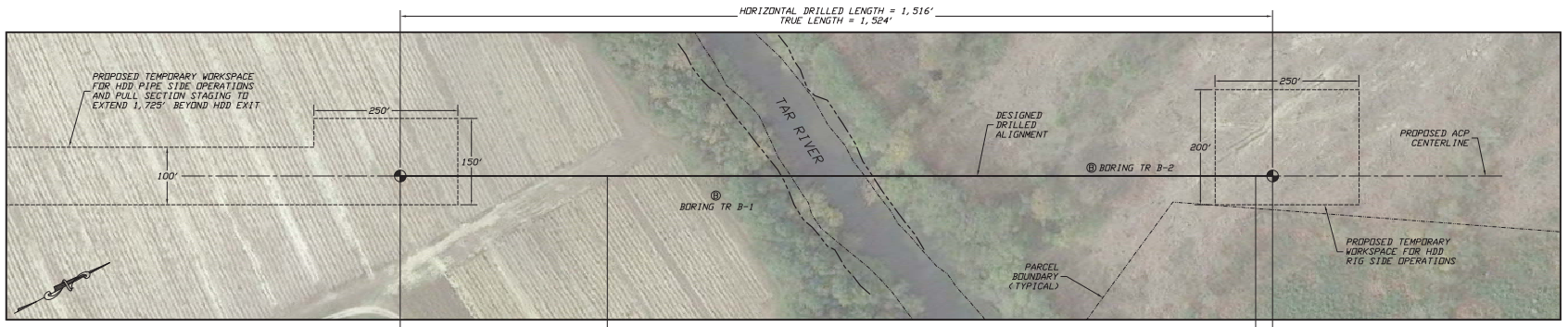
LOCATION	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
NASH COUNTY, NORTH CAROLINA				SHOWN FOR D-SIZED PLOT	SWIFT CREEK	0
DRAWN	DATE	CHECKED	APPROVED			
ACM/KMN	10/07/16	KMN/LKB	JSP			

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

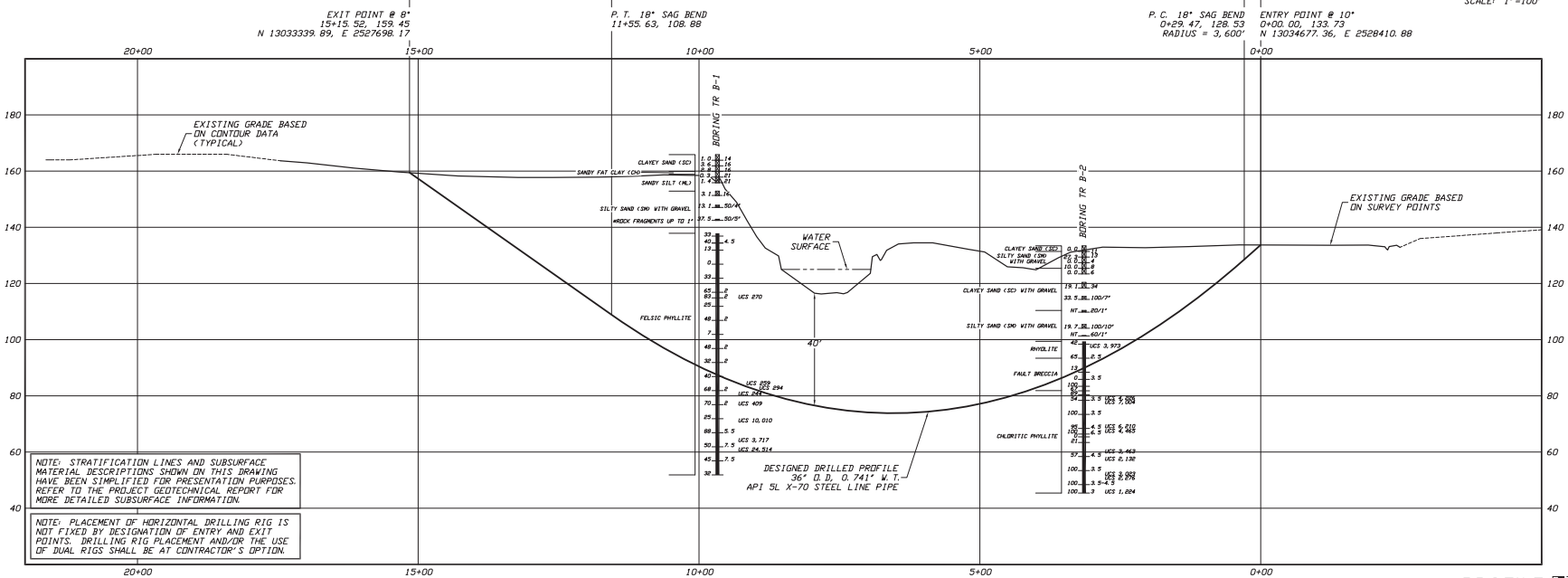
PROJECT NO.
Dominion\1508

MILE POST
AP2-041



PLAN

SCALE: 1"=100'

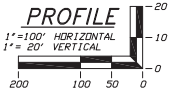


NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RALEIGH, NORTH CAROLINA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT DATED SEPTEMBER 2016 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 20 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

H3-7

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF THE TAR RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION:	NASH COUNTY, NORTH CAROLINA				
DRAWN:	DATE:	CHECKED:	APPROVED:	SCALE:	DRAWING LABEL:
ACM/LKB	10/06/16	KMN	JSP	SHOWN FOR D-SIZED PLOT	TAR RIVER

REVISION: 0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
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2424 East 21st Street
Suite 510
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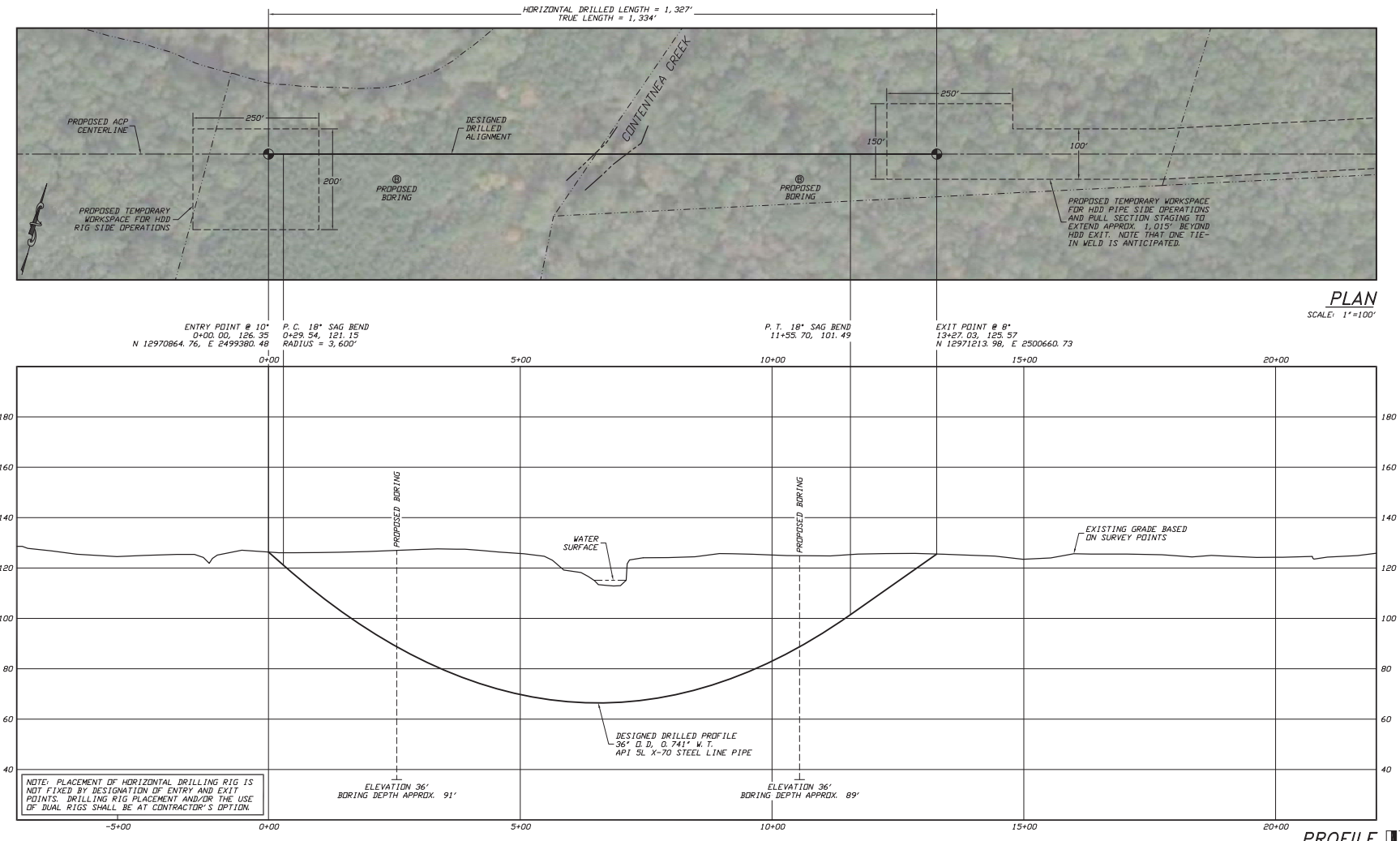
PROJECT NO.
Dominion\1508

MILE POST
AP2-060



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 15 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF CONTENTNEA CREEK
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: WILSON COUNTY, NORTH CAROLINA					
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
ACM	07/25/16	KMN	JSP	SHOWN FOR D-SIZED PLOT	CONTENTNEA CREEK	P2

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.
P2	09/20/16	MODIFY TEMP. WORKSPACE AS DIRECTED BY DOMINION	JSP	KMN	JSP
P1	08/10/16	UPDATE DESIGN BASED ON SURVEY DATA FROM GAI	KMN	ACM	JSP

PRELIMINARY

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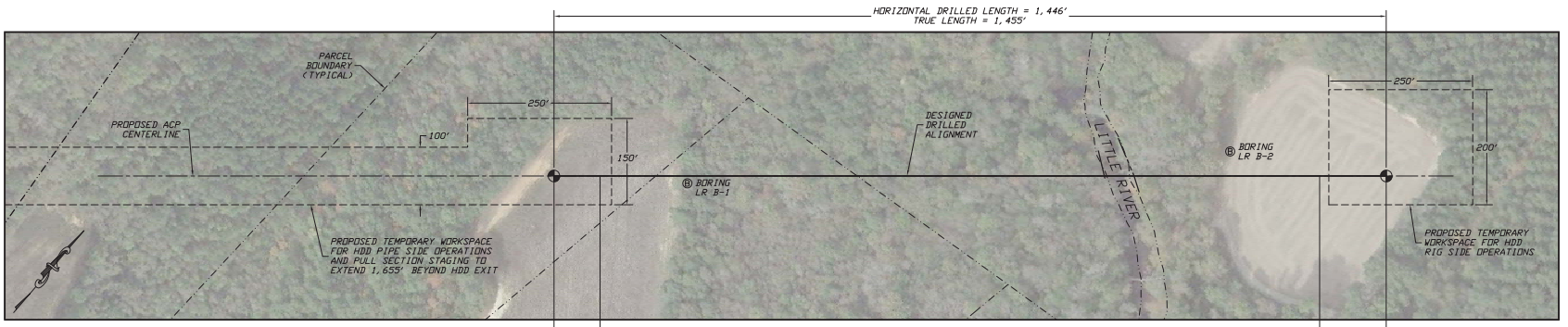
PROJECT NO.
Dominion\1508

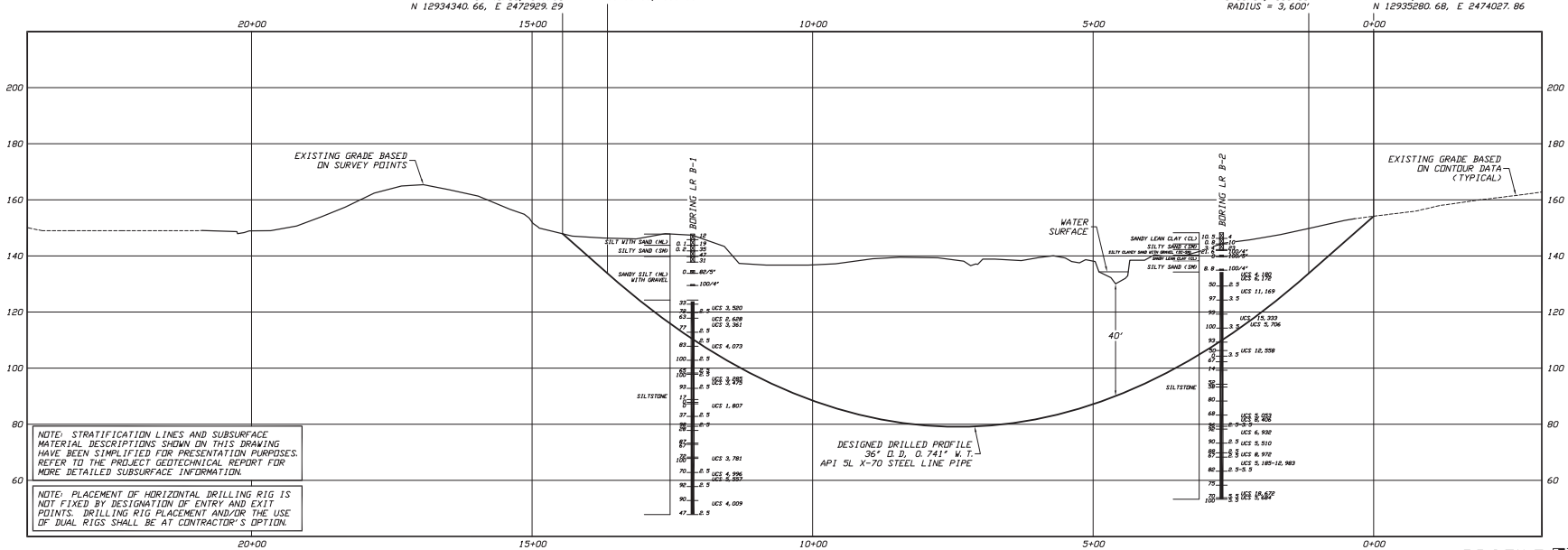
MILE POST
AP2-074

H3-8



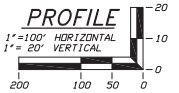
PLAN

SCALE: 1"=100'



PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 R 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE DRAFT GEOTECHNICAL SITE INVESTIGATION REPORT DATED SEPTEMBER 2016 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
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TOPOGRAPHIC SURVEY NOTES

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3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

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3. ELEVATION: UP TO 5 FEET ABOVE AND 20 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
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PROTECTION OF EXISTING FACILITIES

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3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF THE LITTLE RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: JOHNSTON COUNTY, NORTH CAROLINA					
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
ACM/LKB	09/29/16	JSP	JSP	SHOWN FOR D-SIZED PLOT	LITTLE RIVER	0

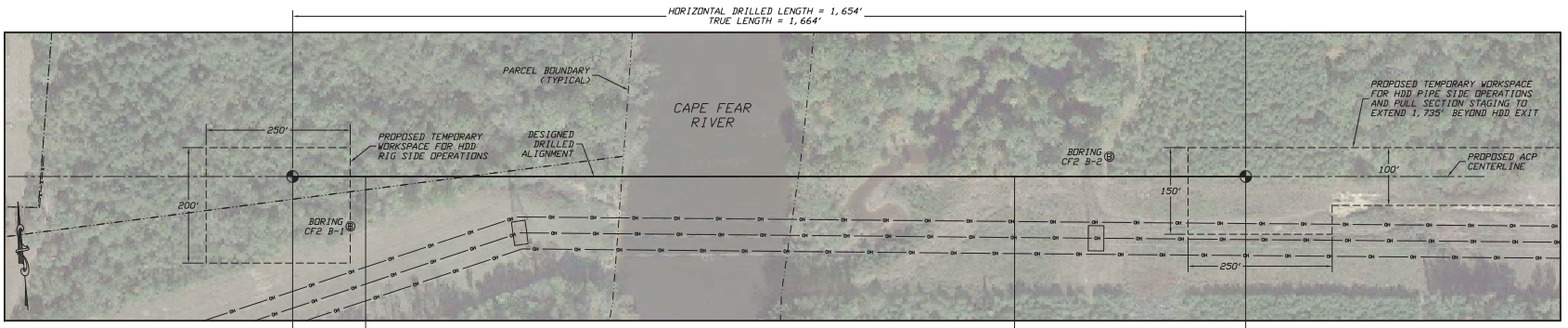
NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

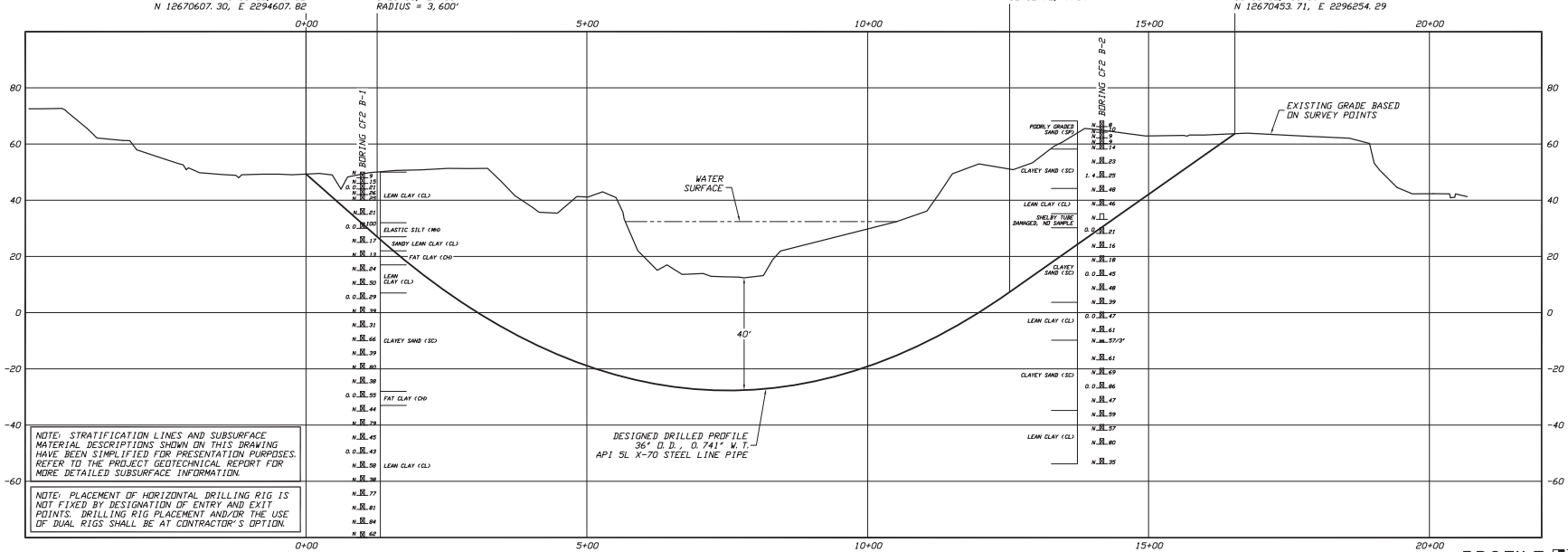
MILE POST
AP2-083

H3-9



PLAN

SCALE: 1"=100'



NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL

20
10
0
200
100
50
0

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

53 □

PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT DATED JUNE 2016 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
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TOPOGRAPHIC SURVEY NOTES

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2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

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3. ELEVATION: UP TO 5 FEET ABOVE AND 20 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

H3-10

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF THE CAPE FEAR RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: CUMBERLAND COUNTY, NORTH CAROLINA				
DRAWN: KMN/ACM	DATE: 08/18/16	CHECKED: DMP	APPROVED: JSP	SCALE: SHOWN FOR D-SIZED PLOT

DRAWING LABEL: CAPE FEAR
REVISION: 0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

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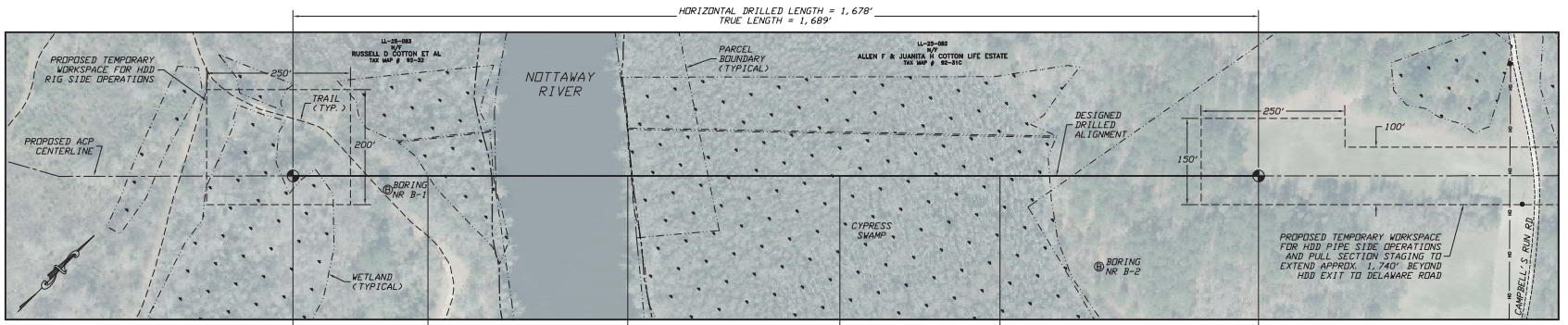
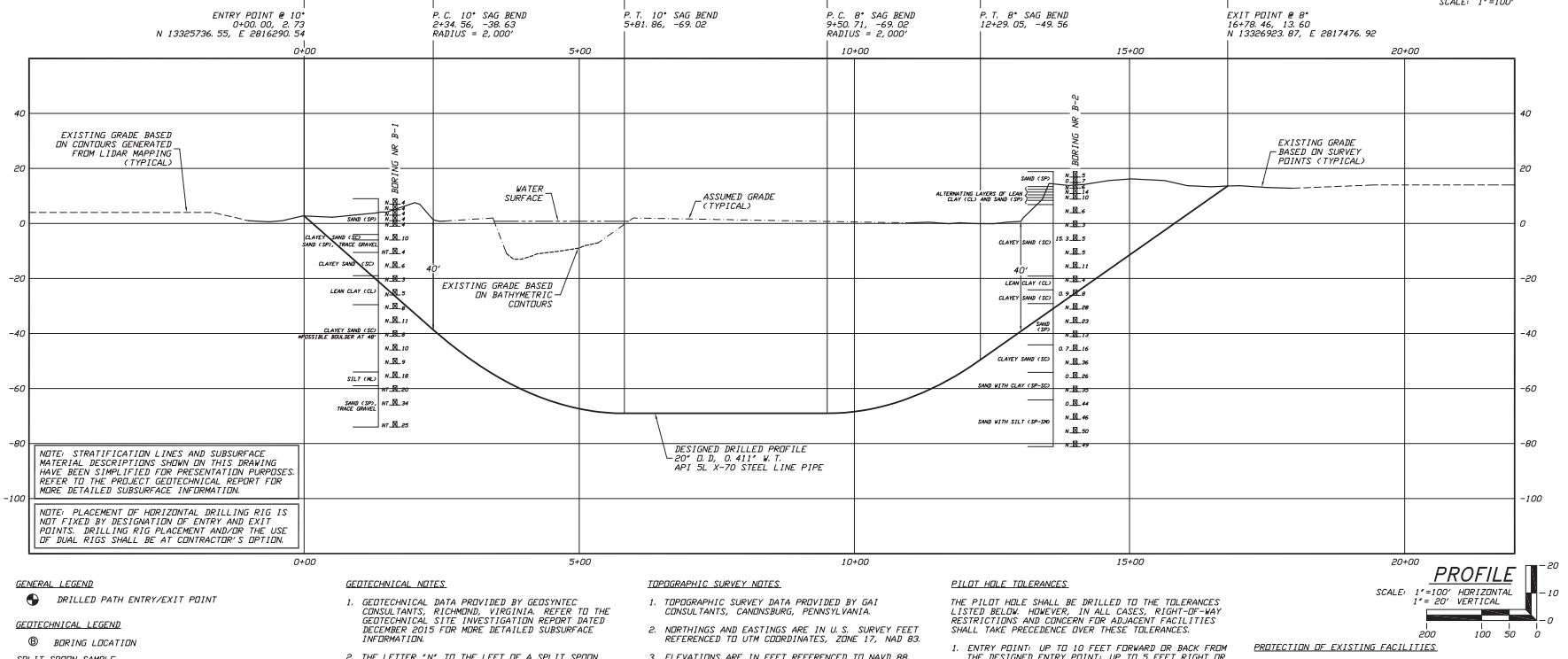
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

MILE POST
AP2-006A



PLAN
SCALE: 1"=100'



PROFILE
SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT DATED DECEMBER 2015 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "NT" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
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TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

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2. EXIT POINT: UP TO 10 FEET SHORT OR 30 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 5 FEET ABOVE AND 30 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 1,350 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF THE NOTTAWAY RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION:	SOUTHAMPTON COUNTY, VIRGINIA	DRAWING LABEL:	REVISION:
DRAWN: KMN	CHECKED: JSP	SCALE: AS SHOWN FOR 0-SIZED PLOT	NOTTAWAY 1
DATE: 02/04/16	APPROVED: JSP		

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.
1	07/13/16	UPDATE HDD ALIGNMENT & BORING LOCATIONS	ACM	DMP	JSP

Jeffrey S. Puckett, P.E.
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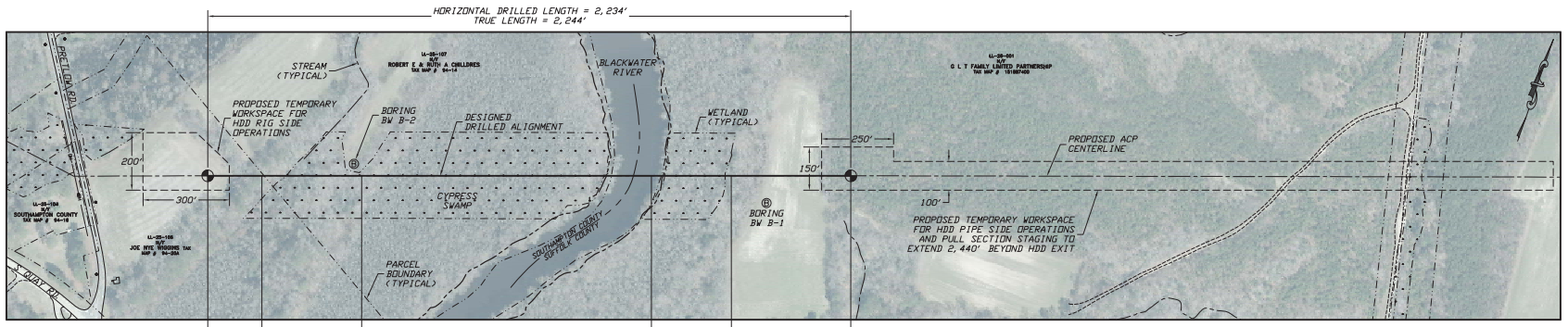
PROJECT NO.
Dominion\1508

MILE POST
AP3-033

H3-11



PLAN

SCALE: 1"=200'

ENTRY POINT @ 10"
0+00.00, 8.26
N 13325402.70, E 2844536.07

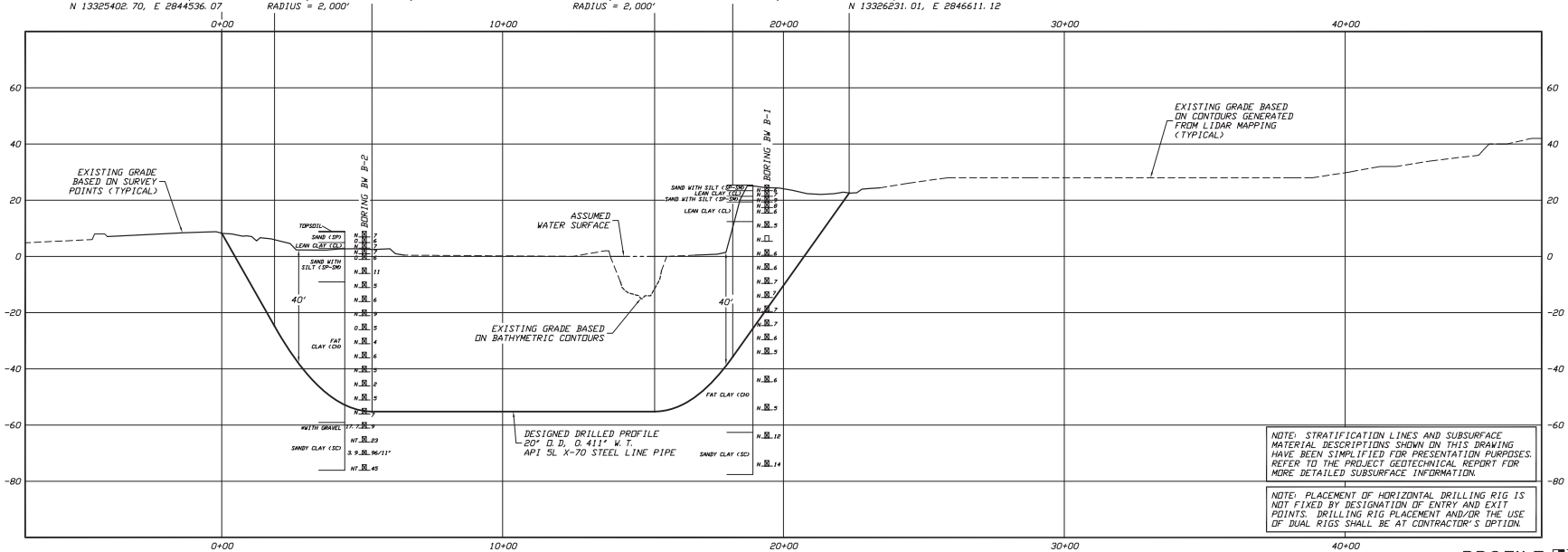
P.C. 10" SAG BEND
1+97.69, -24.84
RADIUS = 2,000'

P.T. 10" SAG BEND
5+34.99, -55.22

P.C. 8" SAG BEND
15+41.07, -55.22
RADIUS = 2,000'

P.T. 8" SAG BEND
18+19.42, -35.76

EXIT POINT @ 8"
22+34.27, 22.55
N 13326231.01, E 2846611.12



NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL

20
10
0
400 200 100 0

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

53 □ — PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE DRAFT PROJECT GEOTECHNICAL REPORT DATED DECEMBER 2015 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY GAI CONSULTANTS, CANONSBURG, PENNSYLVANIA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO UTM COORDINATES, ZONE 17, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: UP TO 10 FEET FORWARD OR BACK FROM THE DESIGNED ENTRY POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
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3. ELEVATION: UP TO 5 FEET ABOVE AND 30 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 1,350 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF THE BLACKWATER RIVER BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: SOUTHAMPTON & SUFFOLK COUNTIES, VIRGINIA					
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
KWN	02/09/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	BLACKWATER	1

NO.	DATE	REVISION DESCRIPTION	BY	(CHK'D)	APP.
1	04/28/16	UPDATE HDD ALIGNMENT BASED ON SURVEYED CL	ACM	DMP	JSP

Jeffrey S. Puckett, P.E.
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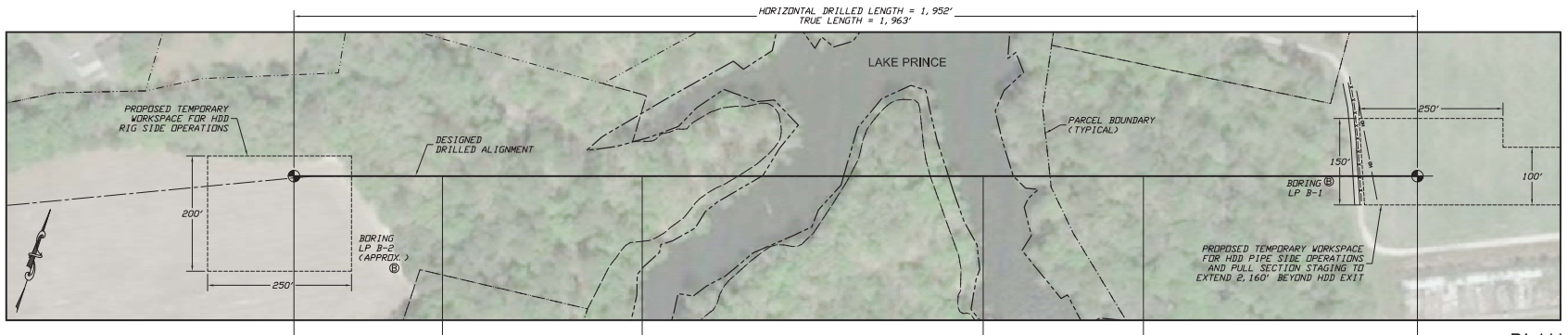
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

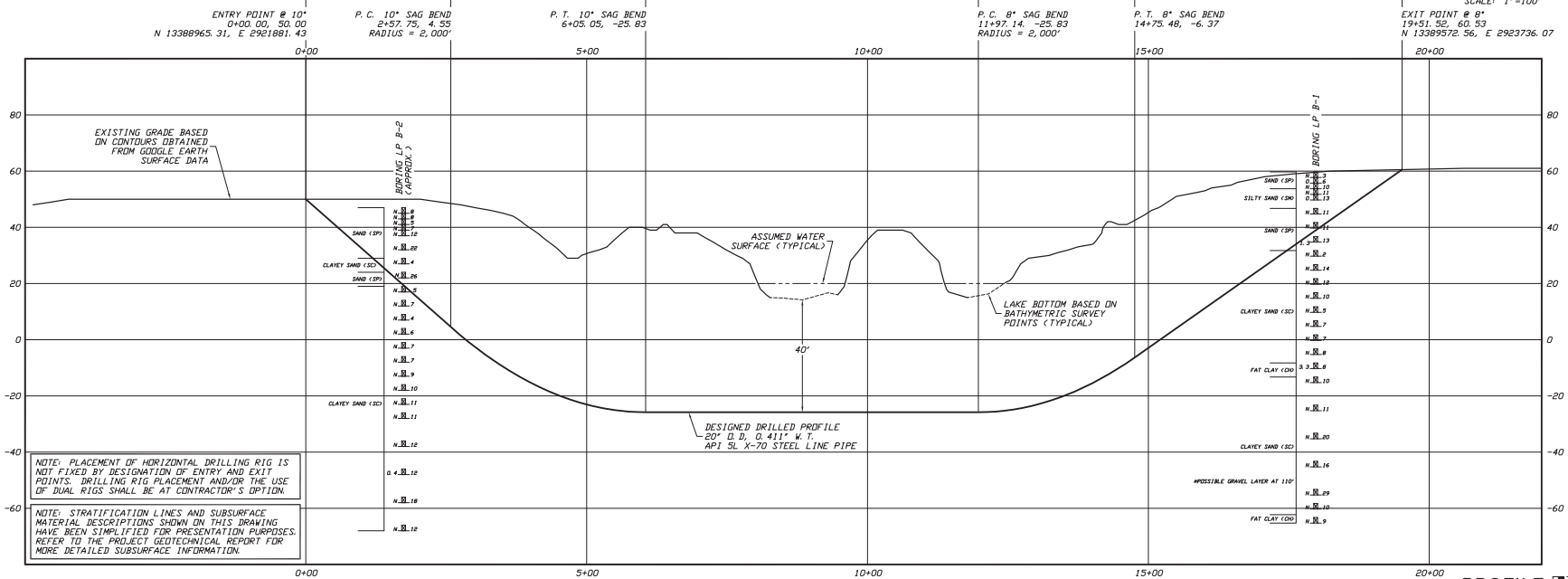
MILE POST
AP3-039

H3-12



PLAN

SCALE: 1"=100'



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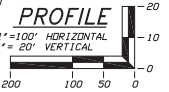
PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

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ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF LAKE PRINCE
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION	DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
SUFFOLK, VIRGINIA	KWN	02/12/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	LAKE PRINCE	0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

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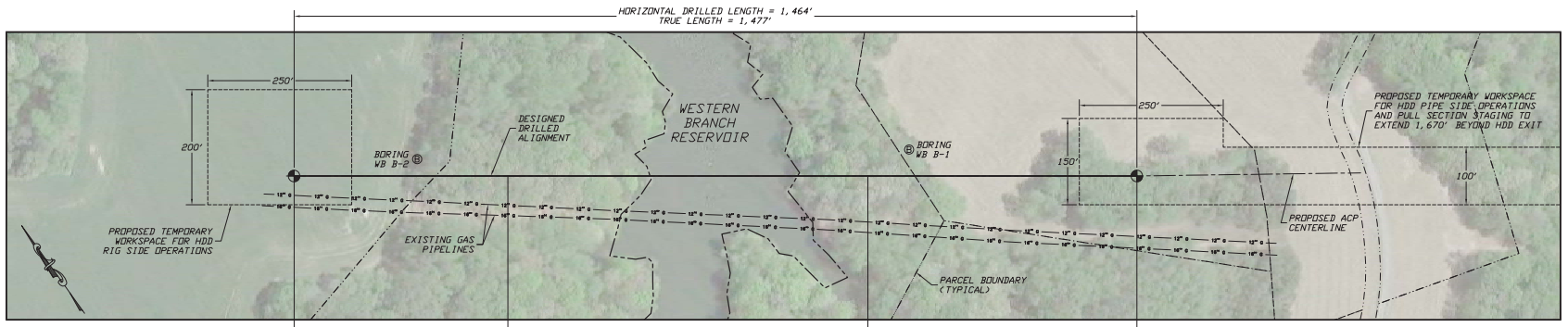
PROJECT NO.
Dominion\1508

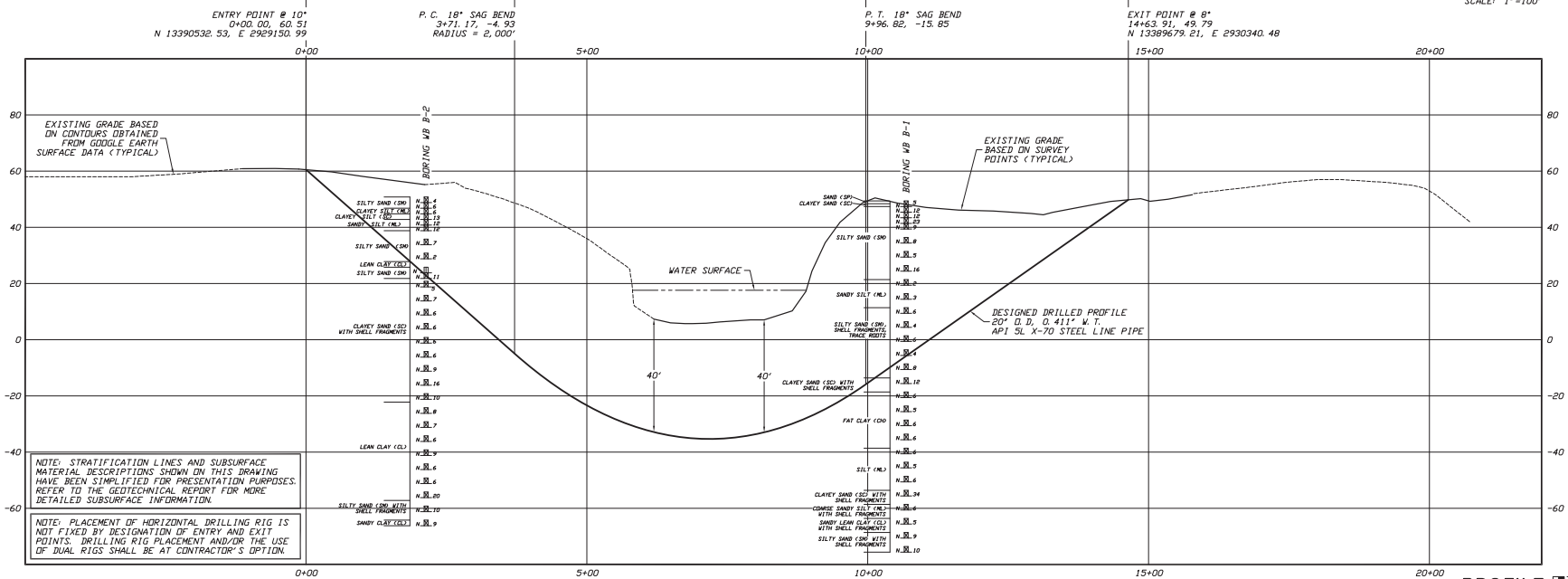
MILE POST
AP3-061

H3-13



PLAN

SCALE: 1"=100'



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PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL

20
10
0
200
100
50
0

H3-14

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

53 III — PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE GEOTECHNICAL SITE INVESTIGATION REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.
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PILOT HOLE TOLERANCES

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3. ELEVATION: UP TO 5 FEET ABOVE AND 15 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 1,350 FEET BASED ON A 3-JOINT AVERAGE (RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

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ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF WESTERN BRANCH RESERVOIR
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: SUFFOLK, VIRGINIA					
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
KMN	06/20/16	ACM	JSP	SHOWN FOR D-SIZED PLOT	WB RESERVOIR	1

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.
1	06/10/16	REVISE GEOTECHNICAL LEGEND	JSP	JSP	JSP

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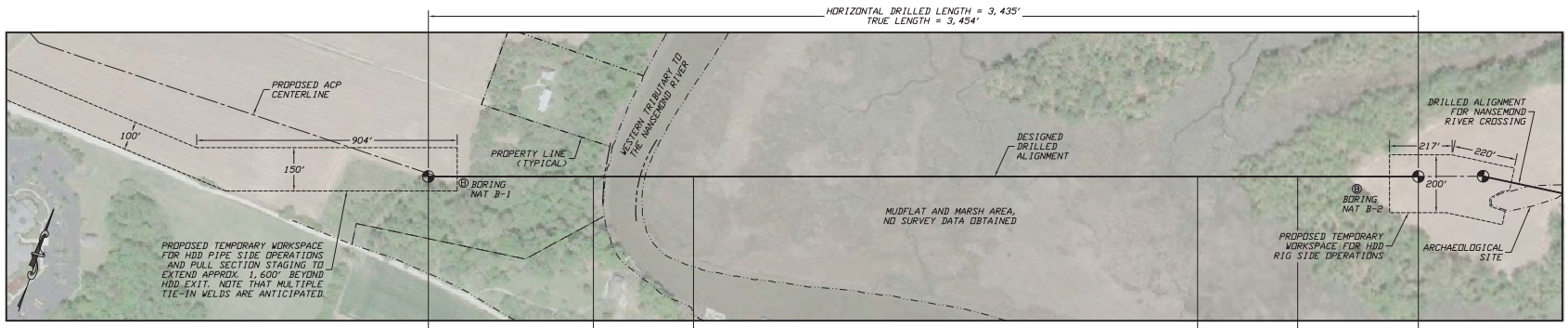
Tulsa, Oklahoma 74114

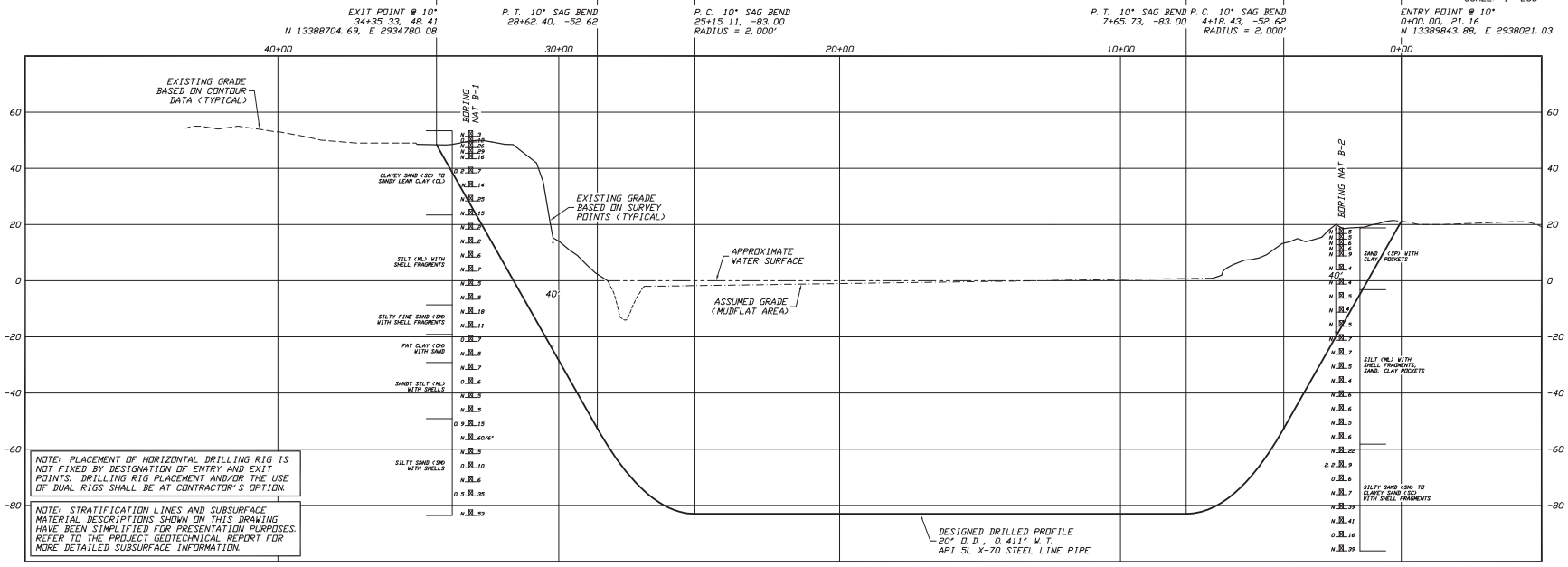
PROJECT NO.
Dominion\1508

MILE POST
AP3-063



PLAN

SCALE: 1"=200'



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PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL

20
10
0
400 200 100 0

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

Ⓑ BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED MARCH 2016 FOR MORE DETAILED SUBSURFACE INFORMATION.
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H3-15

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF THE NANSEMOND RIVER TRIB. BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: SUFFOLK, VIRGINIA					
DRAWN: KMN	DATE: 04/08/16	CHECKED: DMP	APPROVED: JSP	SCALE: SHOWN FOR D-SIZED PLOT	DRAWING LABEL: NANSEMOND TRIB	REVISION: 2

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.
2	06/10/16	UPDATED RIG SIDE WORKSPACE	ACM	JSP	JSP
1	04/29/16	LOWER DESIGN TO REDUCE RISK OF INAD. RETURNS	KMN	ACM	JSP

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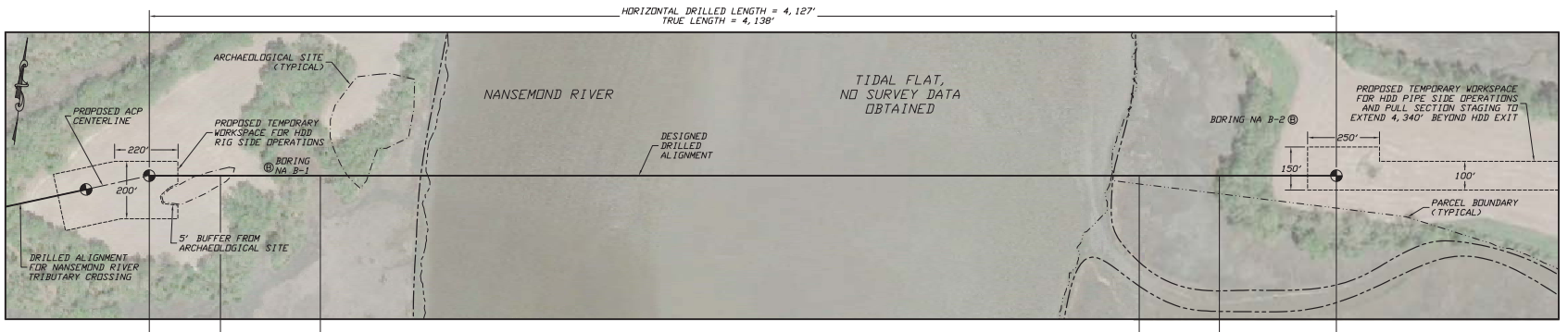
Tulsa, Oklahoma 74114

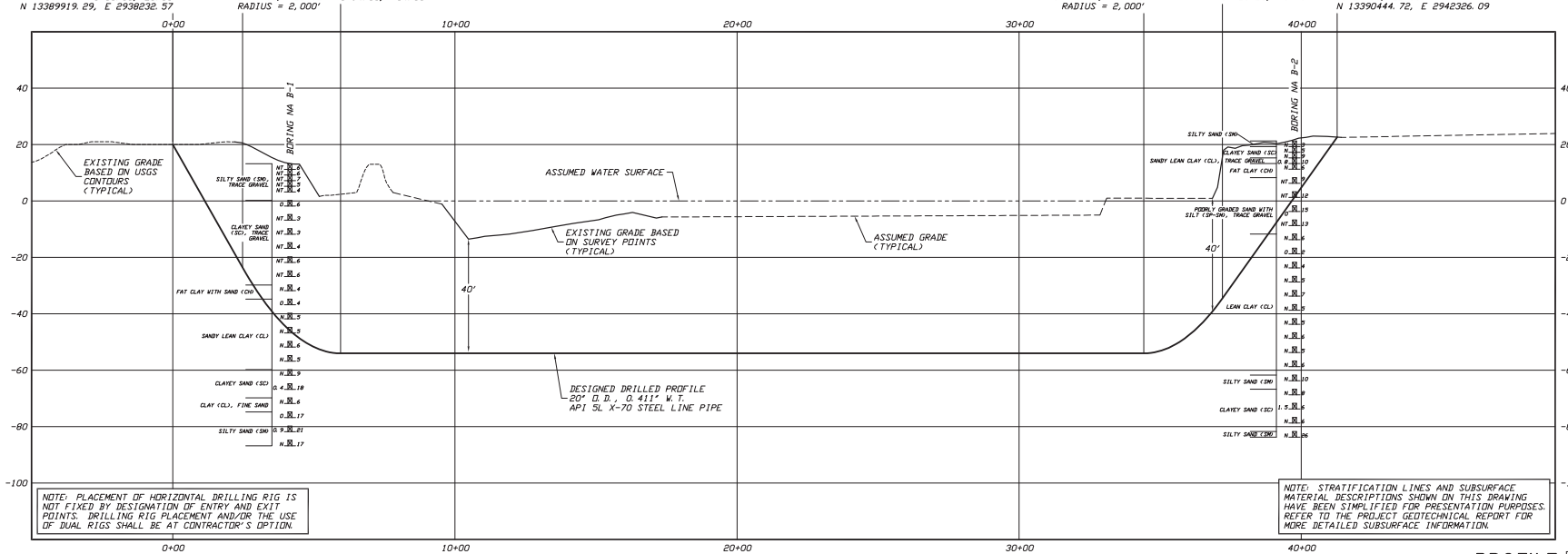
PROJECT NO.
Dominion\1508

MILE POST
AP3-064



PLAN

SCALE: 1"=200'



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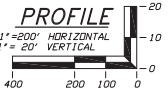
PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

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3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

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2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

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3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF THE NANSEMOND RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION	DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
SUFFOLK, VIRGINIA	KMN	06/03/16	DMP	JSP	SHOWN FOR D-SIZED PLOT	NANSEMOND	0

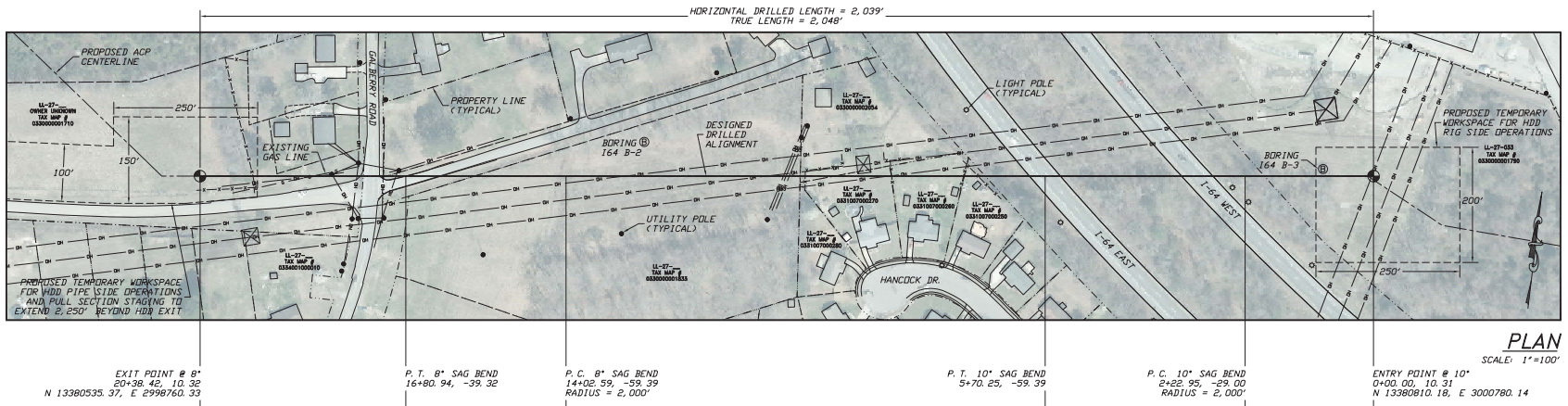
NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 550
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

MILE POST
AP3-065

H3-16



PLAN

SCALE: 1"=100'

EXIT POINT @ 8°
20+38.42, 10.32
N 13380535.37, E 2998760.33

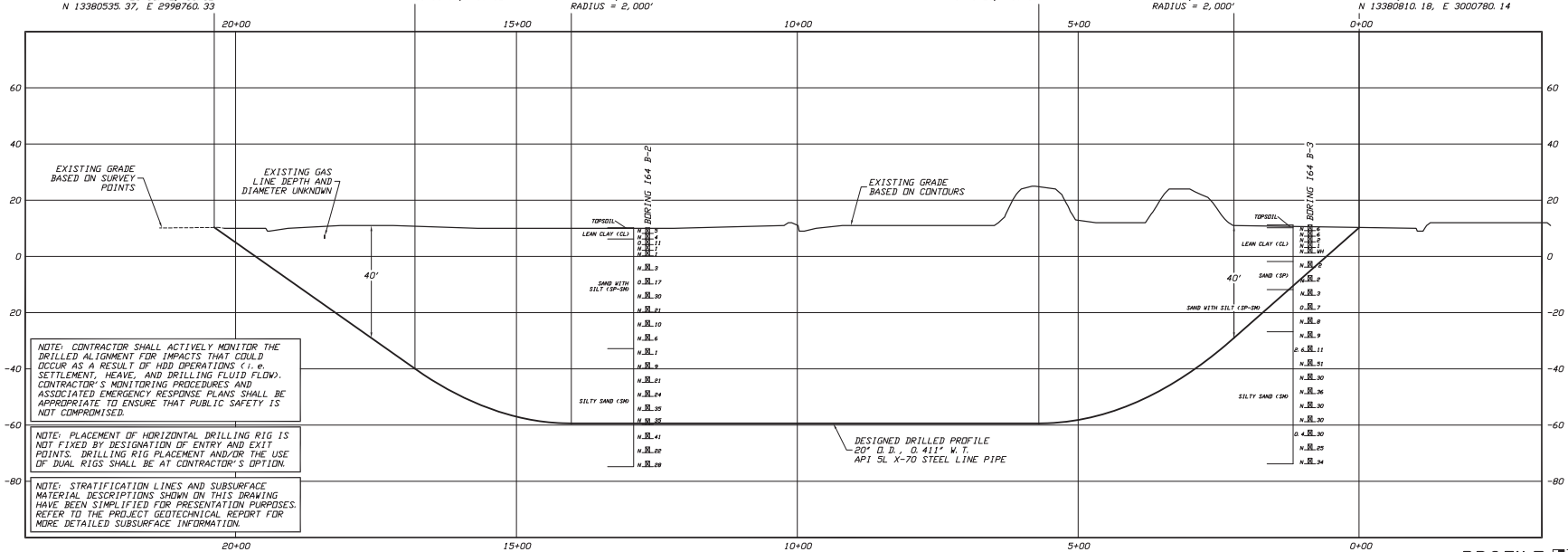
P.T. 8° SAG BEND
16+80.94, -39.32

P.C. 8° SAG BEND
14+02.59, -59.39
RADIUS = 2,000'

P.T. 10° SAG BEND
5+70.25, -59.39

P.C. 10° SAG BEND
2+22.95, -29.00
RADIUS = 2,000'

ENTRY POINT @ 10°
0+00.00, 10.31
N 13380810.18, E 3000780.14



PROFILE

SCALE: 1"=100' HORIZONTAL
1"= 20' VERTICAL

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

(B) BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY GEOSYNTEC CONSULTANTS, RICHMOND, VIRGINIA. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED DECEMBER 2015 FOR MORE DETAILED SUBSURFACE INFORMATION.
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ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF INTERSTATE 64
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: CHESAPEAKE, VIRGINIA					
DRAWN: KWN	DATE: 03/31/16	CHECKED: DMP	APPROVED: JSP	SCALE: SHOWN FOR D-SIZED PLOT	DRAWING LABEL: INTERSTATE 64

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.	REVISION 0

Jeffrey S. Puckett, P.E.
Consulting Engineer
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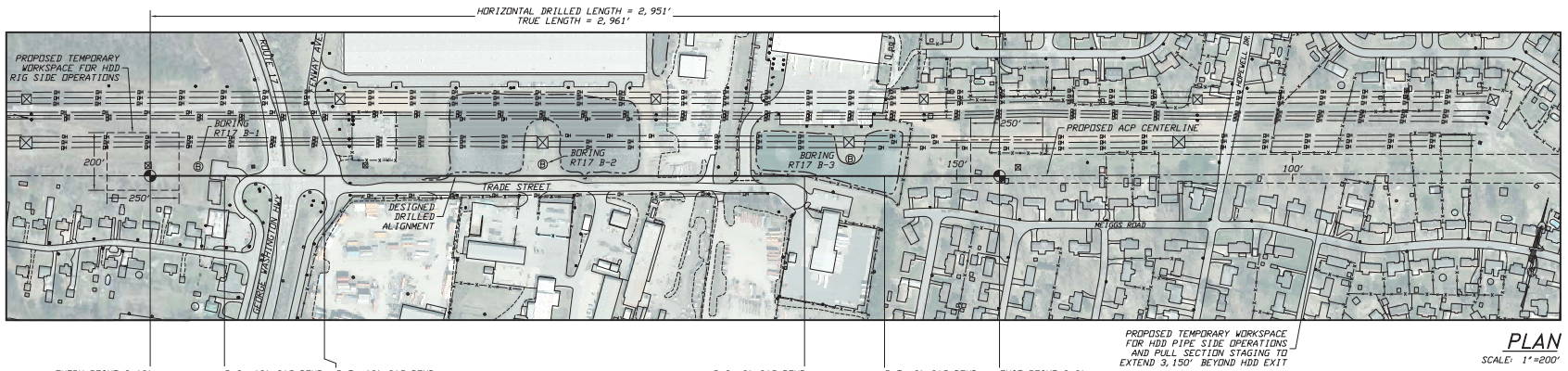
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

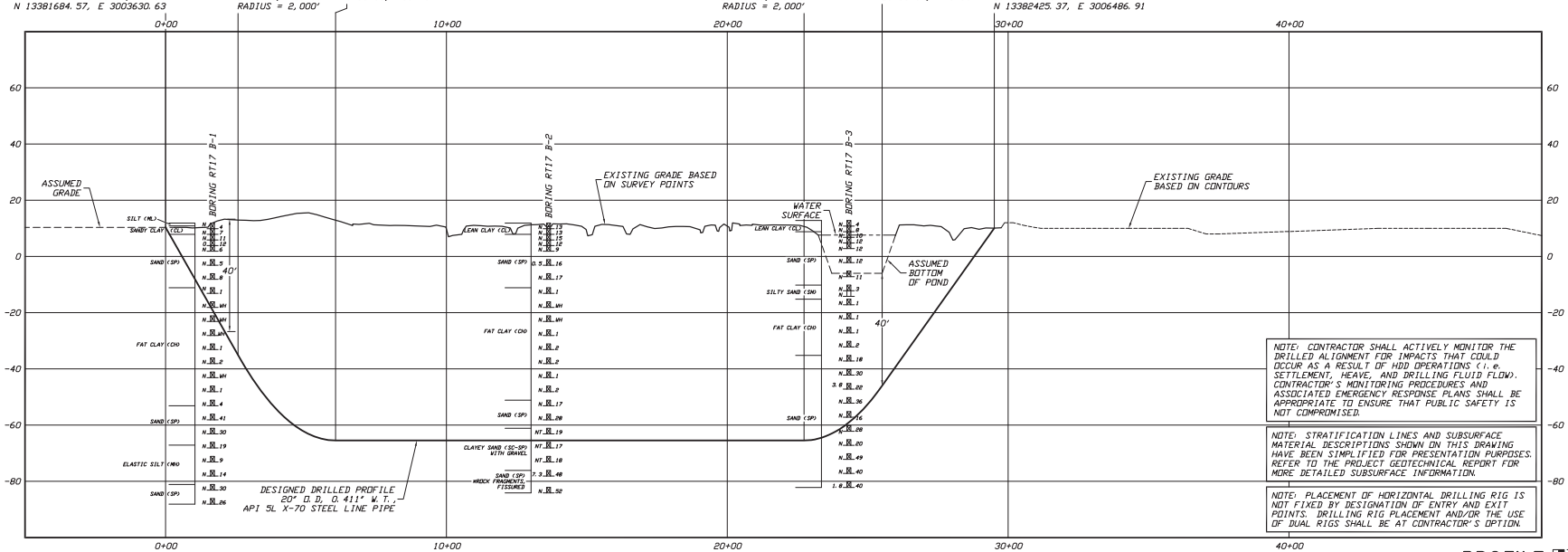
MILE POST
AP3-078

H3-17



PLAN

SCALE: 1"=200'



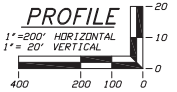
NOTE: CONTRACTOR SHALL ACTIVELY MONITOR THE DRILLED ALIGNMENT FOR IMPACTS THAT COULD OCCUR AS A RESULT OF HDD OPERATIONS (i.e. SETTLEMENT, HEAVE, AND DRILLING FLUID FLOW). CONTRACTOR'S MONITORING PROCEDURES AND ASSOCIATED EMERGENCY RESPONSE PLANS SHALL BE APPROPRIATE TO ENSURE THAT PUBLIC SAFETY IS NOT COMPROMISED.

NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

53 T — PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

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ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF ROUTE 17
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: CHESAPEAKE, VIRGINIA					
DRAWN: KMN	DATE: 04/01/16	CHECKED: ACM	APPROVED: JSP	SCALE: SHOWN FOR D-SIZED PLOT	DRAWING LABEL: ROUTE 17

REVISION: 0

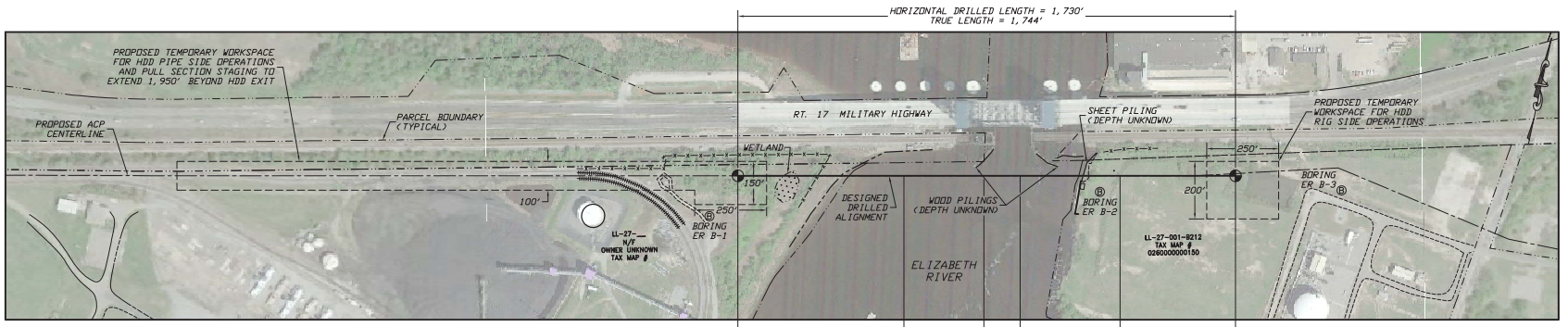
NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

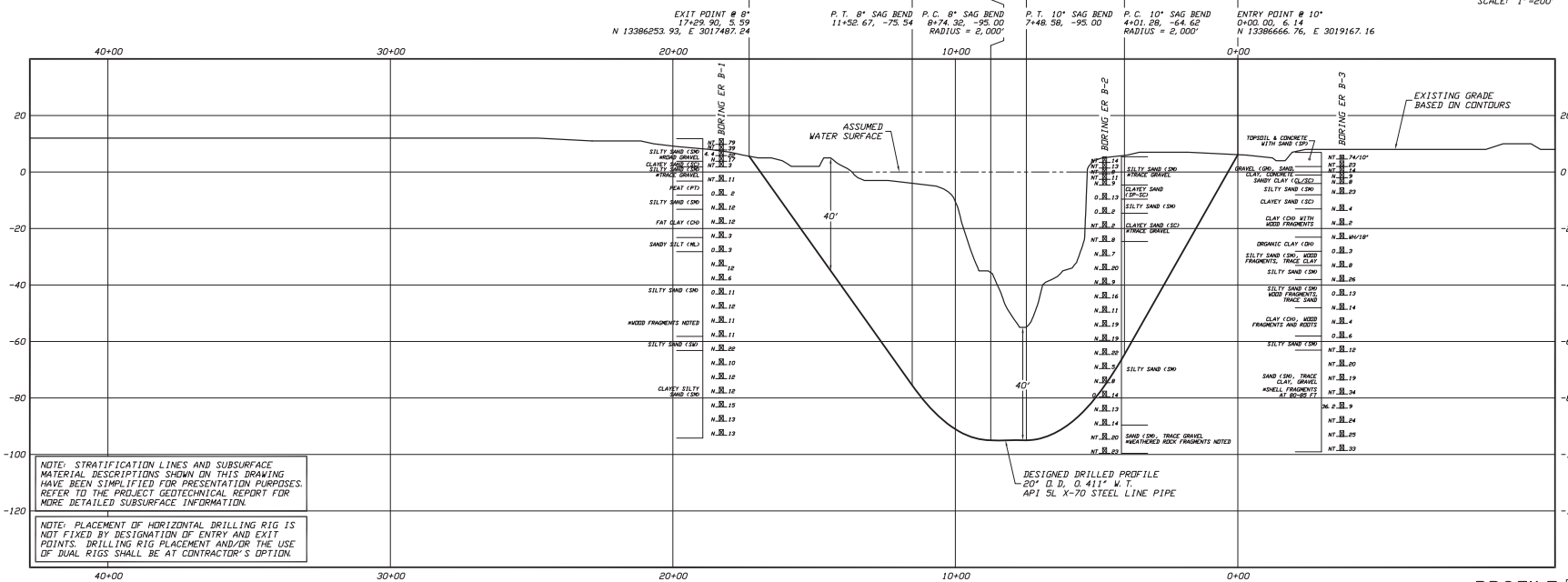
MILE POST
AP3-079

H3-18



PLAN

SCALE: 1"=200'



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PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL

20
10
0
400 200 100 0

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

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53 R 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
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ATLANTIC COAST PIPELINE PROJECT

PLAN AND PROFILE
20-INCH PIPELINE CROSSING OF THE ELIZABETH RIVER BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION	DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
PORTSMOUTH COUNTY, VIRGINIA	KMN	03/30/16	DMP	JSP	SHOWN FOR 0-SIZED PLOT	ELIZABETH RIVER	0

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.

Jeffrey S. Puckett, P.E.
Consulting Engineer
2424 East 21st Street
Suite 550
Tulsa, Oklahoma 74114

PROJECT NO.
Dominion\1508

MILE POST
AP3-082

H3-19

APPENDIX I

KARST TERRAIN ASSESSMENT, CONSTRUCTION, MONITORING, AND MITIGATION PLAN

November 2, 2016

FINAL
Karst Terrain Assessment Construction, Monitoring and Mitigation Plan

Atlantic Coast Pipeline
Randolph and Pocahontas Counties in West Virginia, and Highland, Augusta and Nelson Counties in Virginia

GeoConcepts Engineering, Inc.

19955 Highland Vista Drive, Suite 170
Ashburn, VA 20147
Phone 703 726 8030 • www.geoconcepts-eng.com

GeoConcepts Engineering, Inc.

19955 Highland Vista Dr., Suite 170
Ashburn, Virginia 20147
(703) 726-8030
www.geoconcepts-eng.com

November 2, 2016

Ms. Brittany Moody
Dominion Transmission, Inc.
445 West Main Street
Clarksburg, West Virginia 26301

Subject: **Karst Terrain Assessment, Construction, Monitoring and Mitigation Plan, Atlantic Coast Pipeline, Randolph and Pocahontas Counties in West Virginia, and Highland, Augusta and Nelson Counties in Virginia (Our 15200)**

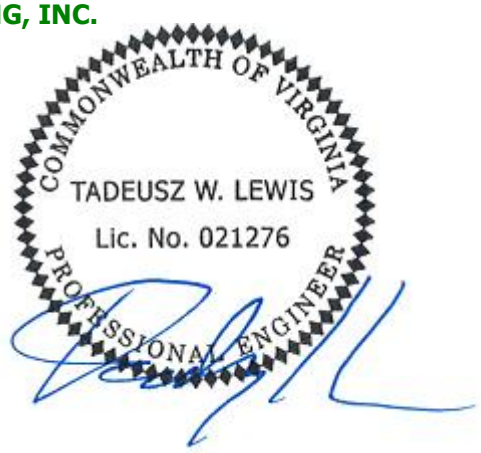
Dear Ms. Moody:

Per your request, GeoConcepts Engineering, Inc. (GeoConcepts) has completed a Karst Terrain Assessment, Construction Monitoring, and Mitigation Plan in support of the development of the Atlantic Coast Pipeline in areas of Pocahontas County, West Virginia, and Highland, Augusta, and Nelson Counties, Virginia.

We appreciate the opportunity to serve as your geotechnical consultant on this project. Please do not hesitate to contact me if you have any questions or want to meet to discuss the findings and recommendations contained in the report.

Sincerely,

GEOCONCEPTS ENGINEERING, INC.



Tadeusz W. Lewis, PE
Principal
tlewis@geoconcepts-eng.com

GeoConcepts Engineering, Inc.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket No. PF15-6-000

and

DOMINION TRANSMISSION, INC
SUPPLY HEADER PROJECT
Docket No. PF15-5-000

Karst Terrain Assessment, Construction, Monitoring, and Mitigation Plan

Prepared by
GeoConcepts Engineering, Inc.
November 2016

GeoConcepts Engineering, Inc.

Table of Contents

Plan Outline

At the request of Atlantic Coast Pipeline, LLC, (Atlantic), and Dominion Transmission, Inc. (DTI), GeoConcepts has developed a plan describing the assessment, monitoring, and mitigation activities for the proposed Atlantic Coast Pipeline (ACP) and the Dominion Supply Header Project (SHP) routes through areas of karst terrain. The requested plan is outlined as follows:

Definitions

This section provides a summary of karst-specific terms used in the plan.

Geological Overview

This section provides a brief discussion of karst terrain and features and the overall regional karst geology in the general area of the project. It is of note that the plan as written is a "generic" document due to possible changes that may occur in the specific project alignment. However, regardless of reroutes the alignment will need to pass across each of the provinces discussed in geological overview section of the plan.

Pre-Construction Assessment and Field Survey

This section describes in detail the pre-construction database and remote sensing review, as well as field survey methods and procedures which are currently being completed.

Construction Monitoring Protocols

This section describes the methods and procedures to be utilized during the construction phase of the ACP/SHP. It includes:

- a description of the pre-excavation electrical resistivity investigation (ERI) methods and procedures, and the manner in which the ERI data will be analyzed, summarized, and presented; and
- a description of the activities to be conducted by the field geologist during excavation and trenching activities, including how the observations will be made and the reporting format and frequency.

Karst Mitigation and Conservation Procedures

This section discusses the best management practices (BMPs) to be utilized for mitigating, remediating, and minimizing impacts to karst features that may be encountered during construction activities. This includes features that either are within or receive drainage from the pipeline right-of-way, or features that are intercepted during the excavation and trenching process, as well as access roads, additional temporary workspace areas, or any other areas where land disturbance necessary for pipeline construction is planned. It is noted that these mitigation and conservation procedures will not apply for existing access roads that do not require land disturbance. The format and manner in which the mitigation and remedial activities will be undertaken and reported are addressed in this section of the plan. The intent is to provide agreed upon solutions to the karst features that may be encountered prior to the start of construction so that those features can be protected. However, in some cases, the actual remedial measure employed may be customized to the specific karst features identified.

Definitions

Karst Specialist – A Licensed Professional Geologist engaged in the practice of engineering geology (or) a Virginia Registered Professional Engineer engaged in the practice of Geotechnical Engineering, with a minimum of 10 years of experience in karst geology characterization and remediation. Practice experience shall be demonstrated by a statement of qualifications.[1]

[1]Adapted from the VA Cave Board Karst Assessment and Survey Guidelines (and) Denton, et al. 2016. All other definitions adapted from Field, 2002.

Cave – A natural hole in the ground, large enough for human entry. This covers the enormous variety of caves that do occur, but eliminates the many artificial tunnels and galleries incorrectly named caves. The size criterion is arbitrary and subjective, but practical, as it eliminates narrow openings irrelevant to explorers but very significant hydrologically, that may be better referred to as *proto-caves*, *sub-conduits*, or *fissures*. A cave may be a single, short length of accessible passage, or an extensive and complex network of tunnels as long as hundreds of kilometers.

Doline; Sinkhole – A basin- or funnel-shaped hollow or depression in limestone, dolostone or other soluble bedrock, ranging in diameter from a few meters up to a kilometer and in depth from a few to several hundred meters. Some dolines are gentle grassy hollows or depressions; others are rocky cliff-bounded basins. A distinction may be made by direct solution of the limestone surface zone (solution dolines), and those formed by collapse over a cave (collapse dolines), but it is generally not possible to establish the origin of individual examples. Generally referred to as a "sinkhole" in the United States, the term doline is more widely accepted by the international geology community.

Throat – An opening within a sinkhole leading into the subsurface through which material passes or has passed from the sinkhole into underlying solutional voids and conduits, which is generally too small to qualify as a cave and often called a *proto-cave*, *sub-conduit*, or *fissure*. Throats may be "open" (i.e. air-filled or water-filled), or "closed/clogged" (filled with debris including but not limited to: loose-soil; gravel; rock; dead-fall wood or brush; or trash).

Parapet – The outer edge or perimeter of a doline (sinkhole).

Ponor – a) Hole or opening in the bottom or side of a depression where a surface stream or lake flows either partially or completely underground into the karst groundwater system. b) Hole in the bottom or side of a doline through which water passes to or from an underground channel. Also known as a swallow hole or swallet.

Solution Cavity – A natural cavity or depression formed by the dissolution of soluble bedrock, typically not large enough to allow the entry of a human being and, therefore, not classified as a cave.

Breccia – Angular fragments of rock commonly, but not always, cemented by finer-grained materials including silica, iron minerals, and calcite to form a new rock. Many fault planes are marked by zones of broken rock, either loose or re-cemented, forming a fault breccia.

Non-Karst Closed Depression – A natural or non-natural topographic depression that is not formed by karst processes and is not floored by bedrock. Examples include (but are not limited to) construction-related soil subsidence, silage pits, farm ponds, scour pools, animal wallows, large animal burrows, and pits created by removal of tree stumps.

Sinking Stream/Swallet – A perennial or intermittent stream whose bed and bank disappear entirely underground, usually through an open throat sinkhole or cave entrance.

Losing Stream – A perennial or intermittent stream which loses flow volume into its bed due to the presence of sub-channel (hyporheic) solution cavities or conduits.

Geological Overview of the Karst Terrain Sections of the Proposed ACP/SHP

Overview of regional karst terrain within the project area

The term "karst" refers to a type of landform or terrain, just like "desert", "marsh", "tundra", "steppe" or "montane". It was named for a province in Slovenia where it was first described in the late 17th and early 18th century by geologists of the former Austro-Hungarian Empire. Simply stated, karst terrain is characterized or diagnosed by the presence of sinkholes, caverns, an irregular "pinnacled" bedrock surface,

and many large springs; however, the development of karst terrain is a result of the presence of soluble bedrock such as limestone, dolomite, marble or gypsum. Any landscape that is underlain by soluble bedrock has the potential to develop a karst terrain landform.

As in any region where soluble bedrock is present, a karst landform regime has developed in three known regions of the proposed ACP/SHP. Folding and faulting of the local carbonate rocks has opened up numerous fractures both parallel with the axis of the geologic structures, as well as perpendicular to them. Surface fractures and joints weather differentially, producing a pinnacled or "saw-tooth" profile at the bedrock/soil interface (referred to as the "epikarst" zone). In contrast, rock-enclosed fractures can be secondarily enlarged by the action of carbon dioxide charged groundwater, in some cases forming water-filled or air-filled conduits. As the regional terrain is "mature" karst, nearly all the fractures have undergone successive cycles of sediment filling and flushing. In areas such as the ACP Project area, where there is little topographic relief and a relatively minimal groundwater gradient, the great majority of solution fissures are sediment-filled.

The most prevalent type of karst features in the project area are dolines or sinkholes, and these features comprise the greatest potential geohazard risk to any type of construction in karst terrain. Sinkholes fall into two broad categories, "vault-collapse" sinkholes, and "cover-collapse" sinkholes. Vault-collapse type sinkholes (i.e., where a cavern "vault" or roof has failed catastrophically) are rare in the ACP/SHP Project area. (Campbell, et al., 2006). Cover-collapse sinkholes, which are common in the ACP Project area, develop by the raveling of fines from the soil overburden into solution channels within the bedrock mass, in which water is the transport medium for the movement of the soil fines. The natural raveling process is generally a very slow one, such that sinkhole development generally occurs over a very long time span. However, various changes at a site can sometimes lead to the very sudden development of sinkholes. The most common changes that will exacerbate sinkhole development are:

1. Increase or redirection of overland or subsurface water flow paths, which accelerates the raveling of soil fines;
2. Removal of vegetation cover and topsoil (i.e., stripping and grubbing), which can reduce the cohesive strength of the soils overlying a conduit; and
3. Sudden changes in the elevation of the water table (such as drought, over-pumping of wells, or quarry dewatering), which removes the neutral buoyancy of the water supporting a conduit's soil plug, and can often result in rapid and catastrophic soil collapse.

Geological Setting

The proposed ACP/SHP will cross three distinct regional provinces of karst geology, from east to west:

1. The **Great Valley subsection of the Valley and Ridge physiographic province**, encompassing the portion of Augusta County, Virginia from the Blue Ridge on the east to Little North Mountain on the west.
2. The **Folded Appalachian subsection of the Ridge and Valley province**, encompassing the westernmost section of Augusta County, and all of Bath County and Highland County, Virginia and extending from the North Mountain area on the east to the Allegheny Mountain on the west.
3. The **Allegheny Front and Appalachian Plateau** provinces of West Virginia, encompassing Pocahontas and Randolph Counties, West Virginia, and the karst section of the SHP located in Westmoreland County, Pennsylvania.

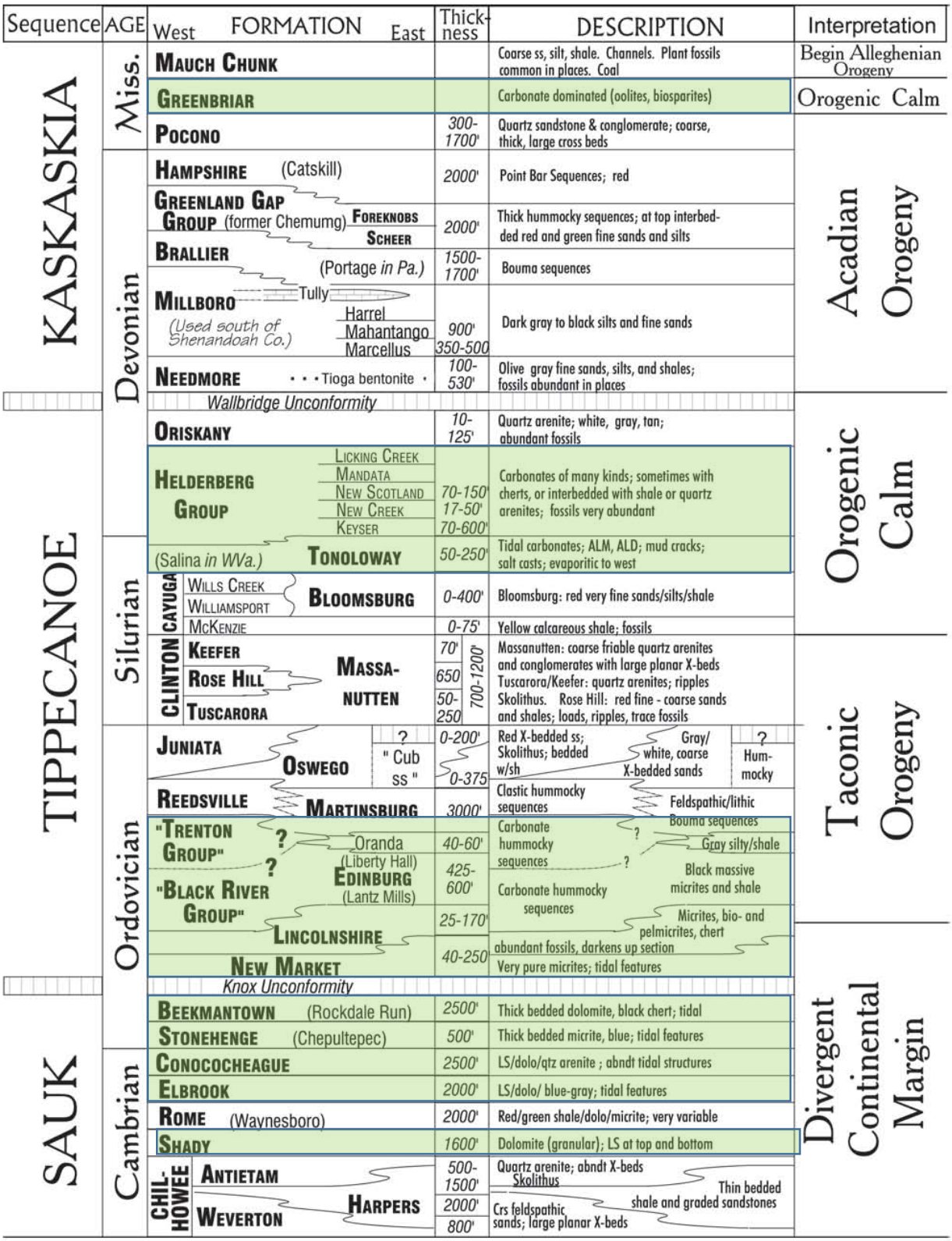


Figure 1. Stratigraphic Column of the central Virginia Great Valley, Folded Appalachians, and eastern Allegheny Front of west central Virginia and eastern West Virginia (Fichter, 2010). (The karst forming units are highlighted in green.)

The Great Valley (Augusta County, VA)

The Great Valley section is a generally downwarped trough (synclinorium) of Paleozoic limestones, shales, and sandstones that lie between the Blue Ridge Massif on the east and the Allegheny Mountains to the west. The Valley extends between the two mountain uplands from northeast to southwest, parallel with the average strike of the bedrock.

The karst terrain of the Great Valley section of the ACP Project Area is characterized by numerous circular to oval-shaped sinkholes, ranging in size from a few feet to several hundred feet in diameter, the majority of which are completely vegetated and lack any opening to the subsurface ("throat") at their base. Sinkhole depths can vary, but are usually controlled by the angle of repose of the sediments lining their walls. Steep, rock-walled sinkholes are rare in this section, but generally occur in the small hills and uplands that are erosional remnants of the prior valley floor.

The Great Valley section contains large karst springs in the region. It is also characterized by sinkholes called "estavelles", which are insurgences for water during dry periods, and flood or act as springs (resurgences) during wet seasons. There are also numerous caves (i.e., air-filled voids large enough to permit the entry of a human being and that have an entrance to the surface) and subsurface caverns (air-filled voids large enough for human entry with no connection to the surface) in the region. Most of the caves and caverns range in length from a few feet to several miles; however, the average length rarely exceeds 2,500 feet. This is in contrast to the Folded Appalachian and Appalachian Plateau provinces to the west, where some of the longest caves in the region have been surveyed, many of which are more than 10 miles in length. Nevertheless, though not of great length, some of the most voluminous underground chambers in the region occur in the Great Valley section.

A unique type of karst terrain has developed in the eastern portion of Augusta County along the base of the Blue Ridge Mountains. Here, the characteristic karst terrain has been buried beneath a mantle of alluvial material which was shed off the mountains to the east. This alluvium ranges in age from less than 1 million years (Quaternary Period) to over 50 million years (Paleogene Period). The alluvium thins towards the west, and disappears completely west of Waynesboro, Virginia. Although the primary karst terrain is mantled by the alluvium, numerous shallow broad sinkholes are present and indicate the presence of large karst features in the underlying bedrock.

Bedrock Geology

Specifically, the proposed ACP Project area in the Great Valley section has been extensively studied and mapped as being underlain by a series of karst-forming carbonate and calcareous clastic rocks (Campbell et al., 2006; DMME, 1993; Rader & Gathright, 2001; Rader & Wilkes, 2001; Hubbard, 1988; Southworth, et al., 2013) ranging in age from the Lower Cambrian to Middle Ordovician geological periods as follows:

Ordovician Period

Martinsburg Formation (Om)

The upper 100 to 200 feet of this formation is a brown, medium-to coarse-grained, fossiliferous sandstone. An olive-green silty shale and dark-gray siltstone comprises the middle portion of this formation, along with a medium-to coarse-grained, locally pebbly sandstone. The Stickley Run Member exists as the lower 400 to 900 feet of the formation. This is a medium-gray to grayish-black, very fine-grained (aphanitic), very thin- to thin-bedded, argillaceous limestone with interbedded medium- to dark-gray, calcareous shale.

Edinburg Formation (Oeln)

A black, fine-grained to aphanitic limestone with layered black shale that commonly contains pyrite, and medium- to light-gray, fine- to coarse-grained, nodular limestone with thin partings of black shale. This formation lies in thicknesses ranging from 450 to 1,000 feet throughout the three subject areas.

Lincolnshire Limestone (Oeln)

Gradational contact with the overlying Edinburg. A light- to very dark-gray, fine- to coarse-grained, medium to very thick-bedded limestone with black chert nodules. The Murat Limestone Member, generally found at the top of the formation, is a light colored, coarse-grained limestone composed of fossil fragments. Thicknesses throughout the subject areas range from 50 to 250 feet.

New Market Limestone (Oeln)

Unconformable upper contact with the Lincolnshire. The upper unit of this formation is a medium-gray, aphanitic, thick-bedded, limestone with scattered calcite crystals. The lower unit is a medium- to dark-gray, fine-grained, thin-bedded, argillaceous, bioturbated limestone that is dolomitic in parts, with its base being a carbonate pebble conglomerate. Formation thicknesses throughout the subject areas range from 100 to 250 feet.

Pinesburg Station Dolomite* (Ob)

This formation is a medium-to light gray, fine-grained, medium- to thick-bedded dolostone, with sparse fossils. When weathered, this dolomite is very light-gray, and exhibits a "butcher-block" structure. A medium-gray, fine-grained limestone exists as the base of this unit. The formation's average thickness is 400 feet.

Rockdale Run Formation* (Ob)

The upper contact with the overlying Pinesburg Station is unconformable. This formation is comprised of a medium-gray, fine-grained, fossiliferous limestone and a light- to medium-gray, fine-grained, laminated dolomitic limestone and dolostone with mottled beds. Thin lenses of gray chert are common near the base of the formation. Formation thickness ranges from 1,500 to 2,400 feet.

Stonehenge Limestone* (Ob)

Upper contact with the Rockdale Run Formation is gradational. The upper 400 to 500 feet is comprised of a medium- to dark-gray and black, fine- to medium-grained limestone, with thin beds of macerated fossil debris. The lower 50 to 150 feet (Stoufferstown Member) is a dark-gray to black, fine-grained limestone with thin sheet-like, crinkly partings due to cleavage, and thin beds of coarse-grained, bioclastic limestone.

***Beekmantown Group (Note – This unit consists of the Pinesburg Station Dolomite, Rockdale Run Formation, and the Stonehenge Limestone)**

Cambrian Period

Conococheague Formation (OCco)

The upper contact with the Stonehenge Limestone of the Beekmantown Group is unconformable. The upper 2,000 feet of this formation is a light- to dark-gray, fine-grained, laminated limestone, dolomitic limestone, and dolostone with flat-pebble conglomerate beds. Some cross laminated sandstone beds occur in the uppermost part of this unit. The Lower 200 to 500 feet (Big Spring Station Member) consists of a light-gray, fine-grained dolostone, medium- to dark-gray, fine-grained laminated limestone and dolomitic limestone, and gray, coarse-grained sandstone and dolomitic sandstone. Beds of flat-pebble conglomerate occur in the dolomite.

Elbrook Formation (Ce)

This unit's thickness ranges from 2,000 to 2,500 feet. The formation is a dark- to medium-gray, fine- to medium-grained limestone, dolomitic limestone, dolostone, and dolomitic shale. These lithologies commonly occur as erosion-surface-bounded sequences of algal limestone overlain by laminated dolomite. Decalcified, ocherous shale-like chips on the ground surface characterize this unit. The lower 300 to 400 feet is green to greenish-gray, fine-grained dolostone, dolomitic limestone, and shale.

Waynesboro Formation (Cw)

The upper contact with the Elbrook Formation is gradational. A dusky-red to olive-gray, fine- to medium-grained sandstone and dusky-red to gray shale exists as the upper 300 feet. The middle 400 feet is a medium- to dark-gray, saccharoidal dolomite and fine-grained limestone. The lower 500 feet is dusky-red, olive-gray, and dark-gray shale and dusky-red to brownish-gray, fine- to medium-grained sandstone. Overall thickness is approximately 1,200 feet.

Tomstown Dolomite/Shady Dolomite (Ct/Cs)

The upper 600 feet is light- to dark-gray, fine- to coarse-grained, medium- to thick-bedded, locally laminated dolostone with white chert rosettes and nodules in the upper 50 feet. The middle unit (about 210 feet) is very light- to medium-gray, medium-grained, very thick-bedded dolostone and high-magnesium dolostone. The lower unit (about 325 feet) is dark-gray to black, very fine-grained, thin- to very thin-bedded limestone and dolomitic limestone with argillaceous laminations. The overall unit thickness ranges from 1,100 to 1,200 feet. The Shady Dolomite is the homologous unit in the southeastern Great Valley at the base of the western edge of the Blue Ridge Mountains.

The Folded Appalachians (Augusta County, Bath County, Highland County, VA)

The western edge of the Great Valley is demarcated by the North Mountain Fault, and the ridges of Little North and Great North Mountain. The rocks underlying this section are younger than those of the Great Valley, dating primarily from the Late Ordovician through the Devonian periods in age. In general, the mountain ridges are underlain by sandstone and siltstone, clastic rocks which are insoluble and not prone to karst terrain development. In contrast, the intervening deep valleys are often floored by carbonate rocks, and a characteristic karst landscape characterized by sinkholes, caves and springs has developed in many cases along the axis and flanks of these valleys (Hubbard, 1988; Rader & Wilkes, 2001; DMME, 1993).

Bedrock Geology

The regional geology of the Folded Appalachians in the project area has been mapped (DMME, 1993) as being underlain by a series of karst-forming carbonate rocks ranging in age from the Lower Ordovician to Lower Devonian geological periods as follows:

Devonian – Silurian Periods

Helderberg Group (Dh)

This group consists of thick- to massivel- bedded, dark gray/black micritic limestone with reef structures. The limestone shows some degree of recrystallization. The uppermost Helderberg is typically silicified near its contact with the overlying Oriskany sandstone. In many areas the Helderberg gives off a distinct petroliferous odor when freshly broken. The contact with the overlying Oriskany Sandstone is poorly exposed regionally, but the contact with the underlying Tonoloway Formation is distinct and often unconformable, where the massive bedding of the Helderberg gives way to the thin-bedding of the Tonoloway Formation. The contact can be identified in places by a lag deposit consisting if flat, packstone rip-ups and pebble conglomerate.

The group is a major cave forming unit of the Folded Appalachian section, however, it is of note that the stratigraphy of this unit has been the subject of much detailed study in recent years (Haynes, et al., 2014). The Helderberg Group consists of a series of individual formations, from oldest to youngest, respectively: the Keyser Limestone, New Creek Limestone, Corriganville Limestone, and Licking Creek Limestone formations. It should be noted that based on biostratigraphic analysis the Keyser Limestone, the basal formation of the Helderberg Group, is considered to straddle the boundary of the Silurian and Devonian periods (Denkler and Harris, 1988a).

The entire Helderberg Group varies regionally, ranging from 85 feet to over 400 feet in thickness. The Keyser is considered the thickest of the individual formations comprising the group, ranging from 50 to 230 feet in thickness.

Silurian Period

Tonoloway Limestone (Sto)

This formation consists of extremely thin-bedded (0.5 inches or less) dark gray micritic limestone interbedded with fissile, calcareous shale. The formation gives off a distinct petroliferous odor when freshly broken. The contact with the overlying Keyser Limestone is distinct; however, it grades into the underlying Wills Creek Limestone. The Tonoloway Formation varies from 150 to 600 feet in thickness.

Wills Creek Limestone (Swc)

This formation consists of thin-bedded (less than 5 inches) dark gray calcareous shale and fossiliferous micrite, which is poorly exposed in the ACP Project area. The thickness is variable, ranging from 3 feet to 230 feet.

Ordovician Period

Middle Ordovician Limestones, Undivided (Olm)

These limestones consist of the Edinburg Formation, the Lincolnshire Formation, and the New Market Limestone. The Edinburg is a black, fine-grained to aphanitic limestone with layered black shale that commonly contains pyrite, and medium- to light-gray, fine- to coarse-grained, nodular limestone with thin partings of black shale. Thickness is 400 feet to 500 feet. The Edinburg grades downward into the Lincolnshire Formation, a light- to very dark-gray, fine- to coarse-grained, medium- to very thick-bedded limestone with black chert nodules. Thicknesses throughout the ACP Project area range from 25 to 250 feet. This unit is underlain by the New Market Limestone. The upper contact with the Lincolnshire is generally unconformable. The upper unit of this formation is a medium-gray, aphanitic, thick-bedded, limestone with scattered calcite crystals. The lower unit is a medium- to dark-gray, fine-grained, thin-bedded, argillaceous, bioturbated limestone that is dolomitic in parts, with its base being a carbonate pebble conglomerate. Formation thicknesses throughout the ACP Project area range from 0 to 150 feet.

Beekmantown Formation (Ob)

This formation is a medium-to light gray, fine-grained, medium- to thick-bedded dolostone, with sparse fossils. When weathered, this dolomite is very light-gray, and exhibits a "butcher-block" structure. A medium-gray, fine-grained limestone exists as the base of this unit. This formation is comprised of a medium-gray, fine-grained, fossiliferous limestone and a light- to medium-gray, fine-grained, laminated dolomitic limestone and dolostone with mottled beds. Thin lenses of gray chert are common near the base of the formation. Formation thickness ranges from 1,500 to 2,400 feet. The Beekmantown Formation typically consists of three members, which although distinct in the Great Valley region are hard to distinguish in the Folded Appalachian province.

The Allegheny Front & Appalachian Plateau (Pocahontas County and Randolph County, WV)

The last section of the folded Appalachian karst is located in eastern Pocahontas County. To the west occurs the relatively flat-bedded geology of the Allegheny Front and Appalachian Plateau provinces. The karst terrain in this area is formed almost exclusively by the carbonate rocks of the Much Chunk and Greenbrier Groups.

In general, the Mauch Chunk and Greenbrier group carbonates exhibit a high density of caves relative to the other two karst section along the pipeline. There are several factors that contribute to this, the main one being that the units act as a drain system for groundwater infiltrating downward through the fractured clastic rocks above them. Where they are exposed along the mountain flanks, the steep groundwater gradients have

enhanced this cavern development. In many places surface water plunges directly into the carbonates via steep-walled, open throat sinkholes (swallets). Most of the caves are linear networks, and exhibit conduit flow, capturing surface streams upgradient which then emerge as springs at the downgradient end.

Bedrock Geology

The Appalachian Plateau section has been mapped (Cardwell, et al., 1968; Davies, 1958) as being underlain by the karst-forming carbonate rocks of the Greenbrier and Mauch Chunk groups, exclusively. The geology is described from youngest to oldest as follows:

Mississippian Period

Mauch Chunk Group – Includes the Bluestone and Princeton Formations (Mbp), Hinton Formation (Mh), and Bluefield Formation (Mbf). The group is predominantly red, green and medium-gray shale and sandstone, with a few thin limestone lenses in each formation. Although the limestone strata in the unit are considered secondary, the topographic position of the Mauch Chunk along the edges of the eroded upland of the Allegheny Plateau where there is a relatively steep downward hydraulic gradient has enhanced water flow through the carbonate lenses, forming karst conduit networks with high transmissivity (Kozar & Mathes, 2001), thus from a karst hydrology viewpoint this unit is significant.

Greenbrier Group (Mg) – In the project area the Greenbrier Group (or "Big Lime" as it is known locally) is up to 400 feet in thickness. It is primarily a gray to dark gray, massively bedded marine limestone, with interbeds of red and green marine and nonmarine shale and thin discontinuous beds of sandstone. The Group is divided into six stratigraphic units; from oldest to youngest they are: the Denmar Limestone, Taggard Shale, Pickaway Limestone, Union Limestone, Greenville Shale, and Alderson Limestone. The principle cave forming units are the Pickaway and Union limestones.

Pre-Construction Assessment and Field Survey

The proposed ACP/SHP involves the installation of a gas pipeline extending through West Virginia, Virginia, and into southern North Carolina. The currently proposed pipeline construction alignment information shows that the primary route being considered for the pipeline passes across approximately 32.5 miles of karst terrain located in Randolph and Pocahontas Counties in West Virginia, and Highland and Augusta Counties in Virginia, based on regional geological mapping. Two alternate routes were also being investigated: the MNF-5 Route, encompassing 11.2 miles of karst terrain in Randolph and Pocahontas Counties West Virginia, and Highland County, Virginia; and the AT South Crossing, encompassing 4.6 miles of karst terrain in Augusta County, Virginia, except where access was prohibited by the landowner.

The "Area of Interest" (hereinafter referred to as the "AOI") assessed by data desktop review generally extended 0.25-mile from either side of the centerline of the proposed pipeline and alternate routes, and 150 feet from the centerline for field review. However, if observed or mapped karst features received drainage from the proposed pipeline work area then these features were delineated to the extent possible, and included in the assessment, even if they were outside of these perimeters.

Thus, the pre-construction assessment and field survey scope can be summarized as follows:

- Located and delineated surface karst features (e.g., sinkholes and karst related subsidence, cave entrances, closed depressions, and sinking and losing streams) within the AOI, with particular emphasis on features that had a direct connection with the phreatic zone such as "open-throat" sinkholes, karst windows, cave entrances, abandoned wells, sinking streams, and areas that could affect the integrity of the pipeline, such as actively forming cover-collapse sinks, areas of soil subsidence, or caves which have passages that extend below the proposed right-of-way at elevations less than 15 feet below the surface. Direct field observations were made by conducting a site reconnaissance over the entire AOI.

- Delineated zones of karst terrain, subsidence, and drainages based on the surface karst features assessment.
- Prepared a report summarizing the methods and findings of the assessment.

Methods and Procedures

The above scope of services was accomplished by the following means:

Existing Data Review and Analysis

Potential karst features were identified remotely and/or by database review, and then their presence was confirmed in the field. This process helped to focus the actual field location and survey tasks. The following sources were reviewed:

1. The (proprietary) Cave Databases of the Virginia Speleological Survey (VSS) and the West Virginia Speleological Survey (WVSS);
2. Caves of Virginia (Douglas, 1961);
3. Description of Virginia Caves (Holsinger, 1975);
4. Caverns of West Virginia (Davies, 1965);
5. Maps of selected karst features (sinkholes, caves, springs) available from the Virginia Division of Mines and Mineral Resources and the United State Geological Survey (USGS);
6. 2-foot and 4-foot contour interval maps for the AOI (to determine the presence of surface karst features not included in the above listed databases based on the presence of closed, descending contours or other suspect karst "fingerprint" features);
7. LIDAR data (where available);
8. Aerial photographs (both recent and historical);
9. USGS Topographic 7.5-minute topographic quadrangles;
10. Sinkhole and depression locations available from the US Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) soil studies for the Counties through which the ACP will pass.
11. Weary, D.J. and D.H. Doctor. 2014. Karst in the United States: A digital map compilation and database, USGS open-file report 2014-1156, 23p

In addition, the survey team reviewed the readily available geological literature for bedrock and structural characteristics, relying upon the closest resolution mapping that existed for the particular AOI being examined.

Field Reconnaissance

Upon completion of the existing data review activities for a specific area, GeoConcepts undertook field reconnaissance and survey activities. Specifically, the field reconnaissance entailed:

1. Location and verification of surface karst features identified in the database review;
2. Location of uncatalogued or previously unidentified surface karst features, specifically sinkholes, cave entrances, dry runs and sinking streams.

The field reconnaissance placed particular emphasis on locations where pathways existed to phreatic groundwater such as open-throat sinkholes, cave entrances, karst "windows", and sinking streams. Potential reroutes were identified based on the field observation of sensitive karst features, such as significant caves, sinking streams, or open throat sinkholes.

The AOI was delineated and the path of the AOI was examined for karst features (both catalogued and previously unidentified) by field survey. This entailed conducting a site reconnaissance over the AOI (i.e., the proposed pipeline route) in a systematic manner, to observe any existing surface karst features that fit the criteria. The locations and outlines of all relevant features were recorded using a sub-meter accurate Global Positioning System (GPS) device. For the purpose of this study, the outline (parapet) of sinkholes were defined by the last closed descending contour at mapping interval available for the area under study. Cave entrances were identified as single points, unless the entrance was located within a larger sinkhole structure, in which case the cave entrance was indicated as a point within the sinkhole's parapet. Sinking streams were located as points of entry into the subsurface; however, losing streams were identified as linear features.

All digital data was transmitted in the Universal Transverse Mercator (UTM) Coordinate system. The horizontal datum of reference is NAD83.

Summary Report

The results of the data review and field survey has been summarized in a final report. The report details the methods and findings, and contains an inventory and contained a delineation of karst features and terrain. The frequency and density of karst features was also correlated with the encompassing geological unit at the formational level (e.g., Elbrook Formation, etc.). The report is accompanied by a data set containing the attributed digital points and polygon data as shapefiles with metadata (maps and/or tables). These data will be used during the construction phase to assist in the pre-construction inspection tasks.

Construction Monitoring

The purpose of this section of the plan is to establish a standard set of monitoring protocols for karst features encompassed by the proposed ACP pipeline right-of-way and adjacent areas. The intent of these protocols is to minimize impact to the subterranean environment, ensure water quality, and protect the integrity of the pipeline.

I. Geophysical Survey

To obtain more information about the subsurface conditions, and possible karst development along the proposed ACP pipeline alignment, an electrical resistivity investigation (ERI) will be conducted in the areas that are mapped with limestone bedrock. The ERI will be performed along the entire length of the pipeline centerline following vegetation clearing but prior to any earth-disturbance and/or excavation activity.

Instrumentation

The geophysical survey instrument which will be used during this survey is an electrical resistivity meter that maps the resistivity changes in the earth. Resistivity refers to the electrical resistance of a material. The ERI survey will be conducted by introducing a measured current into the earth through two electrodes and measuring the resultant voltage (i.e., potential) across two different electrodes. At the low currents used, voltage is proportional to the current. The meter measures the voltage/current ratio or resistance in Ohms.

The ERI survey will be conducted using an earth resistivity meter which measures the apparent conductivity of the subsurface employing an artificial source that is introduced through point electrodes. The automatic electrode system is designed to optimize survey efficiency by gathering maximum information with a minimum of electrodes. The instrument also uses redundancies in the data set to reduce the effects of lateral heterogeneities in the earth and to calculate uncertainties in the data. The survey will be conducted automatically using a dipole-dipole array system.

Interpretation Method

The ERI data will be converted into a resistivity depth model using a Rapid 2D resistivity inversion model and the least-squares method (RES2DINV). Soundings from each line will be modeled to produce the

measured apparent resistivity pseudo-sections. The model will calculate the apparent resistivity pseudo-sections using finite-difference forward modeling. The least-squares optimization technique will be used for the inversion routine that calculates the modeled resistivity section. The generated profiles will include cross-sections that consist of the inverse model resistivity cross-section. The horizontal and vertical scales will be in meters.

The cross-section is the inverse model resistivity pseudo-section. The ER data will be converted into a resistivity depth model (RES2DINV) using a resistivity inversion model by the least-squares method, which will be topographically corrected. RES2DINV will confirm the model reliability by calculating the modeled data into empirical data or the calculated resistivity pseudo-section. The difference between the measured and calculated data is the percent error. The modeled calculated error will be calculated within the five percent range, which is considered very accurate.

Low resistive materials can be caused by certain conductive soils, such as clay, wet silts, and sands, or ionized water. High resistive materials are caused generally by porous soils (i.e., poorly consolidated gravels), laminated bedrock with interstitial clay-filled voids, wood, or large, air-filled cavities. Lower ER anomalies are generally associated with soil-filled voids, saturated sinkhole soils, and water-bearing fractures. High ER anomalies are frequently associated with caverns, buried air filled structures, or weathered, laminated bedrock with air filled cavities.

Resistivity values can vary widely as the geology, mineralogy, and stratigraphy changes from site to site. Therefore, it is important to correlate resistivity results with boring logs for equivalent sections at a specific locality. Typical values are:

Subsurface Material	Resistivity Range (Ωm)
Topsoil	1 – 10
Clays	10 – 100
Sands and Gravels (unconsolidated)	600 – 10,000
Fresh Water	3 – 100
Limestone	100 – 10,000
Sandstone	100 – 1,000
Igneous and Metamorphic Rocks	100 – 1,000,000
Open Voids (i.e. caverns, solution conduits)	>10,000

Although the above values are characteristic of various subsurface materials, the absolute resistivity ranges will vary considerably depending on the local geology. Therefore, it is required that the ERI survey is calibrated using soil test borings. In addition, if high ER anomalies are detected, their locations will need to be documented and further investigated. The specific type of investigation will be dictated by the characteristics of each anomaly identified.

II. Inspection Protocols

Inspection protocols will be provided to the contractor and will be reviewed at a pre-construction meeting led by the Karst Specialist (KS). In addition, all geologist or engineering staff utilized during construction will have received training from the KS prior to mobilization to the site regarding the identification and mitigation of karst features that have been previously identified within the project boundaries, or that may be identified during construction.

Pre-Construction Inspection

Prior to the commencement of any earth disturbance activity, the area of the pipeline that will be affected by the planned activities will be inspected by the karst specialist (KS) as follows:

a. The KS will inspect the entire section of the pipeline ROW in the designated work area, and note any suspect karst features including sinkholes, caves, areas of soil subsidence, or closed depressions.

b. The locations of observed features will be noted on site drawings and flagged for surveying and/or recorded using sub-meter accuracy GPS instrumentation.

c. The KS will issue a report summarizing the findings of the inspection. Findings will supplement the summary report and shall include an inventory of feature type(s), drainages, and potential impact to the feature by the planned activities, and recommendations to limit impacts if they are expected.

d. Features that are considered to have potential impact are: caves, sinkholes with open throats, ponors, open solution cavities, abandoned wells, and sinking streams. (Note – If a sinkhole throat is filled, the type of fill, i.e. rock, soil, flood debris, etc., will be described in detail).

e. Features that are not considered to have a potential impact are: soil-bottomed (stable) sinkholes (i.e., no evidence of recent soil raveling or tension cracks along the parapet), karst springs, or non-karst closed depressions. However, it is of note that land disturbance to stable sinkholes can render them unstable. Not structurally unstable in general, but strictly in terms of raveling of surface materials (sediment) and associated contaminants into the subsurface.

f. The pre-construction inspection will have a "shelf-life" of 1 year from the day of the inspection. If work does not commence within 1 year, a new inspection will need to be completed prior to any earth disturbing activities.

g. The pre-construction inspection report shall be delivered to Atlantic/DTI no later than 1-month after the completion of the field survey.

Monitoring of Pre-Identified Features during Construction

Features identified during the pre-construction inspection will be monitored as follows:

a. If an identified feature with potential impact to the subterranean environment falls within the area designated for earth disturbing activities and cannot be avoided, the feature will be documented by field location and with photographs, and then assessed for pre-construction remediation by Atlantic/DTI staff with input and guidance to be provided by the KS. Remediation will be in compliance with the USDA-NRCS's Conservation Practice Standard Code 527 "Karst Sinkhole Treatment" (2010) and the West Virginia Department of Environmental Protection Division of Water and Waste Management Ground Water Protection Program Sinkhole Mitigation Guidance, August 8, 2005. (see Appendix A)

b. If a feature that has potential impact falls within the right-of-way but is not intercepted by the excavation, that feature will be monitored during the work by Atlantic/DTI staff for changes such as:

    1. soil subsidence;
    2. rock collapse;
    3. sedimentation;
    4. increased surface water infiltration;
    5. flooding;
    6. clogging; and/or other changes in morphology or function that might indicate potential impact to the epikarst stratum caused by the work.

c. All features, whether remediated or left in an undisturbed natural state, will be monitored by Atlantic/DTI staff, or their designee, for any changes in appearance, drainage, siltation, etc., at 1 year, 2 year, and 5 year intervals after the completion of the earth disturbing activities. If changes in the features are observed, Atlantic/DTI staff will report the condition to the KS who will provide consultation on potential impacts to the karst environment and possible remedial actions.

Monitoring of Features that are intercepted during Construction

Features that are intercepted during construction shall be monitored as follows:

Level 1 Inspection of Features Intercepted During Construction

If any feature is intercepted during work activities including drilling, blasting, and excavation or trenching, the onsite geologist will conduct an initial assessment of the feature to determine if further inspection (Level 2) by the KS will be required. Suspect features shall include:

1. Bedrock enclosed conduits, cave entrances[2] and voids;
2. Solution pockets that extend beyond visual examination range (and therefore may be open);
3. Areas of soft soils;
4. Soil voids;
5. Highly fractured bedrock;
6. Areas of breccia enclosed within the surrounding bedrock.

Level 2 Inspection of Features Intercepted During Construction

If any of the aforementioned features are observed during the Level 1 inspection, work will stop within a 100-foot radius of the feature, and then the KS will conduct a Level 2 inspection as follows:

a. The KS will examine the feature and determine if it has potential impact to the subterranean environment based on potential connectivity with the phreatic aquifer via the epikarst stratum (Moore, et al, 2013). The choice of characterization methods will be determined by the KS, and will include any combination of (but not be limited to):

    1. visual assessment;
    2 geophysical survey;
    3 track drill probes;
    4. infiltration or dye trace testing; or
    5. other techniques utilized to facilitate subsurface characterization of karst features.

b. If the feature is determined to have potential impact to the subterranean environment, the KS will advise Atlantic/DTI staff regarding appropriate remedial actions.

c. If the feature is determined to not have potential impact to the subterranean environment, work will resume as planned.

d. All features that are intercepted during construction and subsequently remediated will be located by project surveyors exclusively, and monitored by Atlantic/DTI staff, or their designee, for any changes in appearance, drainage, siltation, etc., at 1 year, 2 year, and 5 year intervals after the completion of the earth disturbing activities. If any changes are observed, the KS will provide consultation on potential impact and recommend remedial actions, if necessary.

e. All Level 2 inspections, findings, and remedial activity will be summarized in a report by the KS, to be delivered to Atlantic/DTI after the completion of the field work.

Monitoring of Features that Form During Construction

Features that form during construction will be monitored as follows:

Level 1 Inspection of Features That Form During Construction

If any feature forms during work activities including hydrostatic testing, drilling, blasting, and excavation or trenching, Atlantic/DTI staff will conduct an initial assessment of the feature to determine if further inspection (Level 2) by the KS will be required. Suspect features will include:

[2]If an opening to a cave is intercepted during construction activities, depending on the location of the cave there should be immediate coordination with the Virginia DCR-NHP Karst Program (or) West Virginia Department of Conservation for investigation.

a. Cave entrances[3]
b. Sinkholes;
c. Soil subsidence areas; and/or
d. Rock collapses.

This will apply to any of the above features that may form either within the work area, whether located along the proposed disturbance section or anywhere within the covered lands within a 100-yard radius the work area.

Level 2 Inspection of Features That Form During Construction

If any of the aforementioned features are observed during the Level 1 inspection, work will stop in the area of the feature based on the observed site conditions, and then the KS will conduct a Level 2 Inspection as follows:

a. The KS will examine the feature and determine if it has potential impact to the subterranean environment based on potential hydraulic connectivity with the karst aquifer via the epikarst stratum.

b. The choice of characterization methods will be determined by the KS, and will include any combination of (but not be limited to) the following:

    a. visual assessment;
    b. electrical resistivity survey;
    c. track drill probes;
    d. infiltration testing; and/or
    e. other techniques utilized to perform subsurface characterization of karst features.

c. If the feature is determined to have potential impact to the subterranean environment, the KS will consult with Atlantic/DTI staff regarding appropriate remedial actions.

d. If the feature is determined to not have potential impact to the subterranean environment, work will commence as planned.

e. All features that form during construction, whether remediated or left in an undisturbed natural state, will be located on the site plans by the project surveyors, and will be monitored for any changes in appearance, drainage, siltation, etc. at 1 year, 2 year, and 5 year intervals after the completion of the earth disturbing activities. If any changes are observed, the KS will provide consultation on potential impact to the karst environment and remedial actions, if necessary. This monitoring will be carried out on all features that form during work activities, regardless of whether they have a potential impact to the karst environment or not.

Karst Mitigation and Conservation Procedures

The following procedures will be used for the mitigation of karst features that may have potential impact on the structural integrity of the pipeline, impact groundwater quality and quantity, or present a risk to human and/or environmental receptors. Please note that other resource protection measures that may be implemented for the ACP may provide redundancy with regard to the karst mitigation and conservation procedures detailed herein Additionally, there may be opportunities to utilize silt fencing or other measures identified for ESC and slope stabilization.

Measures to Avoid Impact to the Karst Aquifer and Environment

These measures shall apply to any karst feature which allows the unfiltered and unimpeded flow of surface drainage into the subsurface environment, including (but not limited to): open throat sinkholes, caves which receive surface drainage, sinking streams, and losing stream segments.

[3]If an opening to a cave forms during construction activities, depending on the location of the cave there should be immediate coordination with the Virginia DCR-NHP Karst Program (or) West Virginia Department of Conservation for investigation.

1. Protect known and/or future mapped recharge areas of cave streams and other karst features by following relevant conservation standards, specifically those pertaining to stream and wetland crossings and spill prevention, containment, and control.
2. Buffers of 300 feet[4] around karst features[5] in all work areas (within and off-ROW including discharge areas) must be clearly marked in the field with signs and/or highly visible flagging until construction related ground disturbing activities are completed.
3. Earth disturbing activities will be conducted in a manner that minimizes alteration of existing grade and hydrology of existing surficial karst features. Land disturbances including permanent filling, excavating, or otherwise altering existing karst features, or any of these activities within 300 feet of a feature, will be avoided, if possible, or minimized. In addition to the aforementioned requirements, the following will be implemented in these areas:
    a. If new open throated sinkholes form within the ROW or construction work area, work in that area will stop and the sinkhole will be isolated from the rest of the work area with sandbags or other suitable materials. The sinkhole will be inspected and appropriate action taken (e.g., pipeline relocated, sinkhole remediated, etc.) to ensure pipeline integrity and protection of the aquatic resource and subterranean habitat. If the sinkhole must be filled, an inverted filter to bridge the karst feature above the water table rather than filling it below will generally be used (see Appendix A).
    b. If a subsurface void should open or be intersected or a new sinkhole forms within the ROW or construction work area, work in that area will stop and the void will be isolated from the rest of the work area with sandbags or other suitable materials. The void will be inspected by the KS and appropriate action taken including filter fabric secured over the void and other such measures as necessary (e.g. pipeline relocated, sinkhole remediated, etc.) to ensure pipeline integrity and protection of the aquatic resource and subterranean habitat (standard operating procedures for sinkhole remediation can be found in Appendix A).
    c. In linear excavations adjacent to karst features, spoils will be placed on the upgradient side of the excavation so that if any erosion takes place the stockpiled soil will flow back into the excavation and not down-gradient towards the karst feature.
    d. Surface water control measures, including, but not limited to: diversion (direct water flow into trench or off right-of-way areas past the area of concern), detention or collection and transportation, will be utilized to prevent construction-influenced surface water from free flowing into open throated surface karst features, and eventually into the subsurface.
    e. Open throated surface karst features will not be utilized for the disposal of water.
4. Blasting will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of known or inferred subsurface karst structures. If rock is required to be hammered or blasted out of the way of a new pipeline installation, then the following parameters will be adhered to:
    a. The excavation will be carefully inspected for any voids, openings or other tell-tale signs of solution activity.
    b. If the rock removal intercepts an open void, channel, or cave, the work in that area will be stopped until a remedial assessment can be carried out by a qualified geologist or engineer with experience in karst terrain.

[4]Derived from the NiSource Multi-Species Habitat Conservation Plan, Madison Cave Isopod Avoidance and Minimization Measures.
[5]Specific geologic structures that characterize the karst landscape including sinkholes, caves, sinking or losing streams, ponors, pinnacled bedrock, and springs.

c. All use of explosives will be limited to low-force charges that are designed to transfer the explosive force only to the rock which is designated for removal (e.g., maximum charge of 2 inches per second ground acceleration).

d. If the track drill used to prepare the hole(s) for the explosive charge(s) encounters a subsurface void larger than 6 inches within the first 10 feet of bedrock, or a group of voids totaling more than 6 inches within the first 10 feet of bedrock, then explosives should not be used (or) a subsurface exploration should be conducted to determine if the voids have connectivity with a deeper structure. The subsurface exploration can be carried out with track drill probes, coring drill, electrical resistivity, or other techniques capable of resolving open voids in the underlying bedrock. If a track drill or coring rig is used, then all open holes will be grouted shut after the completion of the investigation.

5. Horizontal Directional Drilling (HDD) will not be used in karst terrain.

6. If authorized by the landowner, block (e.g. gate) all access roads and ROWs leading to cave entrances or open throat sinkhole structures to prevent unauthorized access.

7. Comply with requirements of project SPCC plan.

8. A Spill Prevention, Control, and Countermeasures Plan (SPCC) has been developed for the proposed ACP/SHP which will further avoid and minimize potential impact of spills by implementing the following measures:

   a. equipment refueling will not be performed within flagged or marked buffer areas of streambeds, sinkholes, fissures, or areas draining into these or other karst features, except by hand-carried cans (5 gallon maximum capacity) when necessary;

   b. equipment servicing and maintenance areas will be sited outside of flagged or marked buffer areas of streambeds, sinkholes, fissures, or areas draining into these or other karst features;

   c. prevent runoff resulting from construction equipment washing operations to directly enter any karst feature by locating these operations outside of the buffer area;

   d. construction equipment vehicles, materials, hazardous materials, chemicals, fuels, lubricating oils, and petroleum products will not be parked, stored, or serviced within 300 feet of any karst feature;

   e. all equipment will be checked by a construction inspector daily for leaks prior to beginning work in karst areas; damaged or defective equipment will be removed or repaired; and

   f. if a reportable spill has impacted a karst feature:

      i. follow the SPCC Plan and

      ii. call the National Response Center (800-424-8802) and the Virginia Department of Environmental Quality (800-469-8892) or the West Virginia Department of Environmental Protection (304-558-5938), as appropriate.

9. Hydrostatic test water will not be obtained from karst features (only free-flowing streams). Water from these sources will be withdrawn at a rate that does not reduce downstream flows by more than 25 percent.

10. Do not discharge hydrostatic testing water from new pipe directly into flagged or marked buffer areas of sinkholes, fissures, or other karst features or channels or surface features that flow towards those features. Discharge hydrostatic testing water in the following manner (in order of priority and preference):

    a. Discharge hydrostatic test water down-gradient of flagged or marked buffer areas of sinkholes, fissures, or other karst features unless on-the-ground circumstances (e.g., man-made structures, terrain, other sensitive resources) prevent such discharge.

    b. If water cannot be discharged downgradient as described in 10a, discharge water into uplands greater than 300 feet from flagged or marked buffer areas of sinkholes, fissures, or other karst

features unless on-the-ground circumstances (e.g. man-made structures, terrain, other sensitive resources) prevent such discharge.

c. If the conditions listed in either 10a or 10b are not practicable, discharge water as far from flagged or marked sinkholes, fissures, or other karst features as is practical and utilize additional sediment and water flow control devices to minimize effects.

References

Campbell, E. V., Williams, S. T., Duncan, I. J., Hibbits, H. A., Floyd, J. M., Reis, J. S. and G. P. Wilkes, 2006, Interstate 81 Corridor Digital Geologic Compilation: Virginia Department Mines, Minerals, and Energy - Division Mineral Resources, Open File Report 06-01.

Davies, W. E., 1958, Caverns of West Virginia, State of West Virginia Geologic and Economic Survey. Volume XIX A., reprinted with supplement, 1965.

Denkler, K. E., and A. G. Harris, 1988, Conodont-based determination of the Silurian-Devonian boundary in the Valley and Ridge Province, northern and central Appalachians. U. S. Geological Survey Bulletin 1837-C:C1 – C8.

Denton, R. K. Jr., 2013, Towards a Karst Assessment Standard Practice, Proceedings of the 13th Conference on Engineering and the Environment in Karst, National Cave and Karst Research Institute, Carlsbad, NM.

Douglas, Henry H., 1964, Caves of Virginia: Virginia Cave Survey, Falls Church, VA, 761 p.

Fichter, Lynn S., Whitmeyer, S. J., Bailey, C. M., and W. Burton, 2010, Straigraphy, structure, and tectonics: An East-to-west transect of the Blue Ridge and Valley and Ridge provinces of northern Virginia and West Virginia, The Geological Society of America Field Guide 16.

Field, Malcolm, 2002, A Lexicon of Cave and Karst Terminology with Special Reference to Environmental Karst Hydrology: United States Environmental Protection Agency, EPA/600/R-02/003.

Hubbard, Jr. David, 1988, Selected Karst Features of the Central Valley and Ridge Province, Virginia: Virginia Division Mineral Resources, publication 83.

Hubbard, D. A., Jr., 2003, Use of regional sinkhole mapping for sinkhole susceptibility maps. *In* Beck, B. F., ed., ASCE Geotechnical Special Publication No. 122, p. 61-71.

Moore, Clyde H. and William J. Wade, 2013, Carbonate Reservoirs: Porosity and Diagenesis in a Sequence Stratigraphic Framework, 2nd Edition, Elsevier.

Rader, Eugene K., and Thomas M. Gathright, 2001, Geologic Map of the Augusta, Page, and Rockingham Counties Portion of the Charlottesville 30 x 60 Minute Quadrangle: Publication 159, Virginia Department Mines, Minerals, and Energy - Division Mineral Resources.

Rader, Eugene K. and G. P. Wilkes, 2001, Geologic Map of the Virginia Portion of the Staunton 30 x 60 Minute Quadrangle, VDMME-DMR, Charlottesville, VA, Pub. 163.

Southworth, S., Aleinikoff, J., N., Bailey, C. M., Burton, W. C., Crider, E. A., Hackley, P. C., Moot, J. P., and R. P. Tollo, 2009, Geologic Map of the Shenandoah National Park Region, Virginia: U. S. Geological Survey Open File Report 2009-1153.

Virginia Division of Mineral Resources, 1993, Geologic map of Virginia: scale 1:500,000.

West Virginia DEP, 2005, Sinkhole Mitigation Guidance Document, August 8, 2005, WVDEP Division of Water and Waste Management, Groundwater Protection Program.

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Appendix A – Sinkhole Mitigation Guidance Documents

West Virginia Department of Environmental Protection
Division of Water and Waste Management
Groundwater Protection Program

Sinkhole Mitigation Guidance

August 8, 2005

Purpose:

These sinkhole mitigation designs serve to allow the filling of sinkholes while maintaining recharge to the aquifer, reducing potential contamination threats to groundwater, and eliminating safety hazards at sinkhole entries.

General:

Consideration should be given to the method used for removing contaminated materials from sinkholes and reducing or eliminating direct inflow of surface water into sinkholes. Land treatment methods that improve the filtration and infiltration of surface water before it enters the sinkhole should be used along with the mitigation of the sinkhole.

Before selecting a treatment option the following should be considered:

- Land use
- Existing and planned land treatment
- Sinkhole drainage area
- Dimensions of the sinkhole opening
- Safe outlet for diverted surface water
- Environmentally safe disposal of sinkhole "clean out" material
- Availability and quality of filter material
- Safety of equipment and operators and laborers during installation

Treatment selection should be based on the dimensions of the sinkhole drainage area and include direct sinkhole treatment with surface water control measures and filter strips. Whichever treatment option is chosen, it should avoid surface water ponding or the creation of high soil moisture conditions in excess of 72 hours.

Treatment designs apply to sinkholes with excavated depths of 5 to 25 feet and with drainage areas up to 15 acres. Excavations up to 5 feet are sufficient for most sinkholes. Sinkholes with excavation depths of greater than 25 feet or with uncontrolled drainage areas greater than 15 acres may require adjustments to the treatment measure(s) and/or surface water control measure(s). In these cases, geologic and engineering assistance must be obtained and a site-specific treatment design prepared.

Treatment for Sinkholes with Drainage Areas Less than 5 Acres

Treat the sinkhole using the mitigation design in Figure 1 of this guidance document. The treatment site should be inspected after periods of heavy precipitation because some material may run into adjacent sinkhole voids causing a surface depression. In this case, maintenance will include adding soil material at the surface. The existing land use or practice may continue over the treated sinkhole as long as the treatment is maintained.

Treatment for Sinkholes with Drainage Areas of 5 Acres or More and Having a Safe Outlet

The following additional treatment criteria are applicable to sinkholes with drainage areas of 5 acres or more where a safe outlet can be provided to divert surface water away from the sinkhole. A safe outlet is one that does not erode, divert surface water to another sinkhole or injection well, or cause flood damage to crops, property, buildings, or highways/roads.

Surface water control measures should be situated to reduce the internal drainage area around the sinkhole to less than 5 acres. The choice of surface water control measures is generally based on site-specific conditions.

Treatment for Sinkholes with Drainage Areas of 5 to 15 acres and Having No Safe Outlet

Treat the sinkhole using the mitigation design in Figure 2 of this guidance document. The site should be inspected after periods of heavy precipitation because some material may run into adjacent sinkhole voids causing a surface depression. In this case, maintenance will include adding soil material at the surface. The sinkhole should remain as unused land.

Vegetated Buffer Area

A vegetated buffer area should be installed around the sinkhole to improve runoff water quality by filtration and adsorption of contaminants. The vegetated buffer area should be installed within the sinkhole drainage area and should begin at the treated sinkhole.

The minimum width (in feet) of the vegetated buffer area is determined by multiplying the sinkhole drainage area (in acres) by seven. This width should provide beneficial filtering for some distance outside the sinkhole because surface water runoff may be temporarily held before reaching the treated sinkhole.

Appropriate vegetation should be used for the buffer area. Use native vegetation as much as possible. **DO NOT** use noxious plants or weeds. It is recommended that a plant nursery be consulted for the appropriate vegetation.

Acceptable Materials

Engineering fabric - must meet the applicable requirements of AASHTO M-288.

Aggregates – fine aggregates, gravel, or rock rip rap that conforms to the West Virginia Department of Highways, Standard Specifications for Roads and Bridges, Sections 702, 703, and 704.

Specifications

Use the following guidance for installing a mitigation design for sinkholes and sinkhole areas with drainage areas of less than 5 acres:

1. Remove and properly dispose of materials dumped in and around the sinkhole in accordance with applicable federal, state, and local laws.

2. Excavate loose material from the sinkhole and try to expose the solution void(s) in the bottom. Enlarge the sinkhole, as necessary, to allow for installation of the filter material.

3. Select stone that is approximately 1.5 times larger than the solution void(s). Place the stone into the void(s) forming a competent bridge. Stone used for the bridge should have rock strength equal to, at least, moderately hard (*e.g.*, resistant to abrasion or cutting by a knife blade but can be easily dented or broken by light blows with a hammer). Shale or similar soft and non-durable rock is not acceptable.

4. Place a layer of filter material over the bridge to a minimum thickness of 24 inches. Approximately 35 percent of the material should be larger than the opening between the bridge and the void(s). There should be no discernable large openings around the bridge. The material should be either gabion stone, stone for rip rap, or stone for special rock fill that conforms to West Virginia Department of Highways, *Standard Specification Roads and Bridges*, Section 704.

5. Place a layer of smaller size filter material over the previous layer to a minimum thickness of 10 inches. The size of the material should be ¼ to ½ the size of that used in the previous layer. The material should be No. 57 aggregate, which conforms to West Virginia Department of Highways, *Standard Specifications Roads and Bridges*, Sections 703.1.1, 703.1.2, 703.1.3, 704.1.4, and 703.2.1. Unacceptable filter material consists of pea gravel or slags (steel, electromagnetic, or power plant).

6. Place a layer of sand-sized filter material over the previous layer ~~at~~ to a minimum thickness of 10 inches. The sand must be compatible in size with the previous layer to prevent piping. The material should be fine aggregate that conforms to West Virginia Department of Highways, *Standard Specification Roads and Bridges*, Sections 702.1.1, 702.1.2, and 702.1.3.

7. Engineering fabric conforming to AASHTO M 288 may be substituted for the stone and sand filter materials discussed in 5 and 6.

8. Backfill over the top filter layer or engineering fabric with soil material to the surface. This should be mineral soil with at least 12 percent fines. Reuse soil material excavated from the sinkhole as much as possible and place any available topsoil over the backfill. Overfill by about 5 percent to allow for settling.

9. Establish vegetation on the mitigated sinkhole and other disturbed areas of the site.

Use the following guidance for installing a mitigation design for sinkholes and sinkhole areas with drainage areas of 5 to 15 acres:

1. Remove and properly dispose of materials dumped in and around the sinkhole.

2. Excavate loose material from the sinkhole.

3. Place a layer of filter material into the sinkhole, allowing the stone to fill the void(s) below the bottom of excavated sinkhole. The size should be ¼ to ½ the size of the void(s). This material can be WVDOH gabion stone, rip rap stone, or special rock fill stone.

4. Place a layer of the same size filter material to a thickness of about ¾ TD (TD = total depth) above the sinkhole bottom.

5. Place a layer of smaller size filter material over the previous layer to a thickness of about ¼ D. Bring this layer to surface level. The size should be ¼ to ½ the size of the previous layer. The material should be No. 57 aggregate, which conforms to West Virginia Department of Highways, *Standard Specification Roads and Bridges*, Sections 703.1.1, 703.1.2, 703.1.3, 703.2.1, and 704.1.4. Unacceptable stone consists of pea gravel or slags (steel, electrometallurgical, or power plant).

6. Shale or similar soft and non-durable rock is not acceptable.

7. Establish vegetation on the mitigated sinkhole and disturbed areas of the site.

Engineering Fabric Requirements for Subsurface Drainage

Engineering fabric used in the mitigation of sinkholes should meet the applicable requirements of AASTHO M 288, Section 7.2

Engineering Fabric Installation

Proper construction and installation techniques are essential to ensure that the intended function of the engineering fabric is fulfilled.

When sewn seams are necessary, the seam strength must be equal to or greater than 90 percent of the specified grab strength, as measured in accordance with ASTM D 4632.

When sewn seams are used for the seaming of the engineering fabric, the thread must be high strength polypropylene, or polyester. Nylon thread is unacceptable.

For Sinkhole Mitigation Design A, place the engineering fabric loosely, with no wrinkles or folds, and with no void spaces between the fabric and the bridge. Overlap successive sheets of engineering fabric a minimum of 12 inches, with the upstream sheet overlapping the downstream sheet.

Prior to covering, the engineering fabric should be inspected to ensure that it has not been damaged (*e.g.* holes, tears, rips) during installation. An engineer or the engineer's designated representative should conduct the inspection. The designated representative should be a certified field inspector.

Damaged fabric must be repaired immediately. Cover the damaged area with an engineered fabric patch that overlaps to 12 inches beyond the damaged area.

Any damaged engineering fabric that cannot be repaired shall be replaced as directed by the engineer.

Place material over the engineering fabric in such a manner as to avoid stretching and subsequently tearing the fabric. Do not drop stone and soil placement from a height greater then one meter. Do not allow stone with a mass of more than 100 kg to roll down the slope of the sinkhole.

Grading the sinkhole slope is not permitted if the grading will result in the movement of the stone directly above the engineering fabric.

Operation and Maintenance

The owner/operator is responsible for maintaining the mitigated sinkhole and sinkhole area. At a minimum, the following maintenance practices should be performed:

1. Mow grass and plantings as necessary to promote vigorous growth.

2. Inspect mitigation measures at least twice a year and after all major rain events. Repairs to the sinkhole mitigation measures should be made promptly were warranted.

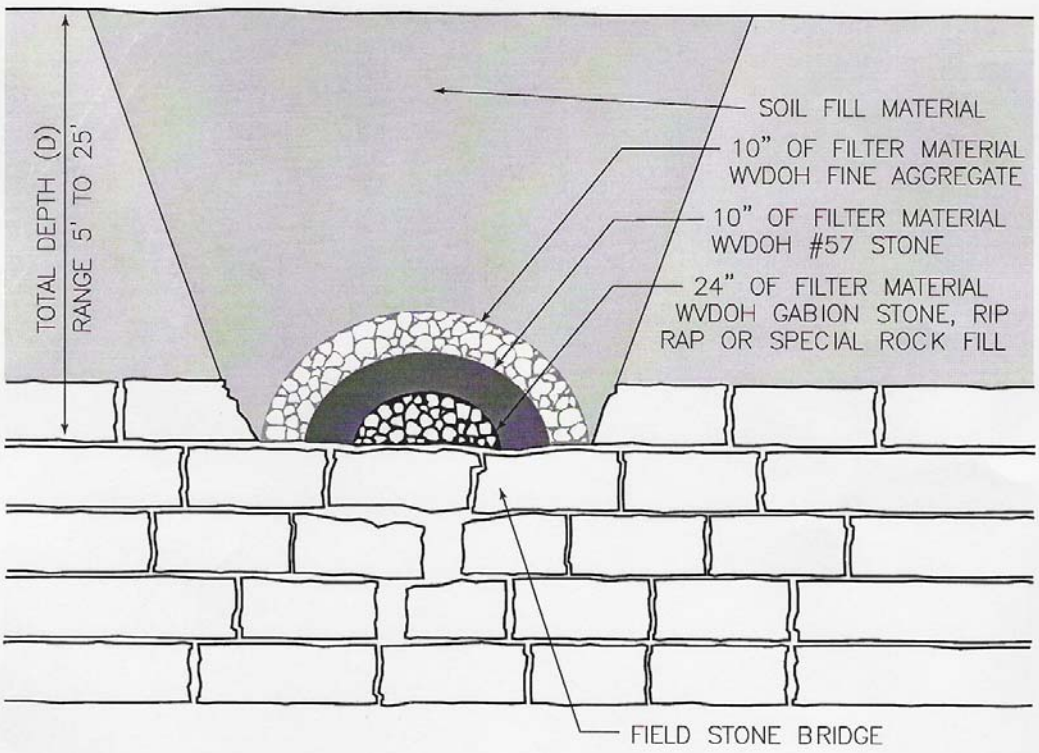
References:

USDA Natural Resources Conservation Center, January 2004. *Maryland Conservation Practice Standard, Sinkhole and Sinkhole Area Treatment, Code 725.*

West Virginia Department of *Highways, Standard Specifications Roads and Bridges*, 2000, Section 702, "Fine Aggregates", Section 703, "Coarse Aggregates", Section 704, "Stone and Crushed Aggregate", Section 715, "Miscellaneous Materials".

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SINKHOLE MITIGATION GUIDANCE

FIGURE 1



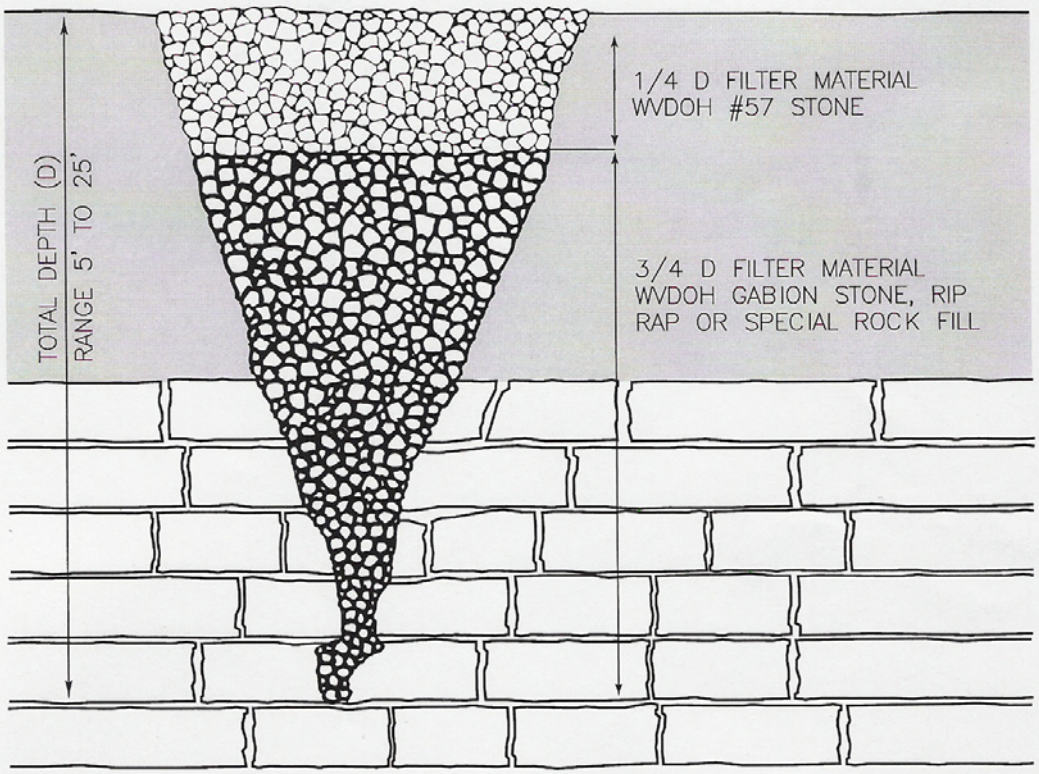
NOTE:
A NONWOVEN GEOTEXTILE MEETING AASHTO M288, SECTIONS 7.1+7.2 MAY BE SUBSTITUTED FOR THE WVDOH #57 STONE AND WVDOH FINE AGGREGATE

SINKHOLE MITIGATION

(DRAINAGE AREA LESS THAN 5 ACRES)

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SINKHOLE MITIGATION GUIDANCE

FIGURE 2



SINKHOLE MITIGATION

(DRAINAGE AREA 5 TO 15 ACRES)

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

KARST SINKHOLE TREATMENT

(No.)

CODE 527

DEFINITION

The treatment of sinkholes in karst areas to reduce contamination of groundwater resources, and/or to improve farm safety.

PURPOSE

This practice may be applied as part of a conservation management system in karst topography, which is an area underlain by solutioned carbonate bedrock with sinkholes and caverns. The practice supports one or more of the following purposes:

- Improve water quality
- Improve farm safety

CONDITIONS WHERE PRACTICE APPLIES

On any land surface or in conjunction with any existing practice where the soils and geologic conditions are characterized by sinkholes or karst topography.

This practice does not apply to erosional or collapse features caused by failure or leakage of underground pipes or constructed surface drainage features (e.g., canals), or due to piping of unstable soil materials, or due to poorly compacted or poorly constructed features.

This practice does not apply to sinkholes that may appear in or beneath structures or in flowing streams. Treatment of sinkholes in these areas will be determined through engineering investigations and structural design solutions.

CRITERIA

General Criteria Applicable to all Purposes

The installation and operation of karst sinkhole treatment(s) will comply with all Federal, State, and local laws, rules, and regulations.

A geologic investigation of the potential impact of the treatment on groundwater, surface water run-in, and the karst features will be conducted by a qualified geologist.

Trash and other material will be removed from the sinkhole and disposed of in an environmentally sound manner.

Excess surface water caused by construction activities will be diverted from the sinkhole area.

Nutrient and pest management plans will be developed for the drainage area of the sinkhole controlled by the landowner.

Vegetative Treatment. All sinkholes treated will have a vegetated buffer established and/or maintained. The buffer will be a minimum of 25-feet wide measured from the rim of the sinkhole. The buffer area may be extended to prevent concentrated flow channels from occurring and entering the sinkhole. The width of the vegetated buffer will be established and maintained in accordance with the type of buffer chosen. The sinkhole and surrounding buffer area will be fenced.

Livestock will be excluded from the vegetative buffer except when grazing would be beneficial to maintenance of the buffer.

Nutrients, herbicides, pesticides, and animal waste will not be applied within an established buffer area. Only mechanical treatments shall be used for weed control.

Appropriate erosion and sediment control measures will be used to reduce the amount of sediment entering sinkhole openings during the establishment of the vegetative buffer.

Surface Water Control. Changes to the volume of surface water that enters a sinkhole may disturb the underground hydrology. To the extent possible, the surface water flow should be maintained at historic (or predevelopment) volumes.

Pre-existing concentrated flow channels will be stabilized but should not otherwise be altered. If a plug or inverted filter is used, the area to be protected will be characterized by a qualified Geologist to enable a suitable design. Concentrated flow caused by construction activities will be dispersed with a suitable spreading or diversion technique.

Sinkhole Treatment/Closing. Adequate protection of most sinkhole and sinkhole areas can be achieved by the use of vegetative buffers and livestock exclusion. However, if an open sinkhole is a safety hazard, it may be treated with a rock filter, gabions, or other methods approved by the State Conservation Engineer or delegated authority.

Sinkholes to be treated or closed via a reverse filter or plug shall be excavated to stable, unweathered bedrock, if possible, prior to construction.

Sinkholes that open into caves shall not be filled under any circumstances. Gated openings may be used for safety reasons.

CONSIDERATIONS

Current and planned land use should be considered. In particular, structures, septic drain fields, wells, feedlots, ponds, and animal waste storage systems should not be located over a sinkhole site or within the impact area.

Sinkholes may be natural conveyances of organic material and nutrients important to cave fauna.

For a sinkhole receiving contaminated overland flow, every effort should be made to first treat the source of the contamination. Although it is important to maintain the hydrology of the karst system, it may be more beneficial to the groundwater quality to divert the contaminated water away from the sinkhole. In some cases, it may be necessary to completely plug a sinkhole with sealing materials rather than treat it with an inverted filter. Acceptable sealing materials are provided in ASTM D 5299, part 6.4. An example of this would be a sinkhole in a feedlot or a site that is difficult to protect by any other method.

The sinkhole treatment should not result in excessive surface water ponding or high soil moisture conditions over an extended period of time.

When filling a sinkhole, mounding of the fill material may be needed to offset future settlement due to consolidation and migration of the fill material into subsurface voids. Additional fill may be required as treatment ages.

Treatment of one sinkhole may have an effect on other sinkholes or solution features in the vicinity.

The use of a conservation easement for the buffer and sinkhole should be considered.

PLANS AND SPECIFICATIONS

Plans and specifications for Sinkhole and Sinkhole Area Treatment will be in keeping with this standard and will describe the requirements for applying the practice to achieve its intended purpose.

Plans and specifications shall include the following:

- Plan view showing sinkhole and sinkhole area Include topographic information and photographs
- The geologic investigation will include a study of potential impacts on the karst resource
- Depth to stable, unweathered bedrock
- Description of planned treatment measures
- The drainage area of sinkhole delineated on a topographic map
- Availability of safe outlet for surface water, if applicable
- Operation and Maintenance requirements
- Special safety requirements

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan will provide specific instructions for maintaining the sinkhole and sinkhole area treatment, including reference to periodic inspections and the prompt repair and/or replacement of damaged components.