ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

and

DOMINION ENERGY TRANSMISSION, INC.
SUPPLY HEADER PROJECT

Supplemental Filing
June 9, 2017

APPENDIX D

Agency Correspondence for the Atlantic Coast Pipeline

APPENDIX D

Supplemental Summary of Public Agency Correspondence for the Atlantic Coast Pipeline

Agency/Contact Name(s)	Date of Correspondence	Format	Description
MULTIPLE AGENCIES			
U.S. Forest Service, National Park Service			
Clyde Thompson, Joby Timm, Mark Woods, Wendy Janssen	6/6/17	Letter	Transmittal of updated visual impact assessment.
FEDERAL AGENCIES			
U.S. Army Corps of Engineers			
Jean Gibby, Samantha Dailey, Emily Greer, Eric Reusch	3/28/17	Minutes	Discussion of Project updates and compensatory mitigation.
STATE/COMMONWEALTH AGENCIES			
VIRGINIA AGENCIES			
Virginia Department of Environmental Quality			
Melanie Davenport	5/31/17	Letter	Response to VDEQ's request for information for developing and evaluating additional conditions for Section 401 water quality certification.
NORTH CAROLINA AGENCIES			
North Carolina Department of Natural and Cultural Resources			
Laura Robinson	6/6/17	Emails	Concurrence on NC Rare Plant Surveys.

Multiple Agencies

U.S. Forest Service, National Park Service

Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, VA 23060
DominionEnergy.com

Dominion Energy®

June 6, 2017

Mr. Clyde Thompson
Forest Supervisor
U.S. Forest Service, Monongahela National Forest
Forest Supervisor's Office
200 Sycamore Street
Elkins, WV 26241

Mr. Joby Timm
Forest Supervisor
U.S. Forest Service, George Washington and Jefferson National Forest
Forest Supervisor's Office
5162 Valleypointe Parkway
Roanoke, VA 24019

Mr. Mark Woods
Superintendent
National Park Service – Blue Ridge Parkway
199 Hemphill Knob Road
Asheville, NC 28803

Ms. Wendy Janssen
Superintendent
National Park Service – Appalachian National Scenic Trail
PO Box 50
Harpers Ferry, WV 25425

Dear Mr. Thompson, Mr. Timm, Mr. Woods, and Ms. Janssen,

As you are aware, Atlantic Coast Pipeline, LLC (Atlantic) 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 Energy Transmission, Inc., a subsidiary of Dominion Energy, to construct and operate the ACP on behalf of Atlantic.

In support of its Project, Atlantic prepared a Visual Impact Assessment (VIA) which provided an analysis and simulations of potential views from key observation points in the vicinity of the proposed ACP where it crosses U.S. Forest Service (USFS) and National Park Service (NPS) lands. Atlantic previously provided the VIA to your offices for review and comment. Atlantic recently updated the VIA to address comments on the visual analysis provided by the USFS. The updated VIA is appended on the attached DVD.

Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, VA 23060
DominionEnergy.com

Atlantic would appreciate any comments you or your staffs have on the updated VIA. Please contact Richard Gangle at (804) 273-2814 or Richard.B.Gangle@dominionenergy.com if there are questions regarding this submittal.

Please direct written responses to:

Richard Gangle
Dominion Resources Services, Inc.
5000 Dominion Boulevard
Glen Allen, Virginia 23060

Sincerely,

Robert M. Bisha
Technical Advisor, Atlantic Coast Pipeline

cc: Jennifer Adams – USFS
Mary Krueger – NPS
David Anderson - NPS

Enclosures

Updated Visual Impact Assessment (DVD)

Federal Agencies

U.S. Army Corps of Engineers – Wilmington District

ATLANTIC COAST PIPELINE PROJECT
MEETING MINUTES

MEETING WITH (COMPANY/AGENCY):
U.S. Army Corps of Engineers (Corps) Wilmington District
Atlantic Coast Pipeline (ACP) Project Coordination Meeting

DATE:	LOCATION:
March 28, 2017	Wilmington District, Raleigh Field Office Raleigh, North Carolina

ATTENDEES AND THEIR AFFILIATION:
Jean Gibby, Chief, Raleigh Regulatory Field Office – USACE Wilmington District
Samantha (Sam) Dailey, Project Manager Regulatory Specialist, Raleigh Regulatory Field Office – USACE Wilmington District
Emily Greer, Regulatory Specialist, Wilmington Regulatory Field Office – USACE, Wilmington District
Eric Reusch, Wilmington Regulatory Field Office – USACE, Wilmington District
Spencer Trichell, Environmental Consultant – Atlantic Coast Pipeline – Dominion Resources Inc.
Linda Morrison, Senior Advisor, USACE Corps Process – Dawson & Associates, Inc. - Dominion contractor
Tony Nardo, ACP Permitting – NRG – Dominion Contractor
TJ Mascia – RES – Dominion Contractor
Daniel Ingram – RES – Dominion Contractor

PREPARED BY:
Tony Nardo

MEETING MINUTES:

Meeting Purpose: To provide an update for the project and to discuss draft supplemental filing and compensatory mitigation plans to complete the PCN application.

Federal Energy Regulatory Commission (FERC) Process and Construction Schedule Updates:
Spencer provided updates to the Notice of Schedule, reviewing that the Draft EIS was issued by FERC on December 30, 2016, with the comment period closing on April 6, 2017, and that the Final EIS is scheduled to be issued by June 30, 2017. With September 28, 2017 being the FERC targeted federal authorization decision deadline, he then discussed that construction is scheduled by Atlantic to begin on November 16, 2017, with tree felling within the right-of-way (ROW) commencing after the bat time of year restriction window. Trees will be cut and cleared later to facilitate construction.

- Biological Assessment (BA) – The draft BA (version 5) was submitted to the FERC with a copy to U.S. Fish and Wildlife Service (USFWS) and the Districts on January 27, 2017. The USFWS has indicated that the draft BA is in good condition, but had requested some minor changes be made during a meeting on March 16, 2017. Another meeting with the USFWS is scheduled for March 29, 2017 to discuss edits and resubmittal of a revised draft BA (version 6) to FERC that would be acceptable to the USFWS, to then begin formal consultation. Atlantic has requested that once the revised draft BA is submitted to the FERC, that the FERC and USFWS will begin formal consultation soon thereafter.
- Migratory Bird Treaty Act (MBTA)/Bald and Golden Eagle Protection Act (BGEPA) – Atlantic submitted a draft Migratory Bird Plan (MBP) to FERC, along with the draft BA, on January 27,

2017, with a copy provided to USFWS and the Districts. Dominion is working toward a final MBP that will be acceptable to FERC and the USFWS.

- Section 106 Process – Atlantic has 3 miles of surveys remaining within SAW regulatory boundaries (approximately 98% to 99% complete). Atlantic met with the North Carolina State Historic Preservation Office (NCSHPO) on March 24, 2017 to discuss the Project. NCSHPO and Atlantic are working closely to address impacts to historic resources.
- District NWP 12 Verification Decision Timetable – Spencer inquired about the timing of the final supplement submittal in order to complete the PCN application and meet the November 2017 planned project construction start. He stated that the final submittal would likely be in the June/July time period. Jean stated that the USACE required completion of the Section 7 and Section 106 process including any signed MOA before verifying the NWP 12. The MOA once received by the District will then become a permit condition of the NWP verification. The ORM table was discussed with Sam stating that she will work with Dominion to get the table where it needs to be considering the single and complete crossing method that was used in the impact tables provided in the recent supplement. Linda advised that when we met with Josh Shaffer with Pittsburgh District, he had requested GIS Shapefiles and requested if SAW would need those too. Jean advised that she will coordinate with Josh and let Dominion know if she needs them.

Draft PCN Supplement February 24, 2017 submittal: Spencer advised that this draft PCN supplement reflects changes in the route and is close to final, so Atlantic is requesting comments and any questions from the District on the submittal package. Sam stated that the package looked good and no major changes were suggested, advising that she will continue her review. Sam had a question about AP-1 proposed in NC and Spencer explained that AP-1 has approximately 200 linear feet of line in NC and terminates at the compressor station in Northampton County, with no impacts proposed to jurisdictional waters of the U.S. including wetlands.

Access Roads (AR) Improvements: Sam mentioned access roads and the impacts associated with them. Spencer then went over Access Road (AR) temporary impacts versus permanent impacts explaining that the limits of disturbance for access roads is generally assumed at 30 feet wide. Spencer explained that temporary AR impacts may include timber mats or stone installed in wetlands and will need to remain in place for up to one year and then removed. Jean brought up the scenario where timber mats had to be stacked upon each other within a wetland that could become a permanent impact because not all the mats can be recovered out of the wetland, possibly resulting in a permanent fill impact. Jean advised that some proposed AR impacts possibly can be attributed to needed landowner upgrades to the roads under forestry or farming exemptions if the private landowner wants those AR improvements to remain for a farming or forestry use, qualifying for a 404(f) exemption. Jean advised that in the case of a forestry 404(f) exemption, the AR improvements would need to be a part of a forestry plan. She stated that for such AR improvements to qualify for a 404(f) exemption, the landowner would need to apply for confirmation that the proposed AR improvements qualify for the 404(f) exemption and the improvements would need to be made prior to the project commencing, with a written notice provided to the District advising the District that the improvements were completed. She also discussed those AR improvements involving placing stone could be possibly considered a maintenance activity and covered under a NWP 3 authorization. NWP 13 may also be used to perform bank stabilization when replacing a culvert. Sam and Jean suggested making a distinction in future applications between temporary and permanent impacts for ARs. Jean advised as an example, for an AR improvement involving an extension of an existing 30 foot culvert to 40 feet, the additional 10 foot extension would be the impact, not the entire 40 feet of culvert. Field reviews of ARs with questionable areas will be coordinated and scheduled by Dominion with Sam in order for the District to get a better understanding of the impacts involved and to provide clearer guidance to Dominion. Sam requested that either the acreage or the length and width of streams with permanent

impacts, needed for ORM data, be included in the impact tables with the next supplement submittal and that whichever method is used, to be consistent.

HDD Waterway Crossings & Guidewires: Jean inquired about the crossing of Section 10 Rivers via HDD and the use of HDD guidewires since there is a current in the wire. Spencer explained that the purpose of the guidewire is to track the location of the HDD drill head and that a guidewire is not necessary for crossing large streams/rivers and that another method would be used to guide the drill bit across the waterway such as a gyroscope. He also stated that Atlantic would commit to not using guidewires across Section 10 Rivers for the project.

NWP Program 2017-2022 NWP 12 Conditions: Pearl discussed the trench backfill NWP condition and questioned how Atlantic would ensure that the top 12 inches of topsoil is returned to the appropriate locations. Spencer explained that the required FERC Procedures outline the segregation of the topsoil from the remainder of the trench fill and that Atlantic will comply with the topsoil segregation condition and replacement of the topsoil within the trench as required by the NWP condition. Tony referred to the Appendix E – Figure D-4 within the supplement that shows the segregation of the top soil excavated from the trench. The figure shows the typical construction ROW in wetlands and how the topsoil pile is separated from the ditch material by a 5-foot strip so as not to mix the different layers.

Compensatory Wetland/Stream Mitigation Plan
Spencer introduced the mitigation discussion for the proposed project, advising that the draft Mitigation Plan includes utilizing the Lowlands site as a PRM site, as previously coordinated with the District, and introduced RES who is Atlantic's mitigation contractor.

Temporary Construction ROW Mitigation: Spencer then discussed that tree stumps would not be removed in wetlands outside of the area over the trench excavation, unless for safety reasons, and asked if compensatory mitigation involving replanting would be required outside of a 30-foot permanently maintained ROW, since the tree stumps will regenerate. Jean advised that the District has reevaluated its initial mitigation guidance within the temporary ROW and decided that no replanting in wetlands would be required, beyond restoration of preexisting elevations and reseeding with native wetland seed mix, if the stumps are left in the ground within the temporary construction ROW since they would regenerate reestablishing the wetland vegetation. Jean discussed that there are some wetland types that will not regenerate from stumps, such as pine flatwoods within Carolina Bays, and that these areas may be required to be replanted in order to 'jump start' the regrowth. Jean also advised that no monitoring within the temporary ROW would be required by the District. Spencer also asked about the 15 foot area that will remain between the collocated existing Transmission Line and the ACP, and asked since this is such a narrow area, will it need to be replanted. Jean advised that her team would discuss how to deal with the pine flatwoods in Carolina Bays, as well as the narrow area between utility lines, with the District's Interagency Review Team (IRT) and get back to Spencer.

Conceptual Umbrella PRM Mitigation Plan: TJ and Daniel then discussed the mitigation options for the project. Daniel indicated that five watersheds do not contain any mitigation banks and that Permittee Responsible Mitigation (PRM) would need to be utilized, with sites having been field identified and under review for inclusion as proposed PRM sites. TJ and Daniel discussed a possible umbrella approach to the PRM sites where there would be a framework provided for the evaluation of potential sites so that the permit could be issued without all of the sites being approved and finalized. Sam and Jean stated they would discuss the proposed umbrella approach at the upcoming District IRT meeting, advising that such a method had not been used before so they were unsure whether such a method would be approved by the District. TJ asked about the use of riparian PRM sites to incorporate mitigation for non-riparian impacts,

since riparian mitigation needs larger sites within the 15 to 30 acre size range to be successful. TJ explained that based on experience, the likelihood of success is small with a 10 acre non-riparian mitigation site, so by incorporating both riparian and non-riparian mitigation together, the sites will be larger and increase the probability of success. Jean stated she will also discuss this question with the IRT and get back to Dominion.

Action Items

1. **Access Road Improvements** - Spencer to send Sam a list of the access roads with questionable improvement impacts and permitting requirements and will schedule a field visit to review several of the proposed road sites.
2. **Timber Mats Guidance** - Jean will review the threshold for timber mat stacking and where it crosses from being considered a temporary impact to a permanent impact. Spencer will also inquire with Engineering about the planned use of mats and provide that information to the District.
3. **Mitigation Plan** –
    a. Jean will discuss with the District IRT the following and get back to Dominion with District guidance:
        1) Dominion's proposed PRM Umbrella Approach
        2) Incorporating mitigation for non-riparian impacts within riparian PRM sites
        3) How to deal with the pine flatwoods in Carolina Bays, as well as the narrow area left between collocated utility lines.

4. **GIS Shapefiles** - Jean advised that she will coordinate with Josh and let Dominion know if she needs them.
5. **Atlantic's Future Supplemental Filings** –
        1) Distinguish between temporary and permanent impacts for Access Roads
        2) Include in the Impact Tables either the acreage or the length and width of streams with permanent impacts, needed for ORM data and be consistent with whichever method is used.
        3) Include Atlantic commitment to not using guidewires across Section 10 Rivers for the project.

Attachments:

Attachment 1: Meeting Sign In sheet

State/Commonwealth Agencies

Virginia Agencies

Virginia Department of Environmental Quality

Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, VA 23060
DominionEnergy.com

May 31, 2017

ELECTRONIC MAIL

Ms. Melanie D. Davenport
Virginia Department of Environmental Quality
Director, Water Permitting Division
P.O. Box 1105
Richmond, VA 23218

Re: Dominion Energy Transmission, Inc., Atlantic Coast Pipeline – Response to Virginia Department of Environmental Quality Request for Information for Developing and Evaluating Additional Conditions for Section 401 Water Quality Certification for Interstate Natural Gas Infrastructure Project

Dear Ms. Davenport:

Please find enclosed response materials to the Virginia Department of Environmental Quality (VDEQ), May 19, 2017 "Request for Information for Developing and Evaluating Additional Conditions for Section 401 Water Quality Certification for Interstate Natural Gas Infrastructure Project". Atlantic Coast Pipeline, LLC (Atlantic) is submitting the response for the proposed Atlantic Coast Pipeline Project (ACP or Project) to assist VDEQ in review of the Project under Commonwealth of Virginia's 401 Water Quality Certification program.

Atlantic is a company formed by four major U.S. energy companies – Dominion Energy, Duke Energy, Piedmont Natural Gas, and AGL Resources. The company was created to develop, own, and perate the proposed ACP, an approximately 600 mile-long, interstate natural gas transmission pipeline system designed to meet growing energy needs in Virginia and North Carolina. Atlantic has contracted with Dominion Energy Transmission, Inc, a subsidiary of Dominion Energy, to seek authorization from the Federal Energy Regulatory Commission under Section 7(c) of the Natural Gas Act to construct, own, operate, and maintain the ACP on behalf of Atlantic.

Atlantic appreciates your review of this information. Please contact Richard Gangle at (804) 273-2814 or Richard.B.Gangle@dominionenergy.com, if there are questions regarding this submittal.

Please direct written responses to:

Richard Gangle
Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, Virginia 23060

Sincerely,

Robert M. Bisha
Technical Advisor, Atlantic Coast Pipeline

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

Section 401 Certification Request for Information: Virginia Department of Environmental Quality

Prepared by

ERM

May 2017

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Atlantic	Atlantic Coast Pipeline, LLC
ATWS	Additional temporary workspace
BIC	Atlantic's Best-in-Class Program
BMP	Best Management Practices
COM Plan	Construction, Operation and Maintenance Plan
DETI	Dominion Energy Transmission, Inc.
EI	Environmental Inspector
EPA	U.S. Environmental Protection Agency
ESC	Erosion and Sediment Control
ETS	Endangered, Threatened and Special Concern
FERC	Federal Energy Regulatory Commission
IC	Incremental Control
LOD	limits of disturbance
Plan	*Upland Erosion Control, Revegetation, and Maintenance Plan*
Procedures	*Wetland and Waterbody Construction and Mitigation Procedures*
Project	Atlantic Coast Pipeline
QA/QC	quality assurance and quality control
SPCC	Spill Prevention, Control, and Countermeasures Plan
SSD	Site-specific Designs
SWPPP	Stormwater Pollution Prevention Plan
TDs	Typical Designs
TMDL	Total Maximum Daily Load
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality

1.0 INTRODUCTION

This document has been prepared in response to the Virginia Department of Environmental Quality (VDEQ) "Request for Information for Developing and Evaluating Additional Conditions for Section 401 Water Quality Certification for Interstate Natural Gas Infrastructure Project," dated May 19, 2017. The following information is provided with the intention to provide details on actions that will be implemented to ensure that the Atlantic Coast Pipeline Project (ACP or Project) activities occurring in upland areas do not result in a discharge or otherwise contribute to an exceedance of the Commonwealth of Virginia (Commonwealth) Water Quality Standards. Atlantic Coast Pipeline, LLC[1] (Atlantic) understands that any conditions developed and included in a draft 401 Certificate will be separate and in addition to any other requirements established by the Virginia Water Protection Permit Program, U. S. Army Corps of Engineers permits, stormwater and erosion and sediment control requirements, and any conditions imposed by the Federal Energy Regulatory Commission (FERC).

Atlantic has submitted additional detailed information regarding proposed construction, restoration, and operation measures to the FERC docket (number CP15-554-000). This information is available for viewing on the FERC website (http://www.ferc.gov). Using the "eLibrary" link, select "General Search" from the eLibrary menu and enter the docket number excluding the last three digits in the "Docket No." field (i.e., CP15-554).

The following sections have been organized to address the specific requests of the VDEQ, including:

- A complete listing of the types of project-related upland ground-disturbing activities that would occur within 50 feet of any perennial, intermittent, or ephemeral surface waters.

- Identification of all perennial surface waters within 50 feet of the limit of disturbance (LOD) that are (a) designated as wild/stocked trout streams, (b) identified as endangered/threatened species waters, (c) designated for public water supply, (d) classified as Tier 3 streams, and/or (e) subject to an established total maximum daily load (TMDL) (identifying the pollutant of concern, including sediment, nutrients, or other).

- Permanent right-of-way maintenance measures relevant to minimizing erosion or other water quality impacts.

- A plan detailing measures to be used to protect water quality from acid forming materials.

- Protections to be employed to prevent any potential impacts associated with hydrostatic testing or dust control activities.

[1] Atlantic Coast Pipeline, LLC (Atlantic) is a company formed by four major U.S. energy companies—Dominion Resources, Inc. (Dominion); Duke Energy Corporation; Piedmont Natural Gas Co., Inc.; and Southern Company Gas, Inc. Dominion Energy Transmission, Inc. has been contracted by Atlantic to construct and operate the project.

- A plan addressing how riparian buffers will be protected to the extent feasible during construction for additional protection of water quality.

- A Spill Prevention Control and Countermeasures (SPCC) Plan.

- Specific engineering and best management practices (BMPs) to be used in areas of steep slopes and slide prone areas.

- A Blasting Plan detailing measures to be used to protect water quality in connection with blasting activities.

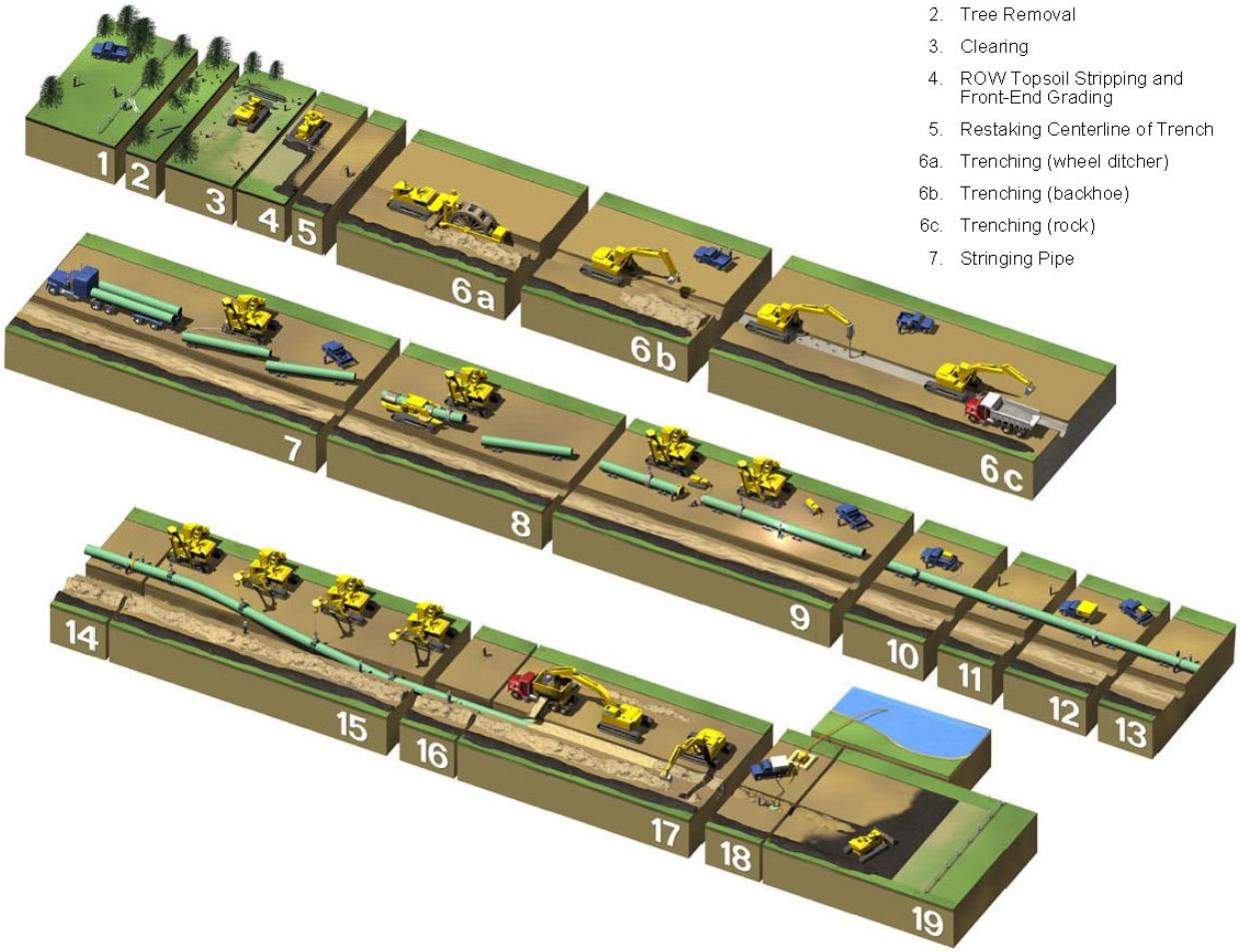
- A Water Quality Monitoring Plan detailing measures to monitor potential impacts to water quality from upland ground-disturbing activities, including a discussion of (a) criteria to identify select critical areas for monitoring with consideration of wild/stocked trout streams, endangered/threatened species waters, public water supplies, TMDL watersheds, Tier 3 streams, or areas near acidic soils; (b) a proposed monitoring schedule (e.g., before, during and after construction activity); (c) chemical monitoring parameters (e.g., temperature, dissolved oxygen, specific conductance, pH, and turbidity) and biological monitoring using VDEQ-approved methods; (d) sample collection, handling and analytical quality QA/QC procedures; and (e) reporting procedures.

- A Karst Mitigation Plan including discussion of measures to (a) identify known karst features within areas of land disturbance activities for construction of a pipeline and related access roads and appurtenances; (b) minimize the potential for any impacts to surface waters including water supply sources; (c) evaluate subsurface flow paths; (d) propose monitoring activities during the period of construction; and (e) mitigation measures applicable in the event of any impacts.

- Description of onsite environmental monitoring and inspection measures to be implemented during construction.

2.0 PROJECT RELATED GROUND DISTURBING ACTIVITIES

Construction of the ACP 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 1.1-1 illustrates each of the steps in a typical construction sequence. Of these construction activities, ground disturbance that will occur within 50 feet of any perennial, intermittent, or ephemeral surface waters includes clearing and grading, access road improvements or construction, trenching, lowering in and backfilling, and right-of-way cleanup and restoration. A description of these ground disturbing activities 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

For environmental review purposes only.

Atlantic Coast Pipeline

Dominion Energy

Atlantic Coast Pipeline and Supply Header Project
Figure 1.1-1
Typical Pipeline Construction Sequence

ERM

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DRAWN BY: GIS

Clearing and Grading

To the extent feasible, Atlantic will minimize tree removal during construction. Cleared vegetation and stumps will either be burned, chipped (except in wetlands), or hauled offsite to a commercial disposal facility. No chips, mulch, or mechanically cut woody debris will be stockpiled in wetlands, and no upland woody debris will be disposed of in wetlands. Non-merchantable timber will not be disposed of by placing it off the right-of-way without landowner approval. No woody debris disposal will be allowed in agricultural areas or wetlands. Burning of non-merchantable wood will be allowed only where the contractor has acquired all applicable permits and approvals (e.g., agency and landowner) and in accordance with Commonwealth and local regulations, and only with site-specific approval from Atlantic.

Following clearing, the construction right-of-way and additional temporary workspace (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.

Typically, topsoil will be segregated from subsoil in non-saturated wetlands, cultivated or rotated croplands, managed pastures, hayfields, residential areas, and in other areas requested by the landowner or land managing agency unless Atlantic is instructed by a landowner or land managing agency not to do so or Atlantic import topsoil in accordance with FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan). Topsoil will be segregated in accordance with the Plan and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures), where required. The depth of topsoil removed will depend on soil conditions and landowner requests or land managing agency requirements. In accordance with the Plan, and 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).

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.

Access Roads

Atlantic has identified roads that will be used to provide access to the Project construction right-of-way, permanent easement, and other facilities during construction and operation of the ACP. Atlantic will utilize existing roads to the extent practicable, but some new roads may need to be built in remote areas. Additionally, new roads will need to be built to provide access to aboveground facility sites (i.e., compressor and M&R stations, valves, and pig launcher/receiver assemblies) during operations. 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. A sufficient number of roads with regular spacing are needed to minimize congestion of construction vehicles and equipment on the right-of-way, having fewer access roads would

increase the duration of construction and create unsafe work conditions for workers. If any existing roads are damaged during construction, Atlantic will restore these roads to preconstruction condition or better.

Along temporary access roads temporary timber construction mats, temporary bridges, culverts, or temporary rip rap will be utilized as a temporary means to stabilize access roads for use during construction. Permanent access roads however may require improvements, such as placement of culverts or widening of the roadbed that will remain in place for operation of the pipeline and associated facilities. Where new culvert placement is required or replacement of existing culverts will occur, Atlantic will design culverts and embed culverts according to the appropriate design parameters per USACE general and regional conditions, or state requirements. Details pertaining to the required improvement of access roads will be provided as engineering designs are completed.

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 diameter of the pipe being installed and the substrate in the vicinity of the trench (see Table 2.0-1). The bottom width of the trench will be sufficient to 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 within or off of the construction right-of-way, it will be conducted in accordance with the Plan and Procedures and applicable permits in a manner that will not cause erosion or result in silt-laden water flowing into a wetland or waterbody. In areas of topsoil segregation, 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.

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 (see Section 10.0 and Appendix A for additional information).

TABLE 2.0-1

Typical Trench Dimensions for the Atlantic Coast Pipeline

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 or more
		Steep terrain	30	13.5	7 or more
AP-2	36-inch	Non-agricultural upland	10–15	7	3
		Agricultural	10–15	8	4
		Wetland	15–20	7	3
		Road, railroad, and waterbody crossings	15–20	9	5 or more
AP-3	20-inch	Non-agricultural upland	5–10	6	3
		Agricultural	5–10	7	4
		Wetland	10–15	6	3
		Road, railroad, and waterbody crossings	10–15	8	5 or more
AP-4	16-inch	Non-agricultural upland	5–10	6	3
		Agricultural	5–10	7	4
		Wetland	10–15	6	3
		Road, railroad, and waterbody crossings	10–15	8	5 or more
AP-5	16-inch	Non-agricultural upland	5–10	6	3
		Agricultural	5–10	7	4
		Wetland	10–15	6	3
		Road, railroad, and waterbody crossings	10–15	8	5 or more

Lowering-in and Backfilling

Prior to lowering-in, the trench will be inspected to confirm it is free of rocks and other debris that could damage the pipe or its protective coating. 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 Plan and Procedures 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. As necessary, trench breakers (stacked sand bags or foam) will be installed in the trench around the pipe in steeply sloped areas 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). Excavated rock will then be used to backfill the trench to the top of the existing bedrock profile in the trench, except that large rock will be buried on the working side of the two-tone cut where the contractor levels the ground for construction. This will prevent large rocks from migrating into the pad material in the trench and

making contact with the pipe. Additionally, excavated rock may be 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.

Final 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 required by permits, in accordance with landowner requests, as required by the Plan and Procedures, or as approved by the appropriate agencies. 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 Plan and Procedures or as directed by the appropriate land managing agency. Disturbed, non-cultivated 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.

3.0 IDENTIFICATION OF PERENNIAL SURFACE WATERS

Table 3.0-1 below identifies perennial surface waters within 50 feet of the LOD which do not cross the project workspace and which are included in one of the following categories:

- designated as wild/stocked trout streams;
- identified as endangered/threatened species waters;
- designated for public water supply;
- classified as Tier 3 streams; and/or
- subject to an established TMDL (identifying the pollutant of concern, including sediment, nutrients, or other).

TABLE 3.0-1

Perennial Waterbodies Within 50 feet of Workspace Not Crossed by Workspace along the Atlantic Coast Pipeline in Virginia [a]

Pipeline Segment/County/ City	Milepost	Feature ID	Waterbody Name	Trout Waters	Potential T&E Species	TMDL Watershed (Impairment) [b]
AP-1						Total N, Total P, TSS
Highland County	86.9	shiy001	Erwin Draft			Total N, Total P, TSS
Bath County	99.3	sbaz007	Gibson Hollow			Total N, Total P, TSS
Bath County	99.3	sbaz005	UNT to Gibson Hollow			Total N, Total P, TSS
Bath County	103.1	sbar007	UNT to Mill Creek		UNT to Potential Freshwater Mussels Water	Total N, Total P, TSS
Augusta County	157.4	saua400	UNT to South Fork Back Creek	UNT to Class I-IV Trout Water,		Sediment, Total N, Total P, TSS, Mercury, PCB, E.Coli
Nelson County	161.1	snex005	UNT to Spruce Creek	UNT to Class I-IV Trout Water,		Total N, Total P, TSS, E. Coli
Nelson County	163.1	snex006	Spruce Creek	Class I-IV Trout Water		Total N, Total P, TSS, E. Coli
Nelson County	184.5	snea407	UNT to James River		UNT to Potential Freshwater Mussels Water	Total N, Total P, TSS
Buckingham County	203.7	sbul002	UNT to Willis River			Total N, Total P, Fecal Coliform
Cumberland County	213.1	scuk003	UNT to Little Willis River			Total N, Total P, Fecal Coliform
Highland County	Contract or Yard	shic100	UNT to Jackson River			Total N, Total P, TSS
City of Suffolk	56.5	ssup025	UNT to Cohoon Creek			Total N, Total P, TSS, Fecal Coliform, Enterococci
City of Chesapeake	57.9	ssuo104	UNT to Western Branch Reservior			Total N, Total P, TSS, Fecal Coliform, Enterococci
City of Chesapeake	71.7	schr012	UNT to East Ditch			Total N, Total P, TSS, Enterococci
City of Chesapeake	74.6	schr002	UNT to Dismal Swamp			Total N, Total P, TSS, Enterococci
City of Chesapeake	78.6	scho011	UNT to Deep Creek			Total N, Total P, TSS, Enterococci
City of Chesapeake	78.9	scho006	UNT to Deep Creek			Total N, Total P, TSS, Enterococci

TABLE 3.0-1

Perennial Waterbodies Within 50 feet of Workspace Not Crossed by Workspace along the Atlantic Coast Pipeline in Virginia [a]

Pipeline Segment/County/ City	Milepost	Feature ID	Waterbody Name	Trout Waters	Potential T&E Species	TMDL Watershed (Impairment) [b]
City of Chesapeake	79.4	scho007	UNT to Deep Creek			Total N, Total P, TSS, Enterococci

[a] There are no Tier 3 streams or designated public water supply sources associated with streams within 50 feet of the workspace but not crossed by the Project.

[b] Impairment abbreviations for watersheds with total maximum daily load (TMDL) include: Total Nitrogen = Total N; Total Phosphorus = Total P; Total Suspended Solids = TSS; Mercury in Fish Tissue = Mercury; Polychlorinated biphenyl in Fish Tissue = PCB; remaining entries are bacteriological nomenclature.

4.0 PERMANENT RIGHT-OF-WAY MAINTENANCE MEASURES

Atlantic will stabilize the permanent right-of-way through the use of industry-standard construction and maintenance practices, such as restorative grading, soil compaction mitigation, and revegetation, as well as implementation of Atlantic's Best-in-Class (BIC) Program in steep slope terrain. Atlantic will restore the right-of-way to meet the VDEQ's stormwater management regulatory requirements (9 Virginia Administrative Code [VAC] 25-870 et seq.).

Atlantic is providing the VDEQ, as a component of the construction stormwater permitting, a quantitative evaluation that includes an analysis of water quality and quantity and demonstrates that post-construction runoff characteristics for ACP will remain hydrologically equivalent to pre-construction runoff characteristics.

Successful management of post-construction runoff from the right-of-way will include the following non-structural BMPs: proper grading to minimize concentrated flow and restore pre-construction flow patterns; mitigation of soil compaction to improve infiltration and decrease runoff volume; and establishment of permanent vegetation. Annual maintenance and inspection programs for the right-of-way will be implemented to provide long-term vegetation management and runoff control.

Through the implementation of these non-structural BMPs, post-construction runoff characteristics of the land surface after the completion of construction and final stabilization will be equivalent to pre-construction conditions. Calculations which demonstrate hydrologic equivalency of the post-construction condition with the pre-construction condition and compliance with Virginia's water quality and quantity criteria as set forth in 9 VAC 25-870-63 and 9 VAC 25-870-66, respectively, and related VDEQ guidance have been prepared and are included in the Virginia ACP *Stormwater Pollution Prevention Plan* (SWPPP) submission. Restoration and maintenance methods used to meet water quality and quantity design criteria and compliance standards of the VDEQ regulatory program are summarized as below.

Grading

Atlantic is required by FERC to restore the ground surface as closely as practicable to original contours to restore natural overland water flow patterns, aquifer recharge, and drainage

patterns. FERC has an established process to review and approve any changes to this requirement in advance while in the field. The FERC variance request process will be included in the SWPPP to be submitted to the VDEQ.

Restoration of the right-of-way 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 measures to minimize post-construction erosion and to control post-construction stormwater runoff. 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.

Additionally, in areas with slope inclinations equivalent to or greater than 30 percent and a slope length greater than 100 feet, 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 right-of-way, and encourage retention of soils;
- the use of additional structural materials (e.g., rock or woody debris) to provide an anchor for revegetation and deposition of soil; and
- the use of grading practices such as stair-stepping or grooving slopes or leaving slopes in a roughened condition by not fine-grading in accordance with Virginia Erosion and Sediment Control Handbook Std & Spec 3.29 (Surface Roughening) on slopes with an inclination exceeding 3 horizontal to 1 vertical (3:1) or that have received final grading but will not be stabilized immediately.

Atlantic will develop and implement other site-specific measures, where warranted, to address land movement, surface erosion, backfill erosion, soil stability, and restoring of the right-of-way in steep slope areas. Specifically, Atlantic is committed to employing measure from the BIC Program to protect the environment in steep slope areas. These measures are the most efficient and protective design or configuration with the least environmental impact while providing reliable construction and operations.

The following special design and construction mitigation measures 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 right-of-way using subsurface drains or other special drainage measures;
- engineering of the backfill around or within steep slope areas to dry the backfill, facilitate 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.

Soil Compaction Mitigation

Atlantic will minimize impacts by implementing the mitigation measures for compaction and rutting as described in the FERC Plan and the ACP SWPPP and approved Erosion and Sediment Control (ESC) plans. Soil compaction resulting from construction activities may reduce the potential for successful revegetation as well as decrease infiltration capability thereby increasing runoff potential. Fine-textured soils with poor internal drainage that are moist or saturated during construction are the most susceptible to compaction and rutting.

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. Mitigation of soil compaction will improve infiltration, decrease runoff volume, and improve growing conditions for vegetation. A description of soil compaction mitigation will be included in the SWPPP to be submitted to the VDEQ.

Atlantic will test for soil compaction using penetrometers or other appropriate devices:

- in residential and agricultural areas (e.g., active croplands, pastures, nurseries, and orchards) disturbed by construction activities;
- in other areas requested by the land managing agency or landowner;
- 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 environmental inspectors (EI), who will be responsible for conducting subsoil and topsoil compaction testing and determining the need for corrective measures.

Where appropriate, such as in steep slope areas, compaction of the soil may be used intentionally to prevent surface erosion and slope instability in the form of landslides, landslips, or surficial slumping. A detailed evaluation and selection of control measures, including mechanical compaction of disturbed slopes, will be implemented in areas of steep terrain in accordance with the BIC Program. A description of soil compaction mitigation will be included in the SWPPP to be submitted to the VDEQ.

Revegetation

A Restoration and Rehabilitation Plan has been prepared for the ACP to address post-construction restoration and rehabilitation activities. The Restoration and Rehabilitation Plan describes seedbed preparation, seed mix selection, seeding methods, lime and fertilizer application, mulching, and supplemental planting. Permanent vegetative cover will be initiated within the timeframes set forth in the Virginia Minimum Standards (9 VAC 25-840-40) and will be considered successfully established when vegetation is uniform, mature enough to survive and will inhibit erosion. The Restoration and Rehabilitation Plan will be appended to the SWPPP to be submitted to the VDEQ.

In accordance with Virginia Minimum Standards (MS-1), permanent or temporary soil stabilization will be applied to denuded areas within seven (7) days after final grade is reached on any portion of the site. Temporary soil stabilization will be applied within seven (7) days to denuded areas that may not be at final grade but will remain dormant for longer than 14 days. Permanent stabilization will be applied to areas that are to be left dormant for more than one (1) year. A permanent vegetative cover will be established on denuded areas not otherwise permanently stabilized. Per Virginia Minimum Standards (MS-3), permanent stabilization is achieved when vegetation is established that is uniform, mature enough to survive and will inhibit erosion.

Maintenance and Inspection

Post-construction maintenance and inspections will be used to monitor the success of the right-of-way restoration and control of stormwater runoff. Atlantic will inspect disturbed areas

after the first and second growing seasons to determine the success of revegetation. In agricultural areas, revegetation will be considered successful when the area has been revegetated and is similar to adjacent undisturbed areas of the same field. In all other non-forested areas, revegetation will be considered successful when the density and cover of non-nuisance vegetation is similar to adjacent areas that were not disturbed by construction activities. In addition, routine operations inspections include visually inspecting the right-of-way once a year.

Following construction, a 50-foot-wide permanent easement will be maintained for operation of the pipeline. Property will be restored as close to its pre-construction condition as practical. In accordance with the FERC Plan and the ACP SWPPP, in non-cultivated uplands, a 10-foot-wide herbaceous corridor will be established and may be maintained annually, as needed. In addition, trees and brush will be cleared over the entire width of the permanent right-of-way on an as-needed basis not to exceed once every three years. In accordance with the Virginia Runoff Reduction Method Instructions and Documentation, dated 28 March 2011, utility rights-of-way that will be left in a natural vegetated state, including areas that will be bush hogged no more than four times per year, are considered hydrologically equivalent to forest/open space.

In wetlands and riparian areas, the FERC 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 trees greater than 15 feet in height within 15 feet of pipelines in wetlands.

Permanent Slope Breakers

In addition to non-structural BMPs, Atlantic will install permanent slope breakers during the construction phase of the Project. The permanent slope breakers will be constructed in accordance with FERC Plan requirements and the ESC Plans. Installed primarily as an erosion control measure, the slope breakers also provide incremental benefit to stormwater management in the near-term post-construction period by preventing erosive flows from exiting the right-of-way.

Permanent slope breakers will be installed during final grading, except in cultivated areas and lawns (unless requested by the landowner), using spacing as shown on the construction alignment sheets. Spacing for permanent slope breakers will be congruent with the FERC Plan requirements and are shown in Table 4.0-1.

Table 4.0-1

Recommended Spacing for Permanent Slope Breakers

Trench Slope	Distance (feet)
5-15	300
>15-30	200
>30	100

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

The use of permanent slope breakers will shorten the drainage path, reduce runoff velocity, and direct water off the right-of-way to a stable well-vegetated area as sheet flow. In the absence of a stable well-vegetated area, an energy dissipating device, such as riprap outlet protection, will be installed at the end of the slope breaker.

Permanent Right-of-Way Maintenance - Conclusion

After the completion of construction and final stabilization, post-construction runoff characteristics will remain hydrologically equivalent to pre-construction runoff characteristics. Atlantic's proposed restoration and maintenance practices meet the relevant Virginia Stormwater Management Program regulatory requirements. In addition, the use of the proposed industry-standard practices is consistent with those required by FERC, and they have been successfully implemented in similar FERC-licensed projects in the Commonwealth.

5.0 PLAN TO PROTECT WATER QUALITY FROM ACID FORMING MATERIALS

The exposure of potentially acid-producing rock or soil materials during excavation can result in the oxidation of iron sulfide minerals in the subsoil or bedrock, thereby producing sulfuric acid. Introduction of sulfuric acid to an adjacent wetland or waterbody could potentially increase the acidity of the water and have negative impacts on aquatic or terrestrial vegetation and wildlife. In addition, incorporation of these materials into the surface could affect revegetation in areas disturbed during construction.

Based on a review of available mapping and agency consultations, several of the geologic formations underlying the ACP are known to contain acid-producing sulfide materials. These formations include consolidated bedrock (e.g., shale and slate) along the inland portions of the Project and unconsolidated marine sediments in the Coastal Plain. A summary of the crossing lengths of these formations by the proposed ACP pipeline facilities is provided in Table 5.0-1. Appendix B includes a more detailed table with the milepost range for each of these units.

TABLE 5.0-1

Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals

Project or Physiographic Province or Unit/Formation	Crossing Length (miles)
ATLANTIC COAST PIPELINE	
Virginia	
Alligator Back Formation	2.1
Ashe Formation	2.3
Candler Formation	4.9
Chesapeake Group	2.8
Millboro Shale and Needmore Formation	9.2
Tabb Formation	13.5
TOTAL	**34.8**

Atlantic will implement a number of measures to avoid or minimize potential impacts resulting from construction activities in areas containing acid-producing rocks or soils. These include the following:

- segregating the top 12 inches of topsoil or all of the soil to the top of an acid producing layer in the trench, whichever is reached first;
- segregating rock or soil from the top of the acid-producing layer to the bottom of the acid-producing layer or to the bottom of the trench, whichever is reached first;
- segregating rock or soil below the acid-producing layer to the bottom of the trench;
- backfilling the trench with acid-producing materials first to a maximum of 12 inches below the surface;
- placing a cover of sand or other clean material around and over the pipe to avoid corrosion; and/or
- applying lime to the topsoil or replacing a minimum of 12 inches of acid-free topsoil.

Atlantic will attempt to limit the duration of stockpiled materials to 30 days or less in areas that contain acid-producing rock or soils. This will reduce the likelihood that these materials are oxidized and acidic drainage is produced. In addition, implementation of the measures outlined in the Plan and Procedures, the ACP SWPPP, and the ESC Plans, such as erosion and sediment controls, will prevent tracking of acid-producing materials along the right-of-way and minimize or avoid impacts on sensitive resources in these areas.

As part of the environmental training, which will be conducted prior to the start of construction, field personnel will be provided the descriptions and potential locations of the geologic formations that could contain significant acid-producing sulfide minerals (e.g., dark subsoils in the Coastal Plain with a sulfurous odor).

The EIs will survey work areas prior to construction for signs of acid-producing materials including sparse vegetation and/or red iron discharges or staining on side slopes. During construction, the EIs will monitor excavation activities and open trenches to identify potential acid-producing formations. The EIs will also monitor stockpiled materials for signs of oxidation and acid drainage. If acid-producing materials are identified, Atlantic will implement the measures outlined above and discussed in Section 6.6.8 of Resource Report 6, which was filed with the FERC Application on September 18, 2015 (Accession Number 20150918-5212).

6.0 HYDROSTATIC TESTING AND DUST CONTROL PROTECTION MEASURES

Water for hydrostatic testing will be withdrawn and discharged in accordance with Commonwealth regulations and required permits. To minimize impacts of short duration, larger volume withdrawals of water from streams, Atlantic will construct pre-fabricated aboveground water impoundment structures adjacent to several of the water withdrawal points. Use of the water holding areas will allow for a longer duration of withdrawal at lower rates to minimize impacts on stream flows. Extending the timeframe for withdrawal of water and complying with Commonwealth regulations and permit requirements will minimize impacts on the aquatic resources within streams used for water withdrawal.

During water withdrawal, surface water intakes will be set in areas of flowing water to avoid sedimentation. The rate of withdrawal will be controlled to assure a continued flow within the surface water source. Typically, water will be withdrawn at a rate of 1,500 to 3,000 gallons per minute at each withdrawal location, unless otherwise specified in applicable permits. Screening on the intakes will be sized according to withdrawal permit requirements. Water withdrawn from waterbodies with known threatened or endangered species will be done so at a rate not to exceed 0.25 feet per second through a screen with a mesh that does not exceed 1 millimeter. Secondary containment will be used on all pumps.

Once hydrostatic testing is complete, the test water will be discharged to well-vegetated upland areas, which will eliminate the translocation of invasive aquatic species that may be present. In addition, this practice will also prevent transporting water from impaired streams (i.e., 303d listed waters) to other waterbodies. Water discharged over land will be directed through containment structures such as hay bales and/or filter bags. The discharge rate will be regulated using valves and energy dissipation devices to prevent erosion. Water will be discharged at a rate commensurate with agency consultations and permit requirements, but will typically range from 1,500 to 2,500 gallon per minute.

No chemicals will be added to the test water during hydrostatic testing. Water will be tested prior to introducing it in the pipeline. The water will be tested again prior to discharge once the hydrostatic test is complete. The water will then be discharged in accordance with the Plan and Procedures, the ACP SWPPP, and the ESC Plans and applicable permits through containment structures such as hay bales and/or filter bags to remove turbidity or suspended sediments (i.e., dirt left in the pipe during construction) and to prevent scour and erosion. Alternatively, the water will be hauled offsite for disposal at an approved location.

Atlantic will not use water from sensitive waterbodies for dust control water or for restoration and revegetation activities. Implementation of the construction and operational practices for FERC-regulated projects (i.e., Plan and Procedures), will also reduce the potential for impacts on listed species. Water used to control dust will be applied at a low rate in order to prevent runoff.

7.0 RIPARIAN BUFFER PROTECTION

In routing the pipeline and selecting crossing methods for waterbodies, Atlantic attempted to minimize the number and lengths of crossings, as well as potential impacts on wildlife, vegetation, and water quality. Atlantic will minimize impacts on riparian buffers by following the Procedures, site-specific modifications to the Procedures requested by Atlantic and approved by the FERC, and additional requirements identified in Federal or Commonwealth wetland and waterbody crossing permits.

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. ATWS will be located at least 50 feet away from the water's edge at each waterbody (with the exception of site-specific modifications as requested by Atlantic and approved by the FERC).

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. Silt fence and/or straw bales (weed-free) located across the working side of the right-of-way will be removed during the day 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). Waterbodies that will be crossed by the horizontal directional drill method (HDD) will avoid impacts to riparian buffers. For the ACP, the HDD method is currently being evaluated for the following six river crossings in Virginia pending the results of geotechnical investigations and final engineering:

- the James River crossing approximately at MP 184.7 of the AP-1 mainline at the Nelson/Buckingham County line in Virginia;

- the Nottoway River crossing approximately at MP 32.6 of the AP-3 lateral in Southampton County, Virginia;

- the Blackwater River crossing approximately at MP 38.6 of the AP-3 lateral at the Southampton County/City of Suffolk line in Virginia;

- the Western Branch Nansemond River crossing approximately at MP 63.6 of the AP-3 lateral in the City of Suffolk, Virginia;

- the Nansemond River crossing approximately at MP 64.4 of the AP-3 lateral in the City of Suffolk, Virginia; and

- the Southern Branch Elizabeth River crossing (part of the Intracoastal Waterway) approximately at MP 81.8 of the AP-3 lateral in the City of Chesapeake, Virginia.

Following construction and 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.

All disturbed banks and riparian work areas will be seeded as soon as possible after final grading, weather and soil conditions permitting and subject to the recommended seeding dates for the area. Seeding is intended to stabilize the soil, improve the appearance of the area disturbed by construction, and restore native flora.

8.0 SPILL PREVENTION, CONTROL, AND COUNTERMEASURES (SPCC) PLAN

To minimize the potential impact of hazardous material spills on water resources during construction and operation of the ACP, Atlantic has prepared and will implement an SPCC Plan. The SPCC Plan is included as Appendix C.

9.0 STEEP SLOPES AND SLIDE PRONE AREAS

The westernmost portion of the proposed AP-1 mainline in Virginia will be constructed in steep, mountainous terrain. Slope instability in the form of landslides, landslips, or surficial slumping can present a significant hazard to pipeline routing, design, construction, and operation in steep slope areas if proper planning and mitigation are not considered in advance. When routing the ACP, the goal was to do so perpendicularly to topographic contours and to minimize routing on steep slopes to the extent practicable, in accordance with Atlantic's program for steep slopes, which includes considerations for slips associated with pipeline construction during routing as well as engineering design, pre-construction planning, construction, and post-construction. Steep slopes have been avoided during routing to the maximum extent practicable and are limited to approximately 46 miles of slopes with an inclination of 30 percent or greater and a length of 100 feet or greater. The BIC Program was designed to proactively address slopes greater than 30 percent and identify mitigation measures beyond standard practices. Details of the BIC Program are provided below and are included in Atlantic's SWPPP.

Atlantic recognizes the increased risk of instability associated with pipeline construction, particularly while traversing steep slopes. As a baseline, Atlantic developed a program for use on projects within steep terrain. The program outlines 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 right-of-way;
- buttressing slopes with sack-crete trench breakers;
- changing slope geometry;
- 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 is dependent on the individual site conditions and constraints.

For the ACP Project, Atlantic is also committed to identifying mitigation measures beyond standard practices through a BIC Program. The focus of the BIC Program is to proactively address steep slopes (defined as slopes with an inclination greater than 30 percent and greater than 100 feet in length) and landslide hazards related to pipeline construction, compressor stations, 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 Carolina, and then exceed 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 and thereby support preparation of steep slope control measures and site-specific ESC Plans for the ACP Project; these plans will be included in the SWPPP. The BIC Program has achieved this by assembling a team of internal Dominion Energy Transmission, Inc. (DETI) stakeholders, along with supporting external subject matter experts, 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 understand if additional mitigation is needed), and operational measures (i.e., monitor and maintain and operate the system, as needed).

The BIC Program Team convened in a series of design workshops to examine the identified hazards and supporting information along the pipeline alignment. The hazards were initially identified by studies such as the Geohazards Assessment or the karst study, and/or from other targeted studies such as the Order 1 Soil Survey. These studies identify and assess or support the review of the hazard, provide a basis to select the appropriate mitigation response to minimize or eliminate the hazard, and then monitor the hazard through ongoing operations.

The conceptual work-flow process of the BIC Program 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). Refer to Figure 9-1 for the conceptual work-flow process diagram describing the general approach.

- 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. Refer to Figure 9-1 for the conceptual work-flow process diagram describing the general approach.

- 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 Program construction practices and/or BMPs. Site and hazard specific plans are being developed based on the recommendations of the Geohazards Analysis Program and mitigation techniques selected by a team of experts. The site and hazard specific plans address the specific geologic hazard (e.g., slip, stream scour, ground displacement) with mitigation measures, as applicable, for construction and/or operation of the Project. Atlantic will incorporate these mitigation measures on ESC Plans in the SWPPP submitted to VDEQ. Additional site-specific design drawings will be submitted to VDEQ construction stormwater review staff at a later date once finalized. Refer to Figure 9-2 for the conceptual work-flow process diagram.

- Hazard Monitoring – Atlantic will monitor mitigation techniques to assess their effectiveness and the need for further mitigation, if appropriate. Refer to Figure 9-3 for a conceptual work flow process diagram.

As one of the initial steps in the BIC Program, Atlantic implemented a comprehensive Geohazards Analysis Program to assess potential geohazards, including slope failures, along the proposed pipeline route. The study for slope failures included:

- 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.

Figure 9-1 Hazard Identification and Assessment

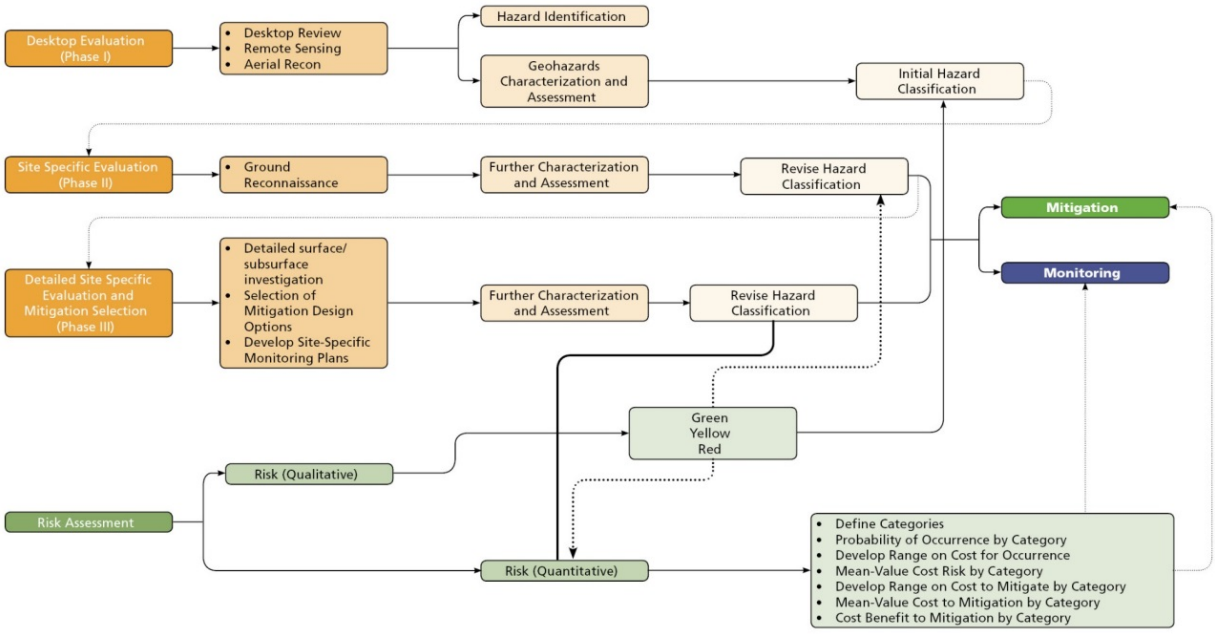


Figure 9-2 Hazard Mitigation

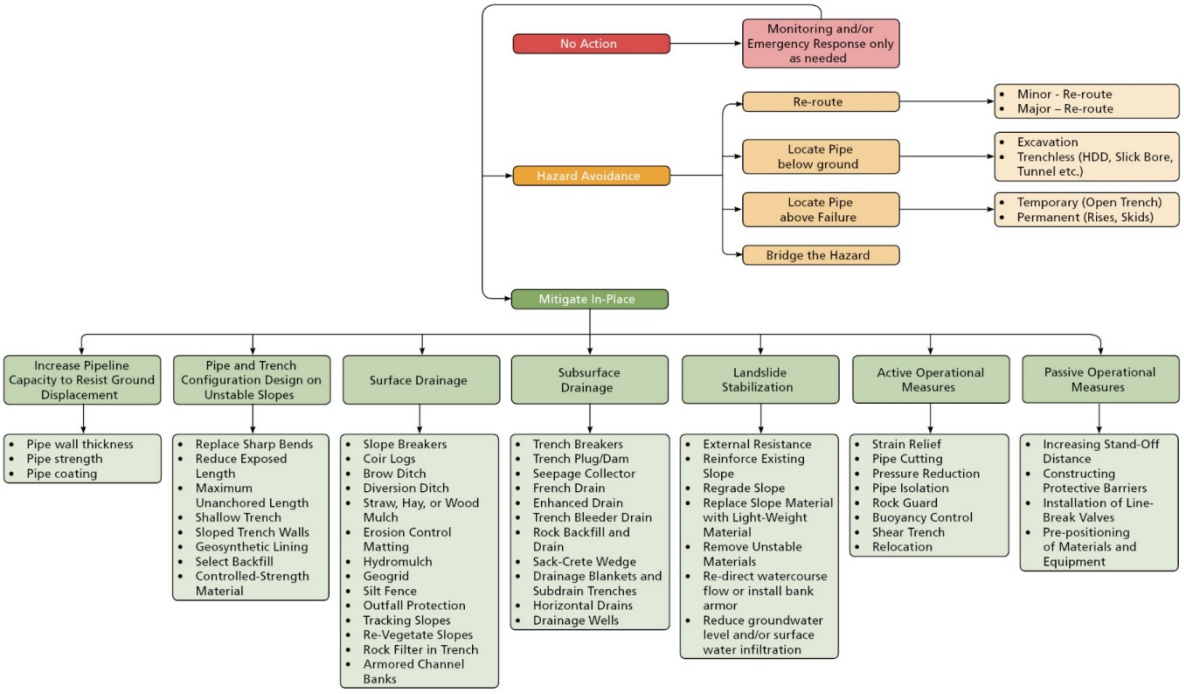
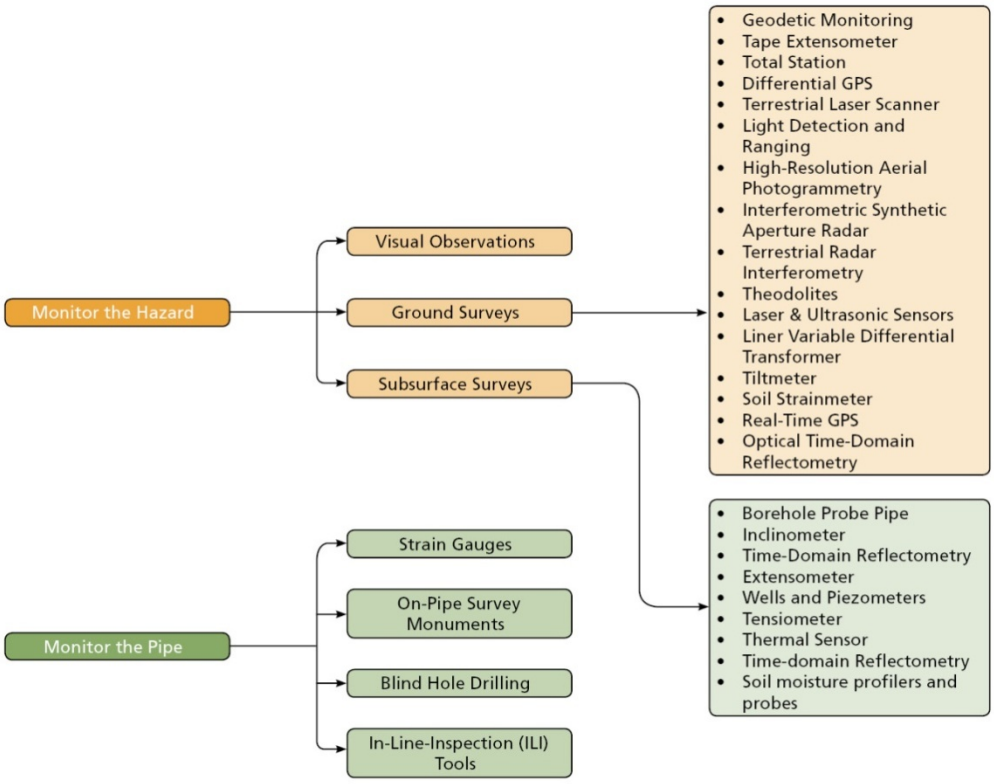


Figure 9-3 Hazard Monitoring



Atlantic has completed the desktop and field reconnaissance portion of the Geohazards Analysis Program and filed a final report to FERC. The final report provided recommendations on geological hazards and potential risks to be mitigated during construction and operation of the proposed ACP facilities. Through desktop study and field verification, the Geohazards Analysis Program identified six recurring typical steep slope hazard scenarios that collectively encompass the majority of the steep slopes identified along the ACP alignment. Some sites may have the characteristics of more than one typical scenario type, particularly those that contain sensitive resources at the slope's toe or where previously modified by cutting and filling.

The six typical scenarios are identified by letters A through F, and each are generally described as follows:

Primary Scenarios

A. steep slopes without evidence of previous movement;

B. steep slopes with evidence of active movement;

C. steep slopes with increased potential to become unstable after construction disturbance; and

D. steep slopes near narrow ridge tops.

Secondary Scenarios

A. steep slopes with a sensitive resource at toe (e.g., streams, wetlands, roads); and

B. steep slopes previously modified by cutting and filling.

Project-specific steep slope geohazard mitigation Typical Designs (TDs) for each of the six typical scenarios were developed as part of the BIC Program. Additionally, Site-specific Designs (SSDs) were developed for those locations with unique geohazard concerns and/or a greater potential for instability. The TDs are included in the SWPPP submitted to VDEQ. The locations where the BIC Program will be implemented are identified on the construction alignment sheets and on plans developed for a select group of the most challenging and unique steep slopes requiring SSDs. The SSDs are currently being prepared and will be provided to VDEQ upon completion.

The TD packages are intended to provide a comprehensive and programmatic approach to address the hundreds of locations along the pipeline alignment. TD packages include Incremental Control (IC) measures (i.e., Typical Details) that provide targeted mitigation for steep slope related hazards that are above and beyond the standard ESCs necessary to meet regulatory requirements. The TDs list ICs that are available for use at a site. The host of ICs for each typical scenario provides options to the field team to respond to site-specific field conditions. These ICs will be implemented in addition to the standard ESC measures which are

shown on the alignment sheets. Detailed drawings of the ICs are also provided in the SWPPP to be submitted to VDEQ.

SSD packages are site-specific steep slope mitigation plans that address specialized steep slope or related hazards and conditions at targeted sites, and require geotechnical, hydro-technical engineering, or geologic technical support to develop the design package. SSD packages typically include detailed engineering drawing sets, showing plan and profile and section views of the intended design, supported by details and specifications, and may require specialized work plans. Incremental controls proposed for SSDs are the same as used for the TDs. There are currently 15 locations along the ACP pipeline (9 are located within Virginia), identified through the Geohazards Analysis Program, that were addressed with a SSD. These design plans are currently being prepared and will be provided to VDEQ upon completion.

Atlantic will provide specific employee training that has been developed from the steep slope program. Atlantic personnel with responsibility for pipeline routing, construction, or operation must be trained in this procedure on an annual basis. The training may be completed by an online learning management system module or may be conducted by Energy Infrastructure Environmental Services personnel or Atlantic Engineering Management. At a minimum, the following personnel will be trained:

- engineering Directors and Managers;
- design and construction engineers;
- operations Directors, Managers and Supervisors;
- construction supervisors; and
- construction and operations Environmental Construction Coordinators.

The training must include the following:

- types and causes of slope failures;
- routing avoidance and desktop methods;
- field reconnaissance;
- risk prioritization;
- pipeline design and engineering to prevent slope failures;
- addressing slope failures during construction;
- addressing slope failures post-construction; and

- reporting requirements.

Atlantic's commitment to address steep slope areas is demonstrated by the up-front reconnaissance to identify steep slope and slide prone areas, and proactively identifying and addressing these areas within project documents submitted as part of the FERC environmental review process, and according to construction stormwater permitting documents, such as the SWPPP, that will be implemented during construction.

10.0 BLASTING PLAN

If consolidated rock is encountered during construction, Atlantic's preferred procedure will be to fracture and excavate the bedrock using standard construction equipment. Blasting of bedrock will only be required in areas where hard, crystalline bedrock is encountered and the bedrock cannot be removed by conventional excavation methods. Atlantic has prepared and will implement a *Blasting Plan* which will identify blasting procedures, including the use, storage, and transportation of explosives. The *Blasting Plan* is included as Appendix A.

11.0 WATER QUALITY MONITORING PLAN

Atlantic has prepared a Water Quality Monitoring Plan in response to the VDEQ "Request for Information for Developing and Evaluating Additional Conditions for Section 401 Water Quality Certification for Interstate Natural Gas Infrastructure Project," dated May 19, 2017.

This plan is provided with the intention to provide details on actions that will be implemented to evaluate potential indirect effects on water quality by the Project activities occurring in upland adjacent to ground disturbing activities along the construction right-of-way. The Water Quality Monitoring Plan is included in Appendix D.

12.0 KARST MANAGEMENT PLAN

Atlantic completed field surveys for karst features in the vicinity of proposed land disturbing activities. Atlantic filed an updated Karst Survey Report with FERC on February 24, 2017.. This information is available for viewing on the FERC website (http://www.ferc.gov).

In addition, Atlantic has prepared and will implement a *Karst Terrain Assessment, Construction, Monitoring and Mitigation Plan* and ESC plans identify measures for avoiding or minimizing impacts on karst features during construction. The *Karst Terrain Assessment, Construction, Monitoring and Mitigation Plan* is included as Appendix E. This plan outlines procedures for monitoring activities for karst features during construction. Based on karst features identified in the vicinity of proposed construction activities, Project ESC plans within the SWPPP that Atlantic is submitting to VDEQ provide the necessary protections of karst features to protect surface water and water supply sources.

To further evaluate flow paths for significant springs in the vicinity of the project, Atlantic is also developing a program in conjunction with Virginia Department of Conservation and Recreation to evaluate subsurface flow paths for significant springs.

Finally, mitigation measures in the event of any impacts are detailed in Atlantic's Resource Report 2, submitted to FERC, within Section 2.1.6. Groundwater Construction Related Impacts and Mitigation. In summary, Atlantic has worked to identify karst features that have an opening into the subsurface bedrock and have the potential to provide a conduit for impacts to groundwater through initial desktop assessments, avoidance of features during routing, and completing more detailed field survey for karst features, as described above in this section. In addition to implementing the measures outlined in the *Karst Terrain Assessment, Construction, Monitoring and Mitigation Plan, SPCC Plan, and Blasting Plan*, specific to conditions in karst areas, Atlantic plans to monitor groundwater quality and yield for public and private supply wells and springs proximate to the Project area, as described in more detail below. Groundwater inventory and sample collection will be conducted before and after construction to determine whether water supplies have been affected by pipeline construction activities. Atlantic and DETI will establish baseline groundwater conditions prior to construction of the Projects through investigative field surveys and a sampling protocol. The surveys will include a groundwater inventory of all wells or springs within 500 feet of the proposed pipeline in karst areas and within 150 feet of the construction workspace along the remainder of the proposed pipeline. In order to conduct these inventories, landowner permission will need to be obtained first.

With landowner permission, water samples will be obtained prior to construction to establish water quality and yield baselines during the varying seasons. These samples will be tested for pH, total suspended solids, total dissolved solids, conductivity, alkalinity, acidity, sulfates, oil/grease, phenolic, iron, manganese, aluminum, fecal coliform, copper, lead, nickel, silver, thallium, zinc, chromium, arsenic, mercury, selenium, cyanide, calcium magnesium, hardness, chlorides, antimony, cadmium, and beryllium. Sampling methods will adhere to the prevailing U.S. Environmental Protection Agency (EPA) and VDEQ sampling, analytical and data quality assurance and quality control procedures. The samples will be analyzed using EPA-approved methods and the analysis will be performed by a certified laboratory.

Any well damage claim will be investigated for cause; during this investigation a temporary potable water source will be supplied to the well owner. This temporary potable water source will be supplied by a potable water storage device and/or a temporary water treatment system to restore potable water.

In the event the damage claim investigation yields positive results that construction activities caused or contributed to well damage. Atlantic or DETI will provide a permanent potable water source. This will be supplied by a permanent water treatment system and/or a new well drilled to a deeper aquifer.

13.0 ENVIRONMENTAL MONITORING

Atlantic is committed to constructing and operating the ACP in a manner that will minimize environmental impacts and comply with applicable permits and approvals, the Plan and Procedures, and other environmental plans or requirements. Atlantic will train company and contractor personnel to familiarize them with environmental plans, permit requirements, and other conditions. EIs will be hired to monitor compliance during the construction and restoration phases of the Project. Atlantic will be responsible for ensuring the implementation of and compliance with environmental requirements during construction of the Project.

Additionally, Atlantic will adopt various BIC technologies and work practices in the areas of slip prevention on steep slopes, air emissions from compressor turbines, and methane leaks from equipment and pipeline components. BIC for natural gas transmission systems means industry-proven, most efficient and/or protective design/configuration, with the least environmental impact providing reliable operations.

Environmental Compliance

Atlantic will incorporate relevant environmental requirements and environmental mitigation plans into the construction bid documents for the Project. Additionally, Atlantic will review these materials with prospective contractors in a pre-bid meeting. The contractor(s) selected for the Project will be required to comply with all relevant requirements regardless of whether they were described in bid documents or discussed at the meeting.

Atlantic will conduct environmental training prior to commencement of construction activities so that contractors are aware of the environmental requirements of the Project. During construction, if a contractor does not comply with the environmental requirements, Atlantic will direct the contractor to comply and may take other corrective actions as necessary, including issuing stop-work orders, until the contractor is in compliance.

Environmental Training

Prior to construction, Atlantic will conduct environmental training for all company and contractor personnel. The training program will focus on the Plan and Procedures, the Plan of Development or Construction, Operation and Maintenance (COM) Plans, Certificate and permit conditions, and construction, restoration, and mitigation plans. In addition, Atlantic will provide large-group training sessions before each work crew begins construction. Periodic follow-up training for groups of newly assigned personnel will be provided as necessary by the EIs. Besides training rosters, which will be kept to verify that personnel have been trained, Atlantic will issue hardhat stickers to be placed on each worker's hardhat as field verification that the worker has completed the training.

Environmental Inspection

Atlantic will assign an appropriate number of EIs per construction spread with additional inspectors, as necessary, to monitor environmental compliance during construction. The EIs will have peer status with other inspectors and will report directly to the spread chief inspector. EIs

will have the authority to stop activities that violate environmental conditions of Federal or Commonwealth environmental permits and landowner agreements and to order appropriate corrective action. EIs will be responsible for:

- ensuring compliance with the requirements of the Certificate as well as Federal and Commonwealth permits, clearances, and other approvals; the Plan and Procedures; Atlantic's construction, restoration, and mitigation plans; and environmental requirements identified in landowner easement agreements;
- evaluating the construction contractor's implementation of environmental mitigation measures;
- act as liaisons between Atlantic and field representatives of environmental regulatory agencies that visit the ACP Project area during construction;
- 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;
- verifying the location of restoration sites, and maintaining appropriate signage for boundaries of sensitive resource areas, waterbodies, wetlands, farm improvements (i.e., repair of fences, drain tiles, irrigation systems, or structures), or areas with special restoration requirements;
- monitoring erosion and sediment control devices and soil stabilization measures in construction areas, and identifying additional needs for new controls or maintenance of existing controls;
- verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including but not limited to wetlands, waterbodies, cultural resource sites, and sensitive species habitats;
- 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 Inspector when environmental conditions (such as wet 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 soils imported for agricultural or residential use have been certified as free of invasive species and soil pests, unless otherwise approved by the landowner;

- determining the need for and ensuring that erosion controls are properly installed, as necessary, to prevent sediment flow into wetlands, waterbodies, sensitive areas, and onto roads;

- inspecting and ensuring the maintenance of temporary erosion control measures at least:

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

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

    - within 24 hours of each 0.5 inch of rainfall.

- ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification;

- keeping records of compliance or non-compliance with conditions of environmental regulatory permits and approvals, including activities that could result in decertification of organic farms; and

- identifying areas that will require special attention to ensure stabilization and restoration success.

Additional monitoring details are included in Section 11.0 Water Quality Monitoring Plan.

Third-Party Compliance Monitoring

In addition to the EIs, Atlantic will participate in a third-party compliance monitoring program during construction of the ACP. Under this program, Atlantic will fund a third-party contractor, to be selected and managed by FERC staff, to provide environmental compliance monitoring services for the Project. The third-party contractor will provide regular reports to FERC staff on compliance issues and assist FERC staff in screening and processing variance requests during construction.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

401 Certification Request for Information Response to the

Virginia Department of Environmental Quality

APPENDIX A

Blasting Plan

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE
Docket No. CP15-554-000
CP15-554-001

and

DOMINION TRANSMISSION, INC
SUPPLY HEADER PROJECT
Docket No. CP15-555-000

Blasting Plan

Updated, Rev. 3

Prepared by

ERM

November 1, 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Atlantic	Atlantic Coast Pipeline, LLC
DTI	Dominion Transmission, Inc.
GPS	global positioning system
PPV	peak particle velocity
Project	Atlantic Coast Pipeline
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

Based on an analysis of the Natural Resource Conservation Service's Soil Survey Geographic Database, approximately 26 percent (155.8 miles) of the proposed ACP and SHP pipeline routes will cross areas with bedrock at depths of less than 60 inches. More than half (81.7 miles) of this bedrock are considered paralithic (soft) and may not require blasting during construction. The remaining areas will 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* outlines the procedures and safety measures that Atlantic's and DTI's construction contractors (referred to as the Contractor below) will adhere to while conducting blasting activities required for the construction of the ACP and SHP. 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 or DTI for approval. Approval of a site-specific Blasting Specification Plan does not relieve the Contractor from responsibility or liability.

3.0 GENERAL REQUIREMENTS

Blasting for grade or trench excavation will be used where deemed necessary by the Contractor, and approved by an Atlantic or DTI representative, after examination of the site. To the extent practical on USFS lands, rock trenching will be accomplished using mechanical means such as rippers, rock hammers, John Henry drills, etc.

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 or DTI with appropriate information documenting the experience, licenses, and permits associated with blasting personnel.

Blasting-related operations will comply with applicable Federal, 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.

4.0 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, the Contractor will verify with an Atlantic or DTI representative that all property owners 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 or DTI its site-specific Blasting Specification Plan for approval prior to the execution of blasting activity.

5.0 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;
  - disposal of waste blasting material; and
  - blasting on steep slopes.

6.0 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 or DTI representative upon completion of blasting activities at each blasting site.

7.0 SAFETY

7.1 Protection of Aboveground and Underground Structures

Where blasting is determined to be required, Atlantic and DTI 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, measures to minimize blasting impacts on steep slopes, 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, the well will be repaired or otherwise restored or the well owner will be compensated for confirmed damages. Atlantic and DTI will provide an alternative potable water supply to the landowner until repairs occur.
- If blasting occurs within 150 feet of any aboveground structures, the Contractor and an Atlantic or DTI 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.
- The Contractor will be responsible for the ultimate resolution of all damage claims resulting from blasting. Such liability is not restricted by the 150-foot inspection requirement cited above.
- Blasting will not be allowed within 15 feet of an existing pipeline, unless specifically authorized by an Atlantic or DTI 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. When blasting in streams, the following additional measures may be implemented, in consultation with the appropriate agencies, to avoid or minimize impacts on fisheries, aquatic resources, and habitats:
    - Prior to the initiation of the designed blast and following audible warning signals, a single cap will be initiated in the stream to alert fish to move away from blasting area.
    - Removing fish from blasting area and relocating them downstream, this will only be used in smaller streams.

- In larger streams a boat can be used both up and down stream to alert fish to move away from blasting area. This tactic can be used only if the operators of the boat can retreat a safe distance from the blast zone as determined by the Blaster in Charge.

- When blasting on steep slopes the following measures will be taken to minimize blasting impacts.
  - A safety berm may be created at the base of each shot to minimize the shot material movement down the slope after initiation if practical.
  - A catch berm may be created at the base of the hill to stop material from leaving the right-of way, if practical.
  - Berms may be constructed on the right-of-way to direct any rolling material away for the offside boundaries.
  - Shots will be initiated from the lowest elevation of the trench.
  - The blaster will conduct test blasts on areas without slope with a reduction of powder factor that will fracture the material while keeping it in place. Tight digging and higher vibrations may be associated with this adjustment.
  - Decking the holes may be considered to lower the pounds per delay.
  - Where multiple trench shots are to be initiated, the shot material will stay in place and remain muck bound. This will hold the following shots in place.
- 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 or DTI 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 or DTI 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 or DTI 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 or DTI representative.
  - Appropriate delay between charges will be used to attain desired fragmentation.

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 or DTI representative and the site in question will be visited and examined by the consultant before any approval is granted.
- Atlantic and DTI may employ two-way radios for communication between vehicles and office facilities. The Contractor will advise Atlantic or DTI and other pipeline 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 or DTI. This work will not be left to the cleanup crew.

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 or DTI 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 or DTI 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.

8.0 KARST

In accordance with Atlantic's and DTI's *Karst Monitoring and Mitigation Plan*, 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.

9.0 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.

State	County	Project Segment	Facilities Crossed	Milepost	Unique_ID	Feature_Name	Blasting Planned (in-stream or within 1000 feet)	Federal Classifications	State/Commonwealth or Federal Time of Year Restrictions (work limited between dates listed)	State and Federal Species Survey Results
West Virginia	Lewis County	AP-1	Perm ROW, Temp ROW	8.2	sleb009	West Fork River	In-stream; Within 1000 feet	Potential for ESA-listed species	April 1 to June 30	No federal mussels observed during survey. Native mussels observed during survey.
West Virginia	Pocahontas County	AP-1	Perm ROW, Temp ROW	76.6	spoc118	Greenbrier River	In-stream; Within 1000 feet	Potential for ESA-listed species	April 1 to June 30	No mussels observed during survey
Virginia	Highland County	AP-1	Perm ROW, Temp ROW	87.2	shie061	Back Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	March 15 to June 30	No mussels observed during survey
Virginia	Highland County	AP-1	Perm ROW, Temp ROW	91.5	nhd_va_j_003	Jackson River	In-stream; Within 1000 feet	Potential for ESA-listed species	October 1 to March 31/March 15 to May 15/March 15 to June 30	Mussel survey pending
Virginia	Bath County	AP-1	Perm ROW, Temp ROW	97.8	nhd_va_j_006	Cowpasture River	In-stream; Within 1000 feet	Potential for ESA-listed species	May 15 to July 31/March 15 to June 30	No federal or state mussels observed during survey. Additional survey anticipated in 2017.
Virginia	Bath County	AP-1	Perm ROW, Temp ROW	103.1	sbar009	UNT to Mill Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	October 1 to March 31/October 1 to May 31	Mussel survey pending
Virginia	Augusta County	AP-1	Perm ROW, Temp ROW	142.5	saub007	Christian's Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No federal or state mussels observed during survey
Virginia	Augusta County	AP-1	Perm ROW, Temp ROW	148.6	sauc113	South River	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No federal or state mussels observed during survey
Virginia	Augusta County	AP-1	Perm ROW, Temp ROW	153.7	nhd_va_a_001	Back Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	October 1 to May 31	Mussel survey pending
Virginia	Buckingham County	AP-1	Perm ROW, Temp ROW	197.9	sbuk012	Slate River	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No federal or state mussels observed during survey
Virginia	Cumberland and Prince Edward Counties	AP-1	Perm ROW, Temp ROW	220.8	scuk011	Appomattox River	In-stream; Within 1000 feet	Potential for ESA-listed species	May 15 to July 31	No federal or state mussels observed during survey
Virginia	Nottoway County	AP-1	Perm ROW, Temp ROW	228.2	snok005	Ellis Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No mussels observed during survey
Virginia	Nottoway County	AP-1	Perm ROW, Temp ROW	229.2	snok008	Flat Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No mussels observed during survey
Virginia	Nottoway County	AP-1	Perm ROW, Temp ROW	230.7	snom006	Little Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No mussels observed during survey
Virginia	Dinwiddie County	AP-1	Perm ROW, Temp ROW	249.1	sdim001	Butterwood Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	March 15 to June 30	Mussel and Roanoke logperch surveys pending
Virginia	Dinwiddie County	AP-1	Perm ROW, Temp ROW	259.3	sdic001	Beaver Pond Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	Roanoke logperch survey pending

State	County	Project Segment	Facilities Crossed	Milepost	Unique_ID	Feature_Name	Blasting Planned (in-stream or within 1000 feet)	Federal Classifications	State/Commonwealth or Federal Time of Year Restrictions (work limited between dates listed)	State and Federal Species Survey Results
Virginia	Dinwiddie and Brunswick Counties	AP-1	Perm ROW, Temp ROW	260.7	sdic007	Nottoway River	In-stream pending FWS consult; Within 1000 feet	Potential for ESA-listed species	February 15 to June 30/May 15 to July 31/March 15 to May 31 and August 15 to October 15/March 15 to June 30	Atlantic pigtoe (federally petitioned, state threatened) and Roanoke logperch (federally endangered) observed during partial survey. Full survey pending.
Virginia	Brunswick County	AP-1	Perm ROW, Temp ROW	267.4	sbrr014	Waqua Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	March 15 to June 30	No federal or state mussels or Roanoke logperch observed during survey
Virginia	Brunswick County	AP-1	Perm ROW, Temp ROW	272.0	sbrr007	Sturgeon Creek	In-stream pending FWS consult; Within 1000 feet	Potential for ESA-listed species	May 15 to July 31	Atlantic pigtoe (federally petitioned, state threatened) observed during survey
Virginia	Greensville County	AP-1	Perm ROW, Temp ROW	286.3	sgra007	Meherrin River	In-stream pending FWS consult; Within 1000 feet	Potential for ESA-listed species	February 15 to June 30/May 15 to July 31/April 15 to June 15 and August 15 to September 30	No federal or state mussels observed during survey
Virginia	Greensville County	AP-1	Perm ROW, Temp ROW	299.6	sgro001	UNT to Fontaine Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	February 15 to June 30	No federal or state mussels observed during survey
Virginia	Greensville County	AP-1	Perm ROW, Temp ROW	299.6	sgro002	UNT to Fontaine Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	February 15 to June 30	No federal or state mussels observed during survey
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	15.7	isdha007	Little Quankey Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No state or federal mussels or Chowanoke crayfish observed during survey.
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	16.9	nhd_nc_a_004	Quankey Creek	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No state or federal mussels or Chowanoke crayfish observed during survey.
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	20.1	shlh008	Marsh Swamp	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No mussels or target aquatic species observed during survey.
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	23.1	shlh017	Beaverdam Swamp	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	Mussel, Carolina madtom, NC spiny crayfish survey pending. No Neuse River waterdogs observed during survey.

State	County	Project Segment	Facilities Crossed	Milepost	Unique_ID	Feature_Name	Blasting Planned (in-stream or within 1000 feet)	Federal Classifications	State/Commonwealth or Federal Time of Year Restrictions (work limited between dates listed)	State and Federal Species Survey Results
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	26.6	shlh009	Burnt Coat Swamp	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No mussel or target aquatic species observed during survey
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	27.4	shlh011	Jacket Swamp	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	Mussel, Carolina madtom, NC spiny crayfish, and Neuse River waterdog survey pending
North Carolina	Halifax County	AP-2	Perm ROW, Temp ROW	32.0	isdha001	Rocky Swamp	In-stream; Within 1000 feet	Potential for ESA-listed species	NA	No live mussels observed, no state or federal target aquatic species observed during survey
Virginia	Greensville and Southampton Counties	AP-3	Perm ROW, Temp ROW	12.4	sgrp001	Meherrin River	In-stream; Within 1000 feet	Potential for ESA-listed species	February 15 to June 30/May 15 to July 31/April 15 to June 15 and August 15 to September 30	No federal or state mussels observed during survey

State	Project Segment	Facilities Crossed	Milepost	Unique_ID	Feature_Name	Waterbody Regime	Blasting Planned (in-stream or within 1000 feet)	Federal Classifications	State and Federal Species Survey Results
WV	TL-635	Pipeline Workspace	18.5	sdoh012	McElroy Creek	Perennial	In-stream; Within 1000 feet	Potential for ESA-listed Species	No federal mussels observed during survey. Native mussels observed during survey.
WV	TL-635	Pipeline Workspace	29.4	swzh028	South Fork Fishing Creek	Perennial	In-stream; Within 1000 feet		No federal mussels observed during survey. Native mussels observed during survey.
WV	TL-635	Pipeline Workspace	29.7	swzg018	South Fork Fishing Creek	Perennial	In-stream; Within 1000 feet		No mussels obseved during survey
WV	TL-635	Pipeline Workspace	30.1	swzg018	South Fork Fishing Creek	Perennial	In-stream; Within 1000 feet		No federal mussels observed during survey. Native mussels observed during survey.

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Virginia Department of Environmental Quality

APPENDIX B

Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals Crossed by the Atlantic Coast Pipeline in Virginia

Appendix B

Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals Crossed by the Atlantic Coast Pipeline in Virginia

Project/Commonwealth/ Component	Milepost Range		Unit Age	Geologic Unit	Primary Lithology	Secondary Lithology
AP-1	87.13	87.36	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	90.94	92.02	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	97.25	97.75	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	101.76	102.17	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	103.65	105.16	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	108.37	108.94	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	109.09	110.49	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	115.23	115.34	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	122.64	122.80	Devonian	Millboro Shale and Needmore Formation	black shale	shale
	177.09	179.20	Proterozoic Z	Ashe Formation - Biotite gneiss	biotite gneiss	N/A
	179.20	179.74	Proterozoic Z-Cambrian	Alligator Back Formation - Feldspathic metagraywacke	meta-argillite	schist
	180.00	180.87	Proterozoic Z-Cambrian	Alligator Back Formation - Feldspathic metagraywacke	meta-argillite	schist
	181.24	183.15	Cambrian	Candler Formation - Phyllite and schist	phyllite	schist
	183.37	184.04	Proterozoic Z-Cambrian	Alligator Back Formation - Feldspathic metagraywacke	meta-argillite	schist
	184.04	184.17	Cambrian	Candler Formation - Phyllite and schist	phyllite	schist
	184.82	186.91	Cambrian	Candler Formation - Phyllite and schist	phyllite	schist
	188.70	189.24	Cambrian	Candler Formation - Phyllite and schist	phyllite	schist
AP-3	34.37	38.01	Quaternary	Tabb Formation; Sedgefield Member	sand	N/A
	38.54	39.24	Quaternary	Tabb Formation; Sedgefield Member	sand	N/A
	55.26	55.52	Tertiary	Chesapeake Group	sand	silt
	55.84	56.44	Tertiary	Chesapeake Group	sand	silt
	57.43	58.06	Tertiary	Chesapeake Group	sand	silt
	60.57	61.27	Tertiary	Chesapeake Group	sand	silt
	61.94	62.26	Tertiary	Chesapeake Group	sand	silt
	62.37	62.67	Tertiary	Chesapeake Group	sand	silt
	65.08	65.23	Quaternary	Tabb Formation; Sedgefield Member	sand	N/A

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APPENDIX C

Spill Prevention, Control, and Countermeasures 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

Spill Prevention, Control, and Countermeasure Plan

Updated, Rev. 1

Prepared by

ERM

July 18, 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Atlantic	Atlantic Coast Pipeline, LLC
DTI	Dominion Transmission, Inc.
EI	Environmental Inspector
Projects	Atlantic Coast Pipeline and Supply Header Projects
RQ	Reportable Quantity
SHP	Supply Header Projects
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan

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

The purpose of this *Spill Prevention, Control, and Countermeasure Plan* (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 and DTI's construction Contractors, [1] 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 and SHP.

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, restoration, and mitigation plans, including this SPCC 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.

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

[1] Contractor or Contractors refer to the company or companies retained by Atlantic/DTI or another contractor to construct the proposed facilities.

effectively contain and cleanup spills that may occur in accordance with applicable regulations and the provisions of this plan.

4.0 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 Environmental Inspector (EI) [2], who will initiate the spill reporting process (see Section 7.0). The Spill Coordinator will be responsible for completing a Spill Report Form (Attachment A) 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 and DTI's environmental team to promptly report spills to appropriate Federal, State/Commonwealth, and local agencies, as required, and to coordinate with these agencies regarding contacting additional parties or agencies as may be required.

5.0 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 will ensure that a copy of this plan is available onsite to all Construction Work Crew members. All cleanup and other construction-related spill activities will be completed by the appropriate Contractors.

Spill prevention measures are described below.

A. Petroleum and Hazardous Liquid Storage, Refueling, and Equipment Maintenance

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

[2] The role and responsibilities of an EI are defined in the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan*.

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 Projects. Contractors also will be responsible for returning the storage impoundment area to its original contours and appearance upon completion of the Projects.

g. Hazardous materials, including chemicals, fuels, and lubricating oils, will be stored only at designated staging areas and in appropriate service vehicles. 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.

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 and DTI, 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.

2. Right-of-Way:

a. All machinery will arrive on the right-of-way in a clean, washed condition, maintained free of fluid leaks.

b. 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.

c. Fuel trucks transporting fuels to construction areas will only travel on approved access roads.

d. 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.

3. 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.

a. Approval must be received from an Atlantic or DTI representative and, where necessary, appropriate regulatory permits must be obtained, prior to refueling in Restricted Refueling Areas.

b. 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.

c. Trained Contractor personnel must be available for refueling, and an EI or another trained Atlantic/DTI representative must be present.

d. 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.

e. 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.

f. Refueling of dewatering pumps, generators, and other small, portable equipment will be performed using approved containers with a maximum volume of 5 gallons.

B. Spill Response Equipment

1. 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.

2. Right-of-Way

    a. 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.

    b. 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.

    c. 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.

    d. 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.

e. If a spill kit is used, it will be replaced within 24 hours.

C. Concrete Coating

1. 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.

6.0 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 8.0).

6. If necessary, an Emergency Response Contractor will be secured for large spills to further contain and clean up the spill.

7.0 SPILL REPORTING

A. All spills will be reported immediately to Atlantic or DTI. 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 and DTI's environmental team will report the spill to the applicable regulatory agencies if the spill meets or exceeds a reportable threshold. Table 1 lists the Federal and State/Commonwealth agencies that would be contacted, as appropriate, 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. **Pennsylvania:**

   a. Liquid hazardous waste spills must be reported when equal to or exceeding the Federal RQs at 40 CFR 302.4, or 10 gallons, whichever is more stringent (25 Pa. Code § 262a.43(2)(i)).

   b. Solid hazardous waste spills must be reported when equal to or exceeding the Federal RQs at 40 CFR 302.4, or 500 pounds, whichever is more stringent (25 Pa. Code § 262a.43(2)(ii).

   c. A spill of oil, petroleum or other hazardous substance that discharges or has potential to discharge into Commonwealth waters must be reported, regardless of amount, (see 25 Pa. Code §§ 91.33, 78.66, 299.217, 299.218, § 262a.43(3)).

2. **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).

3. **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).

TABLE 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
Pennsylvania				
Department of Environmental Protection	Southwest Regional Office	412-442-4000	24-hour hotline	Greene and Westmoreland Counties
Commonwealth of Pennsylvania	Pennsylvania Emergency Response Management	717-651-2001	24-hour hotline	Entire Commonwealth
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				
Department of Environmental Quality (VDEQ)	Pollution Response Program-Valley Regional Office	540-574-7800	Monday – Friday 8:30 am – 4:30 pm	Augusta, Highland, and Nelson Counties
VDEQ	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
VDEQ	Pollution Response Program-Piedmont Regional Office	804-527-5020	Monday – Friday 8:30 am – 4:30 pm	Dinwiddie, Brunswick, and Greensville Counties
VDEQ	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
VDEQ	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
North Carolina				
Department of Environment and Natural Resources	Division of Water Resources – Raleigh Regional Office Emergency Response	919-791-4200 800-858-0368	Monday – Friday 8:00 am – 5:00 pm After hours and weekends	Halifax, Johnston, Nash, Northampton, and Wilson Counties
Department of Environment and Natural Resources	Division of Water Resources – Fayetteville Regional Office Emergency Response	910-433-3300 800-858-0368	Monday – Friday 8:00 am – 5:00 pm After hours and weekends	Cumberland, Robeson, and Sampson Counties

c. Hazardous waste spills must be reported when equal to or exceeding Federal RQs at 40 CFR 302.4 (see 9 VAC 25-880-70, generally describing applicable reporting quantities).

4. **North Carolina:**

a. Petroleum spills into the environment must be reported when (i) 25 gallons or more, or (ii) if the petroleum causes a sheen on nearby surface water, or (iii) if the petroleum is discharged at a distance of 100 feet or less from a surface water body, or (iv) if less than 25 gallons of petroleum cannot be cleaned up within 24 hours (N.C. Gen. Statutes 143-215.85(b).

b. Mineral oil (i.e., light nontoxic liquid petroleum distillate used as a coolant and insulator in electrical equipment owned by a public utility) spills must be reported when (i) exceeding 25 gallons, (ii) discharging directly to surface waters or causing a sheen on surface waters of the State, or (iii) at a distance of 100 feet or less from a surface water and containing 50 parts per million or more of polychlorinated biphenyls (N.C. Gen. Statutes 143-215.85(c)).

c. Hazardous waste spills must be reported when equal to or exceeding the Federal RQs at 40 CFR 302.4 (s*ee* http://portal.ncdenr.org/web/wq/home/er).

d. A spill of oil, petroleum, or other hazardous substance that discharges into State waters must be reported, regardless of amount (N.C. Gen. Statutes 143-215.85(a)).

D. Contractors are responsible for assisting Atlantic and DTI with preparing follow-up written incident reports to regulatory agencies upon request.

8.0 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.

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 Department of Environmental Quality if a reportable spill impacts a karst feature (see Table 1).

9.0 CERTIFICATION BY A PROFESSIONAL ENGINEER

This SPCC Plan has been certified by a professional engineer in accordance with 40 Code of Federal Regulations 112.7 – *General Requirements for Spill Prevention, Control, and Countermeasure Plans*.

_____ _____

Professional Engineer Date

10.0 CERTIFICATION BY THE CONTRACTOR

The Contractor listed below agrees to follow the requirements of Atlantic's and DTI's *Spill Prevention, Control, and Countermeasure Plan* during all work activities conducted for Atlantic or DTI.

_____ _____

Contractor Date

_____ _____

Responsible Official (Print Name) Title

_____

Responsible Official (Signature)

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

and

DOMINION TRANSMISSION, INC.
SUPPLY HEADER PROJECT

Spill Prevention, Control, and Countermeasure Plan

ATTACHMENT A
Spill Report Form

Atlantic Coast Pipeline and Supply Header Project
Spill Report Form

Date of Spill:_____ Date of Spill Discovery:_____

Time of Spill:_____ Time of Spill Discovery:_____

Name and Title of Discoverer:_____

Type of material spilled and manufacturer's name:_____

Legal Description of spill location to the quarter section:_____

Directions from nearest community:_____

Estimated volume of spill:_____

Weather conditions:_____

Topography and surface conditions of spill site:_____

Spill medium (pavement, sandy soil, water, etc.):_____

Proximity of spill to surface waters: _____

Did the spill reach a waterbody? _____Yes _____No

If so, was a sheen present? _____Yes _____No

Describe the causes and circumstances resulting in the spill:_____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5-foot radius to a depth of 1 inch): _____

_____

_____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

_____

Current status of cleanup actions:_____

Name and Company for the following:

Construction Superintendent:_____

_____

Spill Coordinator:_____

_____

Environmental Inspector:_____

Person Who Reported the Spill:_____

_____

Environmental Inspector:_____

Form completed by:_____Date:_____

Spill Coordinator must complete this for all spills, regardless of size, and submit the form to the Environmental Inspector within 24 hours of the occurrence.

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

and

DOMINION TRANSMISSION, INC.
SUPPLY HEADER PROJECT

Spill Prevention, Control, and Countermeasure Plan

ATTACHMENT B

Site-Specific Descriptions and Maps Depicting Locations of Fixed and Mobile Oil Containers and Type of Material Located within Containers

(to be provided by the Contractors prior to construction)

ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

401 Certification Request for Information Response to the

Virginia Department of Environmental Quality

APPENDIX D

Water Quality Monitoring Plan

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

Water Quality Monitoring Plan

May 2017

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Atlantic	Atlantic Coast Pipeline, LLC
LOD	Limits of Disturbance
Project	Atlantic Coast Pipeline
QA/QC	Quality Assurance and Quality Control
TMDL	Total Maximum Daily Load
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VSCI	Virginia Stream Condition Index

1.0 INTRODUCTION AND PURPOSE

This water quality monitoring plan has been prepared by Atlantic Coast Pipeline, LLC (Atlantic) for the Atlantic Coast Pipeline Project (ACP or Project) requested by the Virginia Department of Environmental Quality (VDEQ) in its "Request for Information for Developing and Evaluating Additional Conditions for Section 401 Water Quality Certification for Interstate Natural Gas Infrastructure Project," dated May 19, 2017.

The purpose of the ACP water quality monitoring plan is to evaluate water quality prior to construction to establish baseline conditions above, directly adjacent to, and below the project area of effect along streams that are adjacent to the planned pipeline construction corridor, and after construction within the same stream reaches (above, directly adjacent to, and below), to evaluate whether changes to water quality occurred as a result of ground disturbance from construction. Consistent with to the Request for Information from VDEQ, Atlantic focused on identifying waterbodies to sample according to categories outlined by VDEQ, as further described below.

2.0 STREAM CRITERIA EVALUATED TO SELECT MONITORING LOCATIONS

This water quality monitoring plan relates to perennial surface waters adjacent to the ACP proposed limits of disturbance (LOD) that are not crossed by the Project, and requires sampling in waterbodies that are:

- designated as wild/stocked trout streams or connected perennial tributaries;
- identified as waterbodies with potential for endangered/threatened species, or connected perennial tributaries;
- designated for public water supply (defined as anything within five miles of a public water intake that occurs in the same local watershed as the Project);
- classified as Tier 3 streams;[1]
- within a watershed that is subject to an established total maximum daily load (TMDL), including sediment, nutrients, and related impairments;
- within areas with geologic formations with potential for forming acid producing soils; and
- located where site access has been granted by the landowner or can be gained through public points of access.

[1] There are no Tier 3 waters crossed or directly adjacent to the ACP LOD.

3.0 STREAMS TO BE MONITORED

Applying the criteria in Section 2.0 Atlantic has identified eight streams for monitoring, as listed in Table 3.0-1. Only streams where landowner access or public access is available have been proposed. After determining the streams that are directly adjacent to the Project, and evaluating these streams according to the categories outlined in Section 2.0, the following selection criteria were developed to determine the streams to be monitored:

- only perennial streams were considered to ensure that flow would be present to collect data for the necessary monitoring parameters;
- a minimum of one stream for each category of stream, where available, was selected;
- an attempt was made to select streams that met more than one of the criteria (e.g., were both within a watershed with an established TMDL for sediment and/or nutrients and potential for endangered, threatened and special concern species water);
- streams where reviewed to provide general coverage for distribution along the Project in Virginia; and
- streams which were listed only due to a TMDL for bacteria, or for impairments of elevated chemicals in fish tissue were not considered due to the fact that the Project is not expected to cause or contribute to such impairments.

Maps depicting the recommended eight stream monitoring locations are included in Appendix A.

TABLE 3.0-1

Perennial Waterbody Monitoring Locations

Stream ID	Route ID	Milepost	Waterbody Name	Waterbody Category [a]
sbar007	AP-1	103.1	UNT to Mill Creek	TMDL, Connected Trib. to T&E
saur001	AP-1	109.1	UNT to Guy Hollow	TMDL, Acid
sauc114	AP-1	148.1	South River	TMDL, Public Intake Watershed (upstream), T&E
saua400	AP-1	157.2	UNT to South Fork Back Creek	TMDL, Trout
scuk003	AP-1	213.2	UNT to Little Willis River	TMDL
spek003	AP-1	220.8	UNT to Appomattox River	TMDL, Public Intake Watershed (upstream), Connected Trib. to T&E

[a] Waterbody categories include:

TMDL -	Occurs in a watershed with an established TMDL for sediment or nutrient related impairment.
T&E -	Potential for federally listed threatened or endangered species. Connected Trib, is a tributary that has direct surface water connection.
Acid -	Occurs within geologic unit containing potentially significant acid-producing sulfide minerals.
Public Intake -	Occurs within a local watershed with a public water surface intake within 5 miles of the Project.
Trout -	Naturally occurring or stocked trout waters.

4.0 MONITORING PARAMETERS

Table 4.0-1 provides the recommended monitoring parameters for chemical, physical, and biological parameters.

TABLE 4.0-1

Monitoring Parameters

Chemical Parameters
Temperature
Dissolved Oxygen
Specific conductance
pH
Turbidity (NTU's)
Physical Parameters
Photo documentation , general observations
Biological Monitoring
Family-level macroinvertebrate monitoring

Monitoring of the chemical parameters will take place above, directly adjacent, and below the Project area of effect along the selected stream segments that are adjacent to the disturbed pipeline construction corridor. Chemical parameter monitoring will occur where project or public access is available (i.e., waterbodies on properties where land access has been denied will not be proposed for monitoring).

Photo documentation of physical parameters will occur at all three sample locations, where the chemical parameter sampling occurs. Photos will be taken to document the view across, upstream, and downstream from the sampling locations. VDEQ approved monitoring methods for biological monitoring (i.e., benthic macroinvertebrates) requires that a 300-foot reach should be sampled both above and below the adjacent project area of effect. Similar to chemical sampling locations, project access or public access will be required to conduct the biological sampling.

5.0 MONITORING SCHEDULE

Atlantic will conduct monitoring of chemical and physical parameters as outlined in Section 4.0 once prior to construction, once during active construction, and once after stabilization (i.e., seeding and mulching of the construction right-of-way). Biological monitoring will occur during either the fall or spring index period[2] once prior to construction and once after stabilization.

[2] The spring index period is defined as March 1 through May 31; the fall index period is defined as September 1 through November 30.

6.0 MONITORING METHODOLOGY

Sampling of chemical and physical parameters will be performed in-situ; collection of samples for laboratory analysis is not proposed, and is not possible for temperature and dissolved oxygen parameters. Biological sampling will be performed in the field with laboratory analysis (i.e., sample sorting and identification) as necessary to follow VDEQ sampling protocols. The sampling parameters will be recorded as shown in Table 6.0-1.

TABLE 6.0-1

Sampling Methodology

Chemical Parameters	Sampling Methodology
Temperature	YSI 556 PRO PLUS Multi Probe System, or similar
Dissolved Oxygen	YSI 556 PRO PLUS Multi Probe System, or similar
Specific conductance	YSI 556 PRO PLUS Multi Probe System, or similar
pH	YSI 556 PRO PLUS Multi Probe System, or similar
Turbidity (NTU's)	LaMotte 2020we/wi Turbidimeter, or similar
Physical Parameters	
Photo documentation, general observations	Camera and GPS location. Photos will have unique ID, date, and GPS coordinates. Photo stations will be located with GPS coordinates. General observations will also be recorded (i.e., weather, stream conditions)
Biological Parameters	
Family-level macroinvertebrate monitoring	*EPA's Rapid Bioassessment Protocol* [1] *and A Stream Condition Index for Virginia Non-Coastal Stream* [2]

[1] Barbour, M.T., J. Gerritsen, and B.D. Snyder and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and rivers; periphyton, benthic macroinvertebrates, and fish 2nd edition. U.S. https://cfpub.epa.gov/watertrain/pdf/modules/rapbioassess.pdf

[2] Tetra Tech, Inc. 2003. A Stream Condition Index for Virginia Non-Coastal Streams. Tetra Tech, Inc. Owings Mills, Maryland. Prepared for Virginia Department of Environmental Quality, Richmond, Virginia. http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityMonitoring/BiologicalMonitoring/vsci.pdf

7.0 HANDLING AND ANALYTICAL QA/QC PROCEDURES

All equipment will be calibrated prior to use in accordance with the manufacturer specifications, or according to the best professional judgment of the staff conducting the samples. A calibration log will be kept and made available upon request. A daily equipment check prior to use will be performed to ensure good working order.

In order to address quality assurance/quality control (QA/QC) concerns, all chemical measurements will be taken via independent simultaneous sampling. Two staff members with identical equipment will perform the sampling simultaneously at each determined location to validate that the results are accurate between calibrated equipment. This protocol will also guard against unexpected equipment failures.

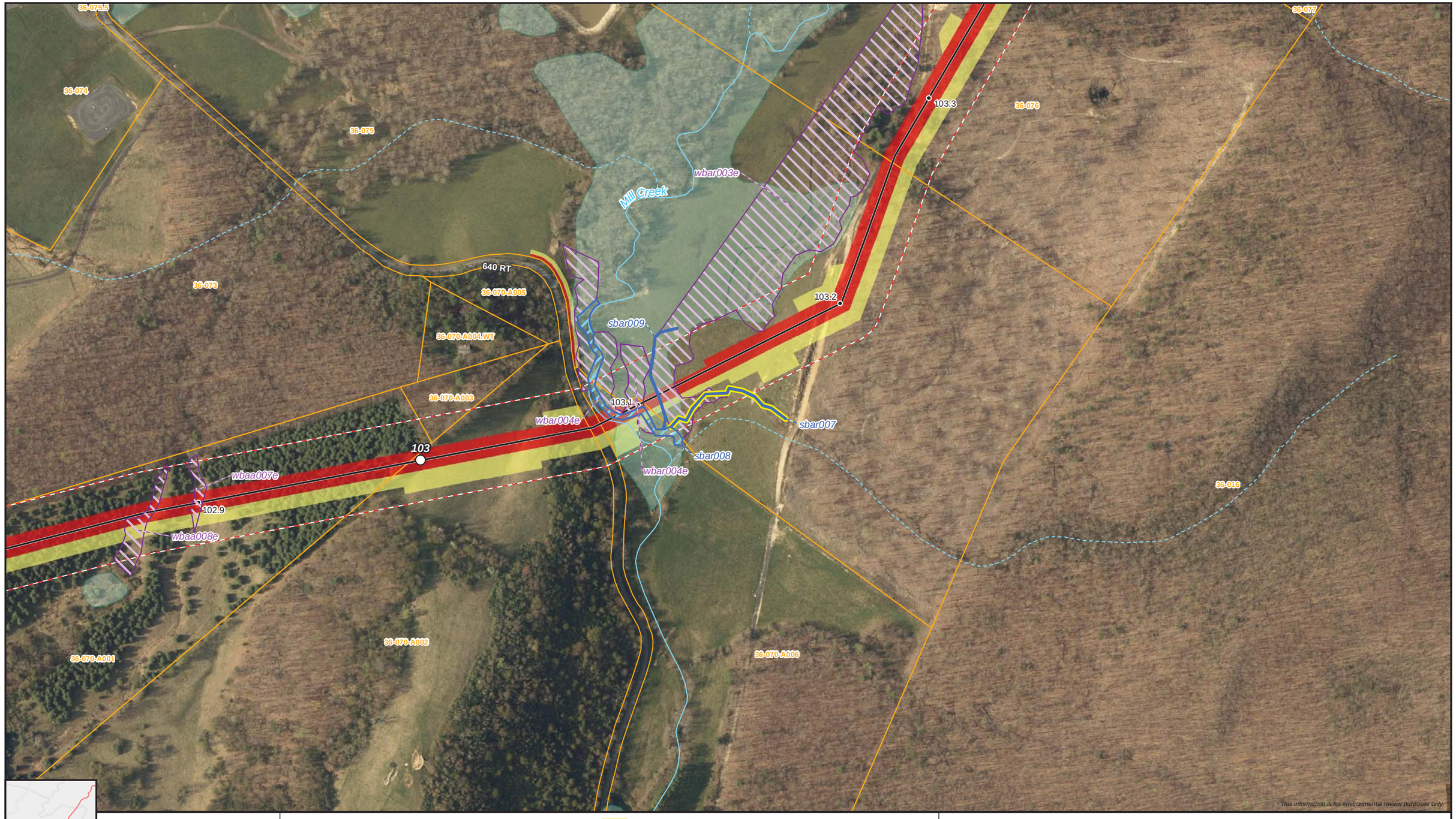
Biological sampling, sorting, identification, and reporting will be conducted by qualified biologists, as outlined in Table 6.0-1. Handling of samples, macroinvertebrate identification in the laboratory, and reporting will be completed under the direction of the qualified biologist and according to the standards outlined above.

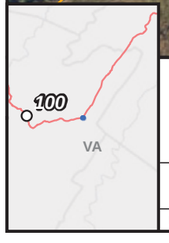
8.0 REPORTING PROCEDURES

Within four weeks of completing each sampling event the data (chemical results, data sheets, metrics, and Virginia Stream Condition Index (VSCI) scores) will be provided to VDEQ via email. All data will be provided in PDF and Microsoft Excel file formats. Photographic information will be provided in a PDF and Microsoft Word file formats. VDEQ is requested to specify the recipients of the email information. Emails will be sent with a "read receipt" to confirm delivery.

Appendix A

Map Set of Monitoring Locations





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- NWI Wetland
- Subject Waterbodies
- Surveyed Waterbody
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- Permanent Workspace
- Temporary Workspace

Atlantic Coast Pipeline
Water Quality Monitoring Plans
Monitoring Site #1
Bath County, Virginia

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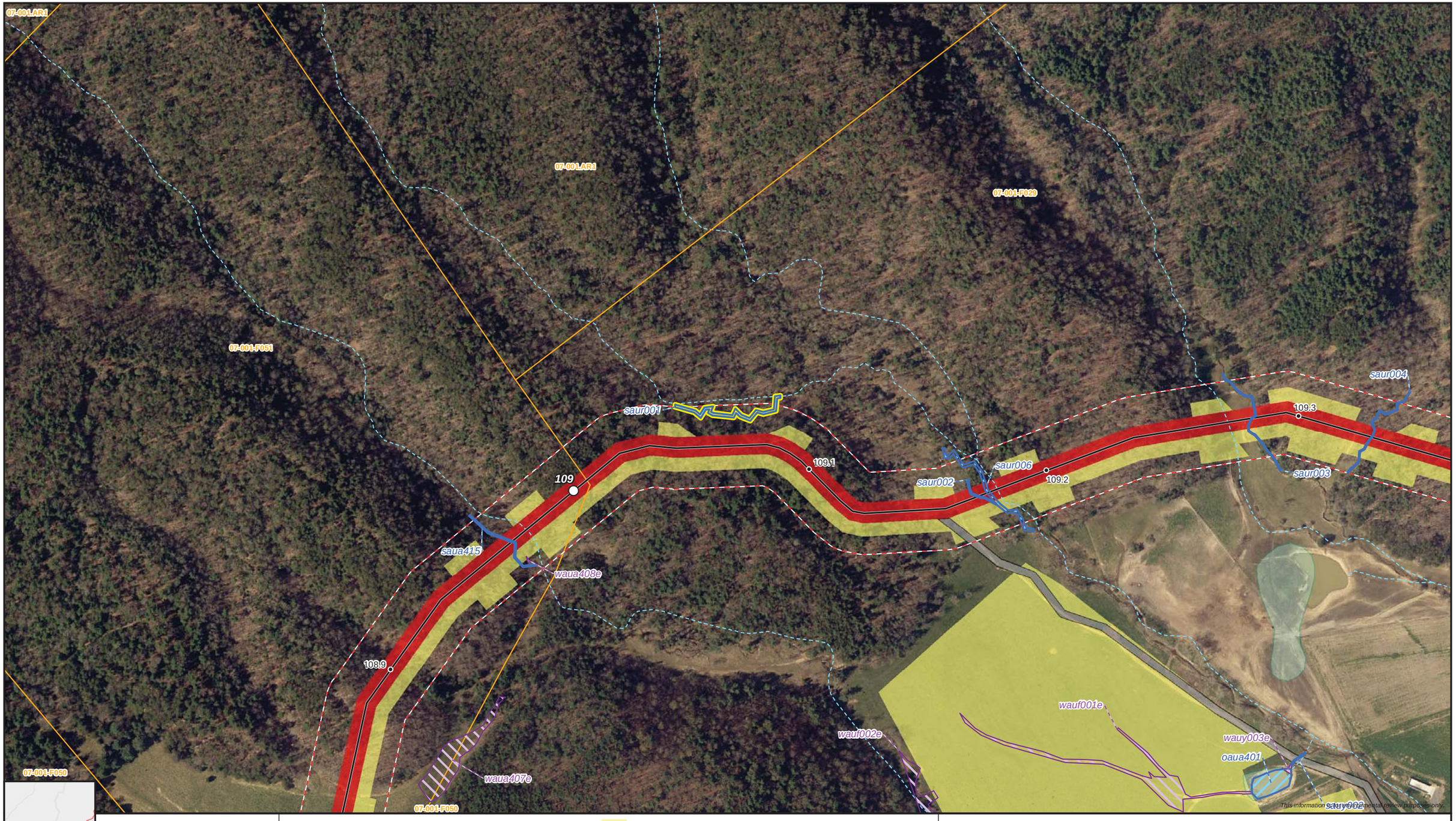
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NWI Wetland
Subject Waterbodies
Surveyed Waterbody
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Access Roads
Atlantic Coast Pipeline
Atlantic Coast Pipeline
Water Quality Monitoring Plans
Monitoring Site #2
Augusta County, Virginia
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Surveyed Waterbody
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Access Roads
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Water Quality Monitoring Plans
Monitoring Site #3
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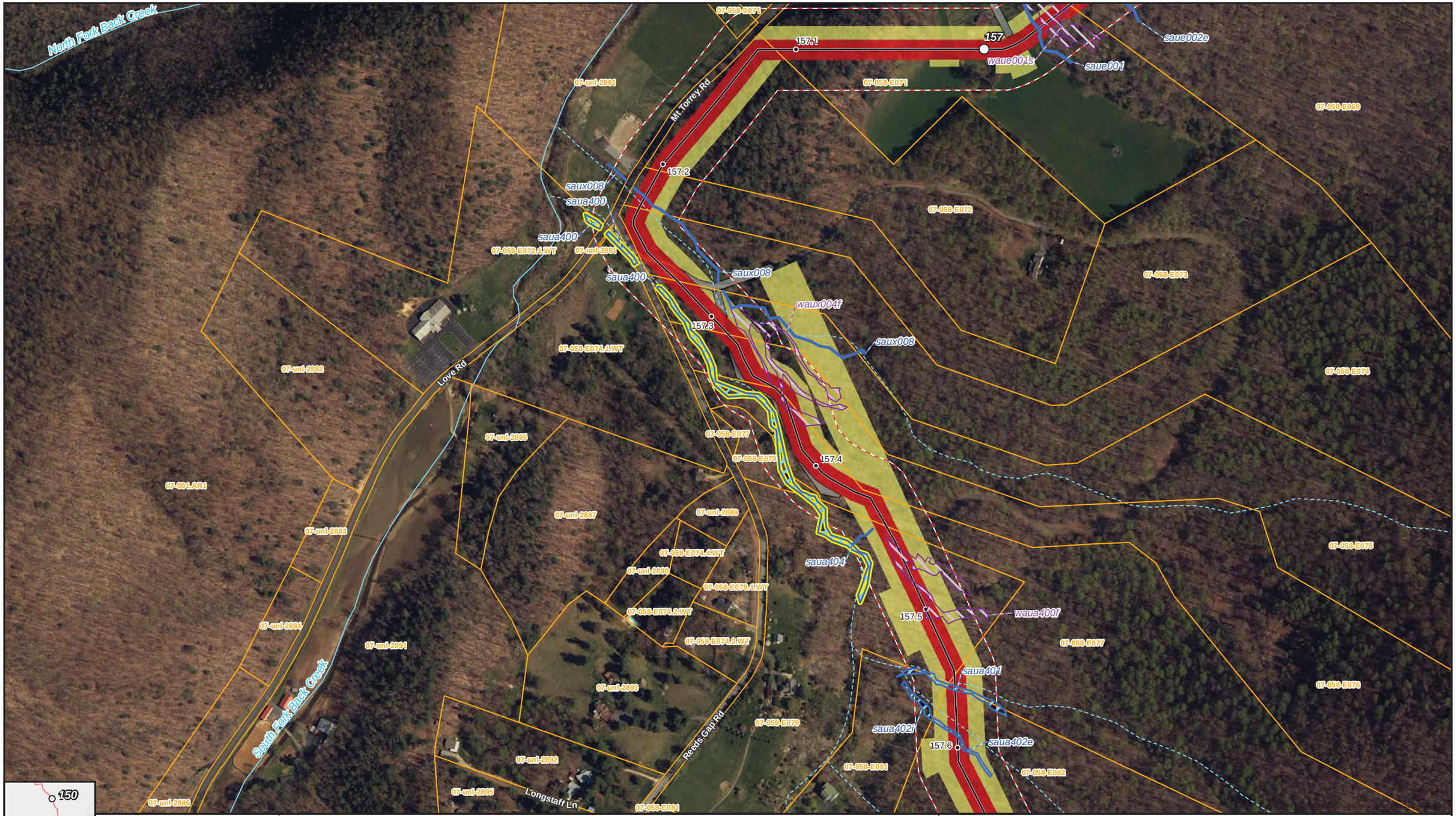

Atlantic Coast Pipeline

Atlantic Coast Pipeline

Water Quality Monitoring Plans

Monitoring Site #4

Augusta County, Virginia

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- Proposed Centerline
- Survey Corridor
- Milepost
- Tenth Milepost
- Parcel Boundary
- NHD Stream/River - Intermittent
- NWI Wetland
- Subject Waterbodies
- Surveyed Waterbody
- Permanent Workspace
- Temporary Workspace
- Access Roads

Atlantic Coast Pipeline

Atlantic Coast Pipeline
Water Quality Monitoring Plans
Monitoring Site #5
Cumberland County, Virginia

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Atlantic Coast Pipeline

Water Quality Monitoring Plans

Monitoring Site #6

Prince Edward County, Virginia

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ATLANTIC COAST PIPELINE, LLC
ATLANTIC COAST PIPELINE

401 Certification Request for Information Response to the

Virginia Department of Environmental Quality
APPENDIX E

Karst Terrain Assessment, Construction, Monitoring and Mitigation Plan

January 20, 2017

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

January 20, 2017

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)**

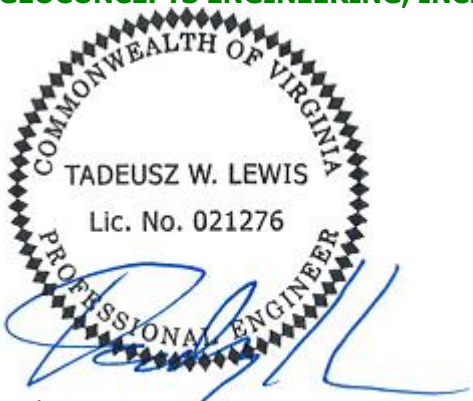
Dear Ms. Moody:

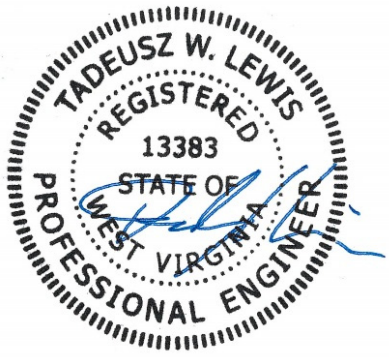
Per your request, GeoConcepts Engineering, Inc. (GeoConcepts) has completed a Karst Terrain Assessment, Construction Monitoring, and Mitigation Plan in support of the development of the Atlantic Coast Pipeline in areas of Randolph and Pocahontas Counties, West Virginia Highland, Augusta, and Nelson Counties, Virginia, and Westmoreland County, PA.

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.
January 2017

GeoConcepts Engineering, Inc.

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Appendix A: Sinkhole Mitigation Guidance Documents

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 the 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.

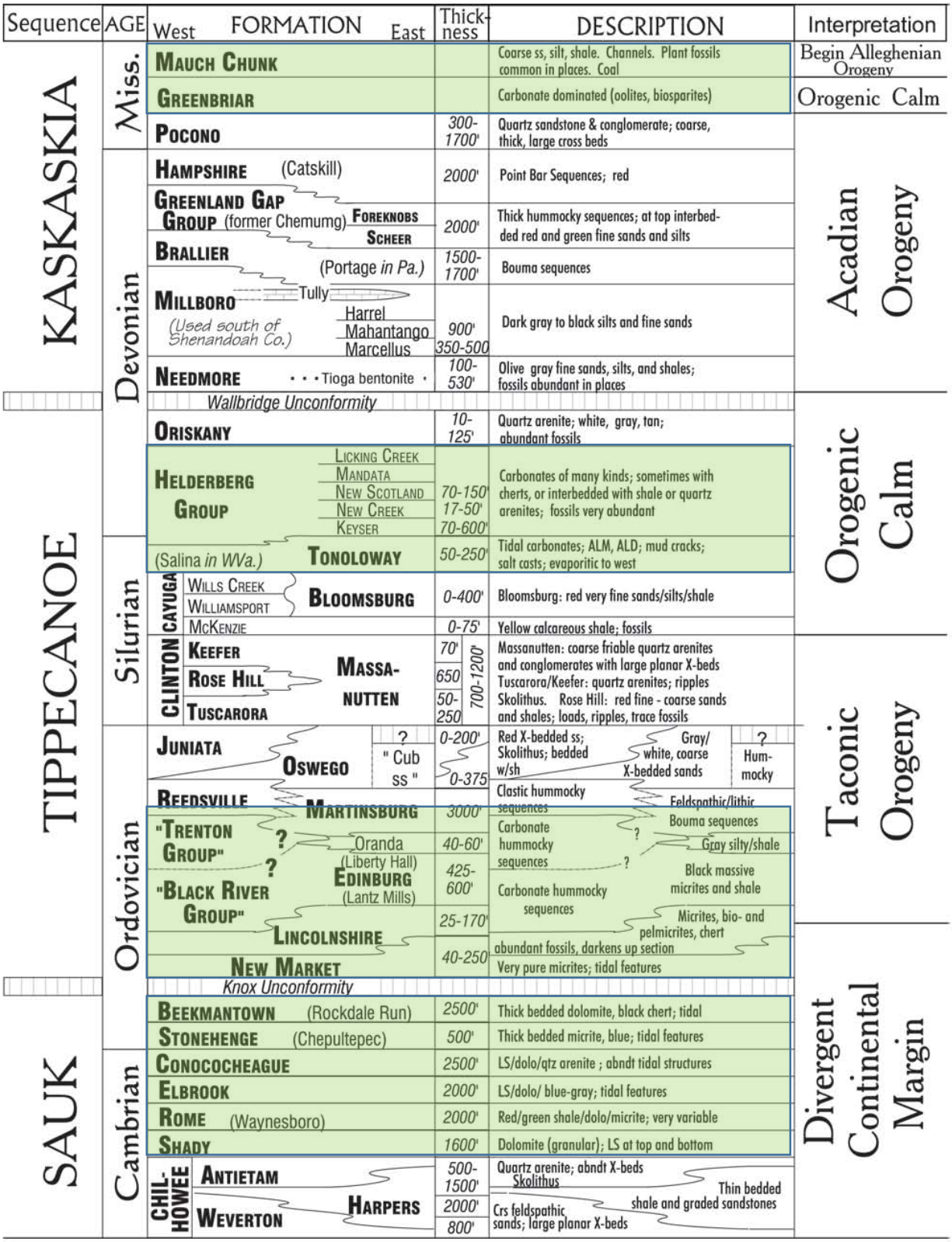

Figure 1. Stratigraphic Column of the central Virginia Great Valley, Folded Appalachians, and eastern Allegheny Front of west central Virginia and eastern West Virginia (Fichter, 2010). (The karst forming units are highlighted in green.)

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 massive-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 of 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 a 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

Juniata, Oswego, Reedsville, Dolly Ridge, and Eggleston Formations (Oun)

Karst forming unit present only in the westernmost Valley and Ridge section of the ACP alignment (Highland and Bath Counties). The Dolly Ridge and Eggleston Formations are the only karst-forming units and consist of a medium-gray, fine-grained, thin-bedded, argillaceous limestone with interbedded olive-gray calcareous claystone, silt argillaceous limestone, gray shale, and K-bentonite beds. Thickness is about 400 feet in Bath and Highland Counties. The unit is laterally equivalent to the Middle Ordovician ("Trenton Group") limestones and part of the lower Martinsburg Formation.

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 Mauch 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 sections 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, Bath, and Augusta Counties in Virginia, based on regional geological mapping.

The "Karst Review Area" (hereinafter referred to as the "KRA") assessed by data desktop review generally extended 0.25-mile from either side of the centerline of the proposed pipeline and alternate routes, and a 300 foot "study corridor" (300FC) extending 150 feet from either side of 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 KRA, 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 300FC where access was available.
- 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 KRA (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 KRA 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 300FC was delineated and the path of the 300FC was examined for karst features (both catalogued and previously unidentified) by field survey. This entailed conducting a site reconnaissance over the 300FC (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). The results of the karst survey work was used during routing and workspace design. In addition, these data will be used during the construction phase to assist in the pre-construction inspection tasks described in the following sections.

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 (Burden, 2012).

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 in karst terrain 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/air track 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, but typically air track borings will be used to verify anomalies observed during an ERI survey.

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 (right-of-way) in the designated work area, and note any suspect karst features including sinkholes, caves, areas of soil subsidence, or closed depressions.

b. The KS shall conduct a final preconstruction field assessment of seeps and springs within 500 feet of construction workspaces in karst terrain. The KS shall subsequently determine if construction activities could have an impact on the seeps and/or springs, and provide construction alternatives to avoid or mitigate impacts where practical.

c. The locations of observed features will be noted on site drawings and flagged for surveying and/or recorded using sub-meter accuracy GPS instrumentation.

d. 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. This inspection is intended to supplement the aforementioned pre-construction karst assessment and field survey report, as new features may have developed, or existing features described in identified in the original assessment may have changed.

e. Features that are considered to have potential impacts 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).

f. 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.

g. 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.

h. 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 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 borings, 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.

[2]If an opening to a cave is intercepted during construction activities, there should be immediate coordination with the US Fish and Wildlife Service, US Forest Service (if within Forest Service ownership land) Virginia DCR-NHP Karst Program (or) West Virginia Department of Conservation, for investigation.

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:

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 a 300-foot radius of 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

[3]If an opening to a cave forms during construction activities, should be immediate coordination with the Virginia DCR-NHP Karst Program (or) West Virginia Department of Conservation for investigation.

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.

III. Notification and Consultation

Notification of, and consultation with State and Federal regulatory and administrative agencies will be completed for the following:

1. Any planned invasive subsurface exploration, including: geotechnical soil borings; rock coring; air track borings; test pits; or other invasive investigative measures that have the potential for intercepting subsurface voids, conduits, or caverns.
2. Any karst features that were identified and located prior to construction that will require remediation or mitigation.
3. Any karst features that were identified and located prior to construction that will require periodic monitoring, whether remediated or left in an undisturbed natural state. The results of the monitoring shall be documented and reported to the appropriate agencies.
4. Any karst features that are intercepted during construction. Notification and consultation will take place after the performance of the Level I inspection.
5. Any karst features that form during construction. Notification and consultation will take place after the performance of the Level I inspection.
6. Any karst features that form following construction which are observed during the post-construction karst feature monitoring (*see* Level 2 Inspection of Features that form during construction, part e).

Federal Agencies to be Notified

United States Fish and Wildlife Service (USFWS)
Federal Energy Regulatory Agency (FERC)
United States Forest Service (USFS)[4]

State Agencies to be Notified (Virginia)

Virginia Department of Conservation and Recreation – Natural Heritage Program (DCR-NHP)
Virginia Department of Environmental Quality (VDEQ)

State Agencies to be Notified (West Virginia)

West Virginia Division of Natural Resources (WVDNR)
West Virginia Department of Environmental Protection (WVDEP)

Karst Mitigation and Conservation Procedures

The following procedures will be used to avoid and minimize any impact of pipeline construction and/or O&M activity which might present a risk to environmental receptors, in particular obligate subterranean taxa. 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.

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. These avoidance measures were derived from the NiSource Habitat Conservation Plan, Madison Cave Isopod Avoidance and Minimization Measures, and the Columbia Pipeline Group HCP and non-HCP species Best Management Practices

[4] Only if within USFS lands.

Guidance Document. They are intended to prevent impact to the karst aquifer and the subsurface habitat of obligate stygobiont species through protection of groundwater quantity and quality (Burden, 2012).

1. Protect known and/or future mapped recharge areas of cave streams and other karst features by following relevant conservation standards, specifically the FERC 2013 Upland Erosion Control, Revegetation and Maintenance Plan, the FERC 2013 Wetland and Waterbody Construction and Mitigation Procedures, and the ACP Spill Prevention, Containment, and Control (SPCC) plan.
2. Buffers of 300 feet around karst features 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. If a karst feature or its 300-ft buffer falls within the 125-ft wide workspace the following steps should be taken:
    a. The workspace should be narrowed (if practicable) to impact as little of the buffer as possible.
    b. No spraying of insecticides or herbicides shall be allowed within the 300-ft buffer.
    c. No refueling, repair or maintenance of vehicle or equipment shall be allowed within the 300-ft buffer.
    d. Soil disturbance within the buffer (i.e. trenching) shall be performed in a manner which prevents sediment from entering the subsurface through the use of carefully designed and continuously maintained sediment and erosion control measures, and shall follow the procedures and BMPs specified in the FERC plans and procedures mentioned in section 1, above.
    e. If the karst feature is located downgradient from the area of soil disturbance, drainage shall be directed away from the karst feature and its 300-ft buffer through the use of diversion trenches, water breaks, or other engineered methods. This shall apply even if the feature itself is located outside of the 125-ft workspace, but the workspace intercepts the 300-ft buffer.
    f. No activity of any kind shall be allowed within the parapet of a sinkhole or within a 25-ft buffer around the parapet, which should remain in an undisturbed, natural state. The sinkhole and the 25-ft parapet buffer should be delineated using temporary fencing.
3. Earth disturbing activities will be conducted in a manner that minimizes alteration of existing grade and hydrology of existing surficial karst features. Pre-existing flow channels will be stabilized but will not otherwise be altered. Concentrated flow caused by construction activities will be dispersed with a suitable spreading or diversion technique. Surface water flow volume will be maintained at historic (or predevelopment) levels as changes to the volume of surface water flow can disturb the subsurface hydrology.
4. Any open-throat sinkholes and cave entrances within 300 feet of the workspace, located downgradient from the centerline which receives drainage from the workspace will be carefully protected using silt fences, diversion trenches, constructed temporary berms around the parapet, or water breaks. If the feature receives flow via a discreet drainage channel, the channel will be equipped with absorptive boom and a double row of silt fences.
5. In addition to the aforementioned requirements, the following will be implemented in construction workspace areas:
    a. If a new open throat, cover-collapse sinkhole forms within the ROW or construction work space, 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 by the KS and appropriate action taken (e.g., pipeline relocated, sinkhole remediated, etc.) to ensure pipeline integrity and protection of the aquatic resource and subterranean habitat. The preferred method for remediation will be the graded/inverted filter method (Ralstein and Oweis, 1999). This technique involves excavation and cleaning out collapsed, soft soils in the weakened zone to limit further soil raveling, and placing rocks or boulders large enough to bridge the bedrock conduit or "throat" at the bottom of the excavation. Progressively finer rock and gravel are then placed and compacted above the base course, above which is placed a layer of permeable

geotextile fabric and soil to the final grade which is then seeded. The advantage of this method is that it allows surface water to continue to infiltrate into the subsurface, but prevents further soil raveling (which is the root cause of cover-collapse sinkholes). The vegetated soil stratum and underlying gravel acts as a natural filter for the water infiltrating to the underlying solution enlarged conduits and fracture system. (see Appendix A).

b. If a subsurface void or conduit should open or be intersected in the process of excavation and/or trenching, 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 the most appropriate remedial method will be determined on a case-by-case basis. Soil voids will be backfilled using the graded filter method as described above. Small conduits (< 1 foot in diameter) may be closed with low mobility grout and/or flowable fill. Large conduits (>1 foot in diameter) will require specific remedial actions (capping, void bridging, or plugging) based on the location and geometry of the conduit (i.e. whether the conduit is located at the bottom, one side, or both sides of the trench).

c. If a subsurface void or conduit should open or be intersected in the process of excavation and/or trenching through which water is flowing (i.e. an underground stream) 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 the most appropriate remedial method will be determined on a case-by-case basis. All efforts will be made to ensure that the existing flow path is not interrupted by isolating the stream using trench breakers, and backfilling the location of the saturated karst feature or stream with permeable material such as well-graded stone or other material which will not interfere with the continued flow of water from one side of the trench to the other.

d. 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 downgradient towards the karst feature.

e. 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.

f. Open throat surface karst features will not be utilized for the disposal of water. This shall include, but not be limited to: hydrostatic test water, water from trench dewatering, or any other water generated by, or utilized in, construction activities.

6. 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 blasting or hammering is deemed necessary 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.

   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.

7. Horizontal Directional Drilling (HDD) will not be used in karst terrain.
8. 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.
9. Comply with requirements of project SPCC plan.
10. 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:
    g. 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;
    h. 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;
    i. prevent runoff resulting from construction equipment washing operations to directly enter any karst feature by locating these operations outside of the buffer area;
    j. 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;
    k. 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
    l. 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.
11. Hydrostatic test water will not be obtained from karst features (only free-flowing streams).
12. Hydrostatic testing water from new pipe installations shall not be discharged into flagged or marked buffer areas of sinkholes, fissures, or other karst features or channels or surface features that flow towards those features. Discharging of hydrostatic testing water shall be performed in the following manner (in order of priority and preference):
    a. Discharge hydrostatic test water downgradient of flagged or marked buffer areas of sinkholes, fissures, or other karst features unless on-the-ground circumstances (e.g., man-made structures, terrain, or other sensitive resources) prevent such discharge.
    b. If water cannot be discharged downgradient as described in 12a, 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 12a or 12b 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.

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West Virginia DEP, 2005, Sinkhole Mitigation Guidance Document, August 8, 2005, WVDEP Division of Water and Waste Management, Groundwater Protection Program.

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.

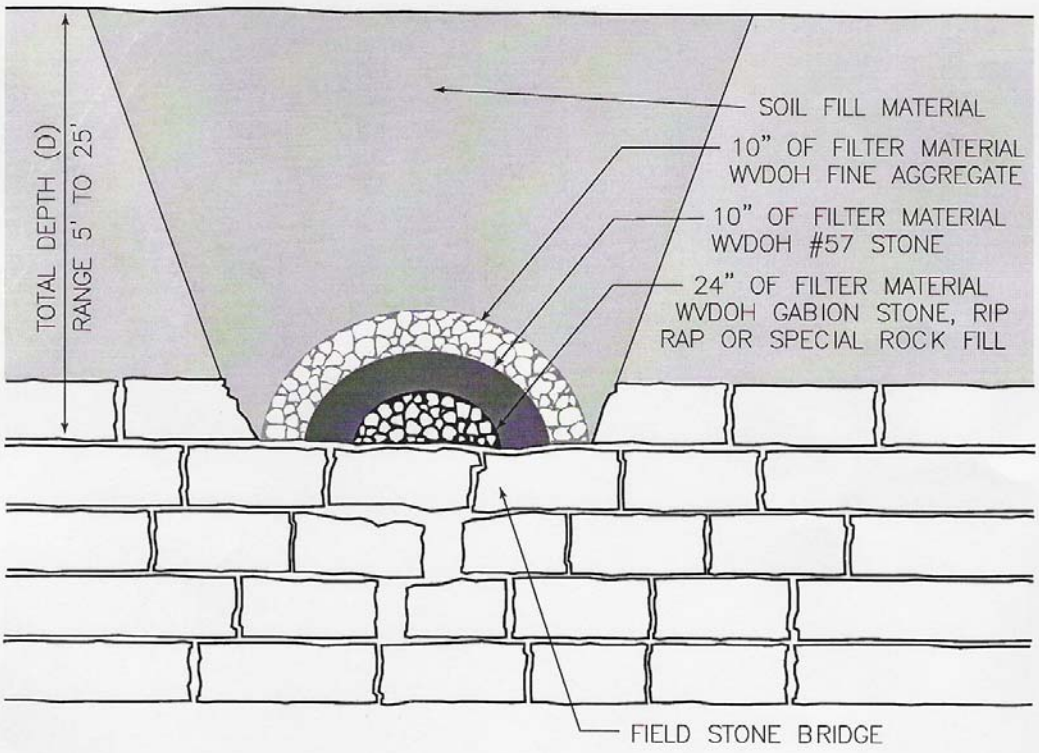
References:

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



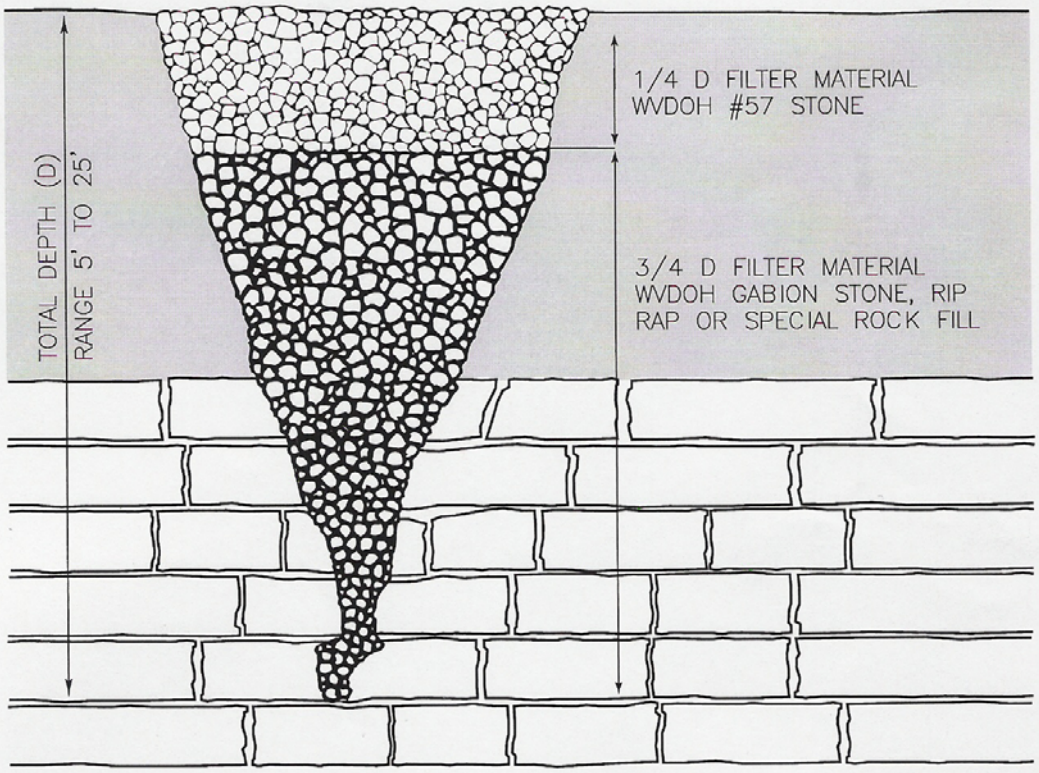
NOTE:
A NONWOVEN GEOTEXTILE MEETING AASHTO M288, SECTIONS 7.1+7.2 MAY BE SUBSTITUTED FOR THE WVDOH #57 STONE AND WVDOH FINE AGGREGATE

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.

North Carolina Agencies

North Carolina Department of Natural and Cultural Resources

Maggie Voth

From: Robinson, Laura <Laura.Robinson@ncdcr.gov>
Sent: Tuesday, June 06, 2017 1:28 PM
To: Dale Suiter; Maggie Voth; 'john_ellis@fws.gov'
Cc: Ratcliffe, Judith; richard.b.gangle@dominionenergy.com
Subject: RE: ACP - NC 2017 Plant Survey Letter

Dear Maggie,

Thank you for including the N.C. Natural Heritage Program in the review of rare plant species within the ACP project boundaries. NCNHP finds these surveys to be satisfactory and has no further comments. I don't have all the email addresses for each person on the original email. Please forward as needed and feel free to contact me if you have any questions.

Laura Robinson
Botanist
NC Dept. of Natural and Cultural Resources
919.707.8647
laura.robinson@ncdcr.gov

121 W. Jones Street | 1651 Mail Service Center | Raleigh, NC 27699-1651

From: Maggie Voth <Maggie.Voth@erm.com>
Sent: Friday, May 26, 2017 1:38 PM
To: dale_suiter@fws.gov; john_ellis@fws.gov; Ratcliffe, Judith
Cc: Sara Throndson; Spencer Trichell (Services - 6); Richard B Gangle (Services - 6); Pat Robblee; Jennifer C Broush (Services - 6); Robert M Bisha (Services - 6); Stu Buchanan
Subject: ACP - NC 2017 Plant Survey Letter

John, Dale, and Judith,
On behalf of the Atlantic Coast Pipeline Project please find the attached letter regarding rare plant surveys in North Carolina. Atlantic requests your review and approval of the Michaux's sumac alternative winter survey methodology described in the letter, as well as the continued application of the 2016 Study Plan methodology for remaining botanical surveys in North Carolina.
Atlantic looks forward to continued coordination with you on this project. Please contact Mr. Richard B. Gangle at (804) 273-2814 or Richard.B.Gangle@dominionenergy.com, or Ms. Sara Throndson at (612) 347-7113 or sara.throndson@erm.com if there are questions.
Thank you, Maggie

Maggie Voth
Project Scientist

Environmental Resources Management (ERM)
1000 IDS Center
80 S. Eighth Street l Minneapolis l MN l 55402
T 612.347.7869 l **M** 651.764.0445
E maggie.voth@erm.com l W www.erm.com