PJM Facilities Study Report

For

Network Upgrade N9146

Transition Cycle #1

June 2025

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff and PJM Manuals. The Transmission Owner (TO) is Virginia Electric and Power Company (VEPCO or Dominion).

A. Project Description

The System Impact Study for PJM Interconnection Transition Cycle #1 has identified the need for PJM Network Upgrade N9146. The scope of this Network Upgrade includes the following:

- Upgrade 1.51 Miles of 115kV transmission line 5 from Fork Union to Bremo

B. Transmission Owner Facilities Study Results

1. Detailed Scope of work for Network Upgrade N9146:

The following is a detailed description of Transmission Owner Upgrades for Network Upgrade N9146. These facilities shall be designed according to the Transmission Owner's Applicable Technical Requirements and Standards. Once built the Transmission Owner will own, operate, and maintain these facilities.

See Preliminary Scoping Summaries located in the Appendices, Attachment #1, #2, and #3.

2. MILESTONE SCHEDULE FOR COMPLETION OF DOMINION WORK

Facilities outlined in this report are estimated to take 42 months to construct, from the time of full execution of the Generation Interconnection Agreement and completion of a construction kickoff call. This schedule may be impacted by the timeline for procurement and installation of long lead items and the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Engineering	1	30
Permitting/Procurement	3	38
Construction	36	42

3. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- The preliminary construction schedule is dependent on outage availability.
- See Attachment 1 and 2 – Preliminary Scoping Summary – Substation for additional assumptions
- See Attachment 3 – Preliminary Scoping Summary – Transmission line for additional assumptions

4. LAND REQUIREMENTS

Dominion will be responsible for the following expectations in the area of Real Estate:

- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation.
- Any other Land/Permitting requirements required by the Network Upgrade

5. ENVIRONMENTAL AND PERMITING

The Dominion will be responsible for the following expectations in the area of Environmental and Permitting:

- Assessment of environmental impacts related to the Network Upgrade including:
    - Environmental Impact Study requirements
    - Environmental Permitting
- A stormwater easement and/or specific stormwater design BMP's to allow access to and use of the facilities, including a maintenance agreement for said stormwater facilities.
- Conditional Use Permit for Substation
- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation
- Any other Permitting requirements required by the Network Upgrade

C. APPENDICES

Attachment #1: Preliminary Scoping Summary - Substation Bremo

Attachment #2: Preliminary Scoping Summary - Substation Fork Union

Attachment #3: Preliminary Scoping Summary - Transmission Line

Attachment #1:

Project Number: N9146 - Bremo

SUBSTATION SCOPE OF WORK

Project Description: Replace Line Lead for Line 5

Date: 6/05/2025

Revision Number: 0

Project Summary

Network upgrade N9146 provides for the uprate of line 5 at Bremo Substation in Fluvanna County, Virginia.

Assumptions & Clarifications:

1. Transmission Line Engineering to remove (2) existing Line No. 5 T-Line structures inside the station and determine location of (2) new H-Frame structures.
2. Transmission Line Engineering to maintain clearances between existing line No. 8 strain bus structure and new Line No. 5 H-Frame.
3. Transmission Line Engineering to maintain drive access between existing line No. 298 bus structure and new line No. 5 H-Frame.

Purchase and install substation material – Network Upgrade:

1. Two (2), 115kV H-Frame structure (By Transmission)
2. One (1), 115kV, 3000A 3-phase line switch (By Transmission)
3. Three (3), 115kV, relay accuracy CCVT
4. Three (3), 90kV, 74kV MCOV surge arrester
5. Conductor, connectors, conduits, control cables, foundations, steel structures and grounding materials as per engineering standards

Attachment #2:

Project Number: N9146 – Fork Union

SUBSTATION SCOPE OF WORK

Project Description: Replace Line Lead for Line 5

Date: 6/05/2025

Revision Number: 0

Project Summary

Network upgrade N9146 provides for the uprate of line 5 at Fork Union Substation in Fluvanna County, Virginia.

Purchase and install substation material – Network Upgrade:

1. Conductor, connectors, and grounding materials as per engineering standards

Attachment #3:

115 kV LINE 5

BREMO – FORK UNION

PROJECT N9146

PRELIMINARY SCOPING SUMMARY

This project serves to partially wreck and rebuild 115kV Line 5 between structure 5/173, outside Fork Union Substation to structure 5/186C, inside Bremo Substation for approximately 1.51 miles, which is located in Fluvanna County, VA. See **Figure 1** for the project location. No additional Right of Way (ROW) will be acquired for this project. The project will install a total of fourteen (14) new structures. A Certificate of Public Convenience and Necessity (CPCN) filing is expected due to the quantity of structures that will need to be replaced as part of this project.

The existing line is mainly composed of wood H-frame suspension and dead-end structures constructed in 1930. The proposed structures to be installed are direct embed single circuit 115kV steel suspension structures, engineered single circuit 115kV steel double deadend h-frame structures on foundations, and engineered single circuit 115kV steel double deadend 3-pole structures on foundations. The existing single (1) 636 ACSR (24/7) "Rook" conductor will be replaced with single (1) 768.2 ACSS (20/7) "Maumee" conductor. The existing single (1) 266.8 ACSR shield wire, dual (2) 4/0 ACSR shield wire, and dual (2) 3/8 Steel shield wire will be replaced with dual (2) DNO-11410 OPGW.

It is assumed that an outage for Line 5 will be acquired for the work specified in this scope, and no temporary line configurations will be necessary for this project.

Design Considerations:

EXISTING FACILITIES TO BE REMOVED:

1. Remove eight (8) existing 115kV single circuit suspension wood h-frame structures as follows:
    a. Structures 5/174, 5/175, 5/176, 5/179, 5/180, 5/181, 5/182, and 5/184

2. Remove one (1) existing 115kV single circuit running angle wood 3-pole structure as follows:
    a. Structure 5/186

3. Remove one (1) existing 115kV single circuit double deadend wood h-frame structure as follows:
    a. Structure 5/183

4. Remove one (1) existing 115kV single circuit double deadend wood 3-pole structures as follows:
    a. Structure 5/185

5. Remove one (1) existing 115kV single circuit steel deadend a-frame backbone structure with switch attachment as follows:
    a. Structure 5/186A
6. Remove one (1) existing 115kV single circuit steel deadend a-frame backbone structure as follows:
    a. Substation strain bus structure (No T Line I.D.)

7. Remove approximately 1.51 miles of 3-phase single (1) 636 ACSR (24/7) "Rook" conductor from the **ahead side** of structure 5/173 to the **back side** of substation strain bus structure inside Bremo Substation.

8. Remove approximately 0.70 miles of single (1) 266.8 ACSR shield wire from the **ahead side** of structure 5/173 to the **back side** of structure 5/178.

9. Remove approximately 0.24 miles of single (1) 4/0 ACSR shield wire from the **ahead side** of structure 5/178 to the **back side** of structure 5/180.

10. Remove approximately 0.18 miles of dual (2) 4/0 ACSR shield wire from the **ahead side** of structure 5/180 to the **back side** of structure 5/181.

11. Remove approximately 0.37 miles of dual (2) 3/8 Steel shield wire from the **ahead side** of structure 5/181 to the **back side** of structure 5/186 outside Bremo Substation.

EXISTING FACILITIES TO BE MODIFIED:

1. Replace three (3) 115kV single conductor strain assemblies with three (3) 115kV single conductor strain assemblies [31.540] on the **ahead side** of the following structure:
    a. Structure 5/173

2. Replace three (3) 115 kV single conductor jumper loop assemblies with three (3) 115kV single conductor jumper loop assemblies [39.225] as follows on the following structure:
    a. Structure 5/173

3. Replace one (1) insulated shield wire strain assembly with one (1) insulated OPGW strain assembly [96.060] on the **ahead side** of the **west pole** of the following structure:
    a. Structure 5/173

4. Replace three (3) 115kV single conductor I-string suspension assemblies with three (3) 115kV overinsulated single conductor I-string suspension assemblies [31.500] as follows on the following two (2) structures:
    a. Structures 5/177 and 5/178

5. Replace one (1) insulated shield wire suspension assembly with one (1) insulated OPGW suspension assembly [96.020] on the **west pole** of the following structure:
    a. Structure 5/177

6. Replace one (1) insulated shield wire deadend assembly with one (1) insulated OPGW deadend assembly [96.060] on the **west pole** of the following structure:
    a. Structure 5/178

PERMANENT FACILITIES TO BE INSTALLED:

1. Install eight (8) 115kV direct embed steel single circuit suspension h-frame structures [11.606] as follows:
    a. Structures 5/174, 5/175, 5/176, 5/179, 5/180, 5/181, 5/182, and 5/184

2. Install one (1) 115kV self-supporting switch structures [11.830] on foundations as follows:
    a. Structures 5/186A
        i. This includes the installation of one (1) 2000A switch.

3. Install one (1) 115kV custom engineered steel single circuit double deadend h-frame structure [12.165 – 115kV Spacing] on foundations as follows:
    a. Structure 5/183

4. Install two (2) 115kV custom engineered steel single circuit double deadend 3-pole structures [12.158 – 115kV Spacing] on foundations as follows:
    a. Structures 5/185 and 5/186

5. Install two (2) 115 kV custom engineered steel single circuit full deadend structures [12.165 – 115 kV Spacing] on foundations as follows:
    a. Structure 5/186B and 5/186C

6. Install one (1) insulated OPGW strain assembly [96.060] as follows on the **east pole** of the following two (2) structures:
    a. One (1) strain assembly on the **ahead side** of existing structure 5/173
    b. One (1) strain assembly on the **back side** of existing structure 5/178

7. Install one (1) insulated OPGW suspension assembly [96.020] on the **east pole** of existing structure 5/177.

8. Install approximately 1.51 miles of 3-phase single (1) 768.2 ACSS/TW/HS (20/7) “Maumee” conductor from the **ahead side** of existing structure 5/173 to the **back side** of new structure 5/186C inside Bremo Substation.

9. Install approximately 1.51 miles of dual (2) DNO-11410 OPGW from the **ahead side** of existing structure 5/173 to the **back side** of new structure 5/186C inside Bremo Substation.
    a. This includes the installation of two (2) fiber splices on the following two (2) structures:
        i. Structures 5/173 and 5/186C

CONCEPTUAL SCOPE NOTES:

1. The existing line consists primarily of wood suspension h-frame and deadend 3-pole structures installed in 1930. These structures are considered insufficient for the proposed conductor, necessitating the rebuilding of the line in the segment between structure 5/174 and structure 5/186C inside Bremo Substation, where these structure types are predominant. Structures 5/173, 5/177, and 5/178 were installed within the last 15 years and are assumed to be sufficient and will remain. Existing structures will need to be analyzed during the detailed design phase of this project. No PLS-CADD modeling was done for this project. Structures were replaced like for like and estimated using typical transmission right of way characteristics.

2. Structures are designed based off the following NESC code parameters: NESC Heavy, 90 mph wind, ¾" Ice & 30 mph wind regardless of project location.

3. It is assumed for detailed engineering that a LiDAR survey will be required.

4. Any potential height restrictions were not accounted for in this design.

5. An existing right of way width of 262 feet between structure 5/173 and structure 5/182 is assumed based on existing plan and profile and Map Viewer information. Line 5 shares the project corridor with Line 1030, Line 2193, and a distribution line east of Line 2193. It is assumed that no additional ROW will be required between structure 5/173 and structure 5/182 for approximately 1.22 miles. The necessary ROW extents will be verified during detailed design.

6. A wetland delineation has not been completed as part of this conceptual package.

7. Line 5 crosses over Line 1030 between structure 5/183 and structure 5/184, outside of Bremo Substation.

8. This project scope assumes that project N9146 occurs prior to other network upgrades included in Transition Cycle 1, Phase 3. The following project(s) may impact the project scope if this assumption

is incorrect:

a. N9199 – Wreck and rebuild 1.63 miles of Line 2193 between Fork Union and Bremo
b. N7812 – Wreck and rebuild 7.3 miles of Line 8 between Bremo and Scottsville

9. Existing backbone structures 5/186B and substation strain bus structure inside Bremo Substation was installed in 1930 and both structures are assumed can be replaced with a 115kV single circuit H-frame structure. Due to the congested nature of the substation, it is assumed that a self-supporting switch outside the substation would be feasible due to existing switch mounted on existing backbone 5/186A. In detailed engineering, this configuration will need to be analyzed.

CONCEPTUAL ESTIMATE NOTES:

1. Engineered steel pole costs were determined based off typical wind and weight spans, line angles, and average structure heights in the typical right of way associated with the structure type.

2. Steel pole foundation costs were based off the projects' location and structure type in the regional soil profile map. The regional soil profile map used for this project is Piedmont.

3. The conceptual estimate assumes that a laydown yard is required for this project.

4. Full Deadend structures 5/186B and 5/186C were estimated based off of standard 115 kV backbone structure costs due to loading on proposed structures.

5. Prior to detailed engineering, a full land rights review would be required. A desktop review was completed to estimate the project cost.

6. Forestry estimate cost inputs include the following assumptions:
    a. Work pad totals based on provided SOW and assumptions from kmz file. Assume 15 mats for tangents and 30 mats for angles at each work pad for reconductor work and 50 mats per pull pad.
    b. DDE structures assumed based off of wire reel lengths - based off of pull pad locations.
    c. Pull pad locations based on location of major road/water crossings and line mileage.
    d. Assuming that existing stone in Substations will be used for access per SOW and that access is existing or will be built by others before the start of construction. Assumes that the substations will be constructed with access roads built to and from Substations and work from inside the substations for Backbone installation.

    e. Assumes no delays due to permitting or real estate issues after work begins. Assume no schedule compressions from SOC/PJM.
    f. Assumes all clearing and forestry costs have been captured by others. No access costs for forestry activities included in this pricing.

g. Stream crossing based on estimates from aerial imagery.
h. Assumes that all existing roads may be dressed with stone that can remain at the end of the project. Assumes existing two track roads in many locations will be impermeable. No costs for stone road removal are included.

Figure 1 – Project Location

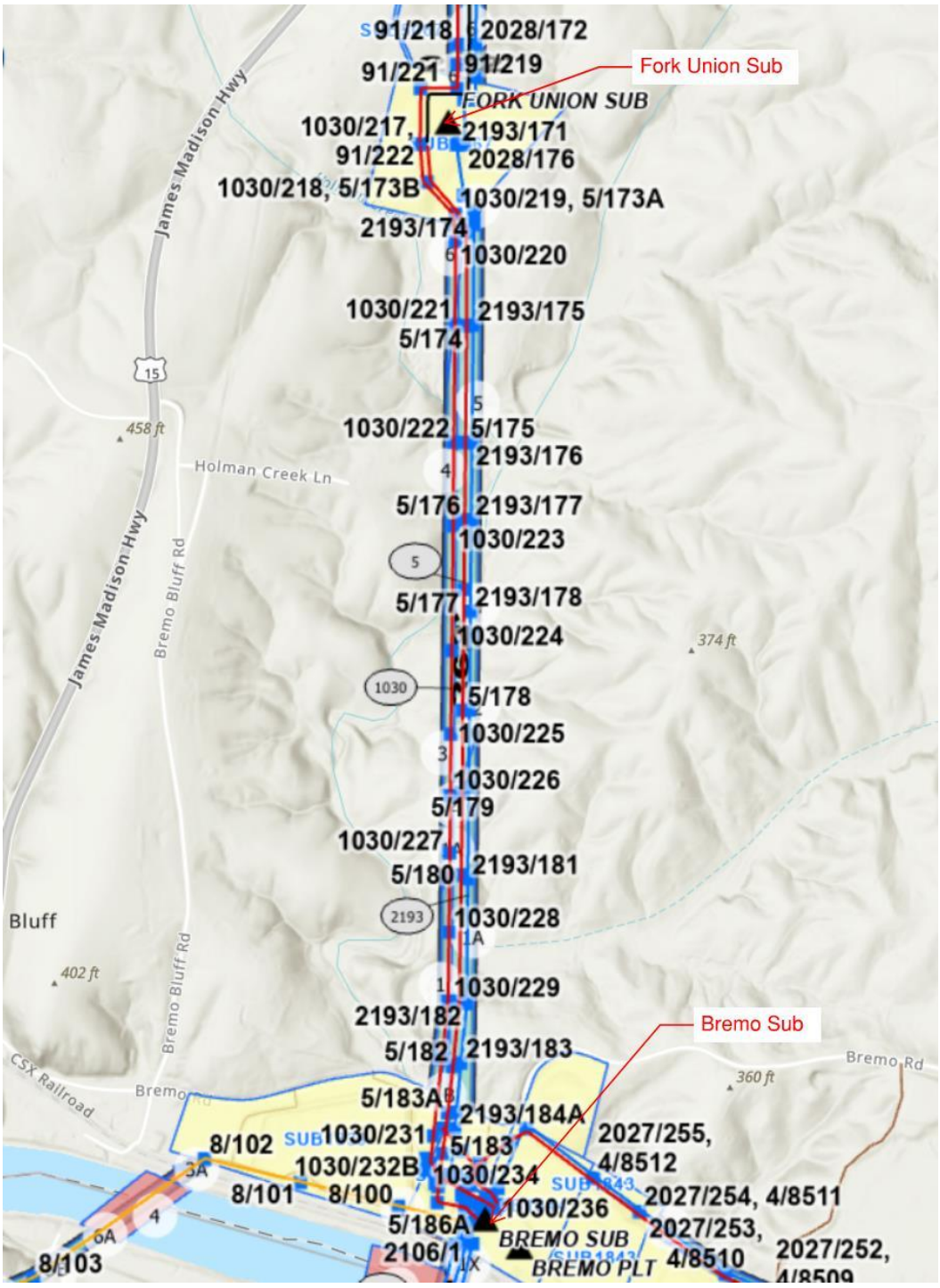
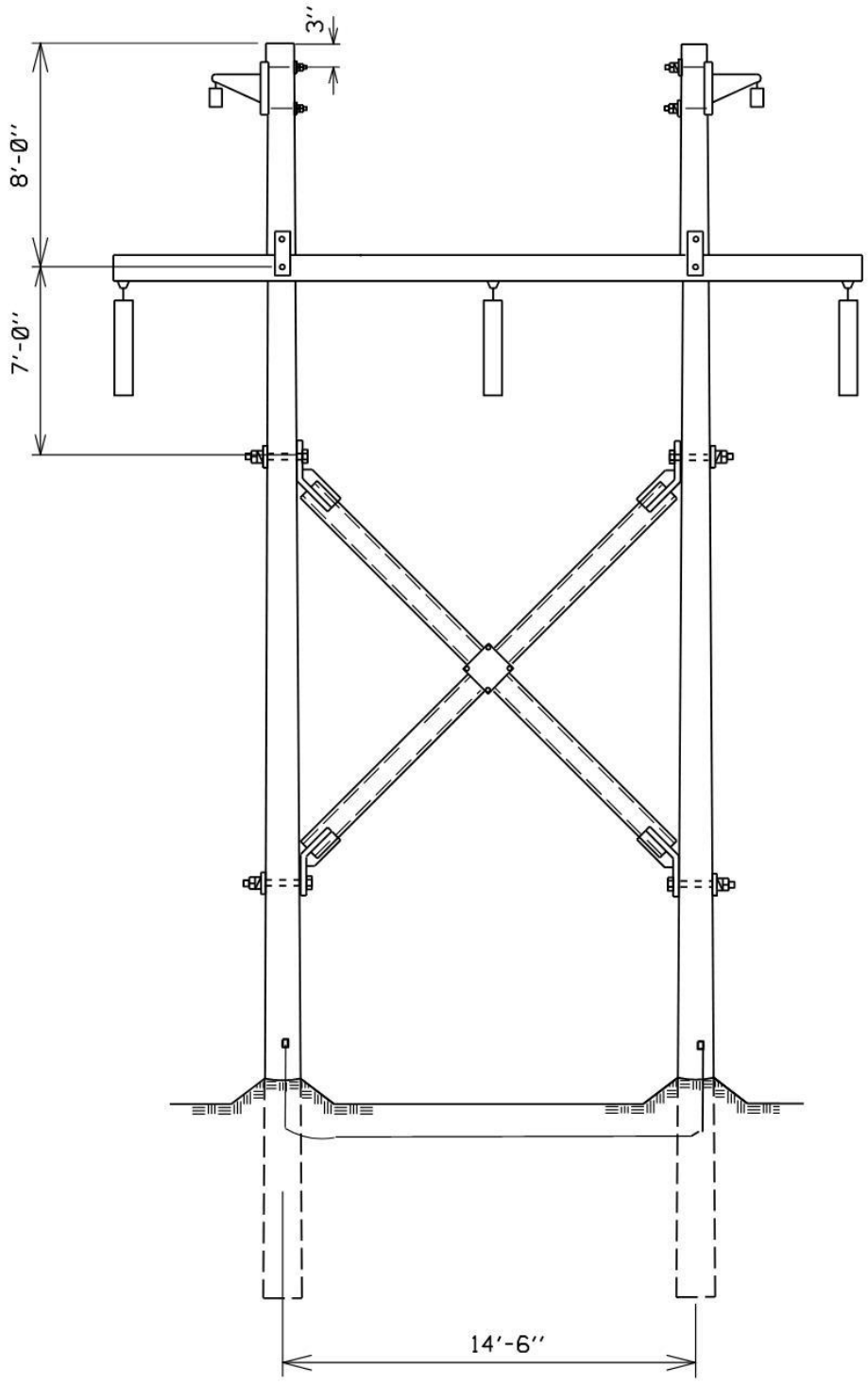


Figure 2 – Proposed Structure Configuration



Required Material Summary

Item	Qty
115kV SC Suspension Steel H-Frames [11.606]	8
115kV Self-Supporting Switches [11.830]	1
115kV SC DDE Steel H-Frames [12.165- 115kV Spacing]	1
115kV SC DDE Steel 3-Poles [12.158 – 115kV Spacing]	2
115kV SC Full Deadend Steel H-Frames [12.165- 115kV Spacing]	2
12,000-Ft DNO-11410 OPGW Reels	2
12,000-Ft 768.2 ACSS/TW/HS “Maumee” Conductor Reels	3