

PJM Facilities Study Report
For
Network Upgrade N9220
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 N9220. The scope of this Network Upgrade includes the following:

- Upgrade 15.42 Miles of 230kV transmission line 298 from Bremo to Buckingham

B. Transmission Owner Facilities Study Results

1. Detailed Scope of work for Network Upgrade N9220:

The following is a detailed description of Transmission Owner Upgrades for Network Upgrade N9220. 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 46 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	46

Due to outage congestion, Network Upgrades and/or internal Dominion projects have been identified as having possible outage conflicts with this network upgrade that may affect the estimated milestones listed above. Additional outage sequencing may be required that includes, but not limited to, the following line upgrades:

- Line 5
- Line 2028

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 PERMITTING

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 Bremono
Attachment #2: Preliminary Scoping Summary – Substation Buckingham
Attachment #3: Preliminary Scoping Summary – Transmission



Project Number: N9220 – Bremo Substation

Project Description: ***SUBSTATION SCOPE OF WORK*** Replace Line Lead for Line 298

Date: 06/20/2025

Revision Number: 0

Project Summary

Network upgrade N9220 provides for the uprate of line 298 at Bremo Substation in Fluvanna County, Virginia.

Purchase and install substation material – Network Upgrade:

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

Purchase and install relay material – Network Upgrade:

1. One (1), 1340 – 24” dual SEL-411L DCB/PLC line panel

Remove relay material – Network Upgrade:

1. Remove Panel No. 21



Project Number: N9220 – Buckingham Substation
Project Description: ***SUBSTATION SCOPE OF WORK*** Replace Line Lead for Line 298

Date: 06/20/2025
Revision Number: 0

Project Summary

Network upgrade N9220 provides for the uprate of line 298 at Buckingham Substation in Cumberland County, Virginia.

Purchase and install substation material – Network Upgrade:

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

230 kV LINE #298
Bremo – Buckingham
PROJECT N9220

PRELIMINARY SCOPING SUMMARY

This project serves to rebuild 230 kV line 298 from Bremo Substation to Buckingham Substation for approximately 15.42 miles, which is located in Cumberland, Buckingham, and Bremo County, VA. See **Figure 1** for the project location. The proposed work requires no additional land and will all be completed within existing right of way. The project will install a total of one hundred and nineteen (119) new structures. This project will require CPCN filing.

The existing line consists mainly of concrete H-frame structures built in 1978. The proposed structures to be installed are single circuit direct embed DOM H-frame structures and single circuit engineered steel H-frame structures. The existing 545.6 ACAR conductor will be replaced with twin bundled (2) 768 ACSS/TW/HS (20/7) “Maumee” conductor. The existing two (2) 3#6 Alumoweld shield wire will be replaced with two (2) DNO-11410 OPGW.

This project scope assumed that N9220 occurs prior to other network upgrades included in Transition Cycle 1 Phase 3.

Design Considerations:

EXISTING FACILITIES TO BE REMOVED:

1. Remove one hundred and twelve (112) existing 230 kV single circuit concrete suspension 2-pole H-frames as follows:
 - a. Structures 298/190, 194-240, 242-258, and 260-306
2. Remove three (3) existing 230 kV single circuit concrete suspension 3-pole structures as follows:
 - a. Structures 298/191-193
3. Remove two (2) existing 230 kV single circuit weathering steel suspension 2-pole H-frames as follows:
 - a. Structures 298/241 and 298/259
4. Remove one (1) existing 230 kV single circuit galvanized steel self supporting switch structure as follows:
 - a. Structure 298/307A
5. Remove one (1) existing 230 kV single circuit concrete double deadend 2-pole H-frame as follows:
 - a. Structure 298/307

6. Remove approximately 15.42 miles of 3-phase twin bundled (2) 545.6 ACAR from existing structure 298/190 to existing structure 298/308
7. Remove approximately 15.42 miles of two (2) 3#6 Alumoweld shield wire from existing structure 298/190 to existing structure 298/308

EXISTING FACILITIES TO BE MODIFIED:

1. Replace three (3) conductor strain assemblies [Reference Drawing 32.630], three (3) conductor jumper assemblies [Reference Drawing 39.227], and two (2) OPGW strain assemblies [Reference Drawing 96.060] on the following one (1) structure:
 - a. Structure 298/308
2. Cut and transfer the existing twin bundled (2) 545.6 ACAR conductor for Line 298 from ahead side of existing structure 298/189 to the back side of proposed structure 298/190.
3. Cut and transfer the existing two (2) 3#6 Alumoweld shield wire Line 298 from ahead side of existing structure 298/189 to the back side of proposed structure 298/190.

PERMANENT FACILITIES TO BE INSTALLED:

1. Install one hundred and seven (107) 230 kV direct embed DOM single circuit suspension H-frames [Reference Drawing 12.557] on foundations as follows:
 - a. Structures 298/194-204, 206-221, 223-238, 240-254, 256-271, 273-289, and 291-306
 - b. See **Figure 2** for a visual of the proposed structure design.
2. Install eleven (11) 230 kV engineered steel single circuit double deadend H-frame structures [Reference Drawing 12.165] on foundations as follows:
 - a. Structure 298/190-193, 205, 222, 239, 255, 272, 290, and 307
 - b. See **Figure 3** for a visual of the proposed structure design
3. Install one (1) 230 kV steel self-supporting switch structure [Reference Drawing 12.830] on foundations as follows:
 - a. Structure 298/307A
4. Install approximately 15.42 miles of 3-phase twin bundled (2) 768.2 ACSS/TW/HS (20/7) "Maumee" conductor from proposed structure 298/190 to existing structure 298/308.
5. Install approximately 15.42 miles of two (2) DNO-11410 OPGW from proposed structure 298/190 to existing structure 298/308.
 - a. This includes the installation of sixteen (16) splices as follows:
 - i. Two (2) splices on structures 298/190, 205, 222, 239, 255, 272, 290, and 308.

CONCEPTUAL SCOPE NOTES:

1. No PLS-CADD modeling was done for this project. Instead, a design span was used to determine the difference in sags between the existing and proposed conductors at max sag conditions. The resulting change in max sags is approximately 10 ft. This change in sags is substantial enough to assume that the line must be rebuilt. Structures were replaced like for like and estimated using typical transmission right of way characteristics.
 - a. Design Span Length = 900 feet
 - b. Existing Design Tension = 5941 lbs NESC Heavy
 - c. Proposed Design Tension = 5941 lbs NESC Heavy
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 100' is assumed based on map viewer information. No new right of way is required as a part of this project.
6. A wetland delineation has not been completed as part of this conceptual package.
7. Wire reel lengths were not accounted for this line design. The assumed pull pad locations to avoid tension splices will be determined during detailed design.
8. This project scope assumes that N9220 occurs prior to other network upgrades included in Transition Cycle 1 – Phase 3. The following projects may impact the project scope if this assumption is incorrect.
 - a. N9217 - Wreck and rebuild 12.73 miles of 230 kV Line 298 from Buckingham to Farmville
 - b. N9221 – Replace wave trap at Buckingham 230 kV
 - c. N9141 – Farmville to Chase City upgrades; wreck and rebuild 115 kV as double circuit 115 kV and 230 kV
9. Critical crossing for this project are:
 - a. Between structures 298/190 and 298/191 crossing over James River
 - b. Between structures 298/190 and 298/191 crossing over a railroad

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

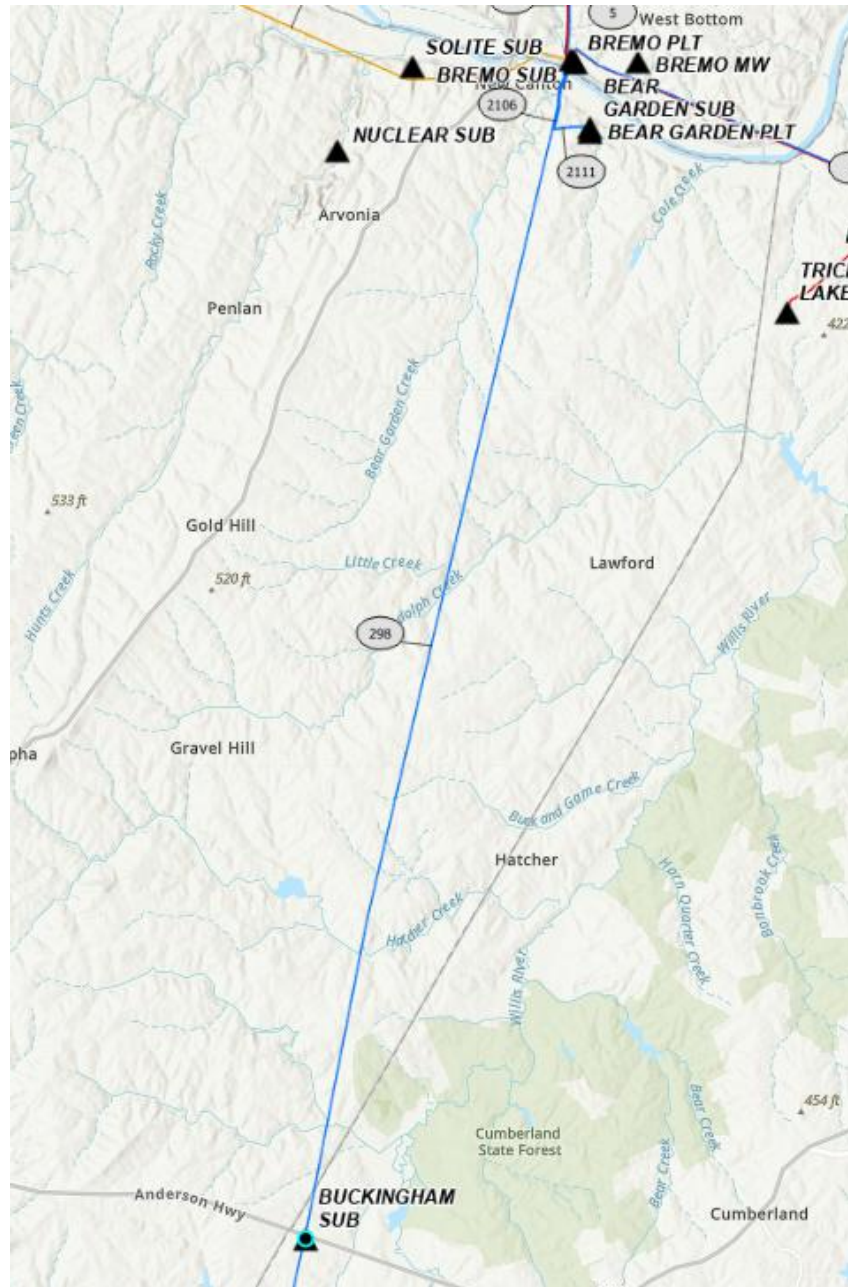


Figure 2 – Proposed Suspension Structure Configuration

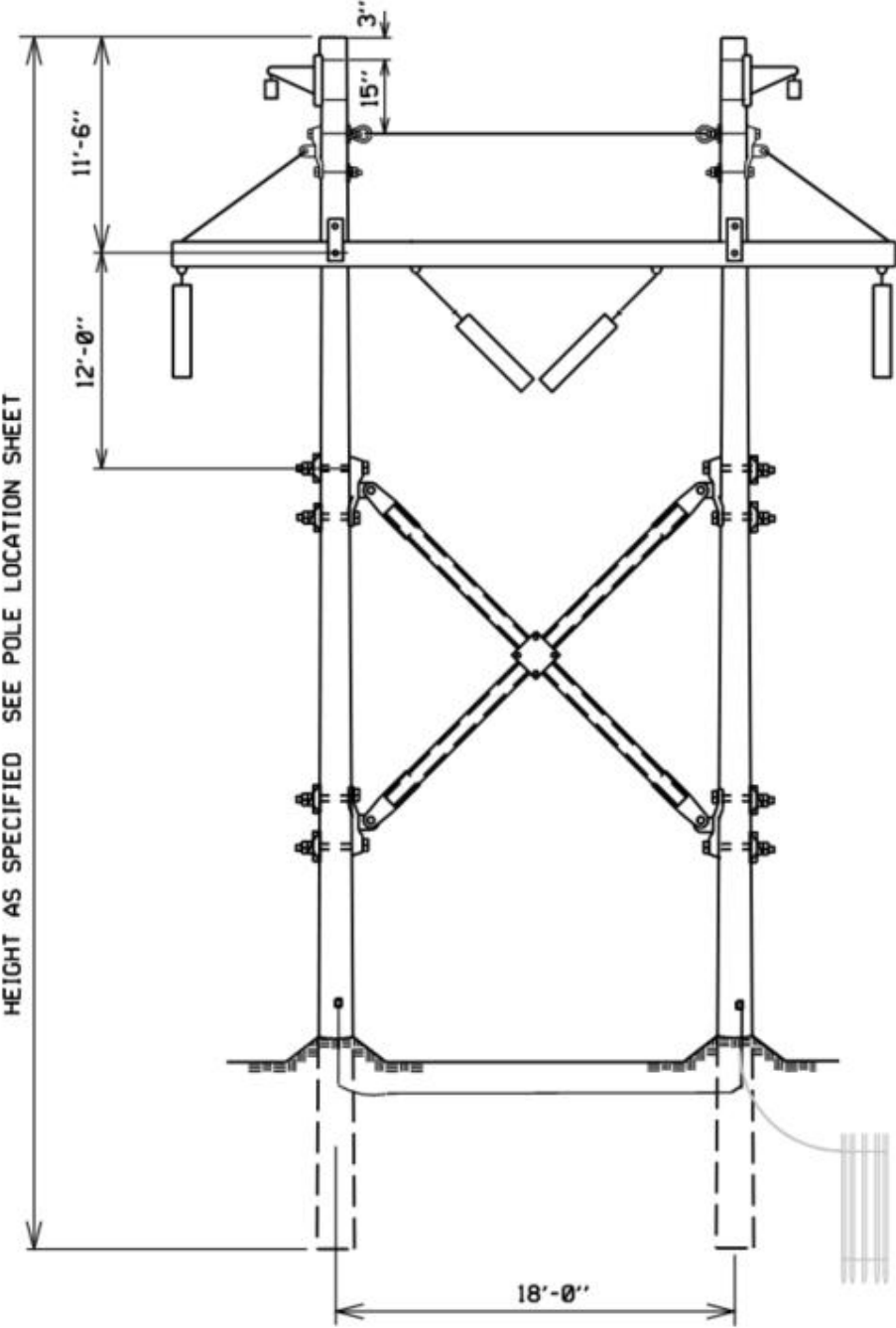
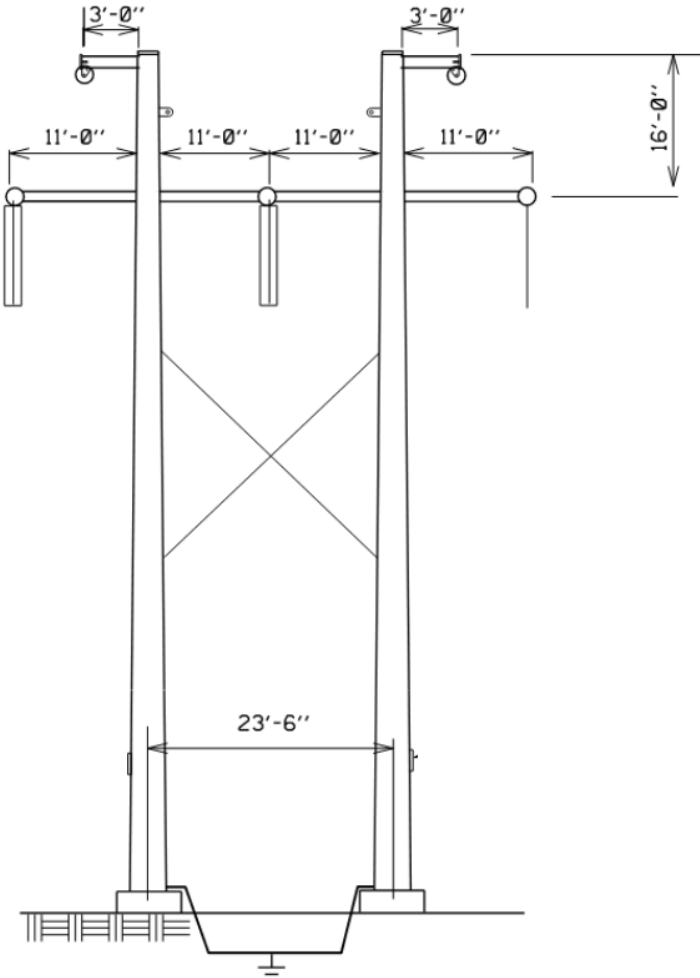


Figure 3 – Proposed Double Deadend Structure Configuration



Required Material Summary

Item	Qty
230 kV Direct Embed DOM H-frame structures [12.557]	107
Engineered Structures	11
Self-supporting Switch Structures	1
12,000-Ft OPGW Reels	16
12,000-Ft Conductor Reels	46